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FEDERAL AVIATION AGENCY STANDARD

CONSTRUCTION OF CONCRETE SHAFT AIR TRAFFIC CONTROL TOWER FACILITY

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DIVISION 1

SECTION A

GENERAL CONDITIONS

1A-01 FIELD OFFICE:

1A-01.1 On the site, or immediately adjacent to it, the Contractor shall provide a temporary office of approximately 300 sq. ft. (minimum), rectangular in shape and having a minimum nominal width of 10 feet, all on one floor for the sole use of the Government for the entire life of the contract. The building, including all interior fittings and furnishings shall remain the property of the Contractor and shall be renewed by him when directed by the Contracting Officer. The structure shall be weathertight and provided with ample heat, light, air conditioning, sanitary facilities, drinking water and a minimum of six convenience outlets. Doors and windows shall be secured with locks. Heating equipment shall maintain an inside temperature of 70°F and cooling equipment an inside temperature of 80°F at the local outdoor design temperatures.

1A-01.2 The Contractor shall supply interior furnishings including a minimum of two (2) 2'-10" x 5'-0" desks with locks on drawers, six (6) chairs, two (2) legal size 4-drawer filing cabinets with locks, one (1) legal size 2-drawer filing cabinet with locks, one (1) plan rack with sticks to hold minimum of ten sets of plans, one (1) 3'-6" x 8'-0" drawing board, one (1) 3'-6' x 8'-0" reference table, sample shelves, drinking facilities and two (2) wastepaper baskets. Phone service and other office equipment and supplies will be furnished by the Government.

1A-01.3 All janitor service, sanitation facilities, electricity, heat and air conditioning with associated service connections shall be furnished and maintained by the Contractor during the entire life of the contract or until the removal of all facilities is requested by the Contracting Officer. The office shall be kept clean and neat and the windows washed periodically by the Contractor.

1A-02 ACCIDENT AND FIRE PROTECTION: The Contractor shall comply with the requirements as outlined in the Safety in Construction and Alteration Work Handbook, AD P 3900.1, as issued by the Federal Aviation Agency.

1A-03 AS-BUILT DRAWINGS, MAINTENANCE MANUAL, UTILITIES SURVEY

1A-03.1 During the progress of the work, the Contractor shall keep on file two complete and separate sets of blackline prints on which shall be accurately and promptly noted, as the work progresses, any changes, revisions or additions to the general construction work, mechanical work or electrical

work. At the completion of the work, the Contractor shall submit two sets of the "as-built" drawings to the Contracting Officer.

1A-03.2 The Contractor shall prepare a maintenance manual which shall consist of a complete set of manufacturers' catalogs, instructions and other similar data, including the necessary photographic cuts, diagrams, valve charts and the like covering all mechanical and manually operated devices furnished and/or installed in the building. This manual is intended to serve to instruct and assist the maintenance men in the care, operation, maintenance and repair of all such devices. Bound copies of the above, in triplicate, shall be submitted to the Contracting Officer.

1A-03.3 Upon completion of the contract, the Contractor shall furnish to the Contracting Officer an accurately dimensioned survey, showing the location and elevation of all utility lines (water, gas, electric, sewer, steam, etc.) including valves, connections and changes in direction, installed under the contract within the contract limits and outside the building walls. The point where utility lines emerge from the building shall be located from the building corners. The points where the utility lines leave the property shall be located from lot monuments. The survey shall be made to scale, as approved by the Contracting Officer, and drawn with waterproof ink on tracing cloth, or by other method approved by the Contracting Officer, which will provide a permanent reproducible record.

1A-04 SHOP DRAWINGS

1A-04.1 The Contractor shall submit for the approval of the Contracting Officer shop drawings, fabrication drawings, erection and setting drawings, schedule drawings, manufacturers' scale drawings, wiring and control diagrams, cuts or entire catalogs, pamphlets, descriptive literature, and performance and test data.

1A-04.2 Submit 6 copies of all drawings, 5 of which shall be black line or blue line prints and the 6th copy being a reproducible print, made by a process approved by the Contracting Officer. Submit catalog, cuts, descriptive literature and the like in 6 copies. Only one copy of each item involved will be available to be returned to the Contractor, unless the Contractor elects to submit more than 6 copies. Upon final approval, the Contractor shall furnish copies of the approved shop drawings to all affected trades.

1A-04.3 Drawings and schedules shall be checked and coordinated with the work of any other trade involved before they are submitted for approval, and shall bear the Contractor's stamp of approval as evidence of such checking and coordination.

1A-04.4 Drawings shall be complete, assembled in sets and shall bear:

Date
Number of Drawing or revision
Name of Project or Facility
Name of Contractor and Subcontractor
Clear identity of Contents and
Location on work

1A-04.5 The Contractor shall allow 30 calendar days for Government review of any one submission.

1A-04.6 The Contractor shall submit within 30 days after date of Notice to Proceed, for the Contracting Officer's approval, a "Shop Drawing Schedule" showing the dates on which shop drawings, fabrication drawings, erection and setting drawings, equipment lists, test data and similar items are to be submitted by the Contractor for the principal items of work, taking into consideration the time required by the Government for the coordination, review and return of such drawings.

1A-05 SAMPLES

1A-05.1 After award of Contract, the Contractor shall furnish, for the approval of the Government, samples required by other sections of the specifications or requested by the Contracting Officer.

1A-06 TEMPORARY TOILETS: The Contractor shall provide adequate temporary toilet accommodations, including water supply, for all persons employed on the work, and located where approved by the Contracting Officer. The accommodations shall be proper enclosures and shall be maintained in proper, safe and sanitary conditions in accordance with local codes and be suitably heated when required.

1A-07 TEMPORARY WATER SUPPLY

1A-07.1 The Contractor shall make his own arrangements for the use of water during construction. Cost of use of water shall be paid by the Contractor.

1A-07.2 From the source of supply the Contractor shall arrange for all temporary connections, including piping, fittings and valves. The Contractor shall provide all necessary hose, water barrels and similar equipment as required for use by the various trades.

1A-08 TEMPORARY LIGHT AND POWER

1A-08.1 The Contractor shall arrange for, provide and maintain all temporary electric light and power as required throughout the work. He shall pay all costs for the installation and use of such temporary light and power.

1A-08.2 The Contractor shall provide all supply lines for light and power, extension outlets, extension cords, trailers, receptacles, bulbs, fuses and other equipment required for safety and for proper execution of the work, and for inspection purposes.

1A-09 TEMPORARY HEAT

1A-09.1 The Contractor shall provide sufficient temporary heat as follows:

1A-09.1.1 As necessary to protect all work, materials and equipment against injury from dampness and cold.

1A-09.1.2 At all times during the placing, setting and curing of concrete, to insure the heating of the spaces involved to not less than 55 degrees Fahrenheit.

1A-09.1.3 From the beginning of the application of expanded polystyrene insulation and/or plaster and during the setting and curing period, to produce a temperature in the spaces involved of not less than 55 degrees Fahrenheit.

1A-09.1.4 For a period of 10 days previous to the placing of interior finishes and until the completion of the building, to produce a temperature of not less than 70 degrees Fahrenheit.

1A-09.2 The Contractor may use smokeless unit heaters (Underwriters', Factory Mutual and Fire Marshal approved) of type approved by the Contracting Officer until the structure is enclosed. The use of kerosene, fuel oil or coke burning salamanders is prohibited.

1A-09.2.1 After the structure is enclosed, provide a complete system of temporary radiation, approved by the Contracting Officer, to protect the enclosed structure from freezing and to expedite the construction work of all trades.

1A-09.2.2 The Contractor may use, with written permission of the Contracting Officer, the permanent heating system as necessary for the proper execution, protection and drying out of the work and shall maintain all apparatus in a condition acceptable to the Contracting Officer.

1A-09.3 All costs in connection with heating, including equipment, installation, operation, attendance, fuel, electricity, etc., shall be paid for by the Contractor.

1A-10 CLEANING AND PROTECTION

1A-10.1 The Contractor shall require each subcontractor engaged upon the

1A-11.2 No materials, rubbish or debris will be permitted to drop free, but shall be removed by the use of the material hoist, rubbish chute or other method approved by the Contracting Officer.

1A-11.3 Hoists and chutes shall be erected as to prevent damage, staining or marring of any permanent work.

1A-12 CONSTRUCTION SIGN

1A-12.1 The Contractor shall furnish and erect a construction sign in accordance with the drawings. The sign shall be erected at commencement of work and located where directed by the Contracting Officer. The Contractor shall maintain the sign in good condition throughout the construction period.

1A-13 PROTECTION OF WORK AND PROPERTY

1A-13.1 The Contractor shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance, whether or not the same has been covered by partial payments made by the Government and whether or not damage to his work was caused by the Contractor or by any subcontractor or by others than the employees of the Government in the course of their employment.

1A-13.2 The Contractor shall have the overall responsibility for the performance and enforcement of all forms of protection against weather and he shall be responsible for repairs and replacements of new or existing material or equipment damaged as a result of inadequate protection. The Contractor shall re-seed and completely restore to original condition grass areas damaged by his operation and shall promptly repair any damage to parking surfaces, walks, curbs, roads, aprons, etc., caused by his or his subcontractors operations.

1A-13.3 Materials and surfaces shown to remain exposed in the final construction which are damaged in the course of contract work shall be repaired or replaced to the satisfaction of the Contracting Officer and at no expense to the Government.

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DIVISION 1

SECTION B

SAMPLES

1B-01 SCOPE: This Section covers the requirement for furnishing samples, certificates of compliance, test reports and related items to the Contracting Officer for testing, selection and approval.

1B-02 APPROVAL

1B-02.1 All samples, certificates and test reports shall be submitted prepaid and in ample time for proper action by the Government before materials, which samples, certificates and reports represent, are delivered at the work. The minimum time necessary for Government approval of samples is 30 calendar days after receipt of sample.

1B-02.2 Properly label each sample with name and quality of the material, manufacturer's name and brand, name of project, Contractor's name and date of submission.

1B-02.3 All materials installed in the work shall match the approved samples. After a sample submitted by the Contractor has been approved no substitution will be permitted without written approval by the Contracting Officer.

1B-03 SAMPLES, CERTIFICATES AND TEST REPORTS

1B-03.1 Unless otherwise directed by the Government Representative, the Contractor shall submit samples, in duplicate, in sufficient size and/or quantity as required to perform the tests called for in the Specification. Each sample shall be accompanied by the manufacturer's certificate of compliance or certified test reports, in triplicate.

1B-03.2 Samples submitted for selection of color, texture and finish shall show the extremes in range, if any, of the colors, textures and finishes of the items to be furnished.

1B-03.3 Where samples, certificate of compliance and test reports are called for in the various Sections of the Specifications, they shall be submitted upon request by the Government Representative. Samples, Certificates of Compliance and Test Reports are required for the following:

Section 2A - Excavation, Filling, Backfilling and Grading

Porous fill
Reinforced paper and/or polyethylene plastic sheets;
fiberglass blanket

Section 2B - Footing Drains

Drain tile or concrete pipe

Section 2C - Paving

Aggregates, each type

Section 2D - Topsoil, Seeding Sodding and Planting

Topsoil
Humus
Fertilizers
Grass Seed
Sod
Insecticides

Section 3A - Concrete and Cement Work

Cement, each type
Air entrainment
Aggregates, each type
Reinforcing steel, wire and mesh and
reinforcing bar accessories
Form ties, form bolts, inserts,
flashing reglets, anchor slots
Form materials, each type
Premolded fillers, water stops,
vapor barriers and slip sheets
Bonding agent
Finishing materials: form oil,
abrasive aggregate, form sealer,
sealer (floor hardener) retardant
form coating, water repellent,
color pigment
Applied cement finish
Colored cement finish
Sealant

Section 4A - Masonry

Cement, each type
Lime
Sand
Concrete block
Glazed block
Face brick
Joint reinforcement
Control joints
Dovetail anchors, anchor slots, anchors,
ties and accessories
Joint Filler

Section 4B - Building Insulation

Thermal insulation, each type
Cement
Sand
Latex mortar additive
Certification

Section 5A - Structural Steel

None Required

Section 5B - Roof Decking

Decking
Weld washers
Hole covers

Section 5C - Miscellaneous Metal

Steel
Aluminum, various alloys, including finishes to be furnished
Sheet steel
Abrasive Safety Nosings
Shop paint, various types, to be furnished
Section of railings, each type, including closed end, brackets and bracket supports
Saddles, each type
Anchor slots, each type
Louver details
Coping
Metal wall panel

Section 5D - Window Walls

Metal: steel and aluminum, including finishes to be furnished
Glass
Tapes, sealants, caulking stops and fillers

Section 6A - Carpentry

Lumber and plywood for cabinets

Section 7A - Metallic Waterproofing

Cement
Sand
Metallic waterproofing compound

Section 7B - Caulking and Sealing

2-part Polyurethane sealants
1-part sealants
Joint primer
Joint fillers
Certification
Color samples

Section 7C - Roofing

None Required

Section 8A - Hollow Metal Work

Sheet steel, including finishes
Corner section of door and frame
Weatherstripping

Section 8B - Glass and Glazing

Glass, each type
Tapes and sealants

Section 9A - Furring, Lathing and Plastering

Plaster, each type, including samples showing each type of finish
Bond adhesive
Lath, each type
Accessories, i.e., grounds, casing beads and corner beads
Resilient furring and clips
Hangers and inserts
Furring channels and angles, each size and type
Wire accessories

Section 9B - Ceramic Tile

Floor tile and base
Primers, sealers, underlayment and grout; thin-set adhesives
Dry-set mortar
Certificate of Grade

Section 9C - Painting and Finishing

Sample of each type or finish to be used
Color samples
Painting schedule

Section 9D - Wall Covering

Sample of wall covering
Primers, sealers and adhesives

Section 9E - Resilient Flooring

Each type of resilient flooring
Adhesive, primer and underlayment
Certification

Section 9F - Sprayed-On Acoustical Treatment

Sample showing texture and color
Certification of Noise Reduction Coefficient

Section 9G - Suspended Acoustical Ceiling

Tile
Suspension members

Section 10A - Metal Toilet Enclosures

Color samples of finishes
Samples of hardware and accessories

Section 10B - Toilet Room Accessories

Catalog cuts for each item to be furnished
Samples of finishes

Section 10C - Builders Hardware

Samples of each type specified
Hardware scheduled

Section 10D - Exterior Metal Partition

Panel finish
Aluminum members
Fasteners

Section 10E - Movable Office Partitions

3 x 6 inch metal plates each kind and finish
Corner section of door, frame and trim

Section 11A - Erection of Control Cab

None Required

Section 12A - Elevator

Samples of all finishes for hoistway entrances, including frames, doors, panels and saddles
Samples of all floor, wall, ceiling and door finishes for elevator cab
Samples of carpet for cab floor

Section 13A - Plumbing

None Required

Section 14A - Heating Ventilating and Air Conditioning

None Required

Section 15A - Electrical

None Required

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DIVISION 2

SECTION A

EXCAVATION, FILLING, BACKFILLING AND GRADING

2A-01 SCOPE: This Section covers the requirement for performing all operations in connection with the Excavation, Filling, Backfilling, Rough and Finish Grading within the project property lines, areas to be paved and seeded outside the property lines and elsewhere on the airport as indicated on the drawings or mentioned in the specifications.

2A-02 PROTECTION: All banks, slopes, and adjacent areas, not specifically excavated or graded, shall be fully protected against damage.

2A-03 SOILS DATA: Bowing logs are found in the contract documents.

2A-04 EXCAVATION

2A-04.1 General: All material now in place, natural or artificial, including rock, boulders, existing structures and foundations, rubbish and debris, shall be removed as necessary for performance of all work under the contract. Excavation will be unclassified and the Contractor shall include in his job price the cost of removing all of the materials encountered. The results of soil borings taken within the property limits and soil probings taken along the routes of the proposed utility lines are found in the contract documents. However, the bidder is required to examine the location of the work and determine for himself the nature of the conditions including sub soil conditions effecting the cost of the work. On request to the Contracting Officer, he may obtain permission to make his own soil borings or probings in order to determine the nature of the sub soil materials to be excavated. All excavations shall be kept free of water, regardless of the elevation at which ground or flood water may be encountered. Sufficient working space shall be provided to permit the placing, inspection, and completion of all work under the contract. Excavated material, unsuitable or not required for filling, backfilling, or grading, shall be removed from the site. The disposal of this material shall be the responsibility of the Contractor. All materials, natural or artificial, whose removal is deemed necessary for the performance of the contract, shall be removed to a depth of 2 feet below the finished grades, unless indicated on the drawing to remain.

2A-04.2 Pits and Trenches: Footing pits and trenches may be excavated to permit forming of concrete, or may be excavated to exact size of the concrete. If footing trenches are excavated to the exact size of the concrete, the sides must be maintained to withstand sloughing during the placing of concrete. Undercutting will not be permitted. If excavations by the contractor's own volition are carried below the required levels, they shall be backfilled with concrete of the class specified for footings, or the foundation shall be laid at the excavated level as directed and at no additional

cost to the Government. All footings shall bear on undisturbed soil unless the foundation material is rock. Where rock occurs and footings are indicated to rest on same, the rock shall be levelled to a clean, even, hard surface. Sloping rock for bearings shall be stepped and treated in the same manner. No footing shall be permitted to rest partly on soil and partly on rock. In the event excavation reveals potential foundation bearing surfaces of part rock and part soil, the Contractor shall be directed to remove the soil and fill the voids with concrete as specified above to the elevations required. The contract shall be adjusted for this additional work in accordance with Clause 3, "Changes" of the General Provisions to the contract.

2A-04.3 Inspection of Excavated Surfaces: When excavations for footings have reached the required elevations, the excavated surfaces shall be inspected and approved by the Government's Representative before proceeding with further construction. The Government's Representative may direct the Contractor to make soil borings in order to determine the suitability of the foundation material. If the material disclosed is satisfactory to the Government's Representative the boring holes shall be filled with concrete of the class specified for the footings. The contract shall be adjusted for the cost of soil borings and concrete fill (if required). If the material disclosed in unsatisfactory, thus requiring further study of the foundation material, additional excavation and concrete fill, revisions to the footings, etc., the Government shall determine the nature and magnitude of the additional work to be performed by the contractor and the contract adjusted in accordance with Clauses 3 and 4 of the General Provisions to the contract.

2A-04.4 Temporary Support and Capping: Any utility lines, piping, conduits, etc., encountered, that are not to be removed, shall be temporarily supported and maintained until permanent support has been restored. Utility lines, piping, conduits, etc., to be removed, shall be cut off and capped in accordance with the regulation of the city or utility company involved, and at the Contractor's expense. Existing utility lines to remain and utility lines constructed during excavation and backfilling, if damaged, shall be repaired at the Contractor's expense.

2A-04.5 Freezing: When freezing weather is expected, excavations shall not be made to the full depth, unless footing can be placed immediately. If excavation is already at full depth the excavation shall be protected from frost.

2A-04.6 Water proofed Surfaces: Excavations adjacent to surfaces where metallic waterproofing occurs shall be kept dry until completion of the waterproofing treatments. Fill and backfill shall not be placed against such surfaces until the waterproofing treatments have been completed, inspected and accepted by the Government's Representative.

2A-04.7 Pipes and Duct Trenches: Excavation for water pipe, sanitary sewer pipes, storm drainage pipes, concrete ductbanks and manholes shall be carried out to lines and grades shown on the drawings or mentioned in these specifications. All excavations shall be kept free of water at all times regardless of its origin. Any water accumulation in trenches or other excavations shall be removed by pumping or by other approved methods. Excavated material suitable for backfilling shall be piled in an orderly manner, a sufficient distance from the banks of the excavation to avoid overloading and to prevent slides or cave-ins. All excavated material not required or unsuitable for backfill shall be removed from the airport. Sheeting and shoring shall be provided along taxiways and runways and where required to withstand sloughing or cave-in of walls and for the protection of the work, existing utilities and structures. The bottom of trenches and other excavations shall be accurately graded to provide uniform bearing and/or continuous support on undisturbed soil for all appurtenances and equipment to be installed and for each section of pipe. Unauthorized overdepths shall be backfilled with loose, granular, moist earth, thoroughly compacted. Whenever wet or otherwise unstable soil that is incapable of properly supporting the item to be installed is encountered, as determined by the Contracting Officer, it shall be removed to the depth required and backfilled with suitable material to the proper grade. In excavating for water and sewer lines, the width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed 8 inches on either side of the pipe. The bottom of the trench shall be manually dug after the trench bottom has been graded and, in order that the pipe rest upon the prepared bottom for as nearly its full length as practicable, shall be only of such length, depth, and width as required for properly making the joint.

2A-05 GROUNDWATER: The Contractor shall control groundwater during excavation, foundation construction and filling operations. Special care must be taken to avoid damage to foundation materials by groundwater which would reduce their load bearing capacity and thereby necessitate a change in footing design and construction. The Contractor shall prepare and submit to the Contracting Officer for approval, the method(s) he plans to use for controlling groundwater during construction operations.

2A-06 FILL AND BACKFILLING

2A-06.1 General: Prior to commencing fill and backfilling operations, excavated and fill areas shall be cleared entirely of concrete form work, debris, etc. Fill and backfill shall be clean earth, free from perishable material, placed in evenly distributed layers of thickness specified herein over the entire areas; properly moistened and thoroughly consolidated by power operated mechanical equipment to prevent subsequent settlement. Material from other sources shall be supplied for fill and backfill when sufficient or suitable material is not available on the site. All fill and backfill shall be well graded coarse granular material free of all organic, frozen, expanding or shrinking material. Fill for seeded or sodded areas, shall be brought to within 6 inches of the finished grades. In event excavated material is not suitable or insufficient amounts for use

as fill and backfill, the contractor shall provide from off site sources, fill and backfill conforming to the above requirements and subject to the approval of the Government Representative.

2A-06.2 Rocks, Stones and Boulders: Rocks, stones and boulders up to 2 cubic feet in size may be incorporated in fill areas (except within 10 feet of any structure) except that earth only containing stones not over 2" shall be used for the top 12" of fill. Rocks, stones and boulders shall be well distributed to eliminate any voids that may cause undue settlement or prevent proper consolidation of the filled areas.

2A-06.3 Drainage: Coarse fill, over footing drains, back of retaining walls, under approach work, and under concrete slabs, shall be clean, hard gravel, broken stone, or slag, unless otherwise indicated on the drawings, and shall comply with Federal Specification SS-A-281b, Class 2, Grade A sized from #4 to two inches. All drainage fill shall be protected against the infiltration of concrete by a layer of reinforced paper UU-P-264a or pure polyethylene plastic sheets, .004 inches thick, and against the infiltration of soil by a 1/2" thick, non-organic flexible 1-lb. density fiberglass blanket similar to Pittsburgh Plate Glass Co.'s "Topsoil Separator Heavy" or approved equal.

2A-06.4 Old Excavations: Any old wells, cisterns, catch basins, existing cavities or voids, and the like that are encountered in proximity to the footings or which come within the assumed pyramid of pressure, shall be cleaned out and filled with 2,000 p.s.i. concrete. Any other old excavations, within the limits of the work under the contract shall be cleaned out and filled with bank-run gravel that passes a 3 inch mesh and well tamped into place, up to existing grade, or within 2 feet of finished grade in seeded areas. The balance of the fill in seeded areas shall be earth.

2A-06.5 Soil Condition: Cohesive soils that have become hard or lumpy, or that have been piled and have become dry, shall be broken up and reconditioned for moisture content immediately before use in filling or backfilling.

2A-06.6 Compaction of Fill and Backfill: Compact each layer of fill and backfill to the specified percent of maximum density obtained at optimum moisture content in accordance with ASTM D-1557, Method D, as follows:

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(a) Fill under concrete floor slabs: 6 inch layers compacted to 95%. Prior to installing fill under floor slabs, the original soil shall be removed to provide a minimum of 12 inches of fill under the slabs. The surface of the remaining original soil shall be compacted to 95% maximum density at optimum moisture content before the fill material is placed and compacted. The last layer of fill shall be built up to an elevation slightly above the finish grades before compaction. The compacted fill surfaces shall be carefully checked for the correct elevations and profiles.

(b) Fill under unpaved areas: 12 inch layers compacted to 90%.

(c) Fill under pavements and sidewalks: 12 inch layers compacted to 95%.

(d) Backfill: 8 inch layers compacted to 95% except that the excavated region adjacent to the tower shaft which provides the bearing surface for the passage way foundations shall be backfilled using 6" layers and compacted to 95%. The backfilling and compaction of this region shall be under the full time supervision of the Contractor and full time observation of the Government Representative. Prior to commencing backfilling operations, all temporary wooden sheets, piling, planking, timbers, etc., are to be removed. Any caving of excavations, or any backfill placed before inspection is completed, shall be removed, by the Contractor at his expense.

2A-06.7 Compaction Tests: The Contractor shall make a compaction test for each specified percentage requirement without cost to the Government. When test results are not satisfied subsequent tests on recompacted areas shall be performed by the Contractor.

2A-06.8 Compaction Equipment: Compaction equipment shall be subject to the approval of the Government Representative. Heavy equipment for spreading and compacting fill and backfill shall not be operated closer to walls than a distance equal to the depth of the wall below the current top of the fill. Power operated mechanical hand dampers or vibrators shall be used between this point and the wall.

2A-07 STRIPPING TOPSOIL: Existing topsoil meeting the requirements of Section TOPSOILING, SEEDING, AND SODDING shall be stripped to a minimum depth of 6", within the contract limits. Topsoil shall be deposited in storage piles, separate from other excavated materials, free from roots, stones and other deleterious material.

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2A-08 GRADING

2A-08.1 General: All grading shall be done to bring the ground to the finished grade. Grade not otherwise shown, shall be uniformly level or sloped between points where elevations are given, or between such points and existing grades, shaped to drain away from building walls.

2A-08.2 Trees: Trees and shrubs, that are removed, shall have their roots removed to a depth of 18 inches below the finished grade.

2A-08.3 Placing: Material shall be placed in evenly distributed layers over the entire area; each layer 12" or less in depth before compaction, spread and compacted as specified. Filling for areas to be seeded, sodded, or receive planting shall be graded to within 6" of finished grade.

2A-08.4 Existing Areas within contract limits to be seeded, sodded or receive planting, but not requiring cut or fill shall be cut to 6 inches below finish grade and leveled for topsoiling.

2A-09 REMOVAL OF TEST PANEL: After completion and acceptance of the concrete for the tower, and when directed by the Contracting Officer, the Contractor shall remove the concrete test panel, including footings, and restore area occupied by the test panel.

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DIVISION 2

SECTION B

FOOTING DRAINS

2B-01 SCOPE: This Section covers the requirement for footing drains and their installation.

2B-02 GENERAL: For location and extent of footing drains see drawings and applicable details.

2B-03 MATERIALS

2B-03.1 Materials shall meet requirements of referenced Federal Specifications, American Society For Testing Material Standards and requirements specified herein.

2B-03.2 Clay Drain Tile: SS-T-310, standard strength; requirements on absorption and saturation coefficient will be waived.

2B-03.3 Perforated Concrete Pipe: ASTM C-4444, standard strength, non-reinforced.

2B-03.4 Porous Concrete Pipe: AASHO M-17660: interlocking tongue and groove joint.

2B-03.5 Wrappings for joints of clay drain tile shall be 18 x 14, .01 inch diameter mesh copper wire cloth strips 3" wide, with both ends locked to a 3/4" strip of 16 ounce copper.

2B-04 LAYING

2B-04.1 Footing drains shall be laid to true grades and alignment, with a continuous fall in the direction of flow.

2B-04.2 Perforated and porous concrete pipe shall be laid with closed joints. Clay drain tile shall be laid with ½" open joints, and the joints wrapped with copper wire cloth.

2B-04.3 Size of pipe as indicated on drawings. Lay on Concrete Drain bed, not less than 3" in depth, firmly compacted. Each section of pipe shall rest upon the bed through the entire length, with recesses formed where required to accommodate bell joints.

2B-04.4 Any pipe which has had its grade or joint disturbed after laying shall be removed and relayed. Interior of all pipe shall be clean before being laid. Drain lines shall be tested with water before being covered. Re-

move any obstructions and repeat test until system is satisfactory.

2B-04.5 Filling of the porous fill over the pipe shall be carefully done in layers so as not to displace the pipe, and all earth and debris shall be kept out of such fill. Stone or gravel shall not be dumped directly onto pipe but shall be carefully placed in a manner which will prevent damage to the pipe. Note: the porous fill is specified in Section, "Excavation, Filling, Backfilling and Grading."

2B-04.6 Footing drains shall be connected to drainage outlets as indicated on drawings.

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DIVISION 2

SECTION C

PAVING

2C-01 SCOPE: This Section covers the requirement for paving and its construction.

2C-02 GENERAL: For location and extent of work see drawings.

2C-03 DESCRIPTION: The paving consists of a 4" Select-Material base course, a 1½" binder course and a 1½" wearing course.

2C-04 SELECT-MATERIAL BASE COURSE

2C-04.1 Materials: 4" compacted thickness of select base-course material consisting of broken stone, disintegrated granite, rock quarry waste or screenings, or combinations of these and sand, all free from vegetable matter, clay lumps or balls of clay. Oversize material shall be removed by screens or by hand picking. All material used in the select-material base course shall meet the applicable gradation given in Table I and be obtained from approved sources.

2C-04.2 Sampling and Testing: All sampling and testing shall be by the Contractor at his expense. Sampling shall be done under the supervision of the Contracting Officer. All tests to determine the requirements specified herein shall be performed under the supervision of the Contracting Officer. The source of the select-material shall be selected in advance of the time when the select-material will be required in the work, and suitablesized samples shall be submitted to the Contracting Officer not less than 30 days before commencing the work. Additional samples of select-material shall be furnished during construction as required by the Contracting Officer. Field testing, to determine the density requirements for the base course as specified shall be performed by the Contractor without cost to the Government. Unless otherwise directed by the Contracting Officer, ASTM Serial Designation D 75-59 shall be used for sampling materials.

2C-04.3 Gradation of Aggregates: The stone or screenings shall conform to the grading shown in Table I and shall be well graded within the limits shown. Either stone or screenings may be used.

TABLE I

Percentage by weight passing
square mesh sieves

STONE BASE COURSE		SCREENINGS BASE COURSE	
Sieve Size	% Passing	Size	% Passing
2-1/2"	100	1-1/2"	100
1/2	40-75	1/2"	50-95
#8	20-50	#8	20-55
#35	8-29	#35	6-28
#200	2-10	#200	2-10
.02 mm	0-3	.02 mm	0-3

2C-04.4 Stockpiling Materials: Select-material shall be stockpiled only at the locations as designated by the Contracting Officer. The piles shall be shaped as directed by the Contracting Officer. Prior to stockpiling the material, the storage sites shall be cleared and leveled by the Contractor. The method of stockpiling shall be such as to prevent segregation.

2C-04.5 Weather Limitations: Select-material base courses shall be constructed only when the weather conditions do not detrimentally affect the the quality of the finished course. Any areas of the base course that are damaged by the effects of freezing temperatures or other weather conditions, during any phase of the construction, shall be reshaped and recompacted by the Contractor to conform with the requirements of the specification, without additional cost to the Government.

2C-04.6 Preparation of Subgrade: Prior to constructing the select-material base course herein specified, the previously constructed subgrade shall be cleaned of all foreign substances. The surface of the subgrade will be inspected by the Contracting Officer for adequate compaction and surface tolerances within the limits as specified. Any ruts or soft-yielding spots that may appear in the subgrade, any areas having inadequate compaction, and any deviations of the surface from the requirements specified shall be corrected by loosening, removing and adding approved material, reshaping, and recompacting the affected areas to line and grade, and to the specified density requirements.

2C-04.7 Placing of Materials: The select-material from approved sources shall be deposited and spread uniformly on the prepared subgrade in a layer of such depth that when compacted, the layer will have a uniform thickness of 4". Portions of the layer in which the aggregates become segregated in spreading shall be removed and be replaced with satisfactory material, or shall be remixed as directed by the Contracting Officer.

2C-04.8 Spreading and Compacting: Immediately following the placing and mixing, the select-material shall be spread evenly to a uniform layer. The loose thickness of the layer shall be such that the compaction requirements as specified below may be obtained with the rolling equipment used, and the finished thickness of the layer conform to the thickness specified. The layer shall be rolled with a power roller. Rolling shall continue until the layer or layers are compacted through the full depth to at least 100 per cent of the density at optimum moisture, based on the weight per cubic foot of the material as determined by American Association of State Highway Officials Method T-99.

2C-04.8.1 Additional water in such amounts as are necessary to obtain the density required shall be applied to the select-material during the compaction operations. The surface of the layer shall be finished by blading and rolling with power rollers. In all places not accessible to the rolling equipment, the select-material shall be compacted with approved tamping equipment. Blading, rolling and tamping shall continue until the surface is smooth and free from waves and irregularities. If at any time the select-material is excessively moistened by rain, it shall be aerated by means of suitable equipment, until the moisture content of the select-material is satisfactory to the Contracting Officer, and the surface then recompacted and finished as specified above.

2C-05 PREPARATION OF SELECT-MATERIAL BASE COURSE: Prior to constructing the binder course, the previously constructed select-material base course shall be cleaned of all foreign substances. The surface of the select-material base course will be inspected by the Contracting Officer for adequate compaction and surface tolerances. The underlying base course for the binder course shall conform to the requirements specified for "SELECT-MATERIAL BASE COURSE". Any ruts or soft-yielding spots that may appear in the select-material base course, any areas having inadequate compaction, and any deviations of the surface of more than 3/8" in 10' from the true profile and cross section, shall be corrected by loosening, removing and adding approved material, reshaping, and recompacting the affected area to line and grade, and to the specified density requirements.

2C-06 PRIME COAT

2C-06.1 The prime coat shall be placed only on a slightly moist, clean base course free from loose or foreign material when atmospheric temperature is above 50° F. From 0.2 to 0.6 gal. per sq. yd. (depending on surface texture) of medium-curing cut-back asphalt (MC-1) shall be applied with a pressure distributor at a temperature between 100° and 175° F., or rapid-curing cut-back asphalt (RC-2) at a temperature between 125° and 200° F.

2C-06.2 MC shall conform to A.S.T.M. D-598.

2C-06.3 RC shall conform to A.S.T.M. D-597.

2C-06.4 Traffic shall be kept off for at least 48 hours or longer if required to allow prime to set.

2C-07 BINDER COURSE: The binder course shall consist of a uniformly graded coarse aggregate and sand, thoroughly mixed with asphalt cement, and shall be laid upon the primed base course to a finished thickness of 1½".

2C-07.1 Materials: Coarse Aggregate shall consist of crushed stone of reasonably uniform quality throughout, clean and free from an excess of dust and from flat or elongated pieces.

2C-07.1.1 All coarse aggregates shall have a percentage of wear by the Los Angeles abrasion machine test of not more than 50 for base or binder courses and 40 for surface courses, as per A.S.T.M. Test C-131. The aggregates shall be of such nature that a thorough coating of the bituminous material will not strip off upon contact with water.

2C-07.1.2 Fine Aggregates shall consist of clean, tough, rough-surfaced grains, free from clay, loam, and other foreign matter. As delivered to the mixer it shall be free from clayey lumps or loosely bonded aggregations, and the individual particles shall be free from adhering dust. All shall pass a No. 4 sieve and not more than 5% a No. 200 sieve.

2C-07.1.3 Asphalt Cement (AC): Asphalt cement shall conform to A.A.S.H.O. M-20 or M-22, and shall fall within the following limits:

Penetration @ 77°F, 100g, 5 seconds	85-100

2C-07.1.4 Mixture shall conform to the following:

TABLE II

PERCENTAGE BY WEIGHT PASSING SIEVES (SQUARE OPENINGS)

Sieve Size	Per Cent Passing
1½ in.	100
1 in.	78-100
½ in.	53-70
No. 4	30-48
No. 10	20-37
No. 40	10-21
No. 80	6-15
No. 200	3-8
Bitumen %	4-6.5

2C-07.1.5 The exact amount of bitumen shall be determined by sample mixes which must show grains completely coated. Samples shall not bleed when compacted. No change will be made in contract price due to variations in quantity of bitumen.

	Tolerances For Approved Mix
Aggregrate passing sieve No. 4 or larger	5%
Aggregate passing sieve No. 10, 40 and 80	4%
Aggregate passing sieve No. 200	2%
Bitumen	0.5%
Temperature of mixing	25° F.

2C-07.2 Mixing: Mixing shall be done in a suitable plug mill or continuous mixer. Minimum time of mixing shall be 30 sec., and mixing shall be sufficient to coat all particles. The temperature of the materials when mixed shall be as follows:

Aggregates	150° to 325° F. and never more than 25° F. above temperature of bituminous material
Asphalt	225° to 340° F.

2C-07.3 Transporting: Transporting shall be done in trucks having insulated, tight, clean, oiled bodies. Each truck load shall be tarpaulin covered.

2C-07.4 Placing: Placing shall be done only when surface is dry and atmospheric temperature is above 40° F. Placing shall not start until prime coat has set.

2C-07.4.1 The contact surfaces of all structures shall be painted with hot bituminous material as used in the mixture.

2C-07.4.2 The mixture shall be spread by mechanical spreaders; only in inaccessible locations shall the mixture be spread by hand. Hand placing shall be from a steel dump board by means of hot shovels. Hand spreading shall be with hot rakes of suitable design. The temperature of the mixture when spread shall be between 225° and 300° F.

2C-07.5 Compacting: The mixture, as soon after it is spread as it will bear the roller without undue displacement or hair cracking, shall be rolled with a 3-wheel roller weighing not less than 10 tons. Roller wheels shall be equipped with scraping and sprinkling devices and shall be kept properly moistened without excess of oil or water. Rolling shall start longitudinally at the sides and proceed toward the center. Each trip of the roller shall overlap the previous trip by at least 1 ft. Alternate trips of the roller shall be of slightly different lengths. The speed of the roller shall not exceed 3 miles per hour.

2C-07.5.1 Where no curb exists the roller wheel shall overlap the shoulder a sufficient number of times to compact the shoulder firmly against the pavement. Then rolling shall be done diagonally in two directions with a tandem roller weighing not less than 8 tons, the second diagonal rolling crossing the lines of the first. If pavement width permits, rolling shall also be at right angles to the center line. Rolling shall be continued until all creases have been removed and 92% to 95% density attained. Mechanical tampers shall be used for compacting in locations inaccessible to the roller.

2C-07.6 Joints: When new mixture is placed against previously placed mixture, the joint shall be cut back to a clean vertical surface and painted with hot bituminous material as used in the mixture.

2C-07.7 Tolerances: The surface shall be true to the established grade. The thickness shall not vary more than $\frac{1}{4}$" from that shown on the plan. The finished surface shall not vary more than $\frac{1}{4}$" in 10' from the true profile and cross section.

2C-08 TACK COAT: The tack coat shall be applied to the binder course before laying the wearing course. It shall be placed like the prime coat using from 0.08 to 0.12 gal. per sq. yd. of RC-2, 3 or 4 at a temperature between 50° and 120° F.

2C-09 WEARING COURSE - FINE MIX: The wearing course shall consist of the same materials plus mineral filler and shall be mixed, placed and compacted the same as the binder course, except as follows:

2C-09.1 Mineral Filler: Shall consist of thoroughly dry stone dust, Portland cement, or other artificially or naturally powdered mineral dust, 65% to 100% of which will pass a No. 200 mesh sieve.

2C-09.2 Fine Aggregate: Ninety-eight to 100% shall pass a No. 10 sieve and not more than 5% a No. 200 sieve.

2C-09.3 Mixture: Mixture of aggregates, mineral filler, and bitumen shall conform to the following:

COARSE MIX

PERCENTAGE BY WEIGHT PASSING SIEVES (SQUARE OPENINGS)

Sieve Size	Per Cent Passing
$\frac{1}{2}$ in.	100
3/8 in.	84-100
No. 4	60-73
No. 10	43-57
No. 40	23-33
No. 80	13-20
No. 200	4-8
Bitumen %	5-7.5

30.

The exact amount of bitumen shall be determined as specified for the binder course.

2C-09.4 Joints: Joints shall be at least 1' from joints in the binder course and shall present the same texture, density, and smoothness as the rest of the pavement.

2C-09.5 Compacting: Compacted density after rolling shall be 93% to 96%. The outside edges of the pavement shall be trimmed neatly to line while the course is being finished.

2C-09.6 Tolerances: The finished surface shall not vary more than 1/8" in 10' from the true profile and cross section. Such tests will be performed by the Contractor in the presence of the Resident Engineer. Any deviation in excess of this amount shall be corrected as directed by the Resident Engineer.

2C-09.7 Appearance: The finished surface shall be uniform in texture and appearance.

2C-09.8 Protection of Pavements: After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled and hardened and in no case in less than 6 hours.

2C-10 APPROVAL OF MATERIALS: Materials may be used if accompanied by manufacturer's certificate of compliance pending any tests which may be made by the Engineer. The manufacturer's certificates shall include certificate of compliance covering quality and grading of aggregates and quality and grades of bituminous materials.

2C-11 TESTS: The contractor shall cut one sample of paving which shall be tested for density at the Contractors expense. Each load of bitumen or mixture shall be tested for temperature of application.

2C-12 EQUIPMENT: All equipment, tools, and machines used in the performance of the work required by this section shall be subject to the approval of the Contracting Officer, and shall be maintained in satisfactory working condition at all times.

2C-12.1 Material Spreading Equipment: The equipment for spreading aggregate shall be adjustable, and capable of spreading material at controlled amounts per square yard.

2C-12.2 Sprinkling Equipment: Sprinkling equipment shall be pressure distributors or other approved equipment, designed to apply water uniformly and at controlled quantities to variable widths of surface.

2C-13 GRADE CONTROL: The lines and grade shall be established by the Contractor under the supervision of the Contracting Officer, and shall be maintained by the Contractor.

2C-14 MAINTENANCE: The finished paving shall be maintained by the Contractor in a condition satisfactory to the Contracting Officer until the contract is completed.

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DIVISION 2

SECTION D

TOPSOILING, SEEDING, SODDING AND PLANTING

2D-01 SCOPE: This Section covers the requirement for performing all operations in connection with the Topsoiling, Seeding, Sodding and Planting and related work within the contract limits.

2D-02 GENERAL: For locations and extent of work see Drawings. The work consists of, but is not limited to the following:

2D-02.1 Preparation of the subgrade after it has been graded as specified under another Section of the Specification.

2D-02.2 Furnishing, placing and spreading topsoil.

2D-02.3 Furnishing and incorporating, organic matter, fertilizer, lime, insecticides and similar materials in the topsoil.

2D-02.4 Grading, rolling, raking and seeding of areas indicated on drawings to be seeded.

2D-02.5 Furnishing and installing sod on slopes and on other areas where noted on drawings.

2D-02.6 Excavating and backfill as required for Plant Materials and the immediate disposal from the Site of all excavated subsoil.

2D-02.7 Submitting samples and analyses for approval in accordance with the requirements of the Specification.

2D-02.8 Furnishing, tagging, planting, staking, fertilizing, spraying and mulching all plant materials.

2D-02.9 Protection, maintenance, guarantee and replacement of seeded and sodded areas and plants.

2D-02.10 Protection and maintenance of existing trees.

2D-02.11 Clean-up.

2D-02.12 All other labor and materials necessary or required to satisfactorily complete the work.

2D-03 WORK SPECIFIED UNDER OTHER SECTIONS

2D-03.1 Grading of subgrade to a point 6" below finished grades for seeded and sodded areas.

2D-03.2 Construction of pavements, gravel walks and sidewalks.

2D-04 STANDARDS

2D-04.1 Analyses and tests of materials such as, but not limited to, topsoil, fertilizers, insecticides and other materials of similar character required to be made under these Specifications shall be made in accordance with the current method of the Association of Official Agricultural Chemists.

2D-04.2 Plant names used in Plant List, as noted on Drawings, conform to "Standardized Plant Names", published by the American Joint Committee on Horticultural Nomenclature (Current Edition).

2D-04.3 The size and quality standards of nursery stock shall conform to those of the American Association of Nurserymen, unless otherwise specified.

2D-05 SAMPLES, ANALYSES AND TESTS

2D-05.1 Samples and certified analyses of a recognized laboratory shall be submitted by the Contractor at his own expense for approval by the Contracting Officer for topsoil, humus, fertilizers, grass seed, sod, insecticides and materials of similar character before delivery to the Site. Manufacturer's certified analysis for Standard Products will be acceptable in lieu of laboratory tests subject to the approval of the Contracting Officer.

2D-05.2 Submit samples in approved containers, in proper amounts, appropriately labeled.

2D-05.3 Samples of grass seed before mixing shall be submitted in one pound bags. The cost of the tests and analyses of each sample shall be borne by the Contractor.

2D-05.4 Approval of samples shall not be construed as final acceptance. The Government reserves the right to take samples of the materials delivered to the Site and have them analysed for comparison with the Specification requirements. If the tests show non-compliance with the Specifications, the cost of such tests shall be borne by the Contractor. Material delivered which does not comply with the Specifications shall be rejected and shall be removed from the site by the Contractor.

2D-06 INSPECTION

2D-06.1 The Contractor shall be responsible for furnishing all certificates of inspection of plant materials as required by Federal, State or other Authorities to accompany each shipment of plants and on arrival, the certificates shall be filed with the Government Representative.

2D-06.2 Prior to inspection of plant materials by the Government Represen-

tative, the Contractor shall select and tag with identification numbers all trees, speciment plants, and three or more samples typical of each kind and size of all other plant materials proposed for use.

2D-06.3 All plants shall be subject to inspection by the Government Representative. Plants required for the work may be inspected and tagged at the place of growth before being dug. Inspection and tagging at the place of growth shall not affect the Government's right to reject such plants on or after delivery thereof to the site.

2D-06.4 Inspection of plants at the place of growth or upon delivery will be for quality and size; variety, color and all other requirements being the responsibility of the Contractor. Inspection for size of ball of roots, latent defects and for other requirements will be made at the Site during progress of the work.

2D-06.5 Tagged samples of plant materials shall be delivered to the Site and planted in locations approved by the Government Representative. These tagged samples shall be maintained, protected and used as standards for comparison with the plants furnished for the work.

2D-06.6 The Contractor shall make a formal request in advance for any inspections at the various nurseries and collecting grounds. This request shall state the location of the nursery or collecting grounds and shall list the particular plants which are to be inspected as well as the size of such plants.

2D-06.7 If the plants and materials which are required to be inspected are more than 100 miles from the site, the cost of the inspection, travel and maintenance of the Government's Inspector shall be borne by the Contractor.

2D-06.8 Inspection of topsoil, humus and manure will be made prior to time of delivery to the Site. The Government may require field, storage pile or pit examination and take samples for analysis.

2D-06.9 Inspection of soils and plant materials shall be made between June 15 and September 15 and between December 15 and March 15, unless otherwise directed by the Contracting Officer.

2D-07 WATER: The Contractor shall arrange for and pay for all water required for the execution of the work.

2D-08 TOPSOIL

2D-08.1 Topsoil shall consist of natural loam, of uniform quality, free from subsoil, hard clods, stiff clay, hard pan, sods, partially disintegrated debris, or any other undesirable material, and shall contain at least 2 percent organic matter determined by loss on ignition of moisture-free samples

dried in accordance with current methods of Association of Official Agricultural Chemists. Acidity range shall be pH 5.0 to pH 7.0 inclusive.

2D-08.1.1 MECHANICAL ANALYSIS

Passing	Retained on	Percentage
1-inch screen		100 percent
1-inch screen	¼-inch screen (gravel) No.	not more than 3 percent
¼-inch screen	100U.S.S. mesh sieve(sand)	40 percent - 60 percent
No. 100 U.S.S. mesh sieve	(very fine sand, silt and clay)	40 percent - 60 percent

All percentages are to be based on dry weight of sample.

2D-08.1.2 CHEMICAL ANALYSIS

Electrical conductivity	under 50
Nitrate nitrogen:	40
Ammonia nitrogen:	25
Phosphorus:	160
Potassium:	250
Calcium:	4000

2D-08.2 Contractor shall furnish a certified report of an approved analytical chemist showing the analyses of representative samples of topsoil proposed for use. Topsoil shall not be delivered to the site until approval of samples by the Contracting Officer, but such approval shall not constitute final acceptance. The Government reserves the right to reject on or after delivery any material which does not meet these specifications, or in which more than sixty percent of the material passing a No. 100 U.S.S. mesh sieve consists of clay as determined by the buoyoucous hydrometer or by the decantation method.

2D-08.3 Topsoil stripped from the site may be used if meeting the requirements specified. Submit analysis. If the existing topsoil is deficient in plant food, it may be enriched in accordance with the recommendations of the local county agricultural agent or the local County Agricultural Extension Director or the Regional Land Grant College, subject to the approval of the Contracting Officer.

2D-08.4 When grading of site is completed, all surface areas designated on contract drawings to receive sodding or seeding, with the exception of surface areas occupied by exposed structures or paved areas shall be topsoiled and left ready for seeding or sodding.

2D-08.5 Seeded and sodded areas shall be surfaced with topsoil at least 6" thick after compacting. Existing grades shall be modified, as necessary to fulfill this requirement, even if existing grades coincide with the finished grades.

2D-08.6 After filling, grading and other contract operations have been completed, to the point where these areas will not be disturbed by any subsequent work, the subgrades shall be cleaned free from waste materials of all kinds, then scarified and pulverized to a depth of 4", graded to remove surface inequalities and then covered with topsoil to the depth specified.

2D-08.7 The topsoil shall be spread uniformly and then compacted by a roller, weighing 85 to 100 pounds per foot of width, to the required lines and levels and the minimum thickness specified. The subgrade and topsoil shall be damp and free from frost when the work is performed and none of the work shall be done under dusty, muddy, or freezing conditions.

2D-08.8 If the topsoil is sandy add peat, 4 bales (6 cu. ft./bale) per 1000 square feet of area. If the topsoil is heavy clay add 5 cu. yds. of coarse sand or 750 pounds of calcined clay per 1000 square feet of area. Regardless of which material is used, thoroughly mix with the upper 6" of soil, using a roto-tiller, disc harrow or other approved mechanical means.

2D-08.9 Fumigate soil with menthyl bromide or other approved soil fumigants before planting to control objectionable grasses, weeds, certain diseases causing soil organisms, nematodes, and certain soil insects. Use soil fumigants according to the manufacturer's directions. Do not use these fumigants under and around trees or other valuable plants.

2D-09 MATERIALS

2D-09.1 Manure: Well rotted cow, horse or sheep manure free from sawdust, shavings or refuse of any kind, and shall not contain more than 25 percent of straw by volume.

2D-09.2 Lime: Ground Dolomitic limestone containing not less than 85 percent of calcium and magnesium carbonates, ground so that 100 percent will pass a No. 10 screen and not less than 50 percent will pass a No. 100 screen. Labels on packages shall show content and screen analysis.

2D-09.3 Fertilizer: A complete fertilizer meeting the requirements of

Federal Specification O-F-241a, with percentages of nitrogen, phosphoric acid and potash as herein specified. Fertilizer shall be furnished in bags or other standard containers, with name, weight and guaranteed analysis of contents clearly marked thereon.

2D-09.3.1 Combined N-P-K content shall be not less than 20 percent of the total, and the N content shall be not less than 5 percent of the total, by weight.

2D-09.4 Bone Meal: Finely ground having a minimum analysis of 2 percent nitrogen and 20 percent phosphoric acid.

2D-09.5 Peat: A natural residue formed by the decomposition of reeds, sedges or mosses from fresh water site, free from lumps, roots and stones, conforming to Federal Specification Q-P-166c. Moss peat shall be of horticultural grade (fine shreds).

2D-09.6 Sand: Clean, coarse, ungraded sand conforming to requirements of ASTM C-33.

2D-09.7 Mulch: Well rotted sawdust, minimum 2 years old, shredded pine bark or tan bark.

2D-09.8 Tree Paint: R.I.W. Tree Surgery Paint, Toch Bros., New York, N.Y.; Sherwin Williams Pruning Compound, or approved equal.

2D-10 MATERIALS FOR GUYING AND WRAPPING

2D-10.1 Stakes: Sound No. 2 Douglas fir of uniform dimension, or white cedar posts sizes as indicated on drawings. Stakes of Douglas fir shall receive 1 coat primer and 2 coats of exterior type oil paint, color black green (almost black).

2D-10.2 Wire: Guy wires for fastening trees to stakes: gauge, pliable galvanized iron.

2D-10.3 Hose: For encasing guy wires; 2-ply reinforced rubber garden hose, not less than ½" diameter; new or used.

2D-10.4 Turnbuckles: Zinc-Coated, with 3" minimum lengthwise opening with each end 3/16" diameter threaded opening fitted with screw eyes.

2D-10.5 Wrapping Material: First quality burlap, at least 8 oz. in weight or two thicknesses of crinkled paper cemented together with bituminous material. Wrapping material shall be in strips 8 to 10 inches wide. Twine for tying shall be a lightly tarred medium or coarse sisal yarn.

2D-11 SEEDING AND SODDING

2D-11.1 Seed: Seed mixtures shall meet requirements of the Federal Seed Act if carried by interstate commerce, or requirements of the State seed law if procured locally. Containers shall be so labeled by the supplier. Minimum percentages, by weight, of pure seed and germination and maximum allowable percentage of weed seed specified herein have been established by application of tolerances provided under the Federal Seed Act. These requirements shall apply whether seed is used individually or mixed. Seed which fails to meet minimum requirements for purity of germination, or exceeds maximum allowance for weed seed will be rejected.

Kind of Seed	Pure Seed (Minimum)	Germination (Minimum)	Weed Seed (Maximum)
Carpet grass... (Axonopus compressus)	89.20 percent	83 percent	0.87 percent
Chewings Fescue (Festuca rubravar.fallax)	95.50 percent	72 percent	0.87 percent
Creeping Red Fescue..... (Festuca ruba	95.50 percent	72 percent	0.87 percent
Alta Fescue.....	95.50 percent	72 percent	0.87 percent
Bermuda Grass..... (Cynodon dactylon)	95.50 percent	77 percent	1.49 percent
Kentucky Blue Grass..... (Poa pratensis)	80.50 percent	72 percent	1.49 percent
Rough Blue grass... (Poa trivialis)	80.50 percent	72 percent	1.49 percent
Redtop..... (Agrostic alba)	89.20 percent	83 percent	1.49 percent
Italian Ryegrass (Lolium multiflorium)	96.80 percent	83 percent	0.87 percent
White Clover..... (Trifolium repens)	94.30 percent	83 percent	1.49 percent
Blue Gama-grass..... (Bouteloua gracilis)	95.50 percent	77 percent	1.49 percent
Lespedeza..... (Lespedeza striata)	94.30 percent	83 percent	1.49 percent

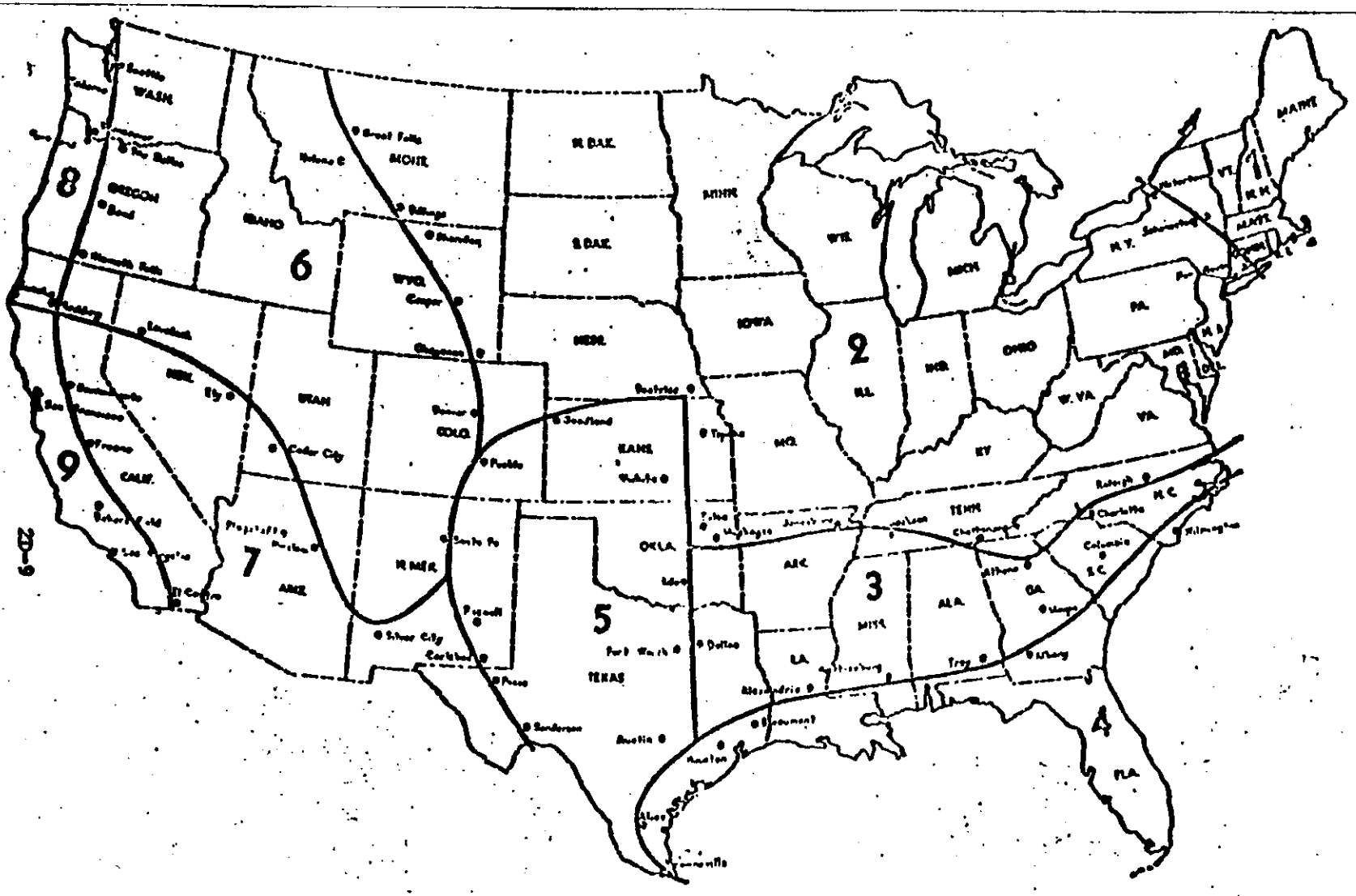
2D-11.2 Delivery: Seed mixtures shall be delivered in original sealed

packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination and weed seed content.

2D-11.3 Type of Seed: Seed shall be one of the "Regular Grass" mixtures specified for the Region in which the Project occurs except that areas subject to shade or restricted sunshine shall be seeded with one of the "Shade Grass" mixtures specified for the Region in which the Project Occurs as indicated on the U.S. Map of Lawn Grass Regions".

2D-11.3.1 Seed Mixtures

Region	Regular Grass	Shade Grass
1	1	12 or 13
2	2 or 3	12 or 13
3	5	14 or 16
4	5, 7 or 8	15
5	4, 6 or 7	None
6	1, 2 or 3	12 or 13
7	1, 6, 7 or 9	None
8	1	12 or 13
9	9, 10 or 11	15



U.S. Map of Lawn Grass Regions

ZA-SID-006

2D-11.4 Regular Grass Mixtures: Percentages are by weight.

1
95% Kentucky Blue
5% White Clover

2
78% Kentucky Blue
15% Red Top
5% Perennial (Italian) Rye
2% White Clover

3
90% Kentucky Blue
10% Creeping Red Fescue

4
Buffalo Grass plugs and
Blue Gamagrass Seed

5
Bermuda Stolons and
Carpet seed for Spring and
Summer Seeding;
Bermuda Stolons and Italian
Rye seed for Fall Seeding.

6
Bermuda Stolons

7
Centipede Stolons

8
St. Augustine Stolon
(Improved Bitter Blue
variety preferred).

9
70% Bermuda seed
30% Red Top

10
67% Kentucky Blue
33% Red Top

11
67% Kentucky Blue
33% White Clover

2D-11.5 Shade Grass Mixtures: Percentages are by weight.

12
60% Kentucky Blue
30% Chewings Fescue
9% Red Top
1% White Clover

13
40% Chewings Fescue
25% Rough Blue
20% Kentucky Blue
15% Red Top

14
Kentucky Blue

15
St. Augustine Stolons
(Improved Bitter Blue
variety preferred).

16
Carpet Seed

2D-11.6 Time For Seeding: The time for seeding, including the planting of stolons or pieces of sod as well as seeding, shall be done at such times as noted below for the State in which the Project occurs.

STATE	SPRING SEEDING	FALL SEEDING
Alabama	Feb. 15 - April 1	Sept. 15 - Oct. 15
Arizona	Early Summer - June (When Ground is Warm)	Fall (Domestic Rye) Usually, Oct. 20 - Nov. 30
Arkansas	April 1 - May 1	Sept. 15 - Oct. 15
California	April 1 - June 1	July 1 - Sept. 15
Colorado	April 25 - June 1	Aug. 15 - Sept. 12
Connecticut	March 15 - June 1	Sept. 15 - Oct. 20
Delaware	March 1 - April 30	Sept. 15 - Oct. 15
Florida	April 1 - June 30	
Georgia	March 1 - May 15	(Plant any Month)
Idaho	April 15 - June 15	Sept. 1 - Sept. 30
Illinois	Feb. 15 - May 1	Sept. 1 - Nov. 1
Indiana	March 10 - April 15	Sept. 10 - Oct. 10
Iowa	March 15 - April 15	Aug. 15 - Sept. 20
Kansas	April 1 - June 1	Sept. 1 - Nov. 1
Kentucky	March 15 - April 15	
Louisiana	Nov. 15 - March 15	
Maine	May 1 - May 15	Aug. 15 - Sept. 10
Maryland	March 15 - April 15	Aug. 15 - Oct. 15
Massachusetts	Feb. 20 - March 20	Aug. 15 - Sept. 20
Michigan	March 30 - April 20	Aug. 15 - Sept. 10
Minnesota	May 15 - July 15	Sept. 1 - Sept. 15
Mississippi	March 1 - May 1	Sept. 1 - Oct. 1
Missouri	March 1 - April 30	Oct. 1 - Nov. 15
Montana	March 15 - May 30	Oct. 1 - Nov. 1
Nebraska	April 20 - May 15	Aug. 1 - Sept. 15
Nevada	April 1 - June 15	Sept. 1 - Oct. 1
New Hampshire	April 25 - May 25	Aug. 20 - Sept. 15
New Jersey	April 1 - May 1	Aug. 15 - Sept. 30
New Mexico	April 5 - April 15	July 15 - Aug. 15
New York	April 15 - June 15	Aug. 1 - Oct. 1
North Carolina	March 15 - April 30	Sept. 1 - Nov. 30
North Dakota	March 15 - April 15	Sept. 1 - Nov. 30
Ohio	April 25 - May 5	Aug. 5 - Sept. 15
Oklahoma	Feb. 15 - April 15	Sept. 15 - Nov. 15
Oregon	April 1 - June 1	Sept. 15 - Oct. 15
Pennsylvania	April 1 - May 15	Sept. 1 - Sept. 15
Rhode Island	April 15 - May 30	Aug. 15 - Sept. 15
South Carolina	March 1 - April 30	Feb. 15 - May 31
South Dakota	May 1 - Sept. 15	
Tennessee	March 1 - May 1	Sept. 1 - Nov. 1
Texas	Jan. 20 - April 20	
Utah	April 1 - July 1	Aug. 1 - Oct. 1
Vermont	April 20 - May 1	Oct. 1 - Oct. 20
Virginia	Feb. 1 - March 15	Sept. 1 - Oct. 15
Washington	Feb. 1 - April 30	Sept. 1 - Oct. 31
West Virginia	March 1 - May 15	July 15 - Aug. 15
Wisconsin	April 15 - June 10	Oct. 10 - Nov. 10
Wyoming	March 1 - June 1	Sept.1 - Oct. 15

2D-11.7 Sod: Sod shall be obtained from areas having growing conditions similar to areas to be covered. Sod shall have a clean growth of acceptable grass, reasonably free of weeds, with not less than 1 1/2 inches of soil firmly adhering to roots. Cutting shall be rectangular strips, of equal width, and size to permit being lifted and rolled without breaking. If the soil is dry, sod shall be watered sufficiently to moisten the soil to the depth at which the sod is to be cut. Damping from vehicles will not be permitted. Damaged sod will be rejected. Replanting shall be done within 48 hours after time of harvesting or sod shall be kept damp until planted.

2D-12 SOIL PREPARATION

2D-12.1 Areas to be seeded shall be raked free of stones and debris and compacted by a roller weighing 85 to 100 pounds per linear foot of width, to the minimum depth specified.

2D-12.2 Areas to be sodded shall be disced and raked free of stones and debris, disced again at right angles and raked. Stones or debris over 1 inch in any dimension shall be removed from the premises.

2D-12.3 Ground limestone or agricultural lime shall be spread on the topsoil at the rate of 45 to 50 pounds per 100 square feet and mixed into the soil to a depth of 2 inches before or at the same time the Commercial fertilizer is applied.

2D-12.4 Fertilizer shall be spread at a rate per thousand square feet of area, in accordance with the following table.

5N-10P-5K:	30 lbs.	8N-6P-6K:	20 lbs.
6N-12P-2K:	25 lbs.	10N-6P-4K:	15 lbs.
7N- 7P-6K:	22 lbs.	10N-5P-5K:	15 lbs.

Fertilizer shall be mixed into the soil to a depth of at least 2 inches by discing or harrowing.

2D-13 SEEDING: Surface shall be fined by raking before seeding. Seed shall be uniformly distributed at the rate of not less than 5 pounds of seed per 1000 square feet of area; 50 percent sown in one direction the remainder sown at right angles to first sowing. Cover lightly by raking and compact the soil by rolling.

2D-14 SODDING

2D-14.1 Banks and slopes with more than 1 foot rise in 3 feet and other areas noted on drawings shall be sodded.

2D-14.2 Soft spots and inequalities in grade shall be corrected.

2D-14.3 Soil shall be watered immediately before sod is planted. Planting shall not be started until the Contracting Officer has approved the condition of the soil. Planting shall be completed before seeding is started in the same area.

2D-14.4 Sod shall be laid without voids and tamped or rolled. Screened topsoil shall be broomed over entire area and the sod shall be throughly watered. The completed surface shall be true to finished grade lines; even and firm at all points. Sod or slopes steeper than 1 or 2 shall be staked with wooden pins about one inch square by 6 inches long, driven flush with top of sod. Stakes shall be placed not more than 18 inches on center.

2D-15 LAWN MAINTENANCE AND PROTECTION

2D-15.1 Lawns shall be protected and maintained by watering, mowing, weeding and replanting as necessary to establish a uniform stand of grass until acceptance by the Government.

2D-15.2 Protect against trespassing and damage of any kind. Promptly renew damaged or washed-out areas. Protect banks from erosion and washing with adequate stabilizing material such as straw or salt hay; renew or replace as necessary.

2D-15.3 During the maintenance period, mow seeded and sodded areas at a height of 2" and at no time allow to exceed 3 1/2".

2D-16 PLANTING

2D-16.1 Plant Materials: As noted on the Drawings.

2D-16.2 Nomenclature: Names of plants required conform to those given in "Standardized Plant Names," prepared by the American Joint Committee on Horticultural Nomenclature. Names of varieties not included therein conform generally with names accepted in the nursery trade.

2D-16.3 Quantities: As necessary to complete planting as shown and located on the drawings.

2D-16.4 Quality and Size: Nursery grown, habit of growth that is normal for the species, sound, healthy, vigorous and free from insects, plant diseases, and injuries. Equal to or exceeding measurements specified in plant list. Plants measured before pruning with branches in normal position; necessary pruning done at time of planting. Sizes and methods of handling according to the code of standards recommended by the American Association of Nurserymen Inc.

2D-16.5 Substitutions: Upon submission of proof that plant is not obtainable, a change order may be procurred, without increase in contract price, if authorized by the Contracting Officer providing for use of nearest equivalent size or variety of plant having same essential characteristics.

2D-16.6 Type of Protection to Roots:

2D-16.6.1 Balled and Burlapped Plants: Plants designated "B&B" in plant list dug with firm natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of plant. Balls firmly wrapped with burlap or similar material and bound with twine, cord or wire mesh. Where necessary to prevent breaking or cracking of ball during process of planting, ball to be secured to a platform.

2D-16.6.2 Bare-root Plants: Plants designated "BR" in the plant list dug and the earth removed without injury to fibrous root system. Roots covered with thick coating of mud by puddling or wrapped in wet straw, moss, or other suitable packing material immediately after digging for protection until delivered.

2D-16.7 Protection After Delivery: Balls of "B&B" plants which cannot be planted immediately on delivery covered with moist soil or mulch or other protection from drying. Bare-rooted plants planted or heeled in immediately upon delivery. All plants watered as necessary until planted.

2D-16.8 Pot-Grown Plants: Plants designated pot-grown, with well established root systems sufficient to hold earth together, after removal from pot but not root bound. Size of plant shown on plant list inside diameter of standard pot in which plants have been grown for at least 3 months prior to delivery.

2D-16.9 Heeled in Plants: If heeled in, all bundles of plants opened and the plants separated before the roots are covered and care taken to prevent air pockets among roots.

2D-17 ANTI-DESICANT: Wilt-proof, available from Nursery Specialty Products, Inc., Craton Falls, New York, delivered in the manufacturer's containers and used according to his instructions.

2D-18 TOP SOIL MIXTURE FOR PLANT PITS AND BEDS: Mix materials thoroughly by hand or rotary mixer in the following proportions: 3 parts by volume of topsoil 1 part manure; 1 part sand; and 5 lbs. bonemeal per cubic yard of soil mixture.

2D-19 TIME OF PLANTING: The Contractor shall prepare topsoil for plant pits prior to planting. Planting operations shall be conducted under favorable weather conditions during the next season or seasons which are normal for such work, as determined by accepted practice in the locality of the project.

2D-20 TRANSPLANTING: Move existing trees and shrubs designated on Drawings for utilization elsewhere on project from original location prior to construction operations. If such plants cannot be set in final locations, ball securely, burlap platform and store temporarily in a protected location; protect balls from drying winds and sun by packing in peat moss or leaf mold; individual tree balls are to be boxed to retain this mulch.

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Procedures for transplanting shall be performed in accordance with standard nursery practices, including watering, and prevention of loss of essential feeding roots or injuries to bark, branches or roots.

2D-21 EXISTING TREES TO REMAIN: Where existing trees are designated on Drawing as trees to remain protect by fencing around the area beneath the spread of branches, defining the area for tree root protection. No material shall be stored and no activity is permitted within the fenced area, except as may be necessary to facilitate work of seeding, or the installation of utility lines. Water shall not be permitted to pond within the fenced areas. Infected existing trees shall be sprayed to prevent spread of disease or insect pests to new plantings. Materials and methods used shall not cause injury to persons or structures.

2D-22 PRUNING AND REPAIR: Upon completion of work under this contract, prune all trees and repair injuries. Amount of pruning limited to minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots as a result of transplanting operations. Do pruning in such a manner so as not to change natural habit or shape of plant. Make all cuts flush leaving no stubs. On all cuts over 3/4 inch in diameter and bruises or scars on bark, the injured cambium shall be traced back to living tissue and removed; smooth wounds and shape so as not to retain water; coat treated area with an approved tree paint.

2D-23 OBSTRUCTIONS BELOW GROUND: Locate new planting where shown on plans excepting where obstructions below ground are encountered or where changes have been made in the construction; then necessary adjustments as approved by the Contracting Officer will be made. No planting except ground cover to be placed closer than 18 inches of pavements and structures. Necessary changes in location must be approved in writing prior to planting.

2D-24 PLANTING - GENERAL

2D-24.1 Planting pits dug and soil for planting to be ready before plants are delivered. Excavate circular pits with vertical sides for all plants. Make diameter of pits for all plants at least one foot greater than the diameter of the ball. Make depth of pits for trees, shrubs and vines sufficient to accommodate ball or roots when plant is set to finished grade allowing 3 inches of compacted prepared topsoil in the bottom of pit as shown in planting details.

2D-24.2 Set plants upright and faced to give the best appearance or relationship to adjacent structures. Do not pull burlap from under balls. Remove wire and surplus binding from top and sides of balls. Spread roots in normal position. Cut off all broken or frayed roots cleanly. Place and compact prepared topsoil carefully to avoid injury to roots and to fill voids. When hole is nearly filled, add water as necessary and allow to soak away. Fill hole to finished grade and form shallow saucer around plant by placing ridge of topsoil around edge of pit. After ground settles, fill with additional soil to level of finished grade.

2D-24.3 Dispose of excess excavated material off site.

2D-24.4 Trees: Where applicable, plant trees before surrounding smaller plants and ground covers are in place. Where trees are shown on Drawing aligned with equal spaces between trees, adjust interval between trees as necessary to keep trees evenly spaced unless otherwise directed.

2D-24.5 Shrubs: Plant on centers as indicated with spacing adjusted if necessary to evenly fill bed using specified quantity of plants.

2D-24.6 Hedges: Plant in trenches excavated at least 4 inches deeper and 12 inches wider than spread of roots or diameter of balls. Adjust spacing if necessary to fill trench evenly with indicated quantity of plants.

2D-24.7 Ground Covers: Plant in beds having minimum 8 inch depth of prepared topsoil with 2 inch depth of peat spread on bed and thoroughly mixed into soil to depth of 6 inches before planting. Treat ground cover beds after preparation for planting, but before any plants are installed within bed area, with Vapam, granular calcium cyanimide or approved equal to destroy weed seeds. Apply according to manufacturer's directions delaying planting for the recommended minimum period to allow dissipation of herbicide. Space plants so that indicated quantity evenly fills ground cover bed.

2D-24.8 Mulch: Trees and planting beds provided with 2 inch layer of mulch within 2 days after planting and kept at this depth throughout maintenance period. Mulch to entirely cover area of saucer around each tree.

2D-24.9 Guying, Staking and Wrapping: Support trees immediately after planting. All trees supported and wrapped, as shown in details.

2D-24.9.1 Guying: Guy trees at points of branching with 3 wire guys spaced equally around and outside perimeter of ball. Cover guy wires with rubber hose or protect bark with approved material at points of contact. Position each guy below crotches and fasten to wood dead man, 18" below grade. Provide one turnbuckle for each guy.

2D-24.9.2 Staking: Support trees without adequate room for guying by 3 stakes, placed in a triangle at perimeter of ball and to sufficient depth to hold tree rigid. Drive stakes vertically, do not twist or pull. Wire tree to top bracing members. Provide rubber hose protection as specified above for guying.

2D-24.9.3 Wrapping: Promptly after planting, trunks of trees wrapped spirally from ground line to height of second branches. All wrappings neat and snug and material held in place by twine at top and bottom.

2D-24.10 Spray: Spray to retard transpiration before digging of each tree, with anti-desicent, using power sprayer to apply an adequate film over trunks, branches, twigs and foliage.

2D-25 MAINTENANCE

2D-25.1 The Contractor shall be held responsible for the maintenance of all work and parts thereof prior to the issuance of the Certificate of Final Acceptance. No trees or shrubs will be accepted unless they show a healthy growth and satisfactory foliage conditions.

2D-25.2 Maintenance shall include watering of lawns, trees and plants, cultivation, pruning, weeding, mowing, spraying, pruning of trees and shrubbery, cleaning up, edging, repairs to guy wires, stakes and wrappings, guards, repairs of minor washouts and gullies to six inches, and all other necessary work of maintenance.

2D-25.3 During the maintenance period and up to the issuance of Certificate of Final Acceptance, the Contractor shall do all seasonal spraying of trees and shrubbery as required principally:

2D-25.3.1 Arsenate of lead spray for caterpillars and chewing insects. Arsenate of lead in powder form shall be used at the rate of two (2) pounds to fifty (50) gallons of water with one (1) pound of Casein Sticker added.

2D-25.3.2 Bordeaux Mixture, dry powder form for fungus and leaf disease. For Leaf blight on Plane trees. Rate: 6 to 8 pounds to 50 gallons of water.

2D-25.3.3 Fish-oil soap, for scale on thorns and flowering crabs. Rate: 1 pound to 10 gallons of water.

2D-25.3.4 Lime-sulphur, liquid form, for scale dormant spray. Rate: 1 gallon to 10 gallons of water.

2D-25.3.5 Nicotine-sulphate plus Volchk's nursery spray. For wooly aphis on thorns, flowering crabs and others. Rate: 1/2 pint nicotine sulphate plus 2 quarts of Volchk's nursery spray to 50 gallons of water. Spraying as listed may be varied as required under special conditions.

2D-26 REPLACEMENTS:

2D-26.1 Any trees, shrubs or vines not found to be in a healthy growing condition, at any time during the period of guaranty shall be removed from the Site and replaced during the immediate planting season following the notification by the Contracting Officer.

2D-26.2 Plant replacements shall be of the same kind and size as specified in the Plant List. All plant replacements shall be inspected, sealed, furnished, planted and mulched as specified, at the Contractor's expense. All paved areas shall be kept clean at all times.

2D-26.3 Where trees are replaced, the Contractor shall be responsible for replacing any pavements damaged or removed.

2D-27 CLEAN UP

2D-27.1 The Contractor shall remove from the Site all subsoil excavated from his work and all other debris, including but not limited to branches, rocks, paper and rubbish in all landscape areas as the work proceeds.

2D-27.2 All areas shall be kept in a neat and orderly condition at all times. Prior to final acceptance, the Contractor shall clean up the entire landscaped areas to the satisfaction of the Contracting Officer.

2D-28 COOPERATION

2D-28.1 Cooperate and coordinate work with that of other trades supplying materials or performing work in contact with, connecting to, underlying or overlaying the work of this Section.

2D-28.2 Provide complete data of requirements for work under this Section to those other trades whose work is affected by, or dependant upon, the work of this Section.

2D-28.3 Provide to the job or install in place, or both, any and all items required to be built into other work in ample time to avoid delaying the normal progress of such other work.

2D-29 VERIFYING CONDITIONS

2D-29.1 Visit the site, verify all conditions covering or affecting the work of this Section. Verify all dimensions.

2D-29.2 Examine all drawings covering the work of this Section and refer to all other drawings, including mechanical and electrical drawings, which may affect the work of this Section or require coordination by this trade.

2D-29.3 Before starting any work, make a thorough examination of those portions of the Project in which the work of this Section is to be performed. Check all work adjoining or underlying locations in which the work of this Section is to be installed. Report any and all conditions which may interfere with or otherwise affect or prevent the proper execution or completion of the work of this Section. Do not commence any work until any all such conditions have been corrected by the trade or trades responsible.

2D-30 GUARANTEES

2D-30.1 The Contractor shall guarantee, in writing, all workmanship and materials (except for lawns) for two years from date of final acceptance.

2D-30.2 At any time within the period of the guarantee, the Contractor shall replace any plant which, for any reason, has died or is in a dying condition, or which has failed to flourish in such a manner or in such a degree that its usefulness or appearance has been impaired: and he shall further make good any other damage, loss, impairment, or defect in materials or work where the loss, impairment, destruction or failure to flourish sufficiently is the result of inferior or defective materials or workmanship or unfavorable weather conditions. The Contractor shall also make good all damage to persons or property caused by defective workmanship or materials.

2D-30.3 After the completion of any work, the Contractor shall, from time to time, inspect the water, cultivation, and other maintenance operations carried on by the Government or its agents with respect to such work, and promptly report to the Contracting Officer any methods, practices or operations which he considers unsatisfactory, and not in accord with his interests or good horticultural practice. The failure of the Contractor so to inspect or report shall be construed as an acceptance by him of the Government's or its agents maintenance operations, and he shall not thereafter claim or assert that any defects which may later develop are the results of such methods, or practices or operations.

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DIVISION 3

SECTION A

CONCRETE AND CEMENT WORK

3A-01 SCOPE: The work covered by this Section consists in furnishing all plant, labor, materials, tools, equipment, appliances, and services required to manufacture, deliver, furnish and install concrete and cement work, and related work, complete, in strict accordance with this Section and the applicable drawings.

3A-02 APPLICATION: Requirements herein for mixing, placing, curing and finishing concrete govern all concrete work in all Section's.

3A-03 GENERAL: For location and extent of work, see drawings.

3A-04 COOPERATION

3A-04.1 Cooperate and coordinate work with all trades supplying materials or performing work in contact with, connecting to, underlying or overlying work of this Section.

3A-04.2 Provide complete data of requirements for work under this Section to those trades whose work is affected by, or dependent upon, the work of this Section.

3A-04.3 Provide to the job or install in place, or both, any and all items required to be built into other work in ample time to avoid delaying the normal progress of such other work.

3A-05 VERIFYING CONDITIONS

3A-05.1 Visit the site; verify all conditions covering or affecting the work of this Section. Verify all dimensions.

3A-05.2 Examine all drawings covering the work of this Section and refer to all other drawings, including mechanical and electrical drawings, which may affect the work of this Section or require coordination.

3A-05.3 Before starting work, make a thorough examination of those portions of the structure in which the work of this Section is to be performed. Check all work adjoining or underlying locations in which the work of this Section is to be installed.

3A-06 SUPERVISION

3A-06.1 During progress of concrete work, provide competent superintendent, acceptable to the Government's Representative, thoroughly experienced in cast-in-place reinforced concrete work, who has been authorized to receive and execute orders of the Government's Representative.

3A-06.2 Duty of superintendent is: to see that all plans, specifications and instructions from the Government's Representative are strictly carried out; supervise installation of all steel reinforcing; check that all formwork has been properly prepared, installed, and cleaned to receive concrete and to provide architectural and structural concrete finishes approved by the Government's Representative; certify that all joints are in proper locations; and check that correct mixture of concrete is used in each specific location.

3A-07 REGULATIONS, REFERENCES, AND STANDARDS

3A-07.1 Have available in field at all times for reference, latest editions of following regulations, standards, etc., which are included in and made part of these specifications subject to any qualifications herein:

(a) Governing Local Building Codes.

(b) "Building Code Requirements for Reinforced Concrete" (American Concrete Institute 318).

(c) "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (American Concrete Institute - 315).

(d) "Recommended Practice for Winter Concreting" (American Concrete Institute - 604).

(e) "Recommended Practice for Hot Weather Concreting" (American Concrete Institute - 605).

(f) "Recommended Practice for Selecting Proportions for Concrete" (American Concrete Institute - 613).

(g) "Recommended Practice for Measuring, Mixing and Placing Concrete" (American Concrete Institute - 614).

(h) "Consolidation of Concrete" (American Concrete Institute - 609).

(i) "Formwork for Concrete" (American Concrete Institute - 662 and SP-4).

(j) "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau" (National Ready Mixed Concrete Association - Ref. 51).

(k) "Standards for Operation of Truck Mixers and Agitators" (National Ready Mixed Concrete Association - Ref. 52).

(l) "Standard Specifications for Ready Mixed Concrete" (ASTM C-94).

(m) "Recommended Practice for Cold Weather Concreting" (American Concrete Institute - 306).

3A-07.2 Where reference is made to Specifications of American Society for Testing Materials (ASTM) or other specific standard, furnish material and/or work in strict accordance with reinforced standard.

3A-07.3 In event of discrepancies between various regulations and standards referred to above, the most stringent requirements shall govern.

3A-08 REJECTIONS

3A-08.1 Defective material may be rejected at any time whether in place or not. Promptly remove and replace rejected material.

3A-09 MEASUREMENTS

3A-09.1 Lay out work in strict accordance with drawings and be responsible for correct location of same. Offsets in any exposed concrete work are not permitted unless so indicated in the drawings. Lay out from at least two pre-established bench marks and axis lines, and individually correct for length and width.

3A-09.2 Align and correspond all exposed concrete joints.

3A-10 TOLERANCES -TOWER SHAFT

3A-10.1 Variation from plumb and elevation in any direction in any single level shall not exceed 1/4".

3A-10.2 Finish tops of walls with steel trowel, tool edges to uniform elevation, and check finally with a straight edge.

3A-10.3 Maintain concrete sections in an alignment such that all faces shall conform to the vertical curve or plane. Where it is necessary to correct for misalignment, humor sections without offsets.

3A-10.4 A maximum tolerance of 1/4" in 12'-0" will be permitted in floors and ceilings, not cumulative.

3A-10.5 Camber forms and shores for beams and slabs 1/4" for each 15'-0" of span, unless otherwise noted on drawings. Camber top surface and set screeds to maintain uniform thickness.

3A-10.6 Tower Formwork

(a) Outside Curved Surfaces:

(1) Variation from plan dimension at any point - 1/4".

(2) Variation from grade at each horizontal lift joint - 1/4".

(3) Variation from grade for entire tower - 3/4".

(4) Variation of any 1" x 4" board from level - 1/8".

(5) Deflection between supports - 1/360 of span.

(6) Variation of level between adjacent boards - 1/16".

(7) Relative variation from curve between adjacent boards 1/16".

(8) Variation from plan position to entire structure - 1".

(b) Inside Vertical Surfaces:

(1) Variation from plumb for each lift - 1/4".

(2) Variation from plumb for entire tower - 3/4".

(3) Variation from grade at each horizontal lift - 1/4".

(4) Variation from grade for entire tower - 3/4".

(5) Variation from plan position for each lift - 1/2".

(6) Variation from plan position for entire structure - 1".

(7) Variation in size and locations of sleeves, openings and inserts - 3/8".

(8) Variation in wall and slab thickness - minus 1/4" and plus 1/2".

3A-11 TOLERANCES FOR CONCRETE WORK OTHER TOWER SHAFT

3A-11.1 Foundations for Base Building and Connecting Corridor: All concrete surface shall be finished within a tolerance of 1/2 inch in 10 feet;

provided that such deviation does not effect the architectural or structural portions of the buildings super structure. Where foundation alignment must be maintained due to architectural or structural requirements, the concrete shall be finished to a tolerance of 1/4 inch in 10 feet.

3A-11.2 Slabs for Base Building and Connecting Corridor: Concrete slabs shall be true plane surfaces finished with a tolerance of 3/8 inch in 10 feet.

3A-12 TEST PANELS

3A-12.1 At the earliest possible time and before commencement of any concrete which will be visible in the finished structure, construct complete, and finish a test panel as shown on the drawings cast in two lifts at a location on the site selected by the Government's Representative. Use a prototype of the forms and the same concrete materials, steel reinforcement, form ties, methods of construction, and finish as will actually be incorporated in the exposed concrete. Have present during this construction the superintendent and foreman mechanics who will be engaged on the actual work. Written approval of the test panel must be secured from the Government's Representative before commencing work on the exposed concrete. The approved test panel will serve as a standard of acceptance for the exposed concrete work.

3A-12.2 Apply to the approved test panel samples of patching mortar and grout for approval of color, texture and technique. Sandblast the test panel to demonstrate texture, technique and selection or penetration. Work must be approved by the Government Representative prior to actual work on the concrete which will be visible in the finished structure. After acceptance, apply water repellent for approval of material and method of application.

3A-13 SHOP DRAWINGS

3A-13.1 General: Shop drawings shall be submitted for all formwork and all reinforcing steel. The Contractor is not permitted to erect or use any formwork for concrete that has not received the written approval of Government Representative.

3A-13.2 Reinforcing Steel: Prepare and submit shop drawings showing positioning and reinforcement of concrete slabs, beams, walls, openings through concrete work, etc.; indicate elevations of foundation and retaining walls showing top and bottom levels, ledges, beam seats, pits, trenches, etc., and give all pertinent dimensions and levels tieing the features into the structure. Show sizes, placing, bending, splicing and lengths of all reinforcement detailed in accordance with ACI-315. Do not fabricate until shop drawings have received written approval of the Government Representative.

3A-13.3 Tower Formwork

(a) Design Criteria: Design formwork for following stresses and performance.

(1) Not less than full hydrostatic pressure of concrete (full head) plus superimposed live and vibration loads.

(2) Not less than 40 mile per hour wind pressure of six pounds per square foot.

(3) Limit maximum deflection to .004 of span between structural members except curved surfaces limited to .0025 of span.

(4) Positive means of adjustment to allow proper alignment at each lift and matching of corner boards when adjacent faces meet.

(5) Corner joints of boards in outside contact form surfaces for curved wall faces capable of being tightly compressed to prevent mortar leakage.

(b) Submissions: Submit formwork shop drawings complete in all respects showing bracing arrangements, lumber cutting lists, methods of aligning , forms, erection and stripping procedures, design criteria, location of inserts, ties, sleeves, etc., and gages, sizes, compositions and grades of all forming materials and components. Also submit drawings or a description of the method of shoring proposed for floor slabs and all horizontal concrete members. Arrange shoring for all concrete members above grade so that it is supported on uncompactible surfaces. Shoring on uncompacted fill is not allowed.

(c) Approval: by the Government Representative is general in nature and does not in anyway relieve the Contractor's responsibility for the design, construction, stability or adequacy of the formwork and shoring and for furnishing all certifications required by local building authorities.

3A-14 NOT USED

3A-15 STORAGE OF MATERIALS

3A-15.1 General: Store unpackaged materials on clean platforms and protect from deterioration and intrusion of foreign matter with suitable covers. Immediately remove damaged material.

3A-15.2 Cement: Store in weathertight structure with floor not less than 1 ft. above ground. Provide easy access for proper inspection and identification of material. Remove hydrated or partially set cement from site immediately.

3A-15.3 Aggregates: Store fine and coarse aggregates separately and prevent segregation of sizes. Avoid intrusion of dirt or foreign materials. Provide screens for sifting. Stockpile aggregates at least 24 hours on site before using.

3A-15.4 Reinforcing Steel and Accessories: Take care to protect against soiling, undue corrosion, and deformation. Store in manner to facilitate selection and minimize rehandling.

3A-16 CEMENT AND AGGREGATES

3A-16.1 Tower Shaft and Concrete Exposed to Weather:

(a) Cement: ASTM C-150, Type I. Cement must contain less than 0.6 per cent alkalies calculated as sodium oxide or contain an addition of a material that has been shown to prevent harmful expansion due to any alkali-aggregate reaction. Use one brand of cement. After selection, take necessary steps to insure uniform color and place on order sufficient quantity to complete the work. Furnish copies of mill tests of all cement. Avoid cement temperatures above 110 degrees F. Balling of concrete due to hot aggregates, water, cement, or any other condition is prohibited. Cement for architectural concrete shall be supplied by one of the following manufacturers and of the type indicated:

(1) Coplay Cement Manufacturing Co.
Coplay, Pennsylvania
Saylor's Type I

(2) Universal Atlas Cement
Hudson, N. Y. Plant
Type I (light buff)

(3) Penn Dixie Cement Corp.
Plant No. 6H (Howes Cave, N. Y.)
Type I (light buff)

(4) Universal Atlas Cement
Universal Plant (Pittsburgh, Pa.)
Type I-S (buff)

(5) Marquette Manufacturing Co.
Pittsburgh (Neville Island Plant)
Type I-S (buff)

(6) Marquette Manufacturing Co.
Hagerstown (Security) Md.
Type I (light buff)

(7) Ideal Cement Co.
Houston Plant
Type I

Other cements, or blends of dark and light cements and/or pozzolanic material, will be considered if it can be demonstrated to the satisfaction of the Government's Representative that the resulting concrete will exhibit color, tone and other physical characteristics similar to those obtained by the cements specified above.

(b) Entrained Air: Air entrain all freshly mixed concrete and determine content in accordance with ASTM C-231. Adjust proportions when batching and maintain desired yield and cement factor. Maintain air entrainment at more than 4% and less than 7%.

(c) Coarse Aggregate: ASTM C-33, gradation No. 67, uniformly graded, maximum size 3/4", clean, hard, durable, uncoated particles free of deleterious materials emanating from the same basic source throughout the job. Furnish affadavits verifying that aggregates are supplied from a source approved by the governing Department of Highways or Public Works for exterior exposure. Slag is not permitted. Submit a service record of at least 10 years verifying that the aggregate is not potentially alkali reactive and demonstrates proven durability to freezing and thawing. These aggregates when tested by petrographic analysis (ASTM C-295) by a recognized geologist shall be durable and non-alkali reactive. If there is any question of durability, the aggregates must be freeze-thaw tested to ASTM C-290 and Contractor must demonstrate aggregate meets its limits.

(d) Fine Aggregate: ASTM C-33, clean, hard, durable, uncoated grains free of deleterious materials and of uniform color emanating from the same basic source throughout the job. Fineness Modulus shall not be less than 2.60 or greater than 2.80. Affadavits and service records governing coarse aggregate apply to fine aggregate.

(e) Admixtures: Admixture other than air entrainment is not permitted.

3A-16.2 Base Building, Connecting Corridor and Other Concrete Work:

(a) Cement: Cement shall be portland cement conforming to ASTM C 150 Type I. Type III, High Early Strength, may be used with the approval of the Government Representative. Only one brand of approved cement shall be used.

(b) Aggregates: ASTM C-33, clean, hard, durable particles, maximum size 3/4" for floor slabs and equipment bases, 1½" for footings and foundation walls.

(c) Admixtures: The concrete shall contain admixtures of pozzolan and an air-entraining agent as specified in 3A-18.2.

3A-16.3 Mixing Water: Potable, clean, free from oil, acid and injurious amounts of vegetable matter, alkalies or other salts. Use water from approved source.

3A-16.4 Test of Aggregate: Furnish data indicating aggregate for all concrete are not potentially alkali reactive and evidence of durability to freezing and thawing for all exposed concrete.

3A-17 CONCRETE MIXES FOR TOWER SHAFT

3A-17.1 Specific Requirements: Allowable stresses for the design of concrete work are based on the specified minimum 28 day compressive strength of the concrete, or on the specified minimum compressive strength at the earlier age at which the concrete may be expected to receive its full load. The strengths of concrete at specified ages for which all parts of the concrete work were designed are shown on the drawings.

3A-17.2 Responsibility: Contractor is solely responsible for creating design mixes fully workable, of required strengths, that produce finishes acceptable to the Government's Representative.

3A-17.3 Submission of Aggregate and Cement Samples: In order to guide the Contractor in selecting the appropriate cement and aggregates, there is on display at the Contracting Officer's office, a sample panel which indicates the required colors and texture desired in the finished

exposed concrete after sandblasting. This panel was made with buff cement (Saylor's I manufactured in Coplay, Pennsylvania), tan sand and crushed stone. The finished exposed concrete work shall generally match this panel in color and texture.

(a) Within 3 weeks from date of Notice to Proceed, the Contractor shall deliver to the Government's Representative, not less than three 1-quart samples, each, of different cements fine aggregates and coarse aggregates which comply with these specifications, supported by the necessary verifying data, and which will in combination with each other produce the color and texture of concrete to match the sample at the office of the Contracting Officer. Within two weeks after receipt of the materials at the laboratory, the Contractor will be advised of the specific cements and aggregates acceptable for use in the concrete design mixes.

(b) Within 2 weeks from notice of acceptable materials, the Contractor shall submit at the site, for approval and acceptance by the Contracting Officer, three sample panels, each 12" X 12" x 3" deep, cast in plastic faced plywood forms and then sandblasted to show the texture of the concrete. The Contractor will be required to use the cement and aggregates used in making the approved samples for the casting of exposed finished concrete.

3A-17.4 Design Mix Requirements: Contractor is responsible for furnishing all design mixes required. Submit design mix and laboratory tests to the Government's Representative for approval. Use only aggregates proposed for finished work. Tests to be approved by the Government's Representative include aggregate soundness and gradations, 6 compression tests at 7 and 28 days, percentage of air entrainment, and slumps for each design mix. Do not begin concrete work until design mixes and test results have been approved by the Government's Representative. Prepare and submit 4 point curves for approval of Contracting Officer. Laboratory cured samples tested must indicate strengths at least 15% higher than those specified on drawings. With the submission of the design mix and laboratory tests for the concrete which will be visible in the finished structure, the Contractor shall ship prepaid to the Governments' Laboratory the following samples of the actual materials he proposes to use: - 1bag (94 lbs.) of cement, 300 lbs. coarse aggregate and 400 lbs. fine aggregate.

(a) Design mixes in accordance with "Recommended Practice for Selecting Proportions for Concrete" (ACI 613-54) subject to this Schedule:

Fineness Modulus of Sand	Volume of Coarse Aggregate per Unit Volume of Concrete (b/bo)
2.60	0.73
2.70	0.72
2.80	0.71

3A-17.5 Proportioning and Consistency: Proportion cement to aggregate on a weight basis to produce densest possible mix with the minimum water requirement.

(a) Tower Concrete: Maximum slump 4" with not less than 6½ (611 lbs.) bags of cement or more than 6 gallons of water per bag of cement including surface water carried by the aggregates. Air entrain at limits specified.

(b) The Contractor must satisfy himself, that he is capable of producing concrete of satisfactory quality, free of voids, honeycombing, or excessive air bubbles with these slumps. Execution of this contract signifies that the Contractor is responsible for the production of concrete of satisfactory quality within the slump limitations specified.

3A-18 CONCRETE MIXES FOR BASE, CONNECTING CORRIDOR AND OTHER CONCRETE WORK

3A-18.1 Concrete Quality: The design of the concrete mixture shall be approved by the Government Representative and shall have a minimum 28-day compressive strength as indicated on the drawings when tested in accordance with ASTM C39 (Test for compressive strength of molded concrete cylinders). The concrete mixture shall be designed to give the most economical and practicable combination of the available aggregates, cement, water and admixture. The resultant mixture shall have the required strength, durability, and hardening qualities and be of a consistency and workability suitable for the conditions of the job. The design, mixing, pouring and curing shall be in accordance with the standards of the American Concrete Institute and the Portland Cement Association.

3A-18.2 Concrete Admixtures: The pozzolith admixture shall be added in accordance to ASTM C340 (Specifications for Portland - Pozzolan cement) and the Pozzolith material shall be equal to that manufactured by the Master Builders Company of Cleveland, Ohio. The air-entraining agent may be included in the cement manufacture process or added during the concrete mixing process and shall be in accordance with ASTM C 175 (Specifications for air-entraining Portland cement). When the air entraining admixture is batched in solution in a portion of the mixing water, the air content shall be not less than 3 per cent nor more than 6 per cent of the volume of the concrete. All air-entraining additions shall comply with ASTM C260 (Specifications for air entraining admixtures for concrete) and ASTM C226 (Specifications for air-entraining additions for use in the manufacture of air-entraining Portland cement).

3A-18.3 Water Content: The water content of all concrete mixtures shall be the minimum necessary to properly place the mixture and shall not exceed 5½ gal. per sack of cement (air-entrained concrete), including the free surface moisture of the aggregates. The indiscriminate addition of water to delayed batches or to batches which have dried and become stiffer than the usual consistency is prohibited.

3A-18.4 Control: The proportions of all materials entering into the concrete shall be in conformance with the approved mix. The proportions shall be changed whenever such change is determined necessary by the Government Representative to maintain the standard of quality required for the concrete. All materials shall be measured by weight except the air-entraining admixture and water, which may be measured by volume. The cement content of concrete shall range from a minimum of 5 to a maximum of 6½ bags per cubic yard.

Concrete mixtures shall be designed to give the most economical and practicable combination of the available aggregates, cement, water, and admixture, that will produce a mixture, having the required strength, durability, and hardening qualities, and be of a consistency and workability suitable for the conditions of the job.

3A-18.5 Batching and Mixing: Concrete may be (a) mixed in a batch type mixing plant at the site, (b) truck mixed, (c) completely mixed at a central ready-mix plant, or (d) partially mixed at a central ready-mix plant. The method used shall insure the production of uniform batches and the mixer used shall not leak mortar or waste materials during the charging, mixing, or discharging operations. The mixing equipment shall be capable of combining the cement, aggregates, water, and air-entraining agent into a thoroughly mixed and uniform mass within the specified time, and of discharging the mixture without segregation. All batching and mixing equipment shall be provided with adequate facilities for accurate measurement and control of each of the materials entering the concrete. All ingredients of the mix shall enter the mixer preferably pre-mixed dry and in such a manner as to avoid "Gumming". If not premixed, the ingredients shall enter the mixer uniformly as possible at the same time. The Government Representative shall have free access to the batching and mixing equipment at all times.

3A-19 INSPECTION AND TESTING

3A-19.1 Concrete testing shall be the Contractor's responsibility and shall be made by a testing Agency acceptable to the Government's Representative. All costs shall be borne by the Contractor.

3A-19.2 Tests for Tower Shaft: The Testing Agency shall make the following tests for each 50 cubic yards of concrete or fraction thereof placed, but not less than one set for each day's placing. When more than one type of structural or architectural concrete is being placed, tests shall be made for each mix.

(a) Compression Test (ASTM C-31 and C-39): Six standard 6" x 12" cylinders. Three cylinders are to be tested at 7 days, and three cylinders at the age of 28 days.

(b) Air Entrainment (ASTM C-138 or C-173): At least two tests shall be made for each day's placing and as often in the opinion of the Government's Representative, when a change in consistency of the concrete mix is noted.

(c) Slump Test (ASTM C-143): Test for slump shall be made periodically or when any cylinders are made and as often in the opinion of the Government's Representative when a change in consistency of the concrete mix is noted.

(d) The test specimens shall be clearly marked and the system of marking shall have a definite sequence.

(e) The test specimens shall be carefully stored and transported so as not to damage them in any way. The Contractor shall provide an insulated shed for the storage of the cylinders.

(f) Records shall be kept identifying each cylinder with the locations of the concrete from which the test specimens were taken.

(g) Specimens shall be cured under laboratory conditions except that when, in the opinion of the Government's Representative, there is a possibility of the surrounding air temperature falling below 40 degrees F., he may require additional specimens to be cured under job conditions.

3A-19.3 Tests for Base, Connecting Corridor and Other Concrete Work: When directed by the Government Representative, concrete samples taken from the concrete already deposited in the forms shall be taken during the pouring operation. The location in the work where the samples were taken and the date the samples were taken shall be recorded by the Government Representative for future reference. The samples shall be used for the measurement of the consistency of concrete by the slump test and the measurement of the compressive strength at 28 days by testing the specimen in a testing machine. The slump test sample and the slump test shall be in accordance with ASTM C-143 and the compressive test sample, curing and compressive testing shall be in accordance with ASTM C-31 and C-39 except that the samples shall be taken from the concrete which has already been deposited in the forms.

3A-19.4 Job Inspection: The Testing Agency shall provide a qualified inspector at the site to see that all structural and architectural concrete and related work is thoroughly mixed and properly placed. It shall be the responsibility of the inspector to control the consistency of the mix in order that there will be no segregation due to excessive water, and to supervise for the proper vibration of the concrete.

(a) The inspector shall take periodic air and slump tests as directed by the Government's Representative, fabricate test cylinders, be responsible for the handling, storing and field curing of the cylinders while on the site and see that cylinders are properly packed for shipment to the laboratory and that the cylinders are shipped at the proper time.

(b) Equipment for testing the air content of the concrete and a slump cone shall be kept at the site at all times.

3A-19.5 Reports: The following reports shall be furnished.

(a) Reports of all tests, as completed.

(b) Weekly reports on amount of concrete placed each day; reports shall include air temperatures and weather conditions for each 24 hour period during curing operations.

(c) Such other reports as the Government's Representative may direct or that may be required.

(d) The Testing Agency shall immediately report to the Government's Representative any discrepancies found in the work.

3A-19.6 Strengths: If strength of laboratory control cylinders at 7 or 28 days for any portion of work falls below compressive strengths called for, the Government's Represnetative has the right to order a change in proportions or of water content for the remaining work; or he may order reshoring and additional moist curing of the sections in question. In addition, at his discretion, the Government's Representative has the right to require tests in accordance with ASTM C-42 (cored cylinders), or order load tests on portions of building so affected. Perform all changes as noted above and/or other required corrective measures as directed by the Government's Representative at no expense to the Government.

3A-20 MATERIALS

3A-20.1 Reinforcing and Steel and Accessories:

(a) Submit mill reports to the Government's Representative before placing steel in forms.

(b) Reinforcing Bars: All tower reinforcing shall be of intermediate grade new billet steel, ASTM A-15 having a minimum yield point of 40,000 psi. Deformations shall conform to ASTM 305-53T. Strength grade shall be branded on each bar. All reinforcement steel shall be cut and bent to the dimensions shown on the drawing. All bars shall be bent cold, by approved machine methods, and shall be in accordance with standard approved practice. Fabrication of the reinforcement steel shall be in accordance with ACI-315 (Manual of Standard Practice for Detailing Reinforced Concrete Structures).

(c) Light Wire Mesh: 14 gauge 2 x 2" square, 21 lbs. per 100 square feet, hot dipped galvanized.

(d) Welded Wire Mesh: ASTM A-185, hot dipped galvanized, cold drawn round steel wire having a minimum tensile strength of 70,000 psi and conforming to ASTM-A82.

(e) Reinforcing Bar Accessories: Plastic of approved color for all chairs, slab bolsters, spacers, high chairs, screeds and similar items coming into contact with form surfaces, or producing concrete that is exposed, receives plaster skim coat, or is painted, similar to "Rustless", "Sylgab" or approved equal. Elsewhere use hot dipped galvanized.

(f) Form Ties:

(1) General Use: Cadimum plated or hot dipped galvanized adjustable type, completely removable or removable to a minimum depth of 1½" from surface leaving hole no larger than 1-3/8"; minimum safe working strength 5000 pounds. Locate in level horizontal rows, plumbed vertically, and in symmetrical arrangement with openings and jointing. The tie layout in architectural concrete in the tower shall be as shown on drawings. No snap ties or wire ties shall be used in architectural (exposed finished tower shaft interior and exterior) concrete.

(2) Tower Curved Wall Surface Formwork: Minimum ultimate strength 12,000 pounds with minimum 5/8 " diameter rod threaded at each end tapering in not more than 18" from 5/8" in front to 3/4" in back and fitted with nut washers and capable of completely sealing hole in outside board form, similar to product manufactured by Superior Concrete Accessories or approved equal. Ties must pass only through centers of 1" x 4" boards and never at joints. Ties shall not exert a bearing pressure of over 760 psi on wood members based on ultimate strength specified. Arrange ties in a symmetrical pattern similar to the general lay out indicated in the drawings.

(g) Form Bolts: Cadmium plated or hot dipped galvanized, ASTM A-307, Use washers against wood.

(h) Inserts: For fastening shelf angles: hot dipped galvanized malleable iron adjustable wedge type with 3/4" bolt complete with necessary "Horseshoe" washer.

(i) Flashing Reglets: Hot dipped galvanized #22 gauge metal, felt filled.

3A-20.2 Premolded Filler: Self expanding cork board, ASTM D-1752, Type III and of Servicised Products Corporation, Code 4324 or Equal of thickness and length indicated. Provide fillers wherever indicated on drawings. Do not use asphalt impregnated filler which will react with joint sealer and stain concrete.

3A-20.3 Water Stops: Extruded rubber, rubber compound or polyvinylchloride. Cross section dumbell (bulbed), ribbed, or otherwise deformed to prevent movement and with expandable center section. Material shall be resistant to acid, alkali solutions and deterioration. Joints shall be heat sealed. Submit descriptive literature and samples for approval.

3A-20.4 Bonding Agent : "Weldcrete" as manufactured by Larsen Prod. Co., or approved equal.

3A-20.5 Vapor Barriers: Pure polyethylene sheet, 6 mils thick, Commercial Standard CS-238.

3A-20.6 Slip Sheets: Laminated sheets of polyethylene at each face. CS-238, 2 mil minimum thickness, permanently bonded to paper.

3A-20.7 Finishing Materials:

(a) Form Oil: Colorless mineral oil, Filmo 40 by Humble Oil Co., or approved equal.

(b) Abrasive Aggregate: For all interior stairs and as called for. Aluminum oxide, natural color, graded to average size #16.

(c) Form Sealer: Fed. Spec. TT-W-572.

(d) Sealer (Floor Hardener): Chemical hardener and dustproofing products as manufactured by Preservative Products Co., Hillyard Chemical Co., Master Builders, C. G. Pardee, or approved equal.

(e) Retardant Form Coating: "Rugasol-F" (Sika Chemical Corporation) or approved equal, applied in accordance with manufacturer's specifications.

(f) Water Repellent: Water repellent shall conform to Federal Specifications SS-W-00110, ("Silicone Resin Based Colorless Water Repellent"), mineral spirit base with a minimum silicone resin content of 5% by weight.

3A-21 CONCRETE FORM MATERIALS

3A-21.1 General: Use full size sheets of material unless smaller pieces will cover area. Form joints in contact material are permitted only at corners, or where maximum sizes of specified materials are inadequate. Where joints must occur, locations are subject to Government Representative's approval. Strengthen joints to be close fitting in plane to prevent leakage of grout or fines. Construct forms to exact profiles, without visible formings and of select, consistent texture in contact surface. Adequately brace to prevent bulging, deflections, and pilloring between form supports. Unless otherwise noted construct all contact surfaces of minimum 5 ply, 5/8" thick Douglas Fir plywood, concrete form exterior grade, CS-45.

3A-21.2 Tower Formwork

(a) General: Each lift in the outside curved surface of the tower is of generally different curvature. Individual forms must be built for each lift using new tongue and groove boards and may not be reused. Where curvatures are the same, studs may be reused.

(b) Lumber:

(1) General: Tongue and groove board forms shall be kiln dried (moisture content by weight 15 per cent or less). Structural lumber shall not have a moisture content in excess of 19 per cent.

(2) Species:

(a) Tongue and groove boards: 1 x 4 T&G Douglas Fir, F. G. Flooring, KD, C and better, conforming to West Coast Lumber Inspection Bureau Rules. Other species may be submitted to the Government Representative for consideration. Such species shall be utilized only if approved in writing by the Government Representative.

(b) Structural lumber: Douglas Fir or Larch, construction grade or Southern Pine, No. 1.

(3) Stress Grading: All structural lumber must be straight, structurally sound, with each piece marked by a grading agency approved by the American Lumber Standards Committee of the United States Department of Commerce and stress graded

to the following minimum working stresses without increase for short duration loading:

(a) Extreme fiber stress in bending - 1450 psi

(b) Compression perpendicular to grain - 380 psi

(c) Compression parallel to grain - 1200 psi

(d) Horizontal Shear - 120 psi

(e) Modulus of elasticity - 1,600,000 psi

(4) Plywood: Minimum CS-45, 5 ply Douglas Fir plywood, concrete form exterior grade, 3/4" thick for wall forms and 5/8" thick elsewhere, laid with face plies parallel to span, i.e.; the strong way. Where forms will be reused, plastic faced (60-60 overlaid) is recommended.

(5) Boards: Tongue and groove, dressed and center matched 1" x 4" sheathing boards must be used to form the outside curved wall surfaces. Take care not to damage tongues or grooves or to foul grooves so as to interfere with the proper matching of the boards. Use only full length boards and do not splice. Lay boards level, even spaced with a maximum tolerance of plus 1/32" and minus 1/16".

(6) Nails: Unless otherwise specified, all nails 20d flat head, diamond point common nails or spikes, two nails per joint. Double headed nails are permitted where required for removal. Use zinc coated annular grooved nails for forms receiving more than 3 uses.

(a) Use zinc coated 6d large flat head, diamond point box nails for attaching 1" x 4" T&G boards to framing. Use 2 nails at the intersection of each board and stud. Use zinc coated 6d common nails for attaching plywood to framing and space nails 12" along studs and end members. Drive nails flush into 1" x 4" boards and avoid dimpling.

3A-21.3 Formwork for Other Concrete Work: The perimeter concrete foundation walls for the Base and Connecting Corridor Buildings which are exposed to view from the finished grade elevations to the wall tops shall be formed from 1"x4" tongue and groove boards conforming to the requirements for the same type of work on the tower shaft. Other forms shall be constructed of wood or metal and be of suitable size to meet the strength requirements to withstand the pressure of freshly placed concrete, etc.

3A-22 FORM WORK

3A-22.1 General: Forms must conform accurately to shape, line and dimensions of concrete members shown on drawings. Brace or tie forms together to maintain position and shape. Insure safety to workmen and passerby. Keep wood forms wet until removed. Formwork shall conform to the recommendation of ACI 347 unless noted.

(a) Build watertight and of low moisture content material, and limit bulging between supports to less than 1/360 of span unless otherwise specified. Maintain forms to eliminate formation of joints due to shrinkage. Detail joints with backup strips to maintain adjacent panels in the same plane. Tightly compress butting joints to prevent leakage.

(b) Reinforce members supporting form work by approved methods of shoring. Frequently check shores during placing operations and until removal. Drive up when settlement occurs; secure when movement is evidenced. Place shores supporting successive stories directly over those below. Provide form watchers whenever concrete is placed. Stop work if any weakness develops and formwork shows undue movement beyond possibility of adjustment.

(c) Provide sufficient openings in narrow wall forms, and in any forms where access to the interior is not readily available to facilitate cleaning and inspecting immediately prior to placing concrete. Location of openings are subject to approval by the Government's Representative.

(d) Form materials having direct contact with concrete on the exterior curved surfaces of the tower shaft shall be of new materials. Used or reused materials on these surfaces will not be acceptable. Other forms may be reused only when in satisfactory condition and resue is approved by the Government's Representative. Assemble so that form removal will not damage concrete. Before reuse repair damaged surfaces and spackle with approved material.

3A-22.2 Inspection of Forms and Reinforcements: Notify the Government's Representative at least 24 hours in advance before concrete is placed. The Government Representative's judgement is final as to the reusibility of forms.

3A-22.3 Cleaning and Oiling Forms: Treat with form oil before reinforcement is placed. Wipe off excess oil with rags to leave surface of the forms just oily to the touch. Care must be taken to prevent oil being sprayed on reinforcing steel which will destroy bond.

3A-22.4 Form removal: Determine the time at which forms may be removed without endangering the structure, subject to the following limitations and the Government's Representative's approval:

(a) Footing Forms: 7 days minimum; continue curing as specified.

(b) Wall Forms: 7 days minimum; continue curing as specified. If necessary, verify with test cylinders at Contractor's expense.

(c) Do not strip superstructure slabs and beams until concrete has attained at least 75% of its design strength. Verify by test cylinders at Contractor's expense.

3A-22.5 Reshoring: Immediately after stripping, fully reshore all slabs and beams which are to be used to support shores for upper slabs. Submit method of reshoring for approval by Government's Representative.

3A-22.6 Protect all sharp edges of concrete and in general maintain integrity of design. Loosen complete sections of forms which can be removed without exerting stresses against corners, offsets or reveals. Prying against exposed concrete surfaces with tools of any description is not permitted. Where noted or indicated on the drawing exposed concrete corners shall be chamfered 3/4 inch.

3A-23 FURNISHING AND INSTALLING INSERTS

3A-23.1 Furnish and install anchors, bolts, inserts, metal ties, nailing blocks and other items to be built into the concrete before concrete is placed. All anchor bolts shall be set true to line and grades as indicated on the drawings. Immediately after the pour, the anchor bolts shall be checked.

3A-23.2 All electrical conduit which must be placed on concrete slabs shall be installed after and above the bottom reinforcing, but before the top reinforcing. Where conduit crossovers are necessary, locate so that reinforcing is not displaced from its specified position. Unless otherwise indicated in drawings, no conduit or outlet boxes may be placed in concrete walls. When necessary, submit layout for approval.

3A-24 JOINTS

3A-24.1 Construction Joints: Construction joints are shown on the drawings. Additional joints are permitted only when approved by the Government Representative.

(a) Before placing concrete at a joint remove all alitance, thoroughly soak old concrete, and slush with 1/2" of neat cement grout. Reinforcing continuous across joint.

(b) Provide keyways approximately 2" x 4" in all construction joints.

3A-24.2 Control Joints: Where located and detailed on the plans, provide shrinkage control joints.

(a) Create vertical plane of weakness by vertical notches on each face of the wall or beam, as detailed.

(b) Continue half of horizontal reinforcing alternately across the joint, and stop half at each side.

(c) Locate all construction joints at the control joints.

3A-24.3 Expansion and Contraction Joints: As located and detailed on plans.

(a) Use premoulded filler, as specified herein, full depth of section.

(b) Install joint sealer in joints specified above and in accordance with Section 7B.

(c) Metal expansion joints, expansion joint covers and nosings are specified in Section 5C and shall be installed in concrete work as necessary.

3A-24.4 Waterstops: Provide waterstops in all expansion and control joints below grade with all joints heat sealed.

3A-25 PLACING STEEL REINFORCEMENT

3A-25.1 All Reinforcing: Securely tied and supported by chairs, bolsters, etc., per ACI-319. Reinforcing must not be displaced during pouring operation. Dowels for walls, columns, etc., must be wired in place before depositing concrete.

3A-25.2 Clearance Distance: Forms to reinforcement including ties over 3/8 ϕ as follows:

(a) Footings -3" from soil

(b) Walls: exposed surfaces -2"

(c) Walls: Interior surfaces -3/4"

(d) Beams, girders and columns -1-1/2"

(e) Slabs on forms -3/4"

(f) Exposed sections -2"

(g) Tolerances: 3/4 inch for foundation, 1/4 inch all other work

3A-25.3 Splice laps:

(a) Bars -24 diameters unless otherwise indicated

(b) Mesh -12"

3A-25.4 Do not cut bars to clear sleeves or slots through slabs or walls. Warb bars around these openings.

3A-25.5 Provide 2 - 4# diagonal bars at each corner of all rectangular openings in slabs or walls.

3A-25.6 All reinforcing steel within limits of one day's pour must be in place, wired, inspected, and approved, before depositing concrete. All reinforcing steel must be placed and wired in sufficient time, as approved by the Contracting Officer, for inspection before depositing concrete.

3A-25.7 For slabs on grade and footing reinforcement, support bars or mesh on precast concrete blocks or plastic asseccories spaced at intervals required by size or reinforcement used to keep reinforcement within minimum height specified above underside of slab or footing. For support of top steel in tower shaft foundation see drawings.

3A-25.8 Extreme care must be exercised in placing reinforcing steel to prevent any marring of interior faces of forms or shifting of forms.

3A-25.9 Tieing reinforcing steel with wire to nails in forms or using wood spacers is not permitted. If necessary, cover may be maintained with plastic doughnuts.

3A-26 DEPOSITING CONCRETE

3A-26.1 Preparation: Before placing concrete in the forms, verify that forms have met all requirements specified; that reinforcing steel, sleeves, inserts and all other materials to be embedded are in place and securely tied; that bonding surfaces of any concrete in contact have been properly prepared; and that forms are absolutely clean. All reinforcement shall be free from loose slakey dust and scale, and free from mud, oil and grease. Clean inside form surfaces and maintain free from dried or hardened spatterings or coatings of concrete immediately prior to placing concrete against that part of surface. Keep all chutes, troughs, pipes and other placing equipment clean and free from coatings of hardened concrete after each run. Discharge water used for flushing clear of concrete already in place.

(a) Force loose wires, nails, dirt and debris to a cleanout with a jet stream of compressed air and collect with large vacuum cleaners. Hose forms thoroughly with water. If placing of concrete does not commence immediately after cleaning, cover openings in forms with tarpaulins.

3A-26.2 Placing: Place concrete on clean, damp, surfaces free from ponded water, ice, frost, mud, debris or objectionable coatings. For exposed concrete sections, special care must be exercised to prevent segregation of concrete and avoid splashing forms or reinforcing with concrete. Any such splashings or accumulations of hardened or partially hardened concrete on forms or reinforcement above general level of the concrete already in place must be removed before work proceeds. Place concrete so that free fall does not exceed 4 feet. Place concrete through canvas or polyvinyl chloride elephant trunks of variable lengths and minimum 6" diameter; or through minimum 2'x2' windows in rear formwork face. Place columns and walls at least 24 hours before slabs and beams resting on them unless otherwise noted.

(a) Place sufficient number of chutes or trunks in forms to insure concrete being kept level at all times. Use of chutes longer than 10' is prohibited. Provide sufficient illumination in interior of forms os that concrete at places of deposit is visible from deck.

(b) Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Carry concreting on at such a rate that concrete is at all times plastic and flows readily into spaces between bars. Lifts of concrete in forms not to exceed heights of 3 feet, and not further than 6 feet from final position. Deposit no concrete that has partially hardened has become contaminated by foreign material, nor retempered concrete.

(c) Prevent splattering or dripping of concrete or mortar on finished surfaces below. Station a mechanic continuously on the level below during concrete placing, equipped with a long handled bristle brush and water hose, to remove any drippings or splatterings resulting from operations above.

(d) No Lifting or Hooking of the steel into position after the concrete is placed shall be permitted for any portion of the work.

3A-26.3 Placing with Vibration: Place concrete with the aid of mechanical vibrating equipment. Vibration equipment: mechanical high frequency type (15,000 VPM) approved by the Government Representative. Apply vibration directly to concrete unless otherwise approved. Intensity of vibration must be sufficient to cause flow or settlement of concrete into place.

(a) Place vibrator at bottom of form before depositing concrete. Apply vibration at point of deposit and in area of freshly placed concrete, of sufficient duration to accomplish thorough compaction and complete embedment of reinforcement and fixtures, but not long enough to cause segregation of mix. Space vibration immersion points not further than 18" in any direction. To secure even and dense surfaces, free from aggregate pockets or honeycomb, supplement internal vibration by external vibration with rubber mallets applied continuously to form surfaces during placement of concrete and while it is plastic. Caution must be exercised using vibrators to prevent any injury to the inside face of forms or any movement or misalignment of reinforcement.

3A-26.4 Construction Joints and Stoppages: Placing of concrete must be continuous between construction joints shown on drawings. If for any reason it is necessary to stop placing concrete at places other than those indicated, such places must be at control joints with the approval of the Government's Representative.

(a) Immediately after concrete placement is completed, clean reinforcement projecting above the concrete. Level surfaces of concrete whenever a run of concrete is stopped.

3A-26.5 Depositing Against Other Concrete: Before depositing new concrete on or against concrete that has hardened, retighten forms and thoroughly clean surfaces of hardened concrete of foreign matter and laitance, then moisten with water. To prevent honeycombing and insure sufficient mortar at juncture of hardened and newly deposited concrete, deposit a layer of cement sand grout (1-2 mix), using identical cement and sand incorporated in architectural concrete mix, against hardened concrete and at all horizontal casting junctions to a thickness of at least 1" on horizontal surfaces, unless otherwise approved. Follow with regular mix concrete.

3A-26.6 Precautions: Keep a sufficient number of spare vibrators accessible at place of depositing concrete to assure adequate vibration in case of breakdown of those in use. If electric power is required for operation of vibration equipment, grounded electrical connections must be available before concreting commences.

3A-27 MIXING AND CONVEYING CONCRETE

3A-27.1 General: Submit details of proposed supplier and concrete mixing plant to Government's Representative for approval. Provide the Government's Representative free access to plant at all times for sampling of materials, or inspection of work. Acceptable temperature limits of concrete: 55° 90° F. In event Contractor elects to batch and mix concrete at site, ASTM C-94 governs.

3A-27.2 Truck Mixed: Concrete may be truck mixed if properly mixed under supervision of Testing Agency at building site and in compliance with ASTM C-94. Color flag trucks to indicate type of concrete being hauled. Mixes, once designed and proportioned must be consistently controlled by ready-mix supplier. Strengths noted are minimum strength acceptable and results of tests competently performed are basis of acceptance. Concrete must be poured into the forms within one hour after water has been introduced to the cement and aggregate mix. Retempered concrete is not permitted.

3A-28 PROTECTION AND CURING

3A-28.1 Protect exposed surfaces of concrete from premature drying. When site temperature exceeds 40° F and is rising, wet cure exposed surfaces of concrete, walls, and spandrels with a continuous stream of water from perforated plastic or rubber hose draped with burlap mats for minimum period of seven days after placing. To facilitate circulation of water, loosen backs of forms one day after placement of concrete. Wet cure slabs seven days with burlap, sand, curing paper, or fog spray. If high early strength cement is used, as permitted herein, the curing time may be reduced to three days. Curing by means of commercial sealing compounds may be used,

for concrete work except exposed architectural concrete. The curing liquid shall be clear and shall conform to Federal Specification TT-C-00800 (Curing Compound, Concrete, for New and Existing Concrete).

3A-28.2 When the temperature is below 40° F or when freezing weather is possible within 24 hours, heat concrete aggregates and mixing water so that temperature of concrete when deposited is above 55° F but less than 80° F. Precautions must be taken to assure concrete temperature of 70° F for at least 24 hours and 50° F for an additional four days, unless climatic conditions make longer periods of controlled concrete temperature desirable. When stripping during cold weather, concrete must not be submitted to thermal shock with maximum temperature drop as specified in "Recommended Practice for Winter Concreting" ACI-604 and ACI-306. Protective measures proposed must be submitted for the Government Representative's approval. Do not mix chemicals or other foreign materials with concrete for purpose of preventing freezing.

3A-28.3 Protect completed concrete from damage by construction operations and during removal of forms, and from freezing winds with additional tarpaulin windbreaks.

3A-28.4 Keep permanent temperature record showing date and outside temperatures. Take thermometer readings at start of work in morning and noon and high-low during night. Record readings obtained to show the effect they may have had during construction.

3A-28.5 Place no concrete during rainstorms. Protect new concrete against damage by rain or injurious action of sun. Keep sufficient coverings on hand for this purpose.

3A-28.6 Take particular care in curing of all finished floor slabs to control shrinkage. Begin curing immediately after finishing.

3A-28.7 Do not pour concrete footings, slabs or mats on frozen soil. Protect against freezing and heaving of subgrade after castings.

3A-29 COLD WEATHER PROTECTION

3A-29.1 Provide and maintain space heaters to provide temporary heat 24 hours per day to protect and cure concrete work when outdoor temperatures at site are below 40°F. Distribute space heaters to provide inside temperature of 55°F. in parts of building where concrete is being placed or being cured. When temporary heat is required, enclose work with tarpaulins, ballooned at top and bottom so that all sections of work will be maintained at 55°F. Enclosure: wind-proof and strong enough to resist weather and wind conditions. Enforce strict fire prevention methods. Take caution to direct heat so that the concrete is not subjected to excessive temperatures or drying out. In place of space heaters for outside form surfaces, vapor proof blanket insulating may be used provided that above concrete temperatures are maintained. Provide adequate and tight moisture barriers for at least 4 days to prevent drying out of concrete. When dry

heat is used, means of maintaining atmospheric moisture shall be provided. All aggregates and mixing water shall be heated to a temperature of at least 70° but not more than 100°F.; the aggregates may be heated by either steam or dry heat. In case of extremely low temperatures, and/or for pouring of thin sections, the GOVERNMENT REPRESENTATIVE may at his discretion, raise the minimum limiting temperature of the fresh concrete in place to 70°F.

3A-29.2 Temporary Heat: Smokeless hot air unit heaters or steam. Salamanders not permitted. Keep all temporary heating equipment properly fueled and attended.

3A-29.3 Whenever there is doubt as to suitability of cold weather conditions, Contractor proceeds with concrete work at his own risk. If the Government's Representative objects to his proceedings, no concrete may be placed.

3A-30 FOOTINGS

3A-30.1 All footings to bear on firm, undisturbed soil as specified in Section 2A.

3A-30.2 Support reinforcing 3" clear of soil on bricks, precast blocks, or plastic chairs.

3A-30.3 Column and wall dowels to be positioned, supported and tied in place before concrete is placed.

3A-30.4 All footing bottoms to be inspected and approved by the Government's Representative, before casting.

3A-31 SUPPORTED SLABS ON FORMS

3A-31.1 Build all forms to required dimensions. Camber as shown on drawing, or specified.

3A-31.2 Lay all reinforcing as shown on approved placing plans. Support bars at specified heights with bolsters, chairs, etc., so that reinforcing will not be moved from the specified position during placing of concrete.

3A-31.3 Lay all conduit in slabs or beams above the bottom bars and below the top bars.

3A-31.4 Place concrete as dry as possible. Vibrate, screed to levels and finish as specified.

3A-32 FLOOR SLABS ON GROUND

3A-32.1 Form depressed ribs under partitions as required, by shaping gravel, or provide permanent side formboards to retain gravel.

3A-32.2 Place vapor barriers lapped at least 4" and lay slab of thickness shown on drawings and reinforced as shown. Screed and float level and finish as specified.

3A-33 MISCELLANEOUS CONCRETE: Provide all miscellaneous concrete or cement work as shown on the drawings or specified, including setting anchor bolts and grouting of base, leveling plates, elevator door sills, and access hatches. Use still 1:3 mix except as specified hereafter. Pack solidly. Provisions for grouting under the column base plates and the beam bearing plates in the base and connecting corridor buildings shall be made in the filed and the method used shall be approved by the Government Representative. The grouting material shall be a NON-SHRINK ready-to-use product requiring only mixing with water at the job site. It shall be equal to Embeco Pre-Mixed Grout as manufactured by the Master Builders Company to Cleveland, Ohio. The underside of the plate shall be cleaned of all grease and oil-like films; the pertinent concrete surfaces shall be cleaned of all similar contamination and debris. The top of the concrete shall be chipped and roughened and all laitance or poor concrete removed. The concrete shall be water-saturated for a period equivalent to 2 hours, the excess water removed and the non-absorbent ende-forms erected. Minimum depth of grout shall be (one) 1 inches and it shall be placed under the plate in such a manner which will avoid air voids. The grout shall be packed and tamped from one to two sides only and shall be sufficiently compacted in order to transfer adequately the column or beam loads to the concrete foundation or beam seat. The shims shall be placed in such a manner that they can be removed after the grout has cured and is capable of transmitting the loads. Cars shall be used in keeping the grout damp during the curing period. The recommendations of the grout manufacturer with respect to mixing, placing, curing and for protecting the exposed surfaces, are to be closely followed.

3A-34 CONCRETE EQUIPMENT PADS: Furnish and install concrete pads for mechanical and electrical equipment of sizes and heights as required to suit each item of equipment. Strength shall be as specified on the drawings and mixture in accordance with Section 3A-18.

3A-35 MANHOLES AND CATCH BASINS: Manholes and catch basins shall be constructed of concrete having a compressive strength of 3000 lbs. per square inch after 28 days. Concrete mixture shall be in accordance with Section 3A-18. Frames and covers shall be given two coats of asphaltum immediately upon arrival on the job site. Unless otherwise shown on drawings, the invert channel shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve as large as the size of the manhole will permit. Changes in size and grade of the channel shall be made gradually and evenly. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. In unpaved areas, the top of the manhole covers shall be ½ inch above the finished grade unless otherwise indicated on drawings. Openings for pipe entrances to in-service sewer manholes shall be made by core drilling or by other drilling apparatus approved by the Contracting Officer.

3A-36 CONCRETE ENCASEMENT FOR DUCTS: This concrete shall be of the strength specified on the drawings and the mixture specified in Section 3A-18.

3A-37 PERLITE INSULATION CONCRETE ROOF

3A-37.1 Scope: These paragraphs cover the requirement for the perlite insulating concrete fill for the roof and its mix, placing and finishing. The perlite contractor shall furnish all plant, labor, materials, equipment and supervision for installing and finishing to grade the perlite insulating concrete fill with the required expansion joints and expansion joint material and the light gauge steel reinforcement mesh. The installation shall be in accordance with the recommendations of the Perlite Institute, Inc.

3A-37.2 Materials: The perlite concrete shall be a 1:6 mix with a maximum over dry density of 27 #/cu. ft. Weight tolerance 24 to 28 #/cu. ft. Cement used for the mix shall be Type III Portland cement high early strength in accordance with ASTM C150. The mix shall contain an air entraining agent of the standard solution or material as recommended by the Perlite Institute Inc. The water shall be clear and free from oil, acid, alkali, organic matter, or other deleterious substances. The perlite concrete mix shall be made from expanded perlite aggregate having a loose density of 7½ to 12 pounds per cubic foor and the design of the mix and the mixing procedure shall be based on the recommendations of the Perlite Institute Inc. A one (1) inch expansion joint shall be installed through the thickness of the perlite concrete at the junctures of all walls with the perlite concrete. The expansion joint may be a one (1) inch air space or one (1) inch of expansion joint material equal to sponge synthetic rubber joint filler conforming to Type I of ASTM D1752. The reinforcing mesh shall be light gauge galvanized steel with a minimum of 16 gauge line wires and 19 gauge mesh wires equal to style 2160-2-1619 Keydeck as manufactured by the Keystone Steel and Wire Company of Peoria, Illinois. The physical properties of the perlite concrete shall have in addition the following characteristics:

(a.) A minimum compressive strength of 125 #/sq. inch at 28 days, oven dry.

(b.) A wet density of 40½ #/cu. ft. ±2#/cu. ft. when placed.

(c.) A thermal conductivity K value of 0.54 to 0.70 (BTU/HR/SQ. FT./ ^{o}F/inch thick) at 28 days.

3A-37.3 Placing and Finishing: Shall be in accordance with the recommendations of the Perlite Institute, Inc. In addition, the following procedure shall be used as a basis for the acceptance of good workmanship. The steel deck shall be cleaned of all surface dust and loose material. Areas of the roof deck which have oil, grease, mud and other adhering and foreign material shall be thoroughly cleaned with mineral spirits. Holes in deck seams, roof openings and weld areas, where the perlite can run out, shall be covered with roof deck tape or sheet metal.

(a) Screeding guides shall be installed and positioned in order to maintain the finished roof slopes as indicated on the drawings. The screeds shall be supported in a manner which will make it possible for them to be removed. The light gauge reinforcing mesh shall be aligned with the 16 ga line wires parallel to the longitudinal centerline of the building (the long dimension of the building). The ends of the mesh shall lap a minimum of six (6) inches and the sides shall lap a minimum of four (4) inches. The mesh shall be cut to fit at the wall coping, and roof openings. The mesh shall be extended into all areas where the perlite will be placed. At areas where the roof is four inches or over in thickness, (bottom of steel deck to top of perlite) the steel mesh shall be supported so that it will be between 1 to 2 inches below the top surface of the perlite. The mesh shall be supported and securely held in the proper position while the concrete is being placed. Supports shall be in accordance with ACI 315. The expansion joint material, when used, shall be installed and supported at the proper elevation in such a manner that it will not move out of alignment during the placing and finishing of the perlite concrete. When no expansion joint material is used, the one (1) inch joint shall be made by using appropriate forming equipment which can be removed after the perlite has cured the required number of days.

(b) The Contractor shall supply temporary vertical shoring and bracing of the underside of the deck during the placing and curing period of the concrete. The shoring method used shall provide a level surface at the proper elevation and be of sufficient strength to support the loads without visible deflection. The support shall be provided with adjustment methods (shims, etc.) by which adjustments can be made if required during the placing of the concrete. Supports shall be kept in place a minimum of 3 days.

(c) The perlite concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent segregation or loss of material. The concrete shall be placed from beam and column supports to middle of roof slab, uniformly in all bays at the same time.

(d) The perlite concrete shall be carefully deposited and screeded in a continuous operation. Rodding, tamping, or vibrating methods shall not be used except at corners or around openings. Excessive consolidating methods, including vibrating, shall be avoided. Steel troweling shall not be used. The finish shall be a smooth wood trowel finish and the finishing time shall be only the time required to finish the surface to the contour as shown on the applicable drawings.

(e) The perlite concrete shall cure for at least three (3) days and be dry enough when the roofing is applied to develop adhesion with the hot pitch of the roofing material.

(f) For winter or cold weather construction work, the recommendations of the Perlite Institute, Inc., shall be followed.

3A-38 PATCHING AND CLEANING

3A-38.1 Patching Architectural Concrete: Patch at earliest practical time any exposed architectural concrete, which is not formed as shown on drawings, is out of alignment or level, or shows defective surfaces resulting from improper casting techniques or injury during the course of construction. The Government Representative's judgement is final as to whether such patching restores quality and appearance or whether removal is required.

(a) After removing forms, inspect concrete surfaces and patch voids, stone pockets, or defective areas permitted by the Government Representative to be patched, immediately in weather over 40°F. and rising. Sufficient cement finishers are to be available to complete required patching operations the same day forms are stripped. Provisions specified including "Protection and Curing" and "Cold Weather Protection" apply to patching exposed architectural concrete surfaces.

(b) Wet area to be patched and space 6 inches wide entirely surrounding it to prevent absorption of water from patching mortar.

(c) Grout for Patching: Approximately equal parts Portland cement and sand using same cement and sand incorporated in architectural concrete mix except to obtain proper color, it may be necessary to add white cement and sand. Add sufficient water to produce a brushing consistency. Brush grout into surface, float surface scouring it vigourously, and finish with light steel troweling. Remove all excess grout from surface by bagging immediately.

(d) Mortar: Brush grout into surface and follow with patching mortar. Use normal architectural concrete mix of same sand and cement but with smallest sized coarse aggregate available. To obtain matching color of adjoining concrete surfaces, it may be necessary to supplement mix with white cement and sand. Add minimum amount of mixing water which is as little as consistent with requirements of handling and placing. Thoroughly compact in place and screed off to leave patch slightly higher than surrounding surface. Leave undistrubed for a period of 1/2 to 2 hours permitting initial shrinkage before final finish. Finish to match adjoining surfaces. Final finish obtained by striking off surface with metal straight edge spanning patch and held parallel to direction of form marks. Remove all excess material from surface by bagging immediately.

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(e) Tie Holes: Use tool that packs tie holes solid with patching mortar above after first thoroughly washing with a detergent solution. Strike off any excess mortar flush with wall with a straight edge spanning the hole and recess circular patch 1/4" from face of concrete.

3A-38.2 Patching for Other Concrete Work: Defective concrete, honey combed portions, voids left by removal of tie rods, ridges and local bulging on all concrete surfaces permanently exposed to view, shall be repaired immediately after removal of forms unless otherwise authorized or directed. Voids left by the removal of tie rods shall be reamed and completely filled with dry-patching mortar. Defective or honey combed portions of concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be secured with keyes, dovetails or anchors. Excessive rubbing of formed surfaces will not be permitted.

3A-38.3 Grinding: Remove nibs, projections and other protuberances, by use of an approved hand stone, on all concrete, exterior and interior, exposed to view.

3A-38.4 Cleaning: The Government Representative may require, at no addition to the contract price, remedial action to remove blemishes, rust stains or discolorations from the exposed concrete. Remedial action consists of any or all of the following:

(a) A clean down with mild solution of detergent and water applied by scrubbing vigorously with soft bristle, then flushing with water. Remove rust stains by applying a paste of oxalic acid, allow to stand for at least 3 hours and remove by rubbing with approved hone.

(b) A clean down with solution of muriatic acid containing not less than 5% nor more than 10% acid by volume, applied to surface previously saturated with clean water by scrubbing vigorously with stiff bristle brushes. Immediately after cleaning drench surfaces with clean water to remove acid. Protect metal and other materials that would be damaged by acid.

(c) Remove deep stains, incrustations of mortar on surfaces by an approved hone or grinding wheel.

(d) Except for rust stains, undertake no cleaning operations until superstructure is entirely completed. Cleaning portions of building as work progresses is not permitted.

3A-39 CONCRETE FINISHES

3A-39.1 Broom: For finishes designated ceramic tile in the drawings: finish, screed, and wood float to proper elevation, generally 1" below nominal floor line. Broom surface when partially set for bonding to subsequent finish application.

3A-39.2 Monolithic: Surfaces receiving resilient flooring or designated as "concrete": float with mechanical or wood float and trowel smooth with steel trowel. After concrete has set to proper degree of hardness, trowel to produce smooth plane surface free of ridges. Dry materials not permitted. Note: Prepare surfaces to receive metallic waterproof as hereinafter specified. Interior equipment pads shall be finished as specified above.

3A-39.3 Other Concrete Finishes: Exterior equipment pads, tops of manholes and catch basins, and exterior door steps shall receive a broom finish. All other surfaces, not otherwise specified, shall receive a wood trowel finish.

3A-39.4 Nonslip: 1/4 lb. of nonslip material dry mixed with 1/8 lb. of Portland cement per square foot of surface. Apply material as dry shake, floated and troweled into surface of concrete while plastic.

3A-39.5 Sealed: Interior concrete floors not receiving other flooring as finish, shall be treated. Concrete shall be thoroughly cured, cleaned, and dried prior to application. Solution shall contain not less than 2 pounds of magnesium fluosilicate and/or zinc fluosilicate crystalline salts per gallon of water. Material shall be delivered ready for use in original sealed containers bearing manufacturer's name and registered trademark. Solution shall be applied using three coats, allowing at least 24 hours between coats. Apply each coat at rate of one gallon per 100 square feet of surface. After final coat is applied and before completely dried, surplus material shall be removed from the surface by scrubbing and mopping with water, leaving surface clean and without discoloration. Dust preventitive solution shall not be permitted to puddle on the surface.

3A-39.6 Protection: Protect all cement floors, treads, and platforms against all mortar or plaster droppings, oil, grease, or other materials which will stain or soil cement finish. Maintain protection until work above is complete. Remove protection when danger to work does not prevail.

3A-39.7 Exposed Concrete: Apply to all exposed cast-in-place concrete, not board formed or sand blasted, where concrete is poorly formed, patched or shows excessive voids at the surface. Mix 1 part Portland cement and 1-1/2 parts fine sand with sufficient water to produce grout having consistency of thick paint. Use white Portland ~~cement for part of cement~~ in grout, to give color desired. Wet surface of concrete sufficiently to prevent absorption of water from grout and apply with a trowel or brush completely filling air bubbles and holes. Immediately after applying grout, float surface with cork or other suitable float, scouring it vigourously. While grout is still plastic, finish with sponge rubber float removing all excess grout

Finish when grout will not pull from holes or depressions. Allow surfaces to dry until it takes on powdery appearance, then rub vigorously with dry burlap to completely remove dried grout. Leave no visible film or grout remaining after rubbing. Complete cleaning operation for any area the day it is started up to but not past pour and control joints. Leave no grout on wall over night. After grout cleaning, if slightly dark spots or streaks remain, wipe off lightly with a fine abrasive hone without using water. Do not rub with hone sufficiently to change texture of concrete. Adjacent surfaces may require this finish for uniformity.

3A-39.8 Sandblasted: Sandblast all exterior exposed architectural concrete on the tower shaft, base and connecting corridor buildings. Operate sandblasting equipment at minimum pressure, approximately 60 to 80 lbs. and use smallest sized silica sand abrasive available, size 00 Ottawa sand. Amount of sandblasting is minimum required to remove skin and surface blemishes but not sufficient to damage sharp arrises. Do not commence sandblasting to the Government Representative's approval. Proceed from top of work down and complete lift before proceeding on other sections. After a section has been sandblasted, wash with water or use compressed air to remove dust and abrasive from surface.

(a) After completion of work, thoroughly clean surfaces of abrasives and waste materials. Protect work which may be damaged by these operations in approved manner. Employ templates to prevent etching of glass or surfaces not intended to be sandblasted.

3A-39.9 Water Repellent: Apply water repellent in accordance with manufacturer's instructions to all exposed cast-in-place concrete surfaces, whether in the interior or exterior of the structure, but not to any horizontal wear surfaces such as treads, etc. Before application demonstrate by samples that water repellent will not stain or change color of exposed concrete.

(a) Prior to applying water repellent, test concrete surfaces with an approved type meter to determine moisture content. Do not apply to concrete having moisture content in excess of manufacturer's recommended maximum percentage. Allow additional time for drying out.

(b) When concrete surfaces are dry enough, and after sandblasting has been completed, spray the water-repellent in accordance with manufacturer's directions using approved equipment. Protect adjacent work during spraying and remove any spray and clean areas accidentally sprayed within 1 hour.

(c) Apply water repellent to all architectural (exposed on the exterior of base and connecting corridor buildings and tower shaft interior and exterior) concrete except floors and stair surfaces treated with sealer.

3A-39.10 Applied Cement Finish:

(a) Base slab shall be not less than 1" below finish floor level. Before concrete has hardened remove all debris and laitance from surface by wire brooming leaving coarse aggregate slightly exposed. Roughen hardened surfaces by shipping, than clean. Keep base slab wet and just prior to placing topping thoroughly clean base slab by scrubbing; remove excess water. Broom a thin coat of neat cement grout over entire surface ahead of placing topping. Dusting will not be permitted.

(b) Finish mix shall consist of 1 part Portland cement, 1 part fine aggregate and 2 parts coarse aggregate graded from 3/8" to No. 8, by volume. Mix in a mechanical batch mixer, for not less than 3 minutes after all materials have been included, using not more than 4 gallons of water for each bag of cement when floating is done by machine and 5 gallons for each bag of cement when floating is done by hand.

(c) After screeding to establish finish lines and levels, compact and then float with wood floats or power floating machines. Floating shall be followed by steel troweling after finish has sufficiently hardened to prevent excess fine material from being worked to the surface, to obtain a smooth surface free from defects and blemishes.

(d) After topping has set to ring the trowel, surface shall receive a second steel troweling to a burnished finish.

3A-40 SURFACES TO RECEIVE METALLIC WATERPROOFING

3A-41.1 Apply to forms of vertical surfaces, a compound to retard setting of surface concrete to a depth of at least 1/16-inch. Upon removal of forms surfaces shall be treated to expose the aggregate, to provide a granular texture. Retarded shall not have an adverse effect on strength of concrete and shall be applied in accordance with manufacturer's directions.

3A-40.2 Concrete slabs shall be prepared by removal of laitance and scum, leaving surface clean and rough. If final set of concrete has occurred, surface shall be cleaned and roughed by mechanical scouring and chipping. Prepared surfaces shall be uniform and allow one inch for metallic waterproofing. Spaces where treatment is to be applied shall be cleared of all stored material, equipment or other obstructions before starting.

3A-40.3 Continuous grooves shall be formed in construction joints and intersections of vertical and horizontal surfaces by inserting strips to form recesses not less than 1 inch deep by 3/4- inch wide.

3A-40.4 Form ties shall be removed, excess concrete and loose materials ground flush and removed, honeycomb, aggregate pockets and voids cut back or undercut to solid concrete and then treated.

3A-41 BARRICADES AND PROTECTION: Furnish barricades and protection for safety of finished concrete work, particularly exposed architectural concrete. If material is passed from outside of building, or if material lift is installed, location of openings must be approved by Government Representative. Protect adjacent concrete work.

3A-42 PUMPING: During concreting operations, provide and maintain all required pumps, suction, and discharge lines. Run in sufficient numbers and capacity to keep all excavated areas free from water when concrete. Maintain equipment in perfect working order.

3A-43 POROUS FILL

3A-43.1 Slabs on ground shall be installed over a well graded porous fill of gravel or broken stone, of thickness indicated thoroughly compacted.

3A-43.2 After the porous fill under slabs on ground is thoroughly compacted and leveled, furnish and install a layer of polyethlene vapor barrier between the porous fill and the concrete slabs, applied in the widest practicable width and will all joints lapped and sealed.

3A-44 CONCRETE CURBS

3A-44.1 Form concrete curbs of size and shapes indicated on drawings constructed of air-entrained concrete of strength indicated on drawings. Reinforce curbs where indicated on drawings.

3A-44.2 Compact material underlying curbs to provide an even bearing subgrade. Remove unsuitable material and replace with acceptable material properly compacted.

3A-44.3 Use forms of metal or surfaced lumber to provide clean, smooth surfaces.

3A-44.4 Finish curbs by steel troweling and then rub exposed surfaces to a uniform, smooth, even surface using carborundum stone. Plastering with mortar to build up or to finish curbs will not be permitted.

3A-44.5 Provide expansion joints where indicated. Provide non-asphaltic premolded filler for the full height and thickness of curb.

3A-44.6 Protect curbs until completion of contract. Replace any damaged curb at no additional cost to the Government.

3A-44.7 Construct sample curb, showing finish and expansion joint and obtain Contracting Officer's approval before proceeding with casting of curbs. Curbs which do not match approved sample curb shall be removed and replaced.

3A-44.8 Provide drop curbs where indicated on drawings.

3A-45 CONCRETE SIDEWALKS

3A-45.1 Bring subgrade to required level below and parallel to finished grade. Remove any unsuitable material in subgrade and replace with suitable fill. Compact subgrade.

3A-45.2 Over subgrade install compacted thickness of porous fill to provide a smooth, true to grade, even bearing surface.

3A-45.3 Over porous fill install a layer of polyethlene kraft paper or dampen the sufaces of the porous fill immediately before placing the concrete. The porous fill shall be dampened by water sufficient only to be absorbed by the porous fill, but shall not be muddy or frozen at time of pouring and shall be maintained in a satisfactory condition and properly drained until the concrete is installed.

3A-45.4 Forms shall be of steel or surfaced lumber with suitable dividing plates of thickness to provide the width of joint indicated. Forms and dividing plates shall be set with their tops at the exact finished grade. Dividing plates shall be located to form the score joint pattern indicated on drawings. Forms shall remain in place until the concrete has thoroughly hardened, but the dividing plates shall be removed promptly after the concrete is of sufficient hardness to prevent the slabs from flowing together. The Contractor has the option of sawing the score joints to the width and depth indicated in lieu of using metal dividing plates.

3A-45.5 Provide expansion joints where indicated. Provide non-asphaltic premolded joint filler, extending to the bottom of the concrete.

3A-45.6 Concrete for sidewalks shall be air-entrained concrete of strength indicated on drawings, poured in one course, uniformly thick and separated at expansion joints with metal dividing plates. Tamp and screed concrete with not less than 2 screeding passes to bring up sufficient mortar to the surface for proper finishing. The Contractor shall handle concrete with care so as not to segregate the materials or disturb the location or elevations of the forms.

3A-45.7 Finish the top surface to produce an acceptable wood float finish. Finishing operations shall follow closely behind pouring operations. Where sidewalks are cracked or damaged, remove the entire panel wherein damage has occured and install a new panel of sidewalk. No patching of sidewalks will be permitted. Submit sample of sidewalk finish for Contracting Officer's approval.

3A-45.8 No pedestrian traffic is to be allowed on sidewalks for 5 days after construction.

3A-46 FILL FOR METAL PAN STAIR TREADS AND PLATFORMS

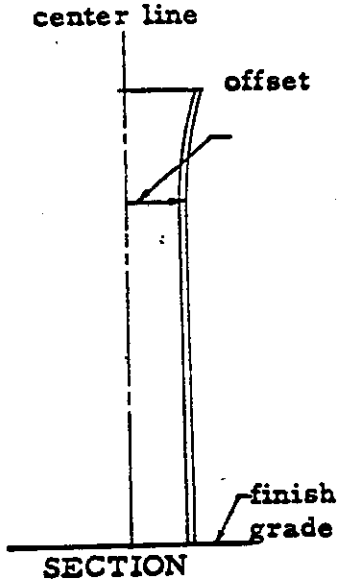
3A-46.1 Fill shall be composed of one (1) part Portland cement, two (2) parts of sand and one and one-half (1-1/2) parts of crushed stone or gravel passing a 1/4 inch sieve and being retained on a 1/8 inch sieve, measured by volume and with only sufficient water added thereto to produce a mixture of the driest consistency for proper finishing. After striking off the fill to the proper levels, the fill shall then be thoroughly compacted and finished by hand floating. After the fill has hardened sufficiently to prevent excess fine material from working to the surface, the treads and platforms shall be brought to a smooth finish, free from defects and blemishes, by additional troweling with a steel trowel.

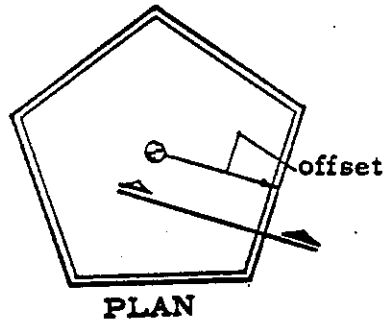
3A-46.2 The treads and platforms of cement or concrete steps and stairs and cement floors where so indicated, shall be made non-slip by embedding in the surface an abrasive aggregate of aluminum oxide applied uniformly at the rate herein before specified.

3A-46.3 The fill for the pans shall be reinforced with a light wire mesh. The light wire mesh shall extend over the entire area of each tread and platform and shall be properly supported 1/2 inch above the bottom of the pans.

TOWER E-1 (60'-Nominal) EXTERIOR CURVE OFFSET TABLE

El. 100'-0" = 0'-0"





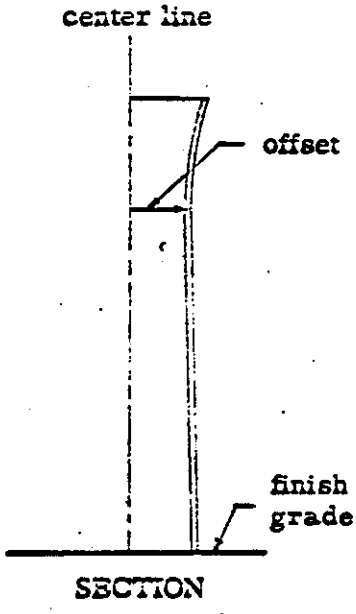
	Height	Offset at face from tower center line
	0'- 0"	8'- 5 3/4+"
	3'- 9"	- 5 5/8+"
C	7'- 6"	8'- 5 9/16"
	11'- 3"	- 5 9/16+"
C	15'- 0"	8'- 5 5/8"
	18'- 9"	- 5 11/16"
C	22'- 6"	8'- 5 3/4"
	25'- 0"	- 5 13/16"
	26'- 3"	- 5 7/8"
	27'- 6"	- 5 7/8+"
C	30'- 0"	8'- 6 1/16"
	32'- 6"	- 6 1/4"
	35'- 0"	- 6 1/2"
C	37'- 6"	8'- 6 7/8"
	38'- 4"	- 7"
	39'- 2"	- 7 1/8"
	40'- 0"	- 7 1/4"
	40'-10"	- 7 3/8+"
	41'- 8"	- 7 9/16"
	42'- 6"	- 7 3/4"
	43'- 4"	- 7 15/16"
	44'- 2"	- 8 1/8+"
C	45'- 2"	8'- 8 1/2"
	46'- 0"	- 8 3/4"
	46'-10"	- 9 1/16"
	47'- 8"	- 9 3/8+"
	48'- 6"	- 9 13/16+"
	49'- 4"	-10 1/4"
	50'- 2"	-10 3/4"
	51'- 0"	-11 1/4+"
	51'-10	8'-11 7/8"
C	52'-11"	9'- 0 11/16+"
	53'- 4"	- 1 1/16+"
	53'- 9"	- 1 1/2"

...continued: (H-1)

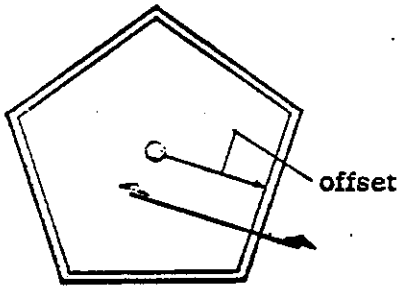
	54'- 2"	- 1 7/8+"
	54'- 7"	- 2 3/8"
	55'- 0"	- 2 13/16+"
	55'- 5"	- 3 3/8"
	55'-10"	- 4"
	56'- 3"	- 4 9/16+"
	56'- 8"	- 5 1/4+"
	57'- 1"	- 6"
	57'- 6"	- 6 3/4+"
	57'-11"	- 7 9/16+"
	58'- 4"	- 8 7/16+"
	58'- 9"	- 9 3/8"
	59'- 2"	-10 3/8+"
	59'- 7"	9'-11 7/16"
	60'- 0"	10'- 0 9/16+"
	60'- 5"	- 1 3/4+"
Top of conc.	60'- 9"	- 2 3/4"
Fin. flr cab	61'-10"	10'- 6 1/4"

C = CONSTRUCTION JOINT

TOWER H-2 (75'-Nominal) EXTERIOR CURVE OFFSET TABLE
El. 100' - 0" = 0' - 0"



SECTION



PLAN

	Height	Offset at face from tower center line
	0'- 0"	8' - 6 7/8"
	2'- 6"	- 6 9/16"+
	5'- 0"	- 6 3/8"
C	7'- 6"	8' - 6 3/16"
	10'- 0"	- 6"+
	12'- 6"	- 5 7/8"+
C	15'- 0"	8' - 5 3/4"+
	18'- 9"	- 5 5/8"+
C	22'- 6"	8' - 5 9/16"
	26'- 3"	- 5 9/16"+
C	30'- 0"	8' - 5 5/8"
	33'- 9"	- 5 11/16"
C	37'- 6"	8' - 5 3/4"
	40'- 0"	- 5 13/16"
	41'- 3"	- 5 7/8"
	42'- 6"	- 5 7/8"+
C	45'- 0"	- 6 1/16"
	47'- 6"	- 6 1/4"
	50'- 0"	- 6 1/2"
C	52'- 6"	8' - 6 7/8"
	53'- 4"	- 7"
	54'- 2"	- 7 1/8"
	55'- 0"	- 7 1/4"
	55'-10"	- 7 3/8"+
	56'- 8"	- 7 9/16"
	57'- 6"	- 7 3/4"
	58'- 4"	- 7 15/16"
	59'- 2"	- 8 1/8"+
C	60'- 2"	8' - 8 1/2"
	61'- 0"	- 8 3/4"
	61'-10"	- 9 1/16"
	62'- 8"	- 9 3/8"+
	63'- 6"	- 9 13/16"+
	64'- 4"	-10 1/4"
	65'- 2"	-10 3/4"

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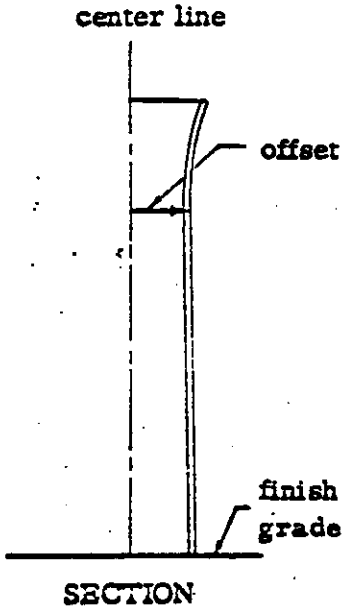
Continued: H-2

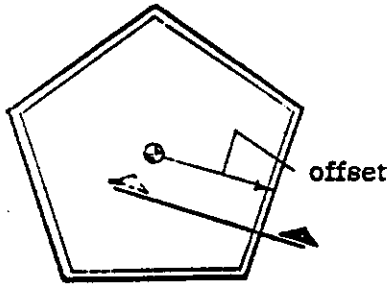
		66'- 0"	-11 1/4"+
		66'-10"	8' -11 7/8"
	C	67'-11"	9' - 0 11/16"+
		68'- 4"	- 1 1/16"+
		68'- 9"	- 1 1/2"
		69'- 2"	- 1 7/8"+
		69'- 7"	- 2 3/8"
		70'- 0"	- 2 13/16"+
		70'- 5"	- 3 3/8"
		70'-10"	- 4"
		71'- 3"	- 4 9/16"+
		71'- 8"	- 5 1/4"+
		72'- 1"	- 6"
		72'- 6"	- 6 3/4"+
		72'-11"	- 7 9/16"+
		73'- 4"	- 8 7/16"+
		73'- 9"	- 9 3/8"
		74'- 2"	-10 3/8"+
		74'- 7"	9' -11 7/16"
		75'- 0"	10' - 0 9/16"+
		75'- 5"	- 1 3/4"+
Top of Conc. Fin. Floor Cab		75'- 9"	- 2 3/4"
		76'-10"	10' - 6 1/4"

C = CONSTRUCTION JOINT

TOWER H-3 (90'-Nominal) EXTERIOR CURVE OFFSET TABLE
El. 100' - 0" = 0' - 0"



SECTION



PLAN

Height	Offset at face from tower center line
0'- 0"	8' - 9 9/16"
0'-10"	- 9 5/16"+
1'- 8"	- 9 1/8"
2'- 6"	- 8 7/8"+
3'- 4"	- 8 3/4"
4'- 2"	- 8 9/16"
5'- 0"	- 8 3/8"+
5'-10"	- 8 1/4"
6'- 8"	- 8 1/8"
C 7'- 6"	8' - 8"
9'- 2"	- 7 11/16"+
10'-10"	- 7 7/16"
12'- 6"	- 7 3/16"
14'- 2"	- 6 15/16"+
C 15'- 0"	8' - 6 7/8"
17'- 6"	- 6 9/16"+
20'- 0"	- 6 3/8"
C 22'- 6"	8' - 6 3/16"
25'- 0"	- 6"+
27'- 6"	- 5 7/8"+
C 30'- 0"	8' - 5 3/4"+
33'- 9"	- 5 5/8"+
C 37'- 6"	8' - 5 9/16"
41'- 3"	- 5 9/16"+
C 45'- 0"	8' - 5 5/8"
48'- 9"	- 5 11/16"
C 52'- 6"	- 5 3/4"
55'- 0"	- 5 13/16"
56'- 3"	- 5 7/8"
57'- 6"	- 5 7/8"+
C 60'- 0"	8' - 6 1/16"
62'- 6"	- 6 1/4"
65'- 0"	- 6 1/2"
C 67'- 6"	8' - 6 7/8"
68'- 4"	- 7"
69'- 2"	- 7 1/8"

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Continued: H-3

		70'- 0"	- 7 1/4"
		70'-10"	- 7 3/8"+
		71'- 8"	- 7 9/16"
		72'- 6"	- 7 3/4"
		73'- 4"	- 7 15/16
		74'- 2"	- 8 1/8"+
	C	75'- 2"	8' - 8 1/2"
		76'- 0"	- 8 3/4"
		76'-10"	- 9 1/16"
		77'- 8"	- 9 3/8"+
		78'- 6"	- 9 13/16"+
		79'- 4"	- 10 1/4"
		80'- 2"	- 10 3/4"
		81'- 0"	- 11 1/4"+
		81'-10"	8' - 11 7/8"
	C	82'-11"	9' - 0 11/16"+
		83'- 4"	- 1 1/16"+
		83'- 9"	- 1 1/2"
		84'- 2"	- 1 7/8"+
		84'- 7"	- 2 3/8"
		85'- 0"	- 2 13/16"+
		85'- 5"	- 3 3/8"
		85'-10"	- 4"
		86'- 3"	- 4 9/16"+
		86'- 8"	- 5 1/4"+
		87'- 1"	- 6"
		87'- 6"	- 6 3/4"+
		87'-11"	- 7 9/16"+
		88'- 4"	- 8 7/16"+
		88'- 9"	- 9 3/8"
		89'- 2"	- 10 3/8"+
		89'- 7"	9' - 11 7/16"
		90'- 0"	10'- 0 9/16"+
		90'- 5"	- 1 3/4"+
Top of conc.		90'- 9"	- 2 3/4"
Fin. Floor cab		91'-10"	10'- 6 1/4"

C - CONSTRUCTION JOINT

95
96-81K

DIVISION 4

SECTION A

MASONRY

4A-01 SCOPE: This specification covers the requirements for mansory and its installation.

4A-02 GENERAL: For location and extent of masonry, see drawings.

4A-03 MATERIALS: Material shall be as specified hereinafter. Material not definitely specified shall be of good commercial quality and suitable for the purpose intended.

4A-03.1 Face Brick: Brick shall be modular sizes, first quality, straight, true, uniform in shape and size and free from checks. Material shall be hard burned shale face brick, manufactured by the extruded wire cut method, conforming to ASTM C216, Type FBS, Grade SW. Bricks shall be nominal 3 3/4 inches x 2 1/4 inches x 8 inches. Color and texture shall be uniform and in accordance with the drawings.

4A-03.2 Concrete Block: Concrete block shall consist of hollow masonry units conforming to the requirements of ASTM Designation C90 - Grade A. Hollow units are (for the purpose of this specification) defined as blocks which have more than 25% voids in every horizontal cross section. When necessary to use solid load-bearing units, they shall conform to Grade A of ASTM C145. The units shall have a maximum linear shrinkage of not more than 0.06 percent when tested in accordance with ASTM C426 and a maximum linear shrinkage of 0.08 percent from saturated to oven dry conditions when tested as in accordance with this specification. Blocks shall be nominal 7 5/8 inches x 15 5/8 inches, thicknesses as shown on drawings, and such special sizes, shapes and units as may be required.

4A-03.3 Glazed Masonry Units: Units shall conform to requirements of Concrete Block. Exposed surfaces shall be covered at point of manufacture with a thermo-setting resinous compound containing at least 75% graded silica sand cast on block by an external heat-polymerizing process. The glazing facing shall return over the ends and edges of block forming a lip not less than 1/16 inch thick. The glazed surface shall conform to ASTM C126.

4A-03.4 Mortar: Mortar shall conform to the requirements for Mortar Type M of Specifications for Mortar for Unit Masonry ASTM C270. It should be noted that under ASTM C270 mortar is not required to meet both the property and the proportion specification. The ASTM property specification test must be prepared in the laboratory. The minimum compressive strength of the mortar as determined by the field compressive test specimens shall not be less than 2500 psi at 28 days. Mortar shall not be used as grout.

4A-03.4.1 Colored Mortar: Mix mortar with mortar color to produce a uniform warm beige color throughout, darker than the color of the face brick. Make trial batches of mortar, allow to dry, and obtain Contracting Officer's approval before using. Submit record of the approved color mix to the Contracting Officer.

4A-03.5 Grout: Fine grout and coarse grout for embedding reinforcing bars in concrete masonry or for filling cells therein for structural purposes shall conform to fine and coarse grout type of ASTM C476. The grout shall have a 28 day compressive strength of 2500 #/sq inch.

4A-03.5.1 Grout for the embedding of architectural chattels shall be composed (by volume) of one part portland cement, three parts sand and two parts pea gravel, to which may be added not more than one-tenth part lime putty, except that; in grout spaces having a minimum horizontal dimension less than 4 inches, the pea gravel shall be omitted. The grout shall contain enough water to flow freely without segregation of the aggregate. Grout shall have a 28 day compressive strength of 2000 #/Sq. In. Mortar shall not be used as grout.

4A-03.5.2 Aggregrates for grout shall meet the requirements of Specifications for Aggregates for Masonry Grout ASTM Designation C404.

4A-03.6 Reinforcing steel bars shall be new intermediate grade conforming to ASTM designation A15 and shall be deformed in accordance with ASTM Designation A305.

4A-03.6.1 Horizontal wall reinforcement shall be fabricated from zinc-coated cold-drawn 3/16" Dia. (#9) steel wire conforming to ASTM A82 and shall be made for use with 12 inch thick composite masonry walls or 12 inch block walls. The configuration shall be equal to No. 12 DUR-O-WAL TRIROD for composite wall and No. 12 DUR-O-WAL for block wall as manufactured by the Dur-O-Wall National Inc., Cedar Rapids, Iowa.

4A-03.6.2 Special corner and intersection type assemblies shall conform to the above requirements. Center to center spacing of the outer longitudinal wires shall be eleven (11) inches.

4A-04 CONSTRUCTION PRACTICES: Every part of the work shall be executed in the best workmanlike manner in accordance with accepted good practice of the trade and in full compliance with this specification. All masonry work shall be plumb, level, straight and true to dimensions shown on the plans. The work shall start, where feasible, at a least important corner or wall. All pattern work, bonds or special details and reinforcement indicated on the drawings shall be accurately and uniformly executed.

4A-04.1 Supervision and Inspection

4A-04.1.1 The Government Representative shall have the right to order whatever certification or tests of materials provided for by this specification or by the ASTM specification under which the material is furnished, which he deems necessary or advisable.

4A-04.1.2 Where specimens are taken by the Government Representative, storage, curing and protection thereof shall be afforded by the Contractor at his expense. The furnishing of cylinder molds for field compressive test specimens of mortar, the delivery of the cylinders to the laboratory and the making of the compression tests of field test specimens will be at the expense of the Federal Aviation Agency. The Contractor at his own expense, shall furnish the Government Representative the necessary material for making the field compressive test specimens for grout. The delivery of the grout specimens to the laboratory and the making of the compression tests of grout specimens will be at the expense of the Federal Aviation Agency.

4A-04.1.3 If the average strength of the laboratory cured specimens falls below the minimum allowable compressive stress, or if there is any other reason to question the quality of the mortar or grout the Government Representative may order such load tests of the completed structure (or portions of the structure) he may deem necessary. If such tests show evident failure, excessive deflection, or lack of recovery of deflection when loads are removed, the contractor will be required (at his own expense) to make such changes or modifications needed to make the structure adequate for its rated capacity.

4A-04.2 Masonry Units

4A-04.2.1 Top of Concrete Foundation Walls: Horizontal concrete surfaces that are to receive masonry shall be clean and damp, with the aggregate of the concrete exposed to assure a good bond between mortar and grout and concrete. All laitance shall be removed as roughness in itself is not indicative of good bond. The first course shall be laid on the concrete, taking care that the mortar bed does not extend into any cells that are to be grouted. Then all cells in this course that are to receive grout shall be grouted to a point 1½ inches below the top of the course. The minimum time between placing foundation and starting masonry shall be when the concrete has attained reasonable strength, but not less than 48 hours to allow for strength and initial shrinkage of the concrete.

4A-04.2.2 Storing and Handling: Masonry units shall be stored in a dry place and off the ground, so that at time of laying, all units shall be sound and clean.

4A-04.2.3 Wetting: Concrete masonry units shall not be wetted before laying, except in hot dry weather when the bearing surfaces may be slightly moistened immediately before laying. In hot dry weather the bearing surfaces of the concrete masonry shall be slightly moistened immediately before laying. All brick having an absorption rate in excess of 0.025 oz per square inch per minute shall be wetted sufficiently so that the rate of absorption when laid does not exceed this amount. The absorption rate shall be determined in accordance with ASTM C67.

4A-04.2.4 Cutting Units: Where masonry unit cutting is necessary, all cuts shall be neat and accurate. Except for minor cuts, units should be cut with a mechanical device.

4A-04.3 Shoring and Scaffolding

4A-04.3.1 Vertical Loads During Construction: All horizontal load bearing members shall be adequately shored. In no case shall shores and forms be removed until it is certain that the masonry has hardened sufficiently to carry its own weight and all other loads that may be placed on it during the construction. The results of suitable control tests may be used as evidence that the masonry has attained such sufficient strength. In addition to the foregoing strength requirement the following arbitrary elapsed times are recommended. Vertical side forms where used for sides of beams, lintels, etc., shall not be removed for 10 days, and then only if the grout has hardened sufficiently to prevent injury. At least 48 hours shall elapse after building masonry columns or walls before constructing the roof.

4A-04.3.2 Lateral Loads During Construction: Partially completed walls and completed walls shall be braced against high winds and heavy rains during the construction period. The wall braces shall be placed at approximately 20 feet intervals and left in place until after the erection of the roof framing, steel deck and perlite concrete. The use of temproary lateral bracing at other positions along the wall as required is left to the discretion of the Contractor and it shall be his responsibility to protect the work during the progress of construction to the completion of the roof.

4A-04.4 Mortar: At time of using, mortar on the boards shall have a slump of approximately 2 3/4 inches. This slump shall be determined by the Field Slump Test for mortars. The exact amount of slump shall be established at the start of construction and maintained throughout the progress of the work.

4A-04.4.1 Admixtures: No admixtures shall be incorporated into the mortar.

4A-04.4.2 Placement: For bed joints the mortar shall be spread in length only to the extent that it will still be plastic when the last unit is placed upon it, thus assuring adequate bond between the mortar and the upper masonry unit.

4A-04.4.3 Re-Tempering: Re-tempering on mortar boards should be done only by adding water within a basis formed with the mortar and the mortar re-worked into the water. Harsh, non-plastic mortar should not be re-tempered nor used. Any mortar which is unused after one hour of the initial mixing shall be removed from the work. Mortar shall be re-tempered with water as required to maintain high plasticity.

4A-04.5 Grout

4A-04.5.1 Mixing: All parts shall be determined by accurate volume measurement at the time of placing in the mixer, and shall be mixed in a mechanical mortar mixer. Care shall be used in accurately measuring all the parts. The mix shall preferably not be less than a multiple of sacks of cement. When less than one sack of cement is used, extreme care shall be used in accurately measuring all the parts. The water, sand (and pea gravel, if used), and cement shall be thoroughly mixed for not less than ten minutes to a fluid consistency. This means, wet enough to pour without segregation or bleeding. At the time of placing, grout should have a slump of approximately 5 inches as determined by the Field Slump Test for Grout.

4A-04.5.2 Admixtures: No admixture shall be incorporated into the grout.

4A-04.5.3 Placement: Mortar "fins" protruding more than 3/8 inches from joints shall be removed before pouring grout. The continuous space between the wythe of the facial brick and the back-up concrete masonry units and the hollow and reinforced cells indicated in the drawings shall be filled with grout. The minimum continuous clear dimensions of vertical cores or grout spaces shall be 2 inches, unless otherwise shown on the drawings. Pour heights in excess of 8 feet shall not be permitted where core dimension is less than 4 inches. Provide cleanouts of the bottom masonry course of each core to be reinforced when the pour height is in excess of 4 feet. When cleanouts are required they shall not be closed until after inspection of the core space and the setting of the vertical reinforcement in fixed position. Where pour heights are in excess of 4 feet, grout shall be poured in lifts of 4 feet maximum for the complete length of the continuous wall section under construction, allowing at least 30 minutes for settlement of grout before pouring the next lift. Grout shall be rodded or puddled during placement to insure complete filling of the core. When grouting is stopped for one hour or longer, the grout pour shall be stopped 1-1/2 inches below the top of a masonry unit. Where horizontal beams and reinforced courses are built of open bottom units such as channel blocks, the top of unfilled cores in the course below such horizontal beams shall be covered to confine the grout fill to the beam section. No material shall be used which destroys the bond between courses. Grouting of beams over openings shall be done in a continuous operation. All grout shall be puddled in a place to insure complete filling of cores and incasement of reinforcement. Any grout that is unused after one hour of the initial mixing shall be removed from the work.

4A-04.5.4 Pour Height: Grout pour height shall not exceed 48 times the minimum net core dimension. Pours shall be stopped 1 ½ inches below the top of a course to form a key at pour joints.

4A-04.5.5 Vibration: Grout shall be rodded or puddled during placement to insure complete filling of the core.

4A-04.6 Reinforcement

/01/

4A-04.6.1 Cleaning: Before being placed, all reinforcement shall be free from loose rust and other coatings that would destroy or reduce bond.

4A-04.6.2 Bending: All reinforcement shall be accurately cut to length and bent without injury to the material. All kinks or bends in the bars caused by handling incident to delivery shall be straightened before placement and without injury to the material. Reinforcing bar hooks shall be made in accordance with the details given in the ACI manual of Standard Practice for Detailing Reinforced Concrete Structures (ACI Manual 315).

4A-04.6.3 Dowels: Dowels from the foundation into the masonry wall columns shall be accurately placed so that the reinforcement will be in proper position to be fully encased in grout in accordance with the plans. Dowels shall be maintained straight. Every effort shall be made for proper alignment of dowels in the masonry units. However, in case a foundation dowel does not line up with the vertical core to be reinforced it shall not be bent over, but shall be grouted into a core in direct vertical alignment, even though it is in a cell adjacent to the vertical wall reinforcement. In all masonry the dowels shall not be bent more than a slope of 1 in 6.

4A-04.6.4 Splices: Splices shall be made only at such points and in such a manner that the strength of the member will not be reduced. Lapped splices shall provide sufficient lap to transfer the working stress of the bars by bond and shear with a minimum lap of 30 bar dimeters, unless otherwise shown on the drawings.

4A-04.6.5 Placement: Reinforcing bars shall be located in all 12" masonry wall and partitions as shown on the drawings. The minimum clear distance between parallel bars, except at splices, shall be equal to the nominal diameter of the bar. Vertical reinforcement may be placed after cleaning cores and before inspection of cores occurs. Vertical reinforcement shall be accurately placed and held in position at top and bottom and at intervals not to exceed 192 diameters of the reinforcement. Horizontal reinforcement may be placed as the work progresses. When mechanical devices are used to hold reinforcement in place care shall be used to see that they do not inhibit the flow of grout.

4A-04.6.6 Clearance: Unless otherwise shown on the drawings, the thickness of grout between masonry units and reinforcement shall be not less than ¼ in. except that; in beams, lintels, etc., the clearance around the reinforcement shall be not less than one-half of the bar diameter, with a minimum of 1/2 inch or the maximum size of aggregate, whichever is greater. Reinforcement in horizontal joints should be kept back at least ½ inch from the face of the masonry. The maximum size reinforcement that may be used in 3/8 inch mortar joint is 3/16 inch.

4A-04.6.7 Horizontal Joint Reinforcement: The horizontal joint reinforcement shall be placed in the first and second bed joints (8 inches c to c) above and below openings and in every second bed joint (16 inch c to c) throughout the remainder of the structure. The horizontal joint reinforcing in the first bed joint immediately above and below openings shall be continuous. In the second bed joint, it shall extend two feet beyond each side of the opening. The joint reinforcement shall be lapped 6 inches minimum at splices and shall bend at corners in such a manner as to insure continuity.

4A-04.7 Alignment

4A-04.7.1 Controlling Joint Thickness: Proper use of a story pole with a tight stretched line shall be used to provide control of joint thickness. Nylon line is recommended.

4A-04.7.2 Vertical and Horizontal Wall Alignment: All masonry work shall be plumb, level, straight and true to dimensions shown on the plans. Masonry shall not vary more than 3/8 inch from plumb in the 10 foot wall height, nor more than 3/8 inch in length in the 36 foot length. All hollow unit masonry shall be built to preserve the unobstructed vertical continuity of the cores which are to be filled.

4A-04.8 Bonding

4A-04.8.1 Bonding shall be as indicated on the drawings.

4A-04.8.2 Running: Where running bond is specified, vertical joints shall occur at center or stretchers in alternate courses. Headers shall not be used.

4A-04.8.3 Stack: Where stacked bond is specified, center lines of vertical joints shall be plumb. The blocks shall be laid equidistant from this center line with not more than 1/8 inch variation in the width of joints, and blocks in each separate stack shall not vary more than 1/8 inch in length.

4A-04.8.4 Racking: When walls are racked, such as at corner leads and temporary construction openings, the grouting procedure shall be the same as for continuous walls. In order to dam the grout at the rack, a block shall be laid across the grout space and the grout shall be held down 1-1/2 inches from the top of each course. This block shall be removed after the grout has solidified. Racking shall be held to a minimum. Care shall be taken that leads at corners or openings are not too high (normally not over about 6 courses). Racking shall not be permitted in wall sections that are less than 4 ft. long.

4A-04.8.5 Toothing: Toothing shall not be permitted.

4A-04.9 Joints

4A-04.9.1 Bed: Unless otherwise shown on the drawings, all bed joints shall be 3/8 inch thick, and all blocks shall be laid with full mortar bedding, i.e., full face shell and web beds. Bed joints shall have sufficient mortar to provide for solid embedment of the units such that extrusions into the grout will not exceed three-eigths inch. Mortar in all bed joints shall be held back 1/4 inch from edges of blocks adjacent to grout spaces, or shall be bevelled back and upward from the grout space. Use extreme care to keep mortar droppings out of grout space. Bed joints shall not be furrowed. All blocks shall be shoved at least one-half inch into place.

4A-04.9.2 Head: Unless otherwise shown on the drawings, all head joints shall be 3/8 inch thick. Head joints shall have sufficient mortar to fill solidly the joints of the units such that extrusions into the grout spaces will not exceed three-eighths inch. All head (or end) joints shall be filled solidly with mortar for a distance in from the face of the unit or wall of not less than the thickness of the longitudinal face shells. In units that are to be grouted, head joints shall be solidly filled.

4A-04.9.3 Moving Units After Placing: Masonry units shall not be moved after they have come in intimate contact with the mortar. It is permissible to tap the units downward, but not to rock or slide them. Where units are required to be moved for leveling or alignment they shall be removed, cleaned of all mortar and reset in fresh mortar.

4A-04.9.4 Tooling: Exterior joints shall be tooled with a tool jointer while the mortar is thumb print fresh, compacting the mortar into the joint and against the masonry units with firm pressure. All tooling shall be done with a clean, preferably stainless steel, joint tool, with the same size and type used for the whole job as specified on the drawings. Joints not exposed to the weather may be either tooled or struck with a trowel, unless otherwise noted on the drawings. Joints of masonry to be plastered may be cut flush. If raked joints are specified, the raking shall be immediately followed by tooling with a flat jointing tool. Joints shall be tooled with a jointing runner 2 foot long, pressing the excess mortar out of the joint rather than dragging it out. The primary object of tooling is to produce weather tightness of joints.

4A-04.9.5 Construction Joints: Where fresh masonry joins masonry that is partially set or totally set, the exposed surface of the finished masonry shall be cleaned with a wire brush and dampened when necessary to obtain the best possible bond with the new work. All loose masonry units and mortar shall be removed. Where horizontal construction joints intersect grouted sections, the grout shall be poured to a point about 1½ inches below the top of the course. Except as specifically called for on the drawings, horizontal construction joints will not be permitted in any bond beam, lintel, or reinforced course.

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4A-04.10 Bolts and Anchors: All bolts, anchors, etc., shall be accurately set into the masonry as the work progresses and shall be thoroughly embedded in mortar or grout. When more than 2 bolts occur in a group, templates shall be used. Unless otherwise shown on the drawings, bolts set vertically in walls, pilasters, or columns shall be set inside horizontal reinforcing steel or ties and shall not be placed closer than 3 inches from the face of the masonry. All vertical bolts shall be solidly grouted in position. Unless otherwise shown on the drawings, horizontal bolts shall be embedded not less than two-thirds of the wall thickness and shall be grouted below and above for solid embedment. Horizontal bolts shall be embedded solidly in the mortar bed and into the grout space.

4A-04.11 Pipes and Conduits: Unless specifically located and detailed on the drawings, no pipes or conduits shall be embedded in the masonry. However, when so indicated on the drawings, pipes or conduits may pass through the masonry by means of sleeves at least large enough to pass any hub or coupling on the pipe line. Such sleeves shall be placed not closer than three diameters, center to center, nor shall they impair the strength of construction, and their location shall be as shown on the drawings. Placement of pipes or conduits in unfilled cores of hollow unit masonry shall not be considered as embedment.

4A-04.12 Windows and Doors: The jambs, heads and sills of masonry openings shall be protected from damage during construction, especially where workmen, materials or equipment are apt to pass through the openings. Window and door openings shall be braced during construction to prevent movement. Window and door frames shall be anchored to masonry at a maximum spacing of 24 inches on center. Anchorage of metal frames often requires placing the frame before laying the masonry.

4A-04.13 Wall Care

4A-04.13.1 During Erection: Care shall be exercised to protect the faces of the masonry from being smeared or splattered with mortar, grout, or splashings from scaffolds; should this occur, the faces shall be immediately cleaned before the mortar or grout has set. All sills, ledges, offsets, other materials, etc., shall be protected from mortar droppings during construction. The tops of all unfinished masonry shall be protected from rain, snow, or other foreign material. No construction supports shall be attached to the wall except where specifically permitted by the Government Representative. All forms shall be made tight, and concrete and grout spilled on the wall shall be washed off before it can set. Temporary capping units or other suitable means shall be used on tops of exposed courses to keep water from penetrating down into the interior of the walls.

4A-04.13.2 Curing: Masonry walls shall not be wetted down after construction is completed, except in extreme hot weather when the walls shall have their surfaces dampened with a light fog spray for a curing period of three days such that the water does not run down the surface.

4A-04.13.3 Freezing: Adequate equipment shall be provided for heating the masonry materials and protecting the masonry during freezing or near-freezing weather. No frozen materials nor materials containing ice shall be used. Sand shall be heated in such a manner as to remove frost or ice. Water or sand shall not be heated to a temperature above 160°F. When necessary to remove frost, the masonry units shall be heated. Whenever the temperature of the surrounding air is below 40°F, all newly constructed reinforced masonry laid in mortar, in which high-early-strength portland cement is used, shall be maintained at a temperature of at least 50 F for not less than 24 hours by means of enclosures, artificial heat, or by other protective methods as will meet the approval of the Government Representative. When any cementing material other than high-early-strength portland cement is used, these temperatures shall be maintained for at least 72 hours. All methods and materials for the protection of the fresh masonry work against freezing shall be subject to the approval of the Government Representative. In general the methods and materials not commonly accepted as suitable for the protection of reinforced concrete construction in freezing weather shall not be used. Salt or other chemical for lowering the freezing temperature of the mortar shall not be used. Calcium chloride in excess of 2 percent by weight of portland cement shall not be used to obtain high early strength of grout or mortar.

4A-04.13.4 Finish: During construction or immediately after completion of a section of masonry all line pin holes and any defects in masonry jointing and also connections to other materials shall be carefully and solidly filled with mortar to match the existing work.

4A-04.13.5 Pointing: Prehydrated mortar shall be used for pointing. Open joints shall be pointed in two operations. The joints shall be half filled solidly and the next day the joints shall be completely filled and tooled. Prehydrated mortar is obtained by mixing the materials with one-half of the mixing water, left to stand for one hour and then mixed with the remaining water.

4A-04.13.6 Cleaning: At the completion of masonry work, the Contractor shall clean down all masonry work, remove his scaffolding and equipment, clean up all debris, refuse and surplus material and remove them from the premises. Cleaning of masonry shall be done about 10 days after the completion of masonry erection, unless otherwise directed by the Government Representative. Acid washing of concrete masonry will not be permitted.

4A-04.13.7 Preparation for Painting and Waterproofing: Surfaces to be painted or waterproofed shall be cleaned of all loose mortar, dirt and efflorescence. Where it is deemed necessary by the Government Representative, the Contractor shall scrape and brush the surfaces. Wire-brushes shall not be used. Masonry surfaces shall have a temperature of not less than 55°F at time of painting or waterproofing.

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4A-05 TEST PROCEDURES

4A-05.1 The test procedures presented in this section of the specifications are for the purpose of controlling the quality of the construction. Unless specifically stated, they are not intended to supersede, waive, or void any portion of any of the ASTM specifications referred to hereinbefore.

4A-05.2 Field Slump Test for Mortar: Use a truncated metal cone 4 inches x 2 inches x 6 inches high, and after dampening, place on a flat, moist non-absorbent base. Fill cone with two layers of mortar, rodding each layer 10 times with a ½ inch bullet-nosed rod, distributing strokes uniformly over the cross section and penetrating underlying layer. Lightly tap cone on opposite sides, level off, carefully lift cone and measure slump.

4A-05.3 Field Slump Test for Grout: Use a truncated metal cone 4 inches x 2 inches x 6 inches high, and after dampening, place on a flat, moist, non-absorbent base. Thoroughly mix or agitate grout before placing in cone to obtain a full representative mix. Fill cone with grout, lightly tap cone on opposite sides, level off, carefully lift cone and measure slump.

4A-05.4 Linear Change (Rapid Method Test): Rapid Shrinkage Test shall be made in accordance with ASTM C341.

4A-06 SAMPLE PANEL

4A-06.1 Prior to starting any masonry work, lay up a section of exposed block and brick masonry, typical of the exterior wall, at least 4 ft. wide by 6 ft. high for the Contracting Officer's approval.

4A-06.2 Sample wall panel shall show the texture, variations in color or texture, coursing, bonding, pointing, color of mortar, method of forming external corners, bond beam lintels and wall intersections, joint reinforcement, anchors, ties etc.. Lay up panel well in advance of starting block work to allow for drying and setting. Sample panel shall remain on the site until ordered removed by the Contracting Officer.

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DIVISION 4

SECTION B

BUILDING INSULATION

4B-01 SCOPE: This Section covers the requirement for building insulation and its installation.

4B-02 GENERAL: Building insulation shall be applied to shaft concrete walls as shown on the drawings.

4B-03 MATERIALS:

4B-03.1 Materials shall comply with the following specifications. Materials for this work shall be shipped to the job site with manufacturers' seals and labels.

4B-03.2 Building Insulation: Expanded polystyrene, self-extinguishing type, conforming to Military Specification MIL-P-40619, Type I, Class 2, and certified by the manufacturer as being suitable as a base for Portland cement and gypsum plaster finishes; thicknesses as indicated.

4B-03.3 Portland Cement: ASTM C-150.

4B-03.4 Mortar Sand: ASTM C-144.

4B-03.5 Latex Mortar Additive: Dow's "styrocrete" or approved equal.

4B-04 APPLICATION

4B-04.1 Concrete and masonry surfaces to receive building insulation shall be clean and dry, reasonably smooth and free from loose and foreign materials. All evidence of form oil shall be removed from concrete surfaces prior to installation of the insulation.

4B-04.2 If outside temperatures drop below 40 degrees F. a surface and air temperature of not less than 55 degrees F. shall be maintained during and after installation of the insulation until mortar or bonding adhesive has set and cured.

4B-04.3 Install insulation to masonry and concrete surfaces using mortar mixed in the proportions of 1 part Portland cement and 3 parts sand to which shall be added the latex mortar additive in proportion as recommended by the manufacturer.

4B-04.4 Bond the insulation directly to masonry or the concrete surface using the latex modified mortar applied to the insulation with a push-box to provide

a 3/16" thick mortar coating.

4B-04.5 Apply the insulation boards horizontally, with all joints square and butted tightly. Allow mortar bond to set and properly cure before application of plaster to the insulation boards.

4B-04.6 At intervals of approximately 15 feet in vertical height install preservative treated, kiln dried, horizontal wood girts, nominal 1-1/4" x 3", to support insulation. Stagger girts so that they occur only in unplastered spaces.

4B-05 PRECAUTIONS

4B-05.1 The following precautions shall be observed in the use of polystyrene insulation:

4B-05.1.1 Do not leave polystyrene insulation exposed to direct sunlight for more than 5 days without covering with an opaque tarp, such as white "Polyfilm" polyethylene film or approved equal.

4B-05.1.2 Do not use solvent base adhesive, mastic, or paint with polystyrene insulation.

4B-05.1.3 Do not apply hot asphalt directly to polystyrene insulation.

4B-05.1.4 Do not permit polystyrene insulation to contact coal tar pitch.

4B-05.2 Consult manufacturer's literature for additional limitations applying to polystyrene insulation.

4B-06 CERTIFICATION AND INSTRUCTIONS

4B-06.1 Contractor shall furnish certificate, signed by the Contractor and the insulation manufacturer, certifying that the insulation has been installed in accordance with the manufacturer's instructions. Certificate shall also state that the insulation furnished and installed conforms to the specified requirements.

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DIVISION 5

SECTION A

STRUCTURAL STEEL

5A-01 SCOPE: This Section covers the requirement for structural steel and its erection.

5A-02 GENERAL: The location and extent of work is as shown on the structural drawings and hereinafter specified, including, but not necessarily limited to the following items.

5A-02.1 All structural steel for base building and connecting corridor including beams, columns, masonry plates, bearing plates, anchor bolts and machine & structural bolts.

5A-02.2 All steel lintels.

5A-03 SPECIFICATIONS: Structural design is based on current AISC & AWS codes and specifications. Design assumptions, where applicable, are based on type 1 (rigid frame) construction in accordance with AISC "Specification for the Design, Fabrication & Erection of Structural Steel for Buildings".

5A-04 WELDER AND WELDING OPERATOR QUALIFICATIONS: Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society, to perform the type of work required, except that this provision need not apply to tack welds not later incorporated into finished welds carrying calculated stress.

5A-04.1 Welding to be submerged arc with low hydrogen mild steel electrode of ASTM-A2333 and of one of the following types: E6015, E6016, E6018, E7015, E7016 or E7018.

5A-04.2 All Low hydrogen electrodes shall be dried for at least two (2) hours between 450 to 500°F before they are used. Electrodes shall be stored and handled in accordance with Section 3 of AWS D1.0.

5A-04.3 Studs shall be "Nelson" type or equal and welded in accordance with the manufacturer's recommendations using templates and stud ferrules as required.

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5A-05 MATERIAL: Structural steel ASTM-A36 unless noted. Columns to be hotrolled carbon steel hollow structural tubing of ASTM-A36 material.

5A-05.1 Anchor bolts, machine bolts shall be in accordance with ASTM-A307 grade A Steel unless noted.

5A-05.2 High strength bolts and nuts shall be of high strength steel in accordance with ASTM-A325.

5A-05.3 Bolted connections to be 3/4" diameter hex. head machine bolts with standard flat steel washer under nut. Nuts to be full self-locking, American standard heavy, equal to "anco" type as manufactured by Bethlehem Steel Co.

5A-05.4 Other material to be as indicated on the applicable drawings.

5A-06 FABRICATION: Fabrication shall be in accordance to the current AISC Specifications.

5A-06.1 Long Span Beams: The long span beams (60-0 approx) shall preferably be in one piece, where necessary to splice the beams, the splices shall be as shown on the applicable drawing.

5A-06.2 Tolerances:

5A-06.2.1 Straightness: Structural members consisting primarily of a single rolled shape shall, unless specified, be straight within the appropriate tolerances allowed by ASTM A6 or as prescribed in the following paragraph. Built-up structural members fabricated by riveting or welding, unless otherwise specified, shall be straight within the tolerances allowed for wide flange shapes by ASTM Specification A6 or by the requirements of the following paragraph.

5A-06.2.1.1 Structural members consisting primarily of a tubular cross-section shall, unless specified, be straight within the appropriate tolerances allowed by ASTM A501 or as prescribed in the following paragraphs.

5A-06.2.1.2 Compression members shall not deviate from straightness by more than 1/1000 of the axial length between points which are to be laterally supported.

5A-06.2.1.3 Completed members shall be free from twists, bends and open joints. Sharp kinks or bends shall be cause for rejection of material.

5A-06.2.2 Straightening Material: Rolled and tubular material, before being laid off or worked, must be straight within the tolerances allowed by ASTM A6 and ASTM A501. If straightening is necessary, it shall be done by methods that will not injure the metal.

5A-06.2.2.1 Shop check mill camber on all beams and place upward before fabrication. Camber of beams shall be as specified on the drawings.

5A-06.2.3 Length: A variation of 1/32 inch is permissible in the overall length of members with both ends finished for contact bearings under compression. Members without ends finished for contact bearing, which are to be framed to other steel parts of the structure, may have a variation from the detailed length not greater than 1/16 inch for members 30 feet or less in length, and not greater than 1/8 inch for members over 30 feet in length.

5A-06.3 Gas Cutting: Gas cutting shall preferably be done by machine. Gas cut edges which will be subjected to substantial stress or which are to have weld metal deposited on them shall be free from gouges; any gouges that remain from cutting shall be removed by grinding. All re-entrant corners shall be shaped notch free to a radius of at least 1/2 inch.

5A-06.4 Planing of Edges: Planing or finishing of sheared or gas cut edges of plates or shapes will not be required unless specifically called for on the drawings or included in a stipulated edge preparation for welding.

5A-06.5 Welded Construction: Surfaces to be welded shall be free from loose scale, slag, rust, grease, paint and any other foreign material except that mill scale which withstands vigorous wire burshing may remain. Joint surfaces shall be free from fins and tears. Preparation of edges by gas cutting shall, wherever practicable, be done by a mechanically guided torch.

5A-06.5.1 Parts to be fillet welded shall be brought in as close contact as practicable and in no event shall be separated by more than 3/16 inch. If the separation is 1/16 inch or greater, the size of the fillet welds shall be increased by the amount of the separation. The separation between faying surfaces of lap joints and butt joints on a backing structure shall not exceed 1/16 inch. The fit of joints at contact surfaces which are not completely sealed by welds, shall be close enough to exclude water after painting.

5A-06.5.2 Abutting parts to be butt welded shall be carefully aligned. Misalignments greater than 1/8 inch shall be corrected and, in making the correction, the parts shall not be drawn into a sharper slope than 2 degrees (7/16 inch in 12 inches).

5A-06.5.3 The work shall be positioned for flat welding whenever practicable.

5A-06.5.4 In assembling and joining parts of a structure or of built-up members, the procedure and sequence of welding shall be such as will avoid needless distortion and minimize shrinkage stresses. Where it is impossible to avoid high residual stresses in the closing welds of a rigid assembly, such closing welds shall be made in compression elements.

5A-06.5.5 All complete penetration butt welds made by manual welding, except when produced with the aid of backing material or welded in the flat position from both sides in square-edge material not more than 5/16 inch thick with root opening not less than one-half the thickness of the thinner part joined, shall have the root of the initial layer gouged out on the back side before welding is started from that side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross-section. Butt welds made with use of a backing of the same material as the base metal shall have the weld metal thoroughly fused with the backing material. Backing strips may be removed by gouging or gas cutting after welding is completed, provided no injury is done to the base metal and the weld metal surface is left flush or slightly convex with full throat thickness.

5A-06.5.6 Butt welds shall be terminated at the ends of a joint in a manner that will ensure their soundness. Where possible, this should be done by use of extension bars or run-off plates. Extension bars or run-off plates, if used, shall be removed upon completion of the weld and the ends of the weld made smooth and flush with the abutting parts.

5A-06.5.7 No welding shall be done when the ambient temperature is lower than 32°F without preheating. When base metal is at a temperature below 32°F, it shall be preheated to at least 70°F prior to tack welding or welding. Preheating shall bring the surface of the base metal within 3 inches of the point of welding to the specified preheat temperature, and this temperature shall be maintained as a minimum interpass temperature while welding is in progress. Minimum preheat and interpass temperatures shall be as specified by the AISC Specifications.

5A-06.5.8 Where required, multiple-layer welds may be peened with light blows from a power hammer, using a round-nose tool. Peening shall be done after the weld has cooled to a temperature warm to the hand. Care shall be exercised to prevent scaling, or flaking of weld and base metal from over-peening.

5A-06.5.9 The technique of welding employed, the appearance and quality of welds made, and the methods used in correcting defective work shall conform to Section 4 - Workmanship, of the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society.

5A-06.6 Bolted Construction - Holes: Holes for bolts shall be 1/16 inch larger than the nominal diameter of the bolt. If the thickness of the material is not greater than the nominal diameter of the rivet plus 1/8 inch, the holes may be punched. If the thickness of the material is greater than the nominal diameter of the bolt plus 1/8 inch, the holes shall be either drilled from the solid, or sub-punched and reamed. The die for all sub-punched holes, and the drill for all sub-drilled holes, shall be at least 1/16 inch smaller than the nominal diameter of the bolt.

5A-06.7 Assembling: Drifting done during assembling shall not distort the metal or enlarge the holes. Holes that must be enlarged to admit the bolts shall be reamed. Poor matching of holes shall be cause for rejection.

5A-06.8 Finished or Machined Surfaces: Machined surfaces shall be controlled milled finished and surface roughness in accordance with Standard ASA B46.1 "Surface Roughness, Waviness and Lay" of the American Standards Association. Machine finished surfaces shall be protected against corrosion by a rust-inhibiting coating that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.

5A-06.9 Special Surfaces:

5A-06.9.1 Surfaces Adjacent to Field Welds: Unless otherwise provided, surfaces within two inches of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.

5A-06.9.2 Inaccessible Surfaces: Surfaces inaccessible after assembly shall be treated in accordance with AISC Specifications before assembly.

5A-06.9.3 Contact Surfaces: Contact surfaces shall be cleaned in accordance with AISC Specifications before assembly but shall not be painted.

5A-07 SHOP PAINT: All Structural Steel, except items embedded in concrete, shall be given one coat of primer in accordance with System Number ST-1 of FAA-STD-003 (Federal Aviation Agency Standard, Paint Systems for Structures).

5A-08 FABRICATION DRAWINGS: The fabrication contractor shall prepare shop fabrication drawings in accordance with paragraphs 3.2.3., 3.2.7, 3.2.8, 3.2.9, 3.2.10 and 3.2.11 of Specification FAA-910 (Specification for Materials and Fabrication of Steel Structures).

5A-08.1 Erection Drawings: The fabrication contractor shall utilize the design drawings for erection drawings by adding appropriate erection marks in the design drawings. New erection drawings by the contractor shall only be made when necessary to clarify erection details.

5A-08.2 Drawings Sent to Field: One copy of the applicable fabrication and erection drawings shall be packed with each structure. Prints shall be enclosed in water-proof envelopes.

5A-09 SHIPPING: The bundling and loading of the structure steel, joists, etc., on rail or truck carrier shall be done in such a manner that the material is protected from damage during shipment.

5A-10 ERECTION: Structural steel framing must be squared and plumbed before permanent field bolts are tightened and/or before permanent field welds are made. The building frame shall be plumbed or leveled to an error not greater than 1 to 500.

5A-10.1 Temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected to during erection, including equipment and the operation of same. Such bracing shall be left in place as long as may be required for safety. (See Masonry Section for wall bracings).

5A-10.2 Wherever piles of material, erection equipment or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from such loads.

5A-10.3 As erection progresses, the work shall be securely bolted, or welded, to take care of all dead load, wind and erection stresses.

5A-10.4 No permanent bolting or welding shall be done until as much of the structure as will be stiffened thereby has been properly aligned.

5A-10.5 Welding, burning and drilling of holes in the structure steel framing shall not be permitted without the approval of the government representative. When necessary to weld any part of the structural steel after erection, the member being welded shall be temporarily be supported in order to relieve the member of the imposed loads.

5A-11 GROUTED STEEL: Provisions for grouting under the column base plates and under beam seats bearing on the masonry walls shall be made during erection in order to maintain the top of the roof framing beams to the same height, as indicated on the drawing, within the tolerance specified herein. The method used shall be approved by the Government Representative.

5A-11.1 The grouting material shall be NON-SHRINK ready-to-use product requiring only mixing with water at the job site. It shall be equal to EMBECO PRE-MIXED GROUT as manufactured by the Master Builders Company of Cleveland, Ohio.

5A-11.2 The underside of the base plate or bearing plate shall be cleaned of all grease and oil-like films; the pertinent concrete surfaces shall be cleaned of all similar contamination and debris. The top of the concrete shall be chipped and roughened and all laitance or poor concrete removed. The concrete shall be water-saturated for a period equivalent to 2 hours, the excess water removed and the non-absorbent edge-forms erected.

5A-11.3 Minimum depth of grout shall be one (1) inches and it shall be placed under the base plate in such a manner which will avoid air voids. The grout shall be packed and tamped from one or two sides only and shall be sufficiently compacted in order to transfer adequately the column and beam loads to the concrete foundation or beam seat. If shims are used they shall be placed in such a manner that they can be removed after the grout has cured and is capable of transmitting the column or beam loads. Care shall be used in keeping the grout damp during the curing period. The recommendations of the grout manufacturer with respect to mixing, placing, curing and for protecting the exposed surfaces, are to be closely followed.

5A-12 INSPECTION OF THE STRUCTURAL STEEL, FABRICATION & ERECTION:

5A-12.1 General: Material and workmanship at all times shall be subject to the inspection of Government Representatives.

5A-12.2 Cooperation: All inspection as far as possible shall be made at the place of manufacture, and the contractor or manufacturer shall cooperate with the inspector, permitting access for inspection to all places where work is being done.

5A-12.3 Rejections: Material or workmanship not conforming to the provisions of the above paragraphs may be rejected at any time defects are found during the progress of the work.

5A-12.4 Inspection of Welding: The inspection of welding shall be performed in accordance with the provisions of Section 5 of the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society.

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DIVISION 5

SECTION B

ROOF DECK

5B-01 SCOPE: This Section covers the requirement for steel roof deck and related items and their installation.

5B-02 GENERAL

5B-02.1 For location and extent of work see drawings and details. The cutting, drilling or punching of openings in the deck for passage of pipes, ducts and the attachment of other items shall be performed in the field by the roof deck contractor.

5B-02.2 The following items of related work are specified and included under other sections of the specifications:

5B-02.2.1 Structural framing for support of decks.

5B-02.2.2 Steel bearing plates on walls.

5B-02.2.3 Perlite concrete fill.

5B-02.2.4 Ceiling suspension system on furring below decks.

5B-02.2.5 Field painting of exposed deck surfaces including touch up.

5B-02.2.6 Flashings, and roof drains.

5B-03 MATERIALS: All steel roof decking and accessories shall be formed from U. S. standard gauge sheet steel conforming to ASTM Specification A-245 or ASTM A366. The material shall have a protective zinc coating applied to the steel before forming which conforms to Federal Specification QQ-S-775, Type 1, Class E. Sheets shall be continuously rolled and uniformly shaped in every respect. Welding shall conform to the American Welding Society Standard Code for Arc and Gas Welding in Building Construction.

5B-04 SUBSTITUTIONS AND MODIFICATIONS: The Contractor shall provide materials and shapes as indicated on the drawings and specified herein. Any substitutions or modifications shall meet all conditions of design, finish and construction and shall be submitted to the Contracting Officer for approval. The steel roof deck is used as a horizontal diaphragm and any substitutions shall meet this design condition.

5B-05 SHOP DRAWINGS AND SAMPLES

5B-05.1 Shop drawings shall indicate size and location of roof framing supports and location, lengths and markings of deck units to correspond with the sequence of installation. Drawings shall indicate fastening methods for deck units, accessories, closure plates, fittings and the type and sequence of connections.

5B-05.2 Submit samples of welding washers, if used and hole opening covers.

5B-06 DECKING TYPE, DESIGN AND FABRICATION

5B-06.1 The American Iron and Steel Institute Specifications for the "Design of Light Gauge Cold Formed Steel Structural Members," and standards of the American Welding Society (AWS), and the Steel Deck Institute (SDI) shall govern the design for decks covered under this section.

5B-06.2 Steel roof decking shall be H. H. Robertson, Section UKX, 18 gauge material or equal. Decking shall be formed to have a moment of inertia of not less than 0.566 in. per foot of width. The roof decking shall have a nominal depth of 1 1/2 inches and shall be formed to provide cells spaced not more than 6 inches on center. The decking shall have an 18 gauge flat bottom plate with male and female lips at the sides which permit proper fastening to insure the transference of both lateral and vertical loads.

5B-06.3 The steel deck shall have hanger tabs pre-punched, Robertson Q- Hanger or equal, spaced on 6 inch centers each way in accordance with the manufacturer's standard practice.

5B-06.4 The Contractor shall provide necessary accessories such as welding washers, covers for openings and closures where required.

5B-07 ERECTION OF STEEL ROOF DECKING

5B-07.1 The deck shall be laid in accordance with the manufacturer's instructions and as shown on the applicable drawings. The deck shall be erected with the flat plate down. The deck units shall be adjusted in place before being permanently welded. Welding to be submerged arc with low hydrogen mild steel electrode of ASTM A233 type E-7016 with mineral or inorganic coating. Welding of the deck shall be done in a manner as to prevent burn-through or excessive distortion. All welds shall be sound and shall be fusion type with sizes and spacings as indicated on the drawings. As each weld is completed the weld spatter and surface oxides shall be immediately brushed away and the weld and welded area shall be reheated to approximately 600 degrees F. and the surfaces shall be re-galvanized with zinc. The zinc alloy shall conform to Federal Specification O-G-93 "Galvanizing Repair Compound" (GALV-WELD alloy as manufactured by the Galv-Weld Products of Bradenton, Florida).

5B-07.2 All welding shall be performed by competent welders who have qualified by tests as prescribed by the American Welding Society to perform the type of work required.

5B-07.3 The side laps of the deck shall be button-punched in accordance with the manufacturer's recommendation. The button-punched shall be spaced as indicated on the drawing.

5B-08 CERTIFICATE: The Contractor shall furnish an affidavit from the manufacturer, certifying that the materials or product delivered to the job meets the requirements specified.

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DIVISION 5

SECTION C

MISCELLANEOUS METAL

5C-01 SCOPE: This Section covers the requirements for miscellaneous metal and related items and their installation.

5C-02 GENERAL: For locations and extent of work, see drawings.

5C-03 MATERIALS

5C-03.1 Steel Shapes: ASTM A-7 or Federal Specification QQ-S-741a, Type I or Type II as best suited for the purpose, Class I.

5C-03.2 Steel Plates and Bars: Cold rolled and hot rolled steel conforming to applicable ASTM or Federal Specifications.

5C-03.3 Wrought Iron: Federal Specification QQ-I-686b, Grade B.

5C-03.4 Cast Iron: Federal Specification QQ-I-652a, class best suited for the purpose, excepting casting for covers and frames ASTM A-48, Class 30.

5C-03.5 Malleable Iron Castings: Federal Specification QQ-I-666c, grade best suited for the purpose.

5C-03.6 Wire, Steel, Cold-Drawn: Federal Specification QQ-W-461e, composition 1020, 1035, or 1045, Finish 1 or 4 as best suited for the prupose.

5C-03.7 Aluminum: Commercial alloys; 6061-T6 for structural shapes; 6063-T5 for rods, tubes and pipes; 6063-T42 for extrusions; 3003 for sheet and plate.

5C-03.8 Safety Treads, Metallic: Federal Specification RR-T-661, types and class best suited for the purpose.

5C-03.9 Gratings, Steel Floor: Federal Specification RR-G-661a, Type I or Type II.

5C-03.10 Iron and Steel, Zinc-Coated: Federal Specification QQ-S-775a, Type I, Class C or D as best suited for the purpose.

5C-03.11 Pipe: ASTM A-72, "Welded Wrought-Iron Pipe", "extra strong" weight unless otherwise indicated; standard malleable iron flush type fittings.

5C-03.12 Bolts and Nuts: ASTM A-307, Federal Specifications FF-B-571a, FF-B-575b, FF-F-584a, FF-B-588.

5C-03.13 Galvanizing: ASTM A-143.

5C-03.14 Shop Paint: Rust-inhibitive paint; zinc chromate, JAN-P-735, red oxide Federal Specification TT-P-31c, or baked-on rust inhibitive paint having equal performance characteristics; as approved by the Contracting Officer.

5C-03.15 Field Paint: Red lead-iron oxide intermediate metal paint for structural steel, Federal Specification TT-P-86c.

5C-03.16 Zinc-Dust Primer: For galvanized surfaces, Federal Specification TT-P-641.

5C-03.17 Other Materials: Materials not specified shall be of the best quality in their class subject to the approval of the Contracting Officer.

5C-04 SUBSTITUTIONS AND MODIFICATIONS

5C-04.1 Base proposals on materials and shapes as indicated on the drawings and details, and as specified. Any substitution proposed shall meet all conditions of design, finish and construction as shown on the drawings and as specified, and shall be submitted to the Contracting Officer for approval.

5C-04.2 Modifications: The fabricator will be permitted to make minor changes in detailing of the work in order to conform to standard procedures or as required to facilitate field erection. No changes shall be made without prior approval of the Contracting Officer in writing.

5C-05 CHANGES IN SHAPES: The Government reserves the right to make minor changes in the shapes and profiles of the members before final approval of the shop drawings. No extra amount above the contract price will be allowed because of these changes.

5C-06 SHOP DRAWINGS AND SAMPLES

5C-06.1 Submit shop drawings for approval prior to fabrication. Drawings shall show in detail all parts of the work, fully dimensioned; full size details showing thickness, profiles, jointing, welds, intersections and assembly of the various members; details of construction, weatherproofing, hardware and hardware schedules; reinforcements, anchorage and structural supports; and such other drawings and details as required to fully illustrate all details of the work, and as required to meet site conditions.

5C-06.2 Submit for approval samples of all finishes.

5C-07 TEMPLATES AND PATTERNS: Include all templates and patterns required in connection with the work of this Section; supply copies to all trades requiring same.

5C-08 FABRICATION, ERECTION AND INSTALLATION

5C-08.1 Manufacture all work in ample time so as not to delay the progress of the work; deliver to job site at such times as required for proper coordination.

5C-08.2 Fabricate, erect and install work in a thorough and workmanlike manner. Execute and erect all work with skilled mechanics. Any parts having defects of any kind in materials, workmanship or finishes will be rejected; remove such rejected work from the site and replace with proper work at not any additional cost to the Government.

5C-08.3 Form work true to detail, with clean, straight and sharply defined profiles. Metal to have smooth finished surfaces except where otherwise specified, indicated on drawings or approved by the Contracting Officer.

5C-08.4 Make all joints of such character and so assembled to be as strong and rigid as adjoining sections. Joints required to be welded shall be continuously welded or spot welded as indicated, specified or approved by the Contracting Officer and with face of welds dressed flush and smooth.

5C-08.5 Form joints exposed to the weather or elements in such manner as to be watertight.

5C-08.6 Make castings clean, smooth, true to pattern, free from defects, and of the best quality, with all edges coming from the mold clean, smooth and perfect.

5C-08.7 Unless otherwise indicated or specified, make surfaces required to be non-slip safe for foot traffic by use of a non-slip abrasive aggregate embedded in the wearing surface at the time of the casting.

5C-08.8 Make connections, assemblies and accessories to adequately and safely sustain and withstand the stresses and strains to which they may be subjected.

5C-08.9 Bolts, nuts, screws, and inserts for exterior work shall be galvanized or cadmium plated unless otherwise indicated or specified.

5C-08.10 Do all cutting, punching, drilling and tapping required for the attachment of other work coming in contact with work of this Section where so indicated or where directions for same are given prior to the approval of shop drawings.

5C-08.11 Do all necessary cutting, drilling and fitting of work in place as required for the proper installation of all work of this Section. Obtain Contracting Officer's approval prior to any drilling, cutting or welding of other work. Holes will be provided in work of other trades, where required to receive the work of this Section, provided templates or installation directions are received prior to the approval of the shop drawings for the trades affected.

5C-08.12 Make provisions for expansion and contraction in horizontal and vertical members exposed to the weather or elements.

5C-08.13 Rivet, bolt and screw heads shall be flat and countersunk in exposed faces of work of finished character unless otherwise indicated or specified.

5C-08.14 Where exposed to view, cut bolts and screws flush with nuts or other adjacent metal.

5C-08.15 Make all exposed fastenings of the same material, color and finish as the metal to which they apply, unless otherwise indicated or specified.

5C-08.16 Except where otherwise indicated or specified for a particular item of work, fasten metal work to concrete or masonry with anchor bolts or straps securely fastened to the item. Expansion bolts, toggle bolts, powder-driven fasteners or similar devices may be used where welded-on anchors are impracticable, subject to the Contracting Officer's approval. Fastenings to wood plugs set in concrete or masonry will not be permitted. Accurately drill holes for expansion or toggle bolts to the exact diameter required. Screws shall be threaded all the way to the head of the screw. Power-driven fasteners shall be tempered heat treated fasteners, of suitable approved types, for fastening to steel, concrete or masonry as required.

5C-08.17 Furnish and set all supporting members, inserts, framing, hangers, bracing, brackets, straps, bolts, angles, struts and the like required to connect the work of this section properly to concrete, masonry, steel or other construction.

5C-08.18 Erect all work to plumb and true lines, level, in perfect alignment throughout, and rigidly and securely anchored in accordance with the approved shop drawings.

5C-08.19 After erection, fill all exposed joints, screw heads, etc., in finished work with an approved mineral filler, making all surfaces smooth and uniform, and ready for the finished coats of paint.

5C-09 DISSIMILAR METALS: Insulate dissimilar metals from each other with 2 coats of asphaltum paint or zinc chromate paint. Metals in contact with concrete or masonry shall be painted a heavy coat of alkali-resistant bituminous paint prior to installation. The above painting is in addition to any required shop painting.

5C-10 SHOP AND FIELD PAINTING

5C-10.1 All metal including galvanized and aluminum, unless otherwise indicated or specified shall be shop prime painted before delivery to the site or exposure to the weather.

5C-10.2 All structural steel framing furnished under this Section shall be given 1 shop coat and 1 field coat of paint.

5C-10.3 All galvanized ferrous metal shall receive an application of zinc-dust primer before application of shop coat of paint.

5C-10.4 Paint for shop and field coats shall conform to requirements specified under "Materials" for paint.

5C-10.5 Structural steel embedded in masonry shall in addition to the shop coat have portions of steel embedded in masonry painted with a coat of approved damp-proofing bituminous paint masked off where required to prevent bleeding onto exposed finished surfaces. The damp-proofing paint may be either shop or field applied.

5C-11 ANCHORS: All anchors, hangers, supports, etc., shall be of adequate size, shape and of sufficient number for the proper fastening of the work. Anchors shall have turned ends, and, where practicable shall extend 12" into masonry and 6" into concrete.

5C-12 HARDWARE

5C-12.1 Heavy duty type; bronze unless otherwise indicated or specified; submit samples for approval.

5C-12.2 Bronze hardware not otherwise specified shall have finish US26D. Unplated steel and iron hardware shall have primed finish for painting. Exposed hardware fastenings shall be finished to match hardware.

5C-13 MISCELLANEOUS FRAMING

5C-13.1 Structural steel framing, clip angles, shelf angles, sill angles, and similar miscellaneous structural framing items shall be of such shapes and sizes as indicated on the drawings and details or as required to suit the conditions and shall be provided with all necessary supports and reinforcing such as hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, and the like as required to properly support and rigidly fasten and anchor same in place and to steel, concrete, masonry and all other connecting and adjoining work.

5C-13.2 Furnish and erect all structrual steel in accordance with the applicable requirements of the "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" by the American Institute of Steel Construction.

5C-14 METAL CURBS: Furnish and install curbs of steel or aluminum plate, as detailed, anchored to concrete at floor openings where indicated on drawings. Curbs to receive a factory applied shop prime coat.

5C-15 LADDERS

5C-15.1 Steel Ladders: Fabricate ladders of mild steel plate stringers and round steel rungs, or sizes indicated on drawings. Rungs to be shouldered and headed to stringers or welded. Anchor with angles and steel straps as detailed.

5C-15.2 Tubular Ladder: Fabricate stringers and rungs of steel tubing; all welded construction; secure to concrete wall with clip angles welded to stringers and expansion bolted to wall. Tubular ladder exposed to weather shall be hot-dip galvanized after fabrication, bonderized or given other approved treatment for paint adhesion, and then shop primed.

5C-15.3 Ladder Rungs: Fabricate of steel rod, in accordance with details, with ends hooked; hot-dip galvanize after fabrication; bonderized or given other approved treatment for paint adhesion, and then shop primed.

5C-16 SADDLES: Fabricate of cast abrasive aluminum to sizes and shapes indicated. Fabricate saddles in single piece, of width indicated, shaped to fit jambs and other adjoining work; cut, and/or drill saddles as required to fit door hardware. Fasten saddles in place with countersunk head stainless steel shake-proof screws not less than 1/4". Fastenings to concrete shall include suitable anchors bedded in concrete. Set exterior saddles in a full bed of mastic cement.

5C-17 MISCELLANEOUS ITEMS: Fabricate sill angles, struts, pipe sleeves and other miscellaneous items in accordance with details.

5C-18 GRATINGS

5C-18.1 Gratings, including frames, shall be of the dimensions, sizes and materials as indicated on drawings.

5C-18.2 Fabricate frames of structural aluminum or steel, as indicated on details, with mitered and welded corners, dressed smooth; anchor to structure as detailed.

5C-18.3 Fabricate gratings of structural aluminum or steel bars, as detailed, assembled on edge, with all intersecting or abutting members pressure-locked or welded in an approved manner. Provide removable and/or hinged sections where indicated on drawings.

5C-18.4 Hinged sections shall be provided with frames and protective side guards when in open position and be fitted with stainless steel hinges and approved locking device.

5C-18.5 Furnish interior aluminum gratings in "mill finish". Interior steel gratings and/or steel frames shall be furnished with shop prime coat.

5C-19 ANCHOR SLOTS

5C-19.1 Surface Mounted Anchor Slots: Fabricate of roll formed 12 gauge strip steel to form 1-5/8" x 1-5/8" channel shaped framing members having a continuous slot with in-turned clamping ridge on each side, similar to the Globe Co.'s #G-5812 or approved equal. Anchor slots shall be galvanized, bonderized and shop painted with manufacturer's standard corrosion resistant enamel in color as designated on the drawings. Install surface mounted anchor slots to masonry or concrete with expansion bolts, to sheet metal with sheet metal screws, and to metal lath with clips and bolts.

5C-19.2 Concrete Insert Anchor Slots: Fabricate of roll formed 12 gauge steel to form 1-5/8" x 1" channel shaped continuous concrete inserts having a continuous slot with in-turned clamping ridge and covered with a closure tape to seal the slot against the intrusion of concrete during concrete pouring operations. Slots shall be similar to the Globe Co.'s #G-100 Series or approved equal. Provide anchoring inserts spaced approximately 4" on centers welded on back of insert for anchoring to concrete. Concrete anchor slots shall be galvanized, bonderized and shop prime painted with a rust-inhibitive primer suitable to receive finish painting as specified under another Section of the Specification. Provide flush mounted end caps. Furnish slots in uniform length to provide a minimum number of joints; install slots in proper alignment.

5C-20 ABRASIVE SAFETY NOSINGS: Stairs where indicated shall have abrasive cast iron safety nosings, of sizes indicated on details. Nosings shall be full length of the tread unless otherwise indicated and have anchors extending into the concrete.

5C-21 PIPE SLEEVES: Pipe sleeves through masonry or concrete shall be seamless ASTM A-120 steel, sized to allow 1/2" between sleeve and pipe. Coordinate with Mechanical Section of the Specifications.

5C-22 RAILINGS

5C-22.1 Furnish and install steel and aluminum railings of the types indicated on drawings. All railings shall be shop prime painted.

5C-22.2 Fabricate pipe, tubular and bar railings in accordance with the details.

5C-22.3 Fabricate pipe railings of "extra strong" weight steel or aluminum pipe, of sizes and materials as noted on details, with flush connections pinned and/or welded and securely fastened to adjoining work. Dress all joints smooth and flush. Provide end caps on all exposed ends of railings.

5C-22.4 Provide brackets as detailed for support of wall railings.

5C-22.5 Provide uprights as detailed for support of railings, welded to pipe railings. Provide brackets, as detailed with strap anchors for embedding into concrete, for support of uprights. Furnish brackets in ample time to be installed in the concrere.

5C-22.6 Provide removable section of railing, complete with necessary fittings, in locations indicated on drawings or where required.

5C-22.7 Fabricate railing for Cab Stair Bulkhead, where indicated on drawings, of aluminum plate in accordance with detail; mill finish with factory applied paint prime coat.

5C-23 COVERS AND FRAMES

5C-23.1 Provide covers and frames for manholes, catch basins, trench drains, elevator inspection holes, sump pit settling chambers and for similar locations where indicated on drawings.

5C-23.2 Fabricate covers and frames in accordance with details. Frames shall include anchors for attachment to connecting work. Covers shall be provided with flush type drop handles or other approved lifting device.

5C-23.3 Cast iron manhole covers and frames subject to vehicle traffic shall be highway type; where subject to foot traffic only use standard type.

5C-23.4 Catch basins and trench drains, shall be cast iron, fabricated as detailed.

5C-23.5 Fabricate steel plate covers and frames as detailed. Construct frames of steel angles or rolled steel shapes with mitered and welded corners and with steel bar stop welded or riveted to frame to receive cover. Anchor to concrete with welded-on strap anchors.

5C-23.5.1 Form covers of steel plate, reinforced around edges with steel angle riveted ro welded to plate. Hinged covers shall be provided with flush bronze hinges having stainless steel pin. Covers to be provided with flush type drop handles or other approved lifting device.

5C-24 STRUCTURAL FRAMES

5C-24.1 Fabricate of rolled steel sections or steel plates of shapes and sizes indicated. Include closure plates bar stops and reinforcing.

5C-24.2 Provide necessary supports and reinforcing such as hangers, angles, clip angles, nuts, strap anchors, etc., required to properly support and fasten frames in place.

5C-24.3 Provide clip angles at bottom of each jamb for attachment to concrete floor slab.

5C-24.4 Provide welded-on jamb anchors for anchoring to adjacent construction. Place anchors 6" from top and bottom of frame and not over 2-feet, apart, unless otherwise indicated.

5C-24.5 Provide continuous welded-on metal bar stops for swing doors. Do all cutting, drilling, tapping and fitting necessary to receive finished hardware, or work of other trades.

5C-25 ELEVATOR HOISTWAY SMOKE EXHAUST DUCT: Fabricate smoke exhaust duct of No. 10 gauge black steel with all joints welded. Support duct from adjacent construction by steel strap hangers properly attached to the exhaust duct and to the building construction in an approved manner. Provide angle collar for connection of duct with exterior louver and at floor opening. Seal collar against smoke leakage.

5C-26 METAL EDGE STRIPS: Fabricate metal edge strips of aluminum or zinc angles, size as indicated on drawings; expansion bolt angles to concrete floor or use powder-driven stud fasteners. Edge of angle exposed to view shall be ground and polished and be set to finish flush with the resilient flooring.

5C-27 METAL STAIRS

5C-27.1 Fabricate steel stair work in accordance with details. Form stringers of steel plate, with butt joints where indicated, reinforced on back with steel splice plates. Weld clip angles to stringers for support of plaster ceilings where indicated. Form combination tread and risers of 14 gauge steel; form tread and riser brackets of steel angles welded to stringers. Form platforms and landings of 12 gauge steel reinforced on underside with steel tees. Provide structural supports for stair work. Form box treads for open riser stairs of 14 gauge steel reinforced with 14 gauge channel reinforcement; bolt box treads to stringers.

5C-27.2 Provide 14 gauge riser plates and 16 gauge stringer closure plates where indicated.

5C-28 HATCHES

5C-28.1 Fabricate aluminum hatches with top and bottom plates reinforced with structural aluminum channels. Provide structural aluminum frames as detailed anchored and/or expansion bolted to concrete or adjacent construction as detailed. Provide neoprene gasket between hatch cover and frame. Furnish hatch covers and frames in "mill finish" with factory applied paint prime coat finish.

5C-28.2 Fabricate steel hatches of plates reinforced with angle stiffeners welded to bottom. Provide angle frames with strap anchors with corners mitered and welded and exposed welds ground smooth. Fit cover with tension spring lift hinges so that the lifting force required to open hatch is 20 lb. maximum and flush type lifting ring. Mount lifting ring so that top is 1/2" above hatch plate on hatches to receive carpet finish and 1/8" above hatch plate on hatches to receive resilient floor finish. Hatches, covers, and frames shall be prime painted.

5C-29 AIR TIGHT LOUVERS: Not used.

5C-30 SHEET METAL LOUVERS

5C-30.1 Fabricate louvers of 16 gage (.0625) galvanized steel for frames and blades. Blades shall be of "leakproof" design as detailed.

5C-30.2 Provide louvers with bird screen of #2 mesh (1/2"), 16 gage (.0625) stainless steel wire secured in a rewireable, removable extruded aluminum frame. Install bird screens to louvers with spring clips or catches fitted to frame.

5C-30.3 Galvanized steel to be bonderized. All parts of louver, including frames, blades and extruded frame of bird screen shall be shop primed and finished in baked enamel in color as designated on the drawings or as approved by the Contracting Officer.

5C-30.4 Louvers and bird screens shall be similar to the products manufactured by the Airolite Co., The Ventilouvre Co., H. H. Bergman Co., or approved equal.

5C-31 EXTRUDED ALUMINUM FASCIA AND GRAVEL STOP

5C-31.1 Fascias shall be formed of extruded aluminum alloy 6063-T42 at least 3/32" thick. Finish similar to Alcoa's C1-204, Alumilite.

5C-31.2 Cross joints shall be butted flush and reinforced with splice plate on back.

5C-31.3 Aluminum facias shall be furnished as herein specified or furnished of aluminum.

5C-31.4 Provide concealed expansion joints as required.

5C-31.5 Fascias shall be of type and manufacturer as called for on drawings or equal.

5C-32 METAL WALL PANELS

5C-32.1 Material for the exterior wall panels shall be sound, durable, and free from defects which would impair their proper function and appearance. Materials shall be fabricated to conform to indicated profiles and cross sections, and to produce watertight enterior wall construction.

5C-32.2 Exterior wall panels shall consist of outer and inner steel plates and insulation. Completed exterior wall panel deflection shall not exceed 1/180th of the span under wind loads of 20 pounds per square foot. Panels shall be for height of wall above window wall without horizontal joints. The exterior wall panels shall be similar to type FL as manufactured by Fenestra Inc., or approved equal.

5C-32.3 The inner and outer plates of the exterior wall panels shall be of a nominal thickness of not less than 20 gauge. The inner plates shall be prime painted and the exterior plates shall be factory applied baked enamel finish of color as approved by the Contracting Offier. The sheets shall be flat, and interlocking at the sides with a male and female lip, so as to provide a continuous protected caulking side joint. The caulking compound shall be inserted into the female lip prior to the erection of the panels so that a minimum of fifty percent of the volume of the lip shall be filled with compound.

5C-32.4 The insulation shall be of the glass fiber type at least 1 1/2" thick and 2 1/2 pounds per cubic foot density conforming to Federal Specification HH-I-521c Type I Class A. The overall heat loss, or U value, through the panel shall not be greater than 0.125 BTU/Hr./Sq. Ft. per ^{o}F temperature difference in still air. The panel manufacturer shall submit laboratory test data to the Government certifing that the panels will meet the thermal requirements. The U value shall be an overall value including joints and tests shall be conducted on three or more panels involving two or more side joints.

5C-32.5 Caulking compound shall be approved non-sagging elastic type standard with the wall-panel manufacturer, and certified in writing as to proper type for intended purpose, applied in the factory in female interlocking ribs to sufficient depth to produce permanently sealed joints when erected.

5C-33 STEEL TELEPHONE BOOTH

5C-33.1 Telephone booth shall be zinc coated rolled steel fireproof construction including preforated metal lining backed by acoustic sound absorbing material. Backboard shall be drilled for telephone instrument and wiring.

5C-33.2 Booth shall have factory applied baked enamel finish of coloa as approved by the Contracting Officer and shall be Model A-65 single opening as manufactured by Suttle Equipment Corporation, Chicago 3, Ill., or approved equal.

5C-34 ALUMINUM WINDOW

5C-34.1 Window shall be aluminum casement combination type and shall conform to that shown on drawings. Necessary hardware, glazing clips and erection fittings shall be furnished for complete installation. Windows shall be constructed of not less than 1/8" thick extruded aluminum members of Alloy No. 6063-T5, Head and jamb members and sills of sizes and gauges and general arrangement as required with all exposed shop joints welded and ground so as to be invisible.

5C-34.2 The window shall meet the physical load test and air and water infiltration tests of the Architectural Aluminum Manufacturers Association Specification CA-2.

5C-34.3 All perimeter members of the ventilators shall be provided with an integral slot to receive vinyl weatherstrip inserted to provide a weather-tight condition when ventilators are locked.

5C-34.3 Windows and trim shall be given an anodized buffed finish similar to Alcoa's Alumilite 204-C1 treatment or approved equal having a minimum coat thickness of .0004 and min coating weight of 17 mg. per sq. inch.

5C-35 WINDOW SILL

5C-35.1 The window sill, connected to the bottom of the window sash shall be constructed as shown on drawings of best quality open hearth sheet furniture steel stock, full cold rolled, full pickled, re-annealed, stretcher leveled and free from scale, rust and other internal and surface defects.

5C-35.2 Miters and copes shall be accurately formed, tight fitting, square and in true alignment. Fastenings shall be concealed except where otherwise noted on drawings. Exposed fastenings shall be countersunk oval-head machine screws. Sheet metal screws shall not be used. Construction joints shall be formed in a substantial manner and ground and cleaned off flush on exposed surfaces.

5C-35.3 Before leaving the fabrication plant sill shall be given one coat of rust inhibiting paint of approved manufacturer. All parts accessible after erection shall receive two coats of paint.

5C-36 EXPANSION JOINT COVERS

5C-36.1 Furnish and install aluminum expansion joint covers as detailed on the drawings in order that relative differential movements between the tower shaft, connecting corridor, and base structures may take place without failure of any elements comprising these buildings. Expansion joint shall be manufactured by Architectural Art Manufacturing, Inc., or approved equal and of the following types:

Aluminum Roof Cover: Type RCW-1
Aluminum Vertical Exterior Wall Cover: Type A-107
Aluminum Floor Expansion Joint Cover: Type AA-1

5C-36.2 Exterior expansion joint covers shall be correctly installed to provide weathertight connections between adjacent structures. Furnish and install closure pieces or "bonnets" to provide a continuous weathertight seal where roof covers adjoin vertical wall covers. Finish for all expansion joint covers shall be Alcoa's Alumilite 204-C1"

5C-37 TOWER SHAFT ENTRANCE JAMBS: Furnish and install aluminum entrance jambs at the entry opening to the tower shaft as detailed on the drawings. Finish for jambs shall be Alcoa's "Alumilite 204-C1".

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136-84K

DIVISION 5
SECTION D

WINDOW WALLS

5D-01 SCOPE: This Section covers the requirements for window walls and related items and their installation.

5D-02 GENERAL: For locations and extent of work, see drawings and applicable details.

5D-03 MATERIALS

5D-03.1 Structural Steel Shapes: ASTM A7 or ASTM A36

5D-03.2 Steel Plates and Bars: Cold rolled and hot rolled steel conforming to applicable ASTM specifications.

5D-03.3 Aluminum: Commercial alloys; 6063-T5 for extrusions, tubes, rods and pipe.

5D-03.4 Stainless Steel: Type 302 (18-8) with surface of metal free from imperfections.

5D-03.5 Glass: Window wall shall be constructed to receive the glazing installed as specified in glass and glazing.

5D-03.6 Other Materials: Materials not specifically specified shall be of the best quality in their class subject to the approval of the Contracting Officer.

5D-04 SHOP DRAWINGS AND SAMPLES

5D-04.1 Submit shop drawings and samples for approval prior to fabrication.

5D-04.2 Submit complete shop, erection and design drawings showing in detail all parts of the work, fully dimensioned; full size details showing thickness, profiles, jointing, welds, intersections and assembly of the various members; details of construction, weather-proofing, hardware and hardware schedules; reinforcements, anchorage and structural supports; and such other drawings and details as required to fully illustrate all details of the work, and as required to meet site conditions. Coordinate all work with glazing installation; submit glazing details.

5D-04.3 Submit for approval, samples of all metal work and finishes, glass, gaskets, tapes, sealants, fillers, etc. All work shall conform, in all respects, to the approved samples.

5D-04.4 Material shall not be delivered or installed before shop drawings, samples etc., have received final approval by the Contracting Officer. Any such work accomplished prior to approval shall be subject to rejection at the expense of the Contractor.

5D-05 SUBSTITUTIONS AND MODIFICATIONS

5D-05.1 Substitutions: Base proposals on materials and shapes as indicated on the drawings and details and/or as specified. Any substitution proposed shall meet all conditions of design, finish and construction as shown on the drawings and/or as specified, and shall be submitted to the Contracting Officer for approval.

5D-05.2 Modifications: The fabricator will be permitted to make minor changes in detailing of the work in order to conform to standard procedures or as required to facilitate field erection. No changes shall be made without prior approval by the Contracting Officer, in writing.

5D-06 CHANGES IN SHAPES: The Contracting Officer may make minor changes in the shapes and profiles of the members before final approval of the shop drawings. No extra amount above the contract price will be allowed because of these changes.

5D-07 TEMPLATES AND PATTERNS: Include all templates and patterns required in connection with the work of this Section; supply copies to all trades requiring same.

5D-08 FABRICATION, ERECTION AND INSTALLATION

5D-08.1 Manufacture all work in ample time so as not to delay the progress of the work; deliver to job site at such times as required for proper coordination.

5D-08.2 Fabricate, erect and/or install work in a thorough and workmanlike manner. Execute and erect all work with skilled mechanics. Any parts having defects of any kind in materials, workmanship or finishes will be rejected by the Contracting Officer; remove such rejected work from premises and replace with proper work at no additional cost to the Government.

5D-08.3 All bolts, nuts, screws, washers and other connections to aluminum work shall be non-magnetic stainless steel. Bolts, nuts and screws for exterior work shall be galvanized or cadmium plated unless otherwise indicated or specified.

5D-08.4 Make provision for expansion and contraction in horizontal and vertical members exposed to the weather or elements.

5D-08.5 Except where otherwise indicated or specified for a particular item of work, fasten metal work to concrete or masonry with anchor bolts or straps securely fastened to the item. Expansion bolts, toggle bolts, powder-driven fasteners or similar devices may be used where welded-on anchors are impracticable, subject to Contracting Officer's approval. Fastening to wood plugs set in concrete or masonry will not be permitted. Accurately drill holes for expansion or toggle bolts to the exact diameter required. Screws shall be threaded all the way to the head of the screw. Powder-driven fasteners shall be tempered heat treated fasteners, of suitable approved types, for fastening to steel, concrete or masonry as required.

5D-09 DISSIMILAR METAL CONTACT SURFACES

5D-09.1 Keep aluminum, bronze and other metal surfaces from contact with dissimilar metals by painting the dissimilar metal with heavy-bodied bituminous paint or zinc chromate primer.

5D-09.2 Metal surfaces in contact with concrete shall be painted with a heavy coat of alkali resistant bituminous paint.

5D-10 TAPES AND SEALANTS: Tapes, gaskets, caulking stops, fillers and sealants shall be of the types, sizes, thickness and composition indicated; install as required by the various conditions, all in accordance with the details, specifications, and recommendations of the manufacturers, as approved by the Contracting Officer.

5D-11 DELIVERY AND STORAGE: Deliver all work in perfect condition; store properly. Remove and replace with approved material damaged in transit or storage.

5D-12 STRUCTURAL STEEL FRAMING: Structural steel framing, plate reinforcing, supplementary steel framing or reinforcing, bracket assemblies, and the like, shall be of such sizes and shapes as indicated on the drawings and details, or as required to suit the conditions and shall be provided with all necessary supports and accessory items such as inserts, hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, powder-driven fasteners, etc., as required to properly and rigidly fasten, anchor or attach same in place and to the concrete, masonry and other connecting and adjoining work.

5D-13 ALUMINUM FRAMES

5D-13.1 Fabricate aluminum frames for window walls, entrances, corridor door frames, sidelights, side panels, mullions, muntins, etc., of aluminum sections 6063 T-5 alloy of sizes and shapes indicated on the drawings and details, with removable stops for holding glass in place as shown, and so arranged that glass may be installed from the outside.

5D-13.2 Form glazing stops of heavy wall aluminum tubing with mitered corners.

5D-13.3 All members when finished shall be true and free from twists, bends and open joints between component parts.

5D-13.4 The faces and edges of all members exposed to view shall be finished to provide smooth, true surfaces.

5D-13.5 Use anodized aluminum with buffed finish similar to Alcoa's "Alumilite 204-C1" treatment or approved equal having a minimum coating thickness of .0004" and a minimum coating of weight of 17 mg. per square inch.

5D-13.6 All joinings, unless otherwise indicated or approved by the Contracting Officer, shall be welded; welds exposed to view shall be ground flush, be finished clean and smooth and shall be free from any uneveness or imperfections.

5D-13.7 Secure glazing stops with countersunk head machine screws.

5D-13.8 Cut, drill and tap door frames as required to receive hardware.

5D-14 ALUMINUM DOORS

5D-14.1 Furnish and install aluminum entrance and corridor doors in locations indicated on drawings. Make doors of sizes and thickness indicated, complete with all glass, glazing, weatherstrips and heavy duty hardware.

5D-14.2 Construct doors with frame as detailed of hollow aluminum sections, 6063 T-5 alloy. Draw frame together with concealed bolts, with compression applied by means of leaf springs in the lower glazing channel.

5D-14.3 Use anodized aluminum with buffed finish similar to Alcoa's "Alumilite 204-C1" treatment or approved equal having a minimum coating thickness of .0004" and a minimum coating weight of 17 mg. per square inch. Make tests by approved procedures to determine coating thickness and quality of seal. Furnish manufacturer's notarized results of tests. Test sealing in accordance with ASTM B-136.

5D-14.4 Hardware: Furnish each door with top pivot and center pivoted hinge without hold-open, similar to Pittsburgh Plate Glass Co.'s "Pittco Checking Floor Hinge" with No. 6 Tension, or approved equal. Provide all doors with anodized buffed finish, 204-C1, custom stainless steel pulls fabricated to the design detailed, fastened to stiles. Fit corridor door with cylinder dead bolt designed to receive a removable core manufactured by the Best Lock Co.; the core will be furnished by the Government. Provide exterior doors with lock housing having anodized buffed (204-C1 finish) flush aluminum plates on each side fabricated in accordance with design as detailed. Fit exterior doors with key operated latch having cylinder on entry side and a thumb turn on the inside; cylinder to receive a removable Best Lock Co. core furnished by the Government. Fit one exterior door as shown on drawings with an electric door strike to be released by signal from selector switch located in Cab Console. Key operation shall over ride the electric operation. Exterior doors to be fully weatherstripped. Provide thresholds of cast abrasive aluminum of sizes indicated on drawings. Provide stainless steel dress plates for interior door closers.

5D-14.5 Submit complete schedule of hardware itemizing in detail all hardware to be furnished for each door. Submit sample of each item of hardware for Contracting Officer's approval.

5D-14.6 Glass: Factory glaze doors with 1/2" thick polished plate glass.

5D-15 PROTECTION, REPAIRING AND CLEANING

5D-15.1 Protect all work provided under this Section against injury, damage, soiling or staining during the delivery, storage and execution of the work. Take special precautions to prevent damage to finished surfaces.

5D-15.2 Repair minor damage to surface finishes in a manner acceptable to the Contracting Officer. Remove defective, damaged or otherwise unacceptable materials and replace with proper work acceptable to the Contracting Officer and at no additional charge to the Government.

5D-15.3 At completion of work, remove all protection, clean all surfaces and leave all work in perfect condition.

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DIVISION 6

SECTION A

CARPENTRY

6A-01 SCOPE: This Section covers the requirement for carpentry and related items and their installation.

6A-02 GENERAL: For locations and extent of work, see drawings.

6A-03 MATERIALS

6A-03.1 Grading: All lumber shall be graded in accordance with latest rules of the Association applicable; solid hardwood stock in accordance with National Hardwood Association rules; fir plywood in accordance with Douglas Fir Plywood Association Standards and Commercial Standard CS-45; softwood lumber in accordance with commercial grades based upon American Lumber Standards specified in Simplified Practice Recommendation R-16.

6A-03.2 Grounds, Nailers and Blocking: Seasoned, kiln dried No. 1 Dimension Short Leaf Southern Pine, Spruce, Douglas Fir or equivalent species.

6A-03.3 Rough Lumber: Seasoned, kiln dried, No. 1 Dimension Long Leaf Yellow Pine, Douglas Fir, Spruce or equivalent species; straight, square edges and straight grain, dressed as required for uniformity and workmanship.

6A-04 PRESERVATIVE TREATMENT: All lumber, except for temporary protection, shall be pressure preservative treated in accordance with minimum standards of American Wood Preservers' Association.

6A-05 ROUGH HARDWARE: Furnish and install all rough hardware, metal fastenings, angle supports, and the like, as indicated on the drawings or required for the proper installation of the work. Furnish and install all nails, screws, bolts and similar items to rigidly secure members in place.

6A-06 GROUNDS, BLOCKING, NAILING STRIPS: All grounds, blocking, framing and nailing strips necessary for the attachment of work shall be provided. Grounds blocking, nailers and framing shall be sized to dimensions required. Where not otherwise indicated, grounds shall be generally 7/8" x 1-½". Grounds, blocking, nailers and framing shall be securely fastened and set to true and paralled lines and in alignment. Provide temporary grounds as required for plaster.

6A-07 TEMPORARY PROTECTION: The following temporary protection shall be provided by the Contractor:

6A-07.1 Provide temporary protection, such as wood doors, wood railings,

protection upon stairs and at floor openings; provide and maintain temporary stairs, ladders, ramps, scaffolds, chutes, runways, etc., as required for the execution of the work of all trades.

6A-07.2 Openings in Slabs: Protect openings with adequate wood railings substantially framed, braced and nailed. Cover openings not required to be kept open with 2" thick planking.

6A-07.3 Finished Surfaces: Provide box protection for finished surfaces exposed to possible damage.

6A-07.4 Stair Protection: Provide temporary wood protection for stairs; cover treads, risers and stringers.

6A-07.5 Elevator Shaft Enclosures: Enclose fronts and exposed parts of elevator shafts so that service can be maintained until permanent fronts are installed. Build doors substantially; hang them, equip with approved hinges, locks and other necessary hardware.

6A-07.6 Exterior Openings: Provide temporary enclosures for exterior openings where required, properly secured and maintained until finished work is in place. Provide temporary doors to give access to building provided with hardware, locks and keys.

6A-07.7 Maintenance: Maintain all temporary protection in good repair during the construction period. Remove when no longer required.

6A-07.8 Temporary Locks: Provide temporary locks, including keys, for temporary doors. Use of the permanent building hardware in connection with temporary doors is prohibited.

6A-08 SHELVING: Furnish and install wood shelving and supports as shown on the drawings. Shelving shall be constructed of 3/4" thick 5 ply fir plywood, Grade B, with exposed edges banded with solid hardwood edge strips.

6A-09 CABINETS: Fabricate cabinets in accordance with details and from sound kiln-dried lumber or plywood of species hereinbefore specified. Make hinged doors flush type of 5 ply, 3/4 inch plywood with edges sanded smooth. Erect cabinets straight, level and plumb and securely anchored in place. Scribe and closely fit cabinets to adjacent work. Each door shall be complete with chromium plated door hinges, door pull and friction catch as shown on details.

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DIVISION 7

SECTION A

METALLIC WATERPROOFING

7A-01 SCOPE: This Section covers the requirement for metallic waterproofing and its installation.

7A-02 GENERAL

7A-02.1 For location and extent of metallic waterproofing see drawings and applicable details.

7A-02.2 Application shall be by a Specialty Subcontractor.

7A-02.3 Waterproofing materials shall be delivered to the project site in original sealed containers with manufacturer's name and brand clearly identified.

7A-02.4 Metallic waterproofing shall not be applied until surfaces to be treated are enclosed or protected from excessive temperature changes. Ambient temperature shall be above 50 degrees F. during application. Water level shall be kept below locations of surfaces being treated until completion of treatment, including curing period.

7A-02.5 Anchorage items shall be installed prior to application of waterproofing. Treatment shall be completed prior to installation, except anchorage items, of utilities along adjacent surfaces.

7A-03 MATERIALS

7A-03.1 Materials shall meet requirements of referenced Federal Specifications, American Society for Testing Material Standards and requirements specified herein.

7A-03.2 Portland Cement: SS-C-192d, Type I or ASTM C-150, Type I.

7A-03.3 Non-Metallic Fine Aggregate: ASTM C-144 for brush coat and ASTM C-33 for plaster coat.

7A-03.4 Water: Free from injurious amounts of oil, alkalis, acids, organic matter and other deleterious substances.

7A-03.5 Metallic Waterproofing Compound shall consist of clean commercial pulverized cast iron with a chemical oxidizing agent, such as sodium peroxide, or potassium peroxide or ammonium chloride.

7A-03.5.1 The pulverized cast iron shall consist of a minimum 85 percent by weight of metallic iron on the magnetic portion. The chemical oxidizing agent content shall be a minimum of 3 percent and a maximum of 5 percent by weight of compound. Presence of dirt, paraffin, bitumen, or other foreign substances in excess of 1.0 percent by weight of waterproofing compound will be cause for rejection.

7A-03.5.2 The iron oxide content shall not exceed 5 percent by weight of magnetic iron. Iron shall not contain more than 0.05 percent by weight of oil on the magnetic portion.

7A-03.5.3 Magnetic iron particles shall be carefully graded as follows:

Sieve Size	Percent Passing
No.20 screen	100
No.35 screen	95 to 100
No.40 screen	90 to 100
No.60 screen	65 to 100
No.100 screen	45 to 70
No.200 screen	10 to 20

7A-04 CERTIFICATION

7A-04.1 The Contractor shall furnish a certified statement from a testing laboratory, approved by the Government, attesting that the metallic waterproofing compound meets the chemical and physical composition specified, as determined by the following methods.

7A-04.2 Magnetic and Non-Magnetic Portions: Provide a 100 gram sample. Transfer portions from one pile to another using a magnet over a watch glass, leaving the non-magnetic behind. Repeat for the entire sample about 15 times. Weigh the non-magnetic portion.

7A-04.3 Total Iron: Determine total iron of compound in terms of percentage weight and metallic iron of magnetic portion in terms of percentage of weight of magnetic portion by standard qualitative chemical analysis procedures.

7A-04.4 Oxidizing Agent: Determine strength of oxidizing agent by standard qualitative chemical analysis technique.

7A-04.5 Oil: Warm fifty gram sample with 50 ml of chloroform. Filter the chloroform into a weighed 100 ml beaker. Repeat the procedure with a 30 ml portion of chloroform. Evaporate the chloroform and reweigh the beaker to give weight of material (oil) soluble in the chloroform.

7A-05 SURFACE PREPARATION

7A-05.1 Areas to receive metallic waterproofing shall be wire brushed to firm unspalled surfaces, clean and free from loose materials, debris, and deleterious substances such as oil, grease, coatings.

7A-05.2 Construction joints, grooved recesses and intersections of vertical and horizontal surfaces shall be stripped and cleaned, and loose and foreign materials removed.

7A-05.3 Walls: Prepared areas that have been cut back or undercut shall be cleaned, moistened with water, slushed with a bond coat of metallic waterproofing compound and water, and filled flush with Portland cement mortar containing metallic waterproofing compound added at the rate of 10 pounds for each sack of cement. Filling and patching shall be applied in layers not exceeding 3/4-inch in thickness, worked into voids, compacted and finished flush with adjacent surfaces.

7A-06 WATERPROOFING TREATMENT

7A-06.1 After surface preparation, the areas, shall be water saturated and treated by applying a minimum of three brush coats of metallic waterproofing compound and water, covering and sealing all pores. Completed treatment shall present a uniformly oxidized surface. Prior to applying each coat, wet the surfaces and keep damp during each application. Each coat shall be completed over the entire surface area before the succeeding coat is applied. Minmum total amount of metallic waterproofing per 100 square feet of surface shall be 15 pounds for the three coats. Allow an interval of 24 hours between application of each coat to permit oxidation of the compound.

7A-06.2 Grooved recesses and intersections of vertical and horizontal surfaces shall be packed with waterproofing mortar composed of one part Portland cement, two parts fine aggregate with 10 pounds of waterproofing compound added to each sack of cement. Mortar shall be compacted into the groove and finished flush with adjacent surfaces.

7A-06.3 Control and expansion type joints, after treatment, shall receive continuous sealant. Sealant shall be in accordance with Calking and Sealing Section.

7A-06.4 Treated surfaces, except floors, shall receive a protective coating, of minimum 3/4-inch thickness, consisting of one part Portland cement and two and one half parts fine aggregate, applied directly over the treatment. The protective coating, unless indicated to receive other finishes, shall be steel troweled to a smooth, level surface. Where other finishes are scheduled, protective coating shall be scratched or roughened to a granular texture.

7A-06.5 After floors have been treated, allow an interval of 24 hours to permit oxidation. Floors shall be dampened, receive a thin broomed coat of neat cement grout, and a topping of one inch minimum thickness. Topping application shall be in accordance with specification for Applied Finish in Concrete Section.

7A-07 CURING: Metallic Waterproofing shall be protected against loss of moisture and cured in accordance with requirements of Concrete Section.

7A-08 RESPONSIBILITY: The Contractor shall maintain all surface areas treated with metallic waterproofing leakproof and free from other defects prior to final acceptance of the building by the Government. After this acceptance, the Contractor shall guarantee all metallic waterproofing work in accordance with Clause 31 to the General Provisions of the Contract.

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DIVISION 7

SECTION B

CAULKING AND SEALING

7B-01 SCOPE: This Section covers the requirement for performing all operations in connection with the installation of Caulking and Sealing, and related work.

7B-02 GENERAL

7B-02.1 For location and extent of work see drawings.

7B-02.2 Use Sealants for sealing vertical expansion joints, and for sealing of joints between metal frames and concrete or masonry, exterior or interior, in all locations where "caulking" or "sealant" is indicated on the drawings or where sealing of joints against weather or water is required.

7B-03 SAMPLES: Submit samples of all materials for approval by the Contracting Officer. Submit color samples of sealants for approval.

7B-04 MATERIALS

7B-04.1 Sealants

7B-04.1.1 Sealants: Non-staining, 1-part 100% acrylic terpolmer sealant as covered by U. S. Federal Stock Catalog Number 8030-985-7119 as manufactured by Tremco Manufacturing Co., or 1-part silicone rubber sealant conforming to TT-S-00230 as manufactured by Dow-Corning Corp., or General Electric Co., or other 1-part sealant conforming to the performance requirements of ASA Standard A-116.1 or Federal Specification TT-S-00230. Sealant for base building contraction joints shall be as specified on the drawings.

7B-04.1.2 Certification: Submit manufacturer's certification, in writing, that the specific brand or product number recommended by the manufacturer for each specific application conforms to the performance requirements of the referenced standards. Furnish certificate from an independent testing laboratory, approved by the Government, attesting that the materials furnished meet the specified performance test requirements.

7B-04.1.3 Color: Furnish sealants in custom colors as selected and approved by the Contracting Officer.

7B-04.2 Joint Primer: Stainless joint primer, of types as recommended by the approved manufacturer of the sealant.

7B-04.3 JOINT FILLER: Non-staining, compressible, closed cell joint filler of polyurethane foam, urethane foam, PVC (polyvinyl chloride), neoprene, vinyl, flexible tubing or similar materials as recommended by the sealant manufacturer and approved by the Contracting Officer. The use of joint fillers which contain or have been treated with oil, grease, or bituminous material is prohibited. All joint fillers shall be tested for compatibility with the primers and sealant to be used.

7B-04.4 DELIVERY: Deliver all materials to site in sealed containers or wrappings with the manufacturer's name and trade mark clearly indicated thereon.

7B-05 SPECIALTY SUBCONTRACTOR: Application shall be made by a Speciality Subcontractor.

7B-06 PREPARATION

7B-06.1 Do not proceed with installation of sealants prior to approval by the Contracting Officer of sealants, primers, joint fillers, compatibility tests and manufacturer's and testing laboratories "Certification".

7B-06.2 Thoroughly clean all joints and spaces to be sealed, in accordance with manufacturer's directions, of dirt, oil, grease, bituminous, resinous, corrosion or other foreign matter preventing proper bond.

7B-06.3 Remove protective coatings on metallic surfaces using solvent that leaves no residue.

7B-06.4 Apply masking tape of suitable width to prevent smears on materials such as concrete or masonry which would be difficult to clean, or as required to prevent staining or soiling or other adjacent materials.

7B-06.5 Clean out joints, full width and depth. Rake out joints to receive sealant to depth not less than 1/4" greater than the depth of the applied sealant. Depth of sealant shall not exceed 1/8" more than the width of the joint. Fill joint back of sealant with joint filler to the required depth. In no case shall sealant be applied without joint filler.

7B-06.6 Grind joints of less than minimum widths and depths indicated and/or specified to the required widths and depths to provide for proper application of the sealant. Do not correct minor variations in width that are not noticeable. Restore any adjacent or connecting work damaged by grinding operations to the satisfaction of the Contracting Officer.

7B-07 APPLICATION

7B-07.1 Apply primer to concrete or masonry surfaces in accordance with manufacturer's directions.

7B-07.2 Apply sealants with approved type pressure guns, suitable for the sealant, equipped with proper nozzles for the joint size. Use sufficient pressure to expel all air and provide a solid filling against the joint filler so as to completely fill the joint or space to be sealed. Rake out joints not completely filled and re-seal as specified. Joints adjacent to painted work shall be sealed before final coat of paint is applied.

7B-07.3 Fill joint to within specified depth from surface with joint filler and fill remainder of joint with sealant.

7B-04.4 Neatly point joints to approved detail. Point exterior joints slightly convex with edges flush with adjacent surfaces. Point interior joints flush with adjacent surfaces, unless otherwise indicated. All sealants, where exposed to view, to be uniformly smooth and free of wrinkles.

7B-07.5 Unless otherwise indicated, color of sealant shall match, as closely as possible, the concrete or masonry mortar color.

7B-07.6 Apply all sealants, joint primers, joint fillers, etc., in strict accordance with the manufacturer's printed directions.

7B-07.7 Joints exposed on exterior or to the elements shall be watertight and weatherproof.

7B-07.8 Install joint sealants as rapidly as the completion of any section of the work permits.

7B-08 CLEANING: Thoroughly clean adjacent materials soiled or smeared by the installation of sealant as the work progresses.

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DIVISION 7

SECTION C

ROOFING & FLASHINGS

7C-01 SCOPE: This Section covers the requirement for built-up roofing and flashings and their installation.

7C-02 GENERAL: For extent of work, see drawings.

7C-03 MATERIALS:

7C-03.1 Base Building: Five ply, 20-year bond, built-up roof with black gravel or slag embedment, Kappers Co., Inc., Specification No. 12 (1966 Catalog) or equal. Mineral aggregate shall be black and conform to ASTM D1863.

7C-03.2 Control Cab: Two ply, 20-year bond, mineral-surfaced glass fiber reinforced roofing, Specification No. 420-TMD, Owens-Corning Fiberglass Corporation or equal. The roofing shall include the 7/16-inch roof insulation of the Owens-Corning Fiberglas Corporation roof system or equal.

7C-03.3 Asphalt: SS-A-666.

7C-03.4 Sheet Flashing: Shall be of tough, impermeable, homogeneous, cured sheet neoprene, not less than 1/16 inch thick, containing anti-ozident and ultra-violet absorber, dimensionally stable in aging, and non-corroding, non-cracking, and non-peeling, as manufactured by Cates Engineering Co., Wilmington, Delaware, or approved equal, having following properties as determined by test:

Tensile strength	1800 p.s.i. (min.)	ASTM D-412
Elongation	450% (min.)	ASTM D-412
Hardness	45 ± 5	Shore "A" Durometer
Cold Test	Flexible after 5 hrs. at -40 degrees F.	ASTM D-736

7C-03.5 Lead-Coated Copper: Shall be 16 ounces, in accordance with QQ-C-576 cold rolled.

7C-03.6 Solder: Shall be 50% lead, 50% tin, QQ-S-57.

7C-03.7 Flux: Shall be muriatic acid killed with zinc or non-acid flux paste.

7C-04 BASE BUILDING ROOFING: The roofing shall be installed in accordance with the manufacturer's recommendations.

7C-04.1 All projections or openings in the deck shall have been completed prior to the application of the roofing. The insulating perlite roof fill must be cured for at least 4 to 5 days and the top surface dry during the installation operation. The surface of the perlite must be smooth and free from projections or holes which might cause rupture of the membrane.

7C-04.2 Nails shall not be used to install any portion of the roofing.

7C-04.3 Immediately before the applicatinn of the roofing, the surface of the perlite shall be thoroughly cleaned of all surface dust and loose material. All voids between the perlite and roof fixtures, such as ventilators and roof drains shall be properly grouted so as to have a smooth transition surface between the fixtures and the adjacent roof surfaces.

7C-4.4 Cant strips shall be provided at all places where the plane of the roof meets a vertical surface requiring flashing. The cant strip shall be of nailable wood or preformed fiber board. When the cant strip is of wood, it shall be of Douglas fir of common grade yard lumber and it shall be chemonite treated against Fungi Decay. The cant strip shall be a minimum of 4" x 4" with a 45° sloped face.

7C-05 CONTROL CAB ROOFING: The roofing shall be installed in accordance with the manufacturer's recommendations.

7C-05.1 Mask all exposed surfaces of penthouse raceway conduit connector units, raceway brackets and parapet closure panels with heavy waterproof kraft paper.

7C-05.2 Joints between roof panels and in the cement asbestos board furnished with the panels shall be grouted and sealed with a synthetic rubber sealant, Hornflex Theokol LP-32 A. C. Horn Co., or equal in accordance with the manufacturer's instructions. The sink at toe of parapet shall be filled with plastic concrete.

7C-05.3 The surface of the deck shall be thoroughly cleaned of all surface dust and loose material.

7C-05.4 The asbestos deck shall be uniformly coated with hot steep asphalt prior to installation of the fiberglass insulation.

7C-05.5 Treated Douglas fir cant strips shall be provided at all places where the plane of roof meets a vertical surface requiring flashing. Suitable grout shall be provided around roof scrupper.

7C-05.6 Two plies of glass fiber mat and the Perma Cap shall be applied in accordance with the manufacturer's recommendations. Perma Cap which is wet or cracked shall not be used.

7C-06 FLASHING: Flash roofs with neoprene wherever roofing terminates. Install flashing in strict accordance with printed instruction of manufacturer using full coating of adhesive both on flashing and surface flashed for bonding to metal, and hot pitch for bonding to roofing. Roll or press flashings firmly in place, with surface smooth and free from wrinkles, buckles, and air pockets. Keep transverse joints to a minimum. Where required, lap 6 inches and bond with adhesive.

7C-06.1 Flash edges of cab roof with neoprene strip of sufficient width to extend out 6 inches on roof, and five inches up parapet. Base building roof edges shall be flashed in accordance with drawings.

7C-06.2 Flash around roof openings in similar manner, carrying neoprene flashing out 6 inches on roof, up cant, and at least 6 inches up metal structure above top of cant.

7C-06.3 Roof drains will be furnished and set by plumbing contractor, but watertightness of installations shall be the responsiblity of the roofing contractor. Flashing shall extend out at least 12" on all sides. Secure tightly to drain with flashing ring and bond to roofing.

7C-06.4 Flashing at vent stacks shall extend out on roof at least 6" on all sides. Form collar round stack by cutting hole 1/3 outside diameter of stack at center of sheet, stretch, and pull flashing down over stack. Bond to stack and roofing.

7C-06.5 Furnish and install miscellaneous flashing in locations and in accordance with details shown.

7C-06.6 Counter flash edges of cab roof with sheet metal of sufficient width to extend out 7 inches on roof, up parapet/penthouse and in under parapet/penthouse closure panel. Flanges of counter flashing shall be painted with an asphalt, embedded in hot bitumen and attached to parapet/penthouse coverplate with #14 stainless steel screws 6 inches o. c.

7C-06.6.1 Surfaces to be covered with sheet metal shall be smooth, clean, free of depressions or holes.

7C-06.6.2 All sheet metal work shall be watertight and weathertight with lines, arises and angles sharp and true and plain surfaces free from waves or buckles.

7C-06.6.3 Soldering shall be done with heavy soldering irons properly tinned before using. Joints shall be avoided whenever possible, but where necessary, shall be completely filled with solder, single locked flat seams.

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7C-06.6.4 Sheet metal work shall be cleaned as each section is completed, neutralize excess flux by washing metal with a solution of washing soda. Adjacent work shall be protected.

7C-06.6.5 All sheet metal work shall be uniform, corner joints shall be mitered and soldered continuously and all sections shall be accurately fitted and rigidly secured. All exposed edges shall be folded, beaded, or returned both for strength and appearance, and the sheet metal shall be fitted closely and neatly to adjacent surfaces. All necessary ribs, stiffeners and other reinforcements required to make all sections rigid and substantial shall be provided by the trade. Proper allowance shall be made in all cases for expansion and contraction.

7C-07 BOND: Before the work included herein will be accepted, the Contractor shall deliver to the Resident Engineer the roofing material manufacturer's 20-year guarantee bond warranting the installation of the bonded roofing to be watertight and free from defects for a period of twenty years after the acceptance of the work.

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DIVISION 8

SECTION A

HOLLOW METAL WORK

8A-01 SCOPE: This Section covers the requirement for hollow metal work and its installation.

8A-02 GENERAL: For location and extent and typical details of hollow metal work see drawings and details. Exposed fastenings and concealed reinforcement shall be of the same metal as the adjoining parts.

8A-03 WORK SPECIFIED UNDER OTHER SECTIONS: Movable metal partitions with associated doors and frames, hardware, field painting and elevator hoistway entrances are included in the specifications for such work, unless otherwise specified.

8A-04 INCLUDED WORK: Hollow metal doors, transom panels, their frames and bucks and the louvers built into doors and transom panels, except those located in movable metal partitions, are included in this Section; also weatherstripping, and other related work.

8A-05 MATERIALS: Materials shall comply with the following Federal Specifications, which are referred to by symbol, and the requirements specified herein.

8A-05.1 Hollow Steel: Prime grade, cold rolled sheet steel, properly annealed and process leveled and having smooth, clean surfaces.

8A-05.2 Fillers, in Fire Doors: A rigid form of asbestos board (solid or cellular) that fills the hollow spaces to the extent necessary to meet the standards of the Underwriters' Laboratories, Inc., for each Class of door required.

8A-05.3 Fillers, in Other Than Fire Doors: Either compressed fiberboard LLL-I-535, corkboard, HH-I-525, or a rigid form of asbestos (solid or cellular) at the option of the Contractor.

8A-05.4 Reinforcing Members: Concealed structural or reinforcing members shall be of well finished sheet stock or rolled shapes.

8A-06 THICKNESS: Thickness specified for sheet steel shall be of the decimal equivalents of Manufacturers' Standard Gauges for the items as specified or indicated on drawings. Minimum thickness shall be as follows:

Item	
Frames for solid plaster partitions	18 ga. (.048")

Items	
All other frames and transoms	16 ga. (.060")
Flush type doors and transoms panels	18 ga. (.048") interior 16 ga. (.060") exterior
Other hollow metal work not otherwise specified or indicated	18 ga. (.048")

8A-07 SHOP DRAWINGS: Shop drawings showing thickness of metal, details of construction, profiles, louvers, connections to other work, fastenings, anchors, reinforcement and location of hardware shall be submitted for approval.

8A-08 WORKMANSHIP

8A-08.1 General: All shapes shall be formed, rolled and formed or cold drawn, according to gauge and profile, with contours and arrises as true and sharp as can be produced in the thickness of metal required. Shapes such as moldings, casings, stops and trim shall be cold drawn. The finished work shall be strong and rigid, neat in appearance and free from defects. Plain surfaces shall be smooth and free from warp or buckle; molded members clean cut, straight and true; miters well formed and in true alignment. Fastenings shall be concealed where practicable.

8A-08.2 Joints in Steel: Construction joints of steel work shall be welded in full depth and width, except as permitted by specified options. Exposed surfaces of welded joints shall be dressed to produce invisible connections. Spot welding shall be used where practicable in preference to the use of rivets, screws or bolts.

8A-09 DOORS AND TRANSOM PANELS

8A-09.1 General: Shall be 1-3/4" thick, and free from warp and twist, reinforcement shall stiffen the sheet metal and shall prevent sagging, and with proper bevel on lock stiles or rails to operate without binding.

8A-09.2 Clearance: Door sizes shall include standard clearance as follows: 3/32 inch at jambs and heads; 3/16 inch at bottoms of doors with thresholds and 11/16 inch at bottoms of doors without thresholds. See Details. Note that the thickness of any resilient floor covering is included in the 11/16 inch clearance. Doors to be undercut where indicated.

8A-09.3 Flush Type Doors and Transom Panels: Flush type doors shall consist of two face plates formed to the required door thickness and with the edges continuously welded to reinforcing plates or channels. The face plates shall be stiffened by channels or Z members not less than .048 inch (18 ga.) thick, spaced not more than 6 inches apart, extending the full height of the plates and welded thereto at close intervals. Filler strips not less than 2 inches wide shall be placed full height in the space between stiffeners. Tops and bottoms of doors shall have continuous formed channels not less than .060 inch (16 ga.) thick, welded to the face plates. Construct transom panels same as for doors.

8A-09.3.1 Stiffner Option: A continuous truss-formed inner core of sheet metal not less than .015 inch (9 ga.) thick may be substituted for the stiffners specified above provided it is spot welded to the face plates every 2-3/4 inches horizontally and vertically over the entire surface of both sides. The core shall include a suitable type of insulation to give the effect of solidity.

8A-09.3.2 Cutouts: Cutouts shall be made and properly framed in flush doors and transom panels having louver panels. Such accessories shall be furnished and installed as a part of each door or transom panel; see details. Provide cutouts for cable trays.

8A-09.4 Louvers: For design and arrangement of metal ventilating louvers, see Details. Louvers shall be stationary, adjustable and fusible link types as detailed, of uniform shape and size, straight and true and evenly spaced; metal not less than .048 inch (18 ga.) thick with plain edges. Adjustable and fusible link louvers shall be provided with all necessary pivots, hardware, fusible links and other required accessories.

8A-09.5 Fire Doors: Fire doors shall conform to the standards of the Underwriters' Laboratories, Inc., as regards fire and casualty hazards. The label of the Underwriters' Laboratories will be accepted as conforming with this requirement.

8A-09.5.1 Label Option: Instead of the label, the Contractor may submit independent proof, satisfactory to the Government, that the doors he proposes to furnish conform to the published standards, including methods of test, of the Underwriters' Laboratories as regards fire and casualty hazards.

8A-09.5.2 Construction: Construction generally shall be as specified for steel doors of similar type, subject to restriction imposed on the required classes as to maximum sizes of doors, areas of glass panels (if any) heights of stops on frames and minimum throw of locks and latches. Fillers are specified under Materials.

8A-10 REINFORCEMENT FOR HARDWARE

8A-10.1 General: Concealed metal reinforcement, of well finished sheet stock or rolled shapes welded in place and tapped for hardware fastenings, shall be provided in doors, and frames, as follows:

8A-10.2 Locks and Latches: For locks and latches and their trim: Box type unit, plate not less than .060 inch (16 ga.) thick. For lock strikes: Offset plate not less than .050 inch (9 ga.) thick.

8A-10.3 Butts and Jamb Pivots: For door butts and jamb pivots: Offset plates not less than .150 inch (9 ga.) thick. Plates in frames to be 10 inches long by the full inside width of the jamb. Plates in doors to be either (a) the full height of the door and as wide as the space between the face plates of the door, or (b) the following combination, at the option of the Contractor: A continuous cold-rolled channel .60 inch (16 ga.) thick the full height of the door and separate plates not less than 10 inches long and as wide as the space between the channel flanges at every butt and pivot location; the channel welded to the face plates of the door and to the reinforcing plates.

8A-10.4 Closers: For door closers and for top and bottom pivots; In doors and frames; Plates not less than .150 inch (9 ga.) thick, of proper length for suitable fastenings and as wide as the space between face plates of door or the flanges of reinforcing channels. Where concealed, overhead closers are required, adequate space, reinforcement and provision for fastenings shall be made for the closers.

8A-10.5 Surface Hardware: For surface applied hardware, other than lock trim: Plates of suitable size not less than .125 inch thick.

8A-10.6 Welding: Steel plates; either continuous fillets at both edges of the long dimension, 1/2 inch fillets not over 2 inches apart in all contact edges, or spot welds at points not over 2 inches apart in both directions on contact surfaces. Any variation due to job conditions shall be as approved by the Government's Representative.

8A-11 FITTING OF HARDWARE: Fitting of hardware shall be done at the factory, either to templates or to the hardware, as may be required.

8A-12 FRAMES

8A-12.1 General: Unless otherwise, all frames shall be combination integral type, channel sections, rebated for doors, and transom panels and of the proper width to suit the details of the walls and to form a continuous trim of uniform width around the opening. Edges of flanges

shall be turned as detailed, and to form retainers for adjustable anchors. Frames shall be furnished with cutouts and concealed reinforcement for hardware, as specified. Reinforcement shall have box covers welded in place. Frames for fire doors shall bear the same classification for fire protection as required for the door. Reinforce heads of frames for openings wider than 3' - 6" with not less than 12 gauge (.105") angles or channels. Provide special clips to hold two frames together where they abut. Exterior frames to have caulking groove, 1/4" wide with closed back, that will retain caulking compound.

8A-12.2 Construction: Corner joints of frames shall be accurately mitered, and welded in full depth and width. Make transom bar of tubular or closed construction: to member with jambs and be butt welded thereto. Reinforce construction with concealed clip angles.

8A-12.3 Clip Angles: The bottom of frames that rest on the floor shall be at the indicated finished floor level and secured to the structural slab with concealed clip angles, expansion bolted to floor. Where metallic waterproofing occurs, make special provision for anchorage so as not to damage waterproofing.

8A-12.4 Frames Without Rough Bucks: Include adjustable steel anchors as specified near the top and bottom of all jambs and at points between, not over 25 inches apart. The bottoms of door jambs, provide for and furnish adjustable floor anchors and include removeable steel spreaders of adequate strength and stiffness.

8A-12.5 Spreader: Provide spreader at bottoms of frames of channel or angle sections so placed and secured that, where the construction will permit, they will be left in place and concealed in the finished work. Where they cannot be concealed in the finished work, they shall be left in place until the frames and bucks are properly set and securely anchored. Spreaders shall be cut or removed to permit the installation of floor hinges or pivots where same occur. The use of permanent spreaders shall not exclude the floor anchors specified.

8A-12.6 Anchors: Frames shall be provided with anchors of the types detailed for the various wall conditions. Anchors shall be placed near the top and bottom of each jamb and at points not more than 25" apart. Anchors shall be of steel, with thickness not less than the metal of the frames or buck. Steel rod and zee bar anchors shall be provided as detailed for anchorage of frames to concrete. T-shaped anchors with stems corrugated or perforated for mortar bond shall be provided for frames anchored to masonry. Adjustable yoke type anchors shall be provided as detailed. Floor anchors shall be 1/2" in diameter, and be fitted with lock nut and traveling nut for vertical adjustment and extend not less than 2" into the concrete below. The lower ends of the anchors shall be grouted in place or fitted with expansion sleeves.

8A-12.7 Erection: All frames shall be accurately set, plumb and true and placed on exact location. The Contractor shall test each frame and any irregular or defective work shall be immediately adjusted and made satisfactory. Frames set in concrete and masonry openings to be filled with Portland cement grout.

8A-13 PRIME FINISH: All metal surfaces shall be cleaned and given one dip or spray coat of rust-inhibitive, metallic oxide paint on all exposed and inaccessible surfaces, and baked, including the inside of doors, transom panels and the backs of panel sheets, trim, louvers and moldings. All surfaces that will be exposed shall then be given a mineral filler in one or two coats, as necessary, to conceal all surface blemishes and insure a smooth even finish, followed by one coat of metallic oxide primer. Each filler and prime coat shall be separately baked and rubbed to a smooth surface.

8A-14 WEATHERSTRIPPING

8A-14.1 Weatherstrip all exterior hollow metal doors and frames with extruded aluminum interlocking weatherstrips, types approved by the Contracting Officer, and specially designed for application to hollow metal doors and frames, similar to the products as manufactured by Zero Weather Stripping Co., Inc., Chamberlin Co. of America, Accurate Metal Weather Stripping Co., Inc., or approved equal.

8A-14.2 Install weatherstrips around the complete perimeter of the opening, including weatherstrip saddles, in accordance with manufacturer's directions, in a manner not to conflict with operating hardware and to provide a smooth operating and weather tight installation.

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DIVISION 8

SECTION B

GLASS AND GLAZING

8B-01 SCOPE: This Section covers the requirement for glass and related items and their installation or glazing.

8B-02 GENERAL: For location and extent of work, see drawings, and applicable details.

8B-03 MATERIALS

8B-03.1 Plate Glass: Federal Specification DD-G-451a, Type I (Polished Plate Glass), glazing quality.

8B-03.2 Glass Thickness: As indicated on drawings; not less than ⅛" thick where not otherwise indicated.

8B-03.3 Neoprene: Closed cell neoprene for cushions, tapes and ropes; 70 durometer for setting blocks, 40 durometer for tapes, ropes and cushions; sizes and shapes as detailed; similar to products manufactured by Pawling Rubber Co., Firestone Tire and Rubber Co., Rubatex Corporation, or approved equal.

8B-03.4 Tapes and Sealants: As hereinafter specified.

8B-04 SHOP DRAWINGS AND SAMPLES

8B-04.1 Submit for approval complete shop drawings showing methods of installation of glass and showing in detail location of tapes, sealants, cushions, blocking and spacers.

8B-04.2 Submit for approval samples of all glass, tapes and sealants.

8B-05 MANUFACTURER'S LABELS: Manufacturer's labels showing grade, thickness, type and quality of glass is required on each piece of glass. Labels must remain on glass until it has been set and inspected.

8B-06 INSTALLATION

8B-06.1 Unless otherwise indicated or specified, glazing in general shall conform to the applicable standards of the Flat Glass Jobbers Assn. "Glazing Manual" as approved by the Contracting Officer.

8B-06.2 Do all glazing at the building after frames, doors, vestibules, partition ends etc., have been installed.

8B-06.3 Glaze all exterior work in such manner so as to be weatherproof and watertight.

8B-06.4 Verify all glass sizes given in any schedule provided by manufacturers furnishing items to be glazed.

8B-06.5 Remove glazing moulds or stops where required; set glass with cushions, blocks, tapes and sealants as required. Replace glazing members after glazing taking every precaution to avoid marking or in any way defacing any portion of the glazing member or adjacent work.

8B-06.6 Set glass in metal frames as detailed with neoprene setting blocks at quarter points. Position glass in center of glazing rabbets; maintain required clearances at perimeter at all four sides. Place continuous neoprene tapes against inside and outside stops set a minimum of ⅛" below sight lines and seal both sides of glass with sealant of required thickness (1/8" minimum). Provide shims, cushions or spacers properly located against frames so as to prevent twisting, rattling or breakage.

8B-06.7 Leave all glass clean and whole, without cracks, scratches or other defects; all setting to be perfect at completion.

8B-06.8 Mark all openings after installation to show that openings have been glazed using paper streamers adhered to frame members and not to glass, or by other approved method.

8B-06.9 Apply sealants, glazing tape, etc., with accurately formed corners and bevels. Clean the sealing surfaces at perimeter of glass and the sealing surfaces of rabbets and stop beads before applying sealants or tape. Use only the approved solvents and cleaning agents recommended by the sealant and tape manufacturers. Make good contact with glass and frame when glazing and facing off. Remove excess sealant from glass, frames or other adjoining surface. Do not set glass until metal frames have been primed and the paint is dry. Do not apply sealant at temperatures below 40 degrees F., or on damp, dirty or dusty surfaces. Remove from surfaces to be glazed any material to which gaskets, tapes, sealants, etc., will not readily adhere.

8B-06.10 Where a combination of sealing materials are required for glazing in the same frame, the Contractor shall certify that all glazing materials furnished are compatible with each other and also compatible with the material used for setting blocks and spacer shims.

8B-06.11 Set glass in interior metal frames with poly-urethane or butyl glazing tapes.

8B-06.12 All glass, tapes, cushions, blocks, sealants, etc., shall be in-

stalled in accordance with the manufacturer's directions and shop drawings as approved by the Contracting Officer.

8B-06.13 Set glass closures between partitions and window glazing as detailed.

8B-07 TAPES AND SEALANTS

8B-07.1 Tapes and sealants shall be of the types, sizes, thickness and composition, and installed as required by the various conditions, all in accordance with the details, specifications, and recommendations of the manufacturers, as approved by the Contracting Officer.

8B-07.2 Tapes shall be closed cell neoprene, of types, thickness and dimensions indicated or required for the specific application where they are to be used.

8B-07.3 Poly-urethane glazing tape shall be as manufactured by Sterling Alderfer Co., Akron, Ohio or approved equal.

8B-07.4 Sealant for exterior glazing shall be a non-staining 1-part 100% liquid polymer base sealant as manufactured by Tremco Manufacturing Co., or 1-part silicone rubber sealant as manufactured by Dow Corning Corporation or General Electric Co., or other 1-part sealant conforming to the performance requirements of ASA Standard A-116.1 or Federal Specification TT-S-00230. Submit manufacturer's certification, in writing, that the brand or product number recommended by the manufacturer for each specific application conforms to the referenced standards. Color of sealant as selected and approved by the Contracting Officer.

8B-07.5 Joints and spaces to be sealed shall be thoroughly cleaned of dirt, oil, grease or other foreign matter which would prevent proper bond, and the surface shall be thoroughly dry and in proper condition before application of the tapes or sealants.

8B-07.6 Apply sealants with an approved pressure gun suitable for the sealant to be used. Before applying sealant, surfaces shall be primed or sealed in accordance with the manufacturer's instructions. Pressure guns shall have nozzles of proper size and shape to fit the various conditions. Sealants shall be driven in with sufficient pressure to completely fill the joints or voids. Strip excess sealant from glass and frame and tool sealant at a sight angle to shed water and produce clean straight sight lines.

8B-07.7 Adjacent materials which have been soiled shall be cleaned immediately before the sealant hardens or stains the adjoining surfaces.

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DIVISION 9

SECTION A

FURRING, LATHING, AND PLASTERING

9A-01 SCOPE: This Section covers the requirement for performing all operations in connection with the installation of Furring, Lathing, and Plastering.

9A-02 GENERAL: Plaster work generally and except as otherwise specified, shall be 3-coat work on metal lath and polystyrene insulation, 2-coat work on concrete walls, and shall include all interior lathing and plastering, metal studs, metal furring, and metal accessories, such as grounds, casing beads and corner beads. For location, extent and character of plaster work, see drawings. Plaster "ceilings" refer to all overhead surfaces that are to be plastered, including suspended construction, unless otherwise shown or specified. Plastered "walls" include walls, partitions, reveals, and recesses, except where other finish is required.

9A-02.1 Areas to receive furring, lathing and plastering are shown or indicated on the Materials and Interior Finish Schedules, sections, details, and elevations contained in the Contract Drawings. Specifications for the suspended Acoustical Ceilings are not contained in this section of the specifications.

9A-03 STANDARD SPECIFICATIONS: The following Standards and publications shall govern, except as modified herein.

9A-03.1 American Standards Association:

ASA A42.1 Standard Specifications for Gypsum Plastering.

ASA A42.3 Standard Specifications for Portland Cement Plaster.

ASA A42.4 Standard Specifications for Interior Lathing and Furring.

9A-03.2 Gypsum Association:

Recommended Specifications for Gypsum Plastering.

9A-04 HANDLING & STORAGE: Manufactured materials shall be delivered in the original, unbroken packages, containers, or bundles bearing the maker's name and brand. They shall be kept dry, off the ground, undercover and away from sweating walls and other damp surfaces until put to use.

9A-05 MATERIALS: Materials shall conform to the following applicable Federal Specifications, which are referred to by symbol, and the requirements specified herein.

9A-05.1 Gypsum Plaster: SS-P-402, Type N (neat) or Type W (Wood Fibered), at the option of the Contractor. Neat plaster shall be fibered for scratch coat.

9A-05.2 Calcined Gypsum: SS-P-402, Type G.

9A-05.3 Lime: Lime shall be either hydrated lime or finely pulverized quicklime, at the option of the Contractor. None of the lime delivered shall be used in the work until samples taken by the Government's Representative have been tested and approved by the Government.

9A-05.3.1 Hydrated: Hydrated Lime; SS-L-351, except that the total free (unhydrated) calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product as delivered on the site shall not exceed 8 percent by weight.

9A-05.3.2 Pulverized Quicklime: Pulverized quicklime; SS-Q-351. All shall pass a No. 20 sieve and not less than 90 percent shall pass a No. 50 sieve. After slaking to a putty, it shall show at the end of 72 hours that the total free (unhydrated) calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product does not exceed 8 percent by weight, calculated on the basis of the lime solids in the putty.

9A-05.4 Portland Cement: SS-C-192d, Type I or Type IA

9A-05.5 Bond Plaster: Bond Plaster shall be factory mixed, specially prepared for use directly on concrete surfaces with the addition of water only. It shall contain not less than 60 percent by weight of calcined gypsum calculated from SO_3 content. The remainder shall consist of materials to control the working quality, setting time, bonding property and expansion on setting. It shall set in not less than 1-½ hours, nor more than 8 hours and shall have a tensile strength of not less than 150 pounds per square inch after aging seven days in moist air at a temperature of 70 degrees to 100 degrees F. Methods of testing shall conform to A.S.T.M. C26.

9A-05.6 Bond Adhesive: Bond adhesive for use on concrete walls when Bond Plaster is not utilized, shall be an aqueous resin emulsion, factory prepared for permanently bonding plaster to damp or dry concrete surfaces and tinted to show by visual inspection where it has been applied. It shall be vermin-proof, non-toxic, highly resistant to acids, not affected by alkalies present in concrete and plaster mixes, non-inflammable and shall not support combusion. It shall be dry to touch on concrete in less than 1 hour, remain flexible when dry, develop a minimum bond strength of 150 pounds per square inch and have a performance temperature range of from minus 35 degrees F. to 275 degrees F. without bond failure. A certificate of compliance with this specification, signed by the manufacturer and endorsed by the Contractor, shall be furnished in triplicate to the Government's Representative.

9A-05.7 Hair and Fiber: Hair and fiber shall be clean and in various lengths from approximately ½ inch to 2 inches.

9A-05.8 Sand: Sand shall be clean, well graded and free from soluble salts

(alkali) and organic matter. When dry, all of the sand shall pass a No. 4 sieve and shall meet the following screen analysis:

Retained on a No. 8 screen.....0 to 5 per cent
Retained on a No. 16 screen....5 to 30 per cent
Retained on a No. 30 screen....30 to 60 per cent
Retained on a No. 50 screen....65 to 85 per cent
Retained on a No. 100 screen...95 to 99 per cent

9A-05.8.1 A maximum of 10 percent passing a No. 100 screen will be allowed. When measured by volume, 85 pounds of damp sand or 80 pounds of dry sand shall equal 1 cubic foot. Volumes specified are on a dry basis.

9A-05.9 Vermiculite and Perlite Aggregates: These materials shall comply with the requirements of ASTM Specification C35.

9A-05.10 Water: Water shall be clean, fresh and free from alkali.

9A-05.11 Lath: QQ-L-101 , except as otherwise specified. Weights specified are per square yard. Lath not otherwise specified shall be either 24 or 26 gauge, flat, expanded metal lath not lighter than 3.4 pounds, or 2-½ mesh per inch 19 gauge woven wire lath not lighter than 2.48 pounds.

9A-05.11.1 Welded Wire Fabric: Welded wire fabric with integral paper backing may be substituted for the expanded metal or woven wire lath specified above, except where plaster is to be applied to both sides of the lath. The fabric shall be 16 gauge wires, not larger than 2 by 2 inch mesh, stiffened or self-furring type, with ribs or stiffeners at intervals of not more than 5 inches. Paper shall be of absorbent quality or shall be perforated.

9A-05.11.2 Flat-Rib: Flat-rib (1/8 inch) expanded metal lath shall weigh not less than 3.4 pounds.

9A-05.11.3 Rib Lath: Rib lath shall have 3/8 inch ribs or equivalent stiffeners and shall be either expanded metal weighing not less than 4 pounds, or 2-½ mesh per inch, V stiffened, woven wire weighing at least 3.3 pounds. Provide 3/4" rib lath where indicated.

9A-05.12 Accessories: Metal accessories such as grounds, casing beads and corner beads shall be zinc-coated metal not less than 26 gauge, with expanded or perforated flanges or clips so shaped as to permit complete embedment in the plaster. Spot weld 20 gauge sheet metal closure strips to casing beads. Provide 20 gauge end caps.

9A-05.13 Hangers and Inserts: Hangers shall be of ample length. Inserts and other means of attachment as installed, shall develop the full strength of the hangers used. Steel flats; 1 by 3/16 or 1-1/4 by 1/8 inches with 7/16 inch diameter holes, punched on the center line and equipped with 3/8

inch diameter bolts; no hole less than 3/8 inch from an end. Rods; 3/16 inch diameter. Steel to be zinc coated, cadmium-plated or painted. Wire loops and hangers are specified below.

9A-05.14 Metal Furring: Metal furring; either hot-rolled or cold-rolled steel shapes, except where hot-rolled shapes are specified; painted with rust inhibitive paint.

9A-05.14.1 Cold-Rolled Channels: Cold-rolled channels; flanges not less than 7/16 inch wide and the following minimum weights per 1,000 linear feet; 300 pounds for 3/4 inch, 475 pounds for 1-½ inch, 590 pounds for 2 inch.

9A-05.14.2 Hot-Rolled Channels; Hot-rolled channels; the following minimum weights per 1,000 linear feet; 300 pounds for 3/4 inch, 410 pounds for 1 inch, 1120 pounds for 1-½ inch and 1260 pounds for 2 inch.

9A-05.14.3 Cold-Rolled Angles: Not less than 2" x 2" x 1/8" or form of 14 ga. (.0781") bent plate.

9A-05.15 Metal Studs: Hot rolled channels 2, 2-½, 3-½, 4 and 6 inches wide as required; or not lighter than 18 gauge strips or 7 gauge wire, dip-painted with asphaltum or other rust inhibitive paint.

9A-05.15.1 Deflection: When subjected to bending in a plane parallel with the long axis of the section by center loading on a clear span of 5 feet, the deflections of the studs shall not exceed those given below:

4 inch and wider; 100 pounds load; 0.10 inch deflection.
3-½ inch; 100 pounds load; 0.15 inch deflection.
2-½ and 2 inch; 50 pounds load; 0.20 inch deflection.

9A-05.16 Wire Accessories: Wire accessories shall conform to applicable Federal Specifications and shall be soft annealed. Steel shall be zinc-coated.

9A-05.16.1 Steel Wire, Corrosion-Resisting: QQ-W-461 (Composition FS 430).

9A-05.16.2 Steel Wire: QQ-W-461, Finish D.

9A-05.16.3 Hangers: Corrosion-resisting steel not less than .125 inch diameter, or steel not less than .162 inch in diameter.

9A-05.16.4 Loops: Loops for attachment of furring to concrete: Steel, minimum diameters for areas supported; .08 inch up to 8 square feet; .105 inch up to 12 square feet and .120 inch up to 16 square feet.

9A-05.16.5 Ties for Brackets: Ties for attaching brackets and runner chan-

nels to steel shapes or inserts; Steel not less than .08 inch in diameter, double-wrapped or two strands saddle tied.

9A-05.16.6 Ties for Furring: Ties for attaching furring channels to steel joints; steel loops not less than .062 inch diameter, or a double wrapping of lacing wire.

9A-05.16.7 Lacing Wire: Lacing wire; steel, not less than .047 inch diameter.

9A-05.17 Options

9A-05.17.1 Lime Plaster: Lime plaster may be substituted for gypsum plaster, except (a) for use directly on concrete, and (b) for brown coat on gypsum bond plaster.

9A-05.17.2 Mill-Mixed Gypsum Plaster: Mill-Mixed Gypsum Plaster in the proportion of 1 part gypsum to 2-1/2 parts sand, by weight, or 100 pounds of gypsum to 2-1/2 cubic feet of either vermiculite or perlite, may be used instead of the job mixtures of gypsum plaster specified for scratch and brown coats on metal lath.

9A-05.17.3 Mill-Mixed Gypsum Plaster: Mill-mixed Gypsum Plaster in the proportion of 1 part gypsum to 3 parts sand, by weight, or 100 pounds of gypsum to 3 cubic feet of either vermiculite or perlite, may be used instead of the job mixtures of gypsum plaster specified for use on concrete walls.

9A-06 MIXTURES AND MIXING

9A-06.1 General: Measurement by volume shall be made in containers of known capacity. The amounts of sand specified are on a dry basis. No lumpy, caked or frozen materials shall be used. No mortar that has commenced to set shall be retempered or used in the work. Mixing equipment, boxes and tools shall be cleaned for each batch.

9A-06.2 Proportion Control: The materials shall be proportioned as specified, with only such variations as will, under prevailing conditions, improve the quality of the work and as shall be approved by the Government Representative. All ingredients shall be accurately measured using an automatic mechanical measuring device that will consistently maintain the specified proportions within a plus or minus tolerance of not more than 5 percent be weight or volume and thoroughly mixed until evenly distributed throughout.

9A-06.3 Lime Putty: Lime putty shall be a stiff mixture of lime and water and shall be kept moist until used. Putty from hydrated lime shall be allowed

to soak at least 24 hours before it is used. Putty from quicklime shall be slaked and allowed to soak at least 72 hours after cooling, before it is used. During the slaking of the lime care shall be taken to avoid either burning or drowning the lime.

9A-06.3.1 Lump Lime: Aged lime putty made from lump lime may be used provided the total estimated amount required for the job is slaked, strained and stored in a vat or vats for at least three weeks before any of the lime is delivered to the site. The putty shall be made by a firm regularly engaged in supplying the trade with putty in bulk and with a plant fully equipped with the proper machinery and storage capacity; the plant and methods used to be subject to Government inspection and approval.

9A-06.4 Gypsum Plaster: Neat plaster shall be mixed 1 part plaster to 2 parts sand for first (scratch) coat on lath, and 1 part plaster to 3 parts sand for second (brown) coat on lath and for use on concrete walls. Parts are by weight. Use vermiculite or perlite plaster for exhaust duct enclosures.

9A-06.4.1 When vermiculite or perlite is used as an aggregate, the first (scratch) coat on lath shall be mixed in the proportions of 100 pounds of gypsum neat plaster to not more than 2 cubic feet of vermiculite or perlite.

9A-06.4.2 For second (brown) coat on lath the proportions shall be 100 pounds of gypsum neat plaster to not more than 3 cubic feet of vermiculite or perlite.

9A-06.5 Lime Plaster: Lime plaster for first (scratch) coat on lath; 1 volume of putty and not more than 2-½ volumes (or 200 pounds) of sand gauged with 10 to 15 pounds of Portland cement per cubic foot of lime putty, with 7-½ pounds of hair per cubic yard of mortar. For second (brown) coat on lath 1 volume of putty and not more than 3 volumes (240 pounds) of sand, with 3-½ pounds of hair per cubic yard of mortar. An equivalent bulk of fiber may be substituted for the hair specified.

9A-06.5.1 Limitation: Lime plaster shall not be used directly on concrete nor as a brown coat on gypsum bond plaster.

9A-06.6 Finish Coat: Finish coat, not otherwise specified, for both gypsum plaster and lime plaster shall be prepared gypsum (lime free) white finish, or shall be a mixture of lime putty and calcined gypsum in the proportions of three parts lime putty to one part calcined gypsum by volume. In either case, it shall produce a smooth, hard, white finish.

9A-07 INSTALLATION OF FURRING, AND LATH

9A-07.1 General: Provide metal furring (other than structural steel) for

all lines, contours and planes where lath is required for plastering and include all necessary hangers, bolts, inserts, clips, fastenings and attachments which shall be of such size, number and design as will develop the full strength of the members.

9A-07.2 Workmanship: Metal furring shall be erected to true lines and surfaces and be rigidly supported and fastened in place. Grounds, furring, framing etc., shall be tested and all needed corrections made before lathing or plastering is begun.

9A-07.3 Metal Furring to which the lath will be attached shall be wired to the brackets, bearing members and other steel supports at every intersection or point of contact. Where attached directly to structural steel and wherever wiring as specified is not practicable, bolts or zinc-coated metal clips of equivalent strength shall be used.

9A-07.4 Irregular Surfaces: Brackets for irregular surfaces shall be shaped to within 2 inches of the finished profiles, spaced not over 3 feet on centers, cross braced as required and bolted or wired in place. Larger sizes and closer spacing than specified shall be used where so shown. Wire continuous cross furring to the brackets at all principal angles and at points between not over 12 inches apart.

9A-07.5 Access Panels: Provide framed openings in the furring of plastered surfaces for the support and attachment of access panels, where indicated on the drawings. Install access panels, furnished by other trades, to framing openings.

9A-07.6 Ceilings: Suspended ceilings shall consist of inserts and hangers or wire loops and ties, main runners, cross furring and metal lath except where otherwise detailed or specified. Suspend furring by hangers or rods of proper length to provide ceiling heights as indicated on drawings.

9A-07.6.1 Suspended ceilings over Tower Shaft Stair where required, shall consist of continuous wall angles, furring channels, and metal lath.

9A-07.6.2 Continuous wall angles and casting beads shall be provided adjacent to vertical surfaces where reveals are indicated on drawings.

9A-07.6.3 Fixture Recesses. (Ceiling): Provide openings in the furring of suspended ceilings and equip with frames for the support and attachment of any recessed lighting fixtures included under Mechanical and Electrical Sections of the Specifications. The frames shall consist of 1-½ inch channels with the web vertical, squared to accurate dimensions and bolted at corners. They shall provide 3/8" clearance for the fixture housing on all sides and be punched for the housing attachments. See drawings for housing sizes. The supporting frames shall be correctly spaced, leveled and aligned

on top of the cross furring channels and wired thereto. Any abutting runner channels shall be screwed or bolted to the frames through bent ends. It is intended that the fixture housing to be installed before lathing and plastering and that the work of the trades involved be co-ordinated.

9A-07.6.4 Suspended Ceilings: Attach ceiling runner channels suspended from overhead construction by means of inserts and flats, steel rods or corrosion resistant wire hangers so spaced that the area supported shall not exceed the maximum permitted or the size used. Runner channels shall be 4'-0" on centers and as follows: For spans up to 3 feet, 1-½ inch cold-rolled; for spans up to 4 feet, 1-½ inch hot-rolled; for spans up to 5 feet, 2 inch hot-rolled. Cross furring channels; maximum spacings on centers; 12 inches for flat expanded or wire lath; 16 inches for paper-backed wire fabric; 19 inches for flat rib expanded or V stiffened wire lath; 24 inches for 3/8 inch rib lath. Minimum sizes: 3/4 inch for 12 and 16 inch spacings; 1 inch hot-rolled for 19 and 24 inch spacings.

9A-07.7 Metal Studs

9A-07.7.1 General: Cuts or drawings showing complete details of assembly and anchorage shall be submitted.

9A-07.7.2 Workmanship: Metal studs shall be set to the required dimensions, properly aligned, made plumb and true and have both ends fastened to horizontal members anchored to wall ledge and structural ceiling slab. The connection to ceiling member shall be a metal clip, or similar device, specially formed to fit the stud and long enough to provide for secure wiring thereto and allow for several inches of vertical adjustment. Studs shall be rigidly framed at corners and around openings and fastened to the bucks or frames of openings.

9A-07.7.3 Bridging Requirements: Studs shall be bridged horizontally near the center, with 3/4 inch channels passed through openings in the studs and wired to every stud.

9A-07.7.4 Attachment: Provision shall be made in studs for rigidly bolting all blocking and special braces or framing for the attachment and support of equipment indicated to be supported by the stud construction.

9A-07.8 Lathing:

9A-07.8.1 General: Metal lath shall be used as a base for all plaster work on metal furring and framing, and wherever suitable base of masonry or concrete is not indicated or provided under the contract. For lath of types and weights specified, the maximum allowable spacings of supports are as follows:

Flat expanded and wire lath: 16 inches on walls; 12 in. on ceilings.

Paper-backed wire fabric:	16 inches on walls and ceilings.
Flat rib expanded lath:	19 inches on walls and ceilings.
V-stiffened wire lath:	24 inches on walls; 19 in. on ceilings.
3/8 inch rib lath:	24 inches on walls and ceilings.

9A-07.8.2 Workmanship: Lath generally shall be laid with the long dimension at right angles to the supports, edges lapped ½ inch and ends lapped at least 1 inch. Rib lath shall have the ribs "nested" at sides and lapped 1 inch at ends. Wire lath shall be tightly stretched. End joints of sheets shall be made generally only at bearings and shall be staggered. If ends occur between bearings the ends shall be lapped one inch and laced or adequately tied with lacing wire. Lath shall be continuous around the corners of intersecting plaster surfaces.

9A-07.8.3 Fastening: Metal lath generally shall be fastened at points not over 6 inches apart along supports, or attached to the metal furring at 10-inch intervals by specially designed steel wire clips of not lighter than 13 gauge which interlock and provide a continuous support for the lath along the furring, and side joints shall be wired at least once between supports. Rib lath shall be fastened at all ribs. Lath abutting masonry or concrete surfaces that are to be plastered shall extend onto same at least 4 inches and be fastened every 6 inches.

9A-07.8.4 Lath Reinforcement: Expanded strip lath at least 6 inches wide shall be centered on and secured across all flush joints (vertical and horizontal) between concrete surfaces and abutting partitions; across narrow chases for pipes and conduits in masonry furring and partitions; and similar strips 16 inches long fastened diagonally at the head corners of openings in partitions of concrete masonry units. Fasten the strips sufficiently to retain position during plastering.

9A-07.8.5 Cornerites: Expanded cornerites, not less than 3 by 3 inches, shall be installed in all internal angles where partitions that will be plastered, intersect unfurred ceilings and abut walls that also are to be plastered. Cornerites shall be fastened sufficiently to retain position during plastering.

9A-07.9 Accessories:

9A-07.9.1 General: Casing beads and corner beads shall be set to straight, true lines and the flanges securely fastened in place at points not more than 8 inches apart. Beads shall be level and plumb and casings parallel with floors, ceilings, and rake of stairs.

9A-07.9.2 Corner Beads: All exposed external plaster corners shall have

metal corner beads.

9A-07.9.3 Screeds: Plaster screeds for the brown coat shall be run around the margins of all ceilings and walls and on intermediate lines about 6 feet apart. The screeds shall be brought into perfect line and level to establish the exact surface of the brown coat and allowed to set up, and then used as a guide for rodding the brown coat.

9A-08 APPLICATION OF PLASTER ON SURFACES OTHER THAN POLYSTYRENE INSULATION

9A-08.1 General: Surfaces to be plastered shall be clean and free from frost, loose particles, paint, efflorescence, grease, oil, acid and similar foreign matter.

9A-08.2 Concrete: Concrete walls shall be given one full-covering coat of bond adhesive evenly applied by brush or spray as taken from sealed containers and without adulteration. All under coats of plaster shall be dampened to eliminate excessive suction and permit proper spreading of the plastic materials.

9A-08.3 On Lath: The first (scratch) coat shall be applied with sufficient material and pressure to cause perfect adhesion and to key with or embed in the lath. It shall cover, the face of the lath to a depth sufficient to allow for scratching, and shall be cross-scratched in both directions before the mortar has set. The scratch coat for gypsum plaster shall be allowed to set, but not dry out, before the brown coat is applied. The scratch coat for lime plaster shall be allowed to set hard and dry out before the brown coat is applied. The brown coat shall be brought out to the screeds and grounds, straightened to a true surface with rod and darby and left rough, ready to receive the finish coat.

9A-08.4 On Concrete: The first (brown) coat shall be applied with sufficient material and pressure to form a good bond and then doubled back to bring the plaster to the screeds and grounds, straightened to true surfaces with rod and darby and left rough, ready to receive the finish coat.

9A-09 PLASTER ON POLYSTYRENE INSULATION

9A-09.1 General: This Specification describes the minimum requirements for plastering over polystyrene insulation board in normal temperature applications. In addition the plastering shall conform to the applicable requirements of "American Standards Association Specifications for Gypsum Plaster, A 42.1", latest edition as approved by the Contracting Officer.

9A-09.2 Precautions:

9A-09.2.1 When the outdoor temperature at the building site is less than 55

degrees F., maintain a uniform temperature of not less than 55 degress F. continuously throughout all spaces to receive plaster over polystyrene insulation for a period of not less than one week prior to the application of plaster, while plastering is being done, and after the plaster is dry. The heat shall be well distributed in all areas to prevent concentrated or uneven heat on the plaster.

9A-09.2.2 Provide ventilation to properly dry the plaster during and subsequent to its application. In cold weather do not depend upon opening windows to provide circulation to dry plaster. In areas lacking natural ventilation, provide temporary circulation or other supplementary means of ventilation. Caution must be used to insure that ventilation is uniform to prevent concentrated air movements.

9A-09.2.3 Examine the surface of the polystyrene insulation carefully before plastering to insure that all boards are well bonded and evenly applied, with all joints staggered and tightly butted so that no plaster fins will extend through to the wall.

9A-09.2.4 Since polystyrene insulation is a water barrier, plaster tends to dry more slowly on it than on masonry or lath. Therefore, a rich mix with a minimum of water shall be used and with adequate drying time allowed between coats.

9A-09.3 Preparation:

9A-09.3.1 Cover wood grounds and nailers with polyethylene film or other approved vapor barrier to protect wood from wet plaster. Cover the wood strips, over the vapor barrier, with metal lath stapled to the polystyrene insulation.

9A-09.3.2 Install corner beads on all exterior corners, provide cornerite at all interior corners and angles. Provide 4" wide metal lath around the perimeter of all openings in the polystyrene insulation. Corner beads, cornerite, casing beads and metal lath shall be stapled only to the insulation.

9A-09.4 Basecoat: Use gypsum neat plaster with sand aggregate. Lightweight aggregate base coats shall not be applied over polystyrene insulation.

9A-09.5 Finish Coat: Trowel Finish; use gypsum-lime putty or other standard prepared gypsum trowel finish plasters.

9A-09.6 Water: Use clean water free from impurities which will impair set of the plaster. Do not add more water than is necessary to obtain a workable mix. Do not add accelerator or retarder to the mix.

9A-09.7 Base Coat Proportions:

9A-09.7.1 Scratch Coat: 100 pounds gypsum neat plaster to a maximum of 250 pounds of damp loose sand.

9A-09.7.2 Brown Coat: 100 pounds gypsum neat plaster to a maximum of 350 pounds of damp loose sand.

9A-09.8 Finish Coat Proportions: Gypsum-Lime Putty Trowel Finish; mix in proportions of 50 pounds silica sand, 50 pounds slaked lime putty, plus a minimum amount of gauging plaster.

9A-09.9 Plaster Thickness: Minimum thickness of 5/8" for three coat work unless otherwise indicated. Install plaster grounds and temporary screeds where necessary to insure such thickness. Make finish coat 1/16" and under no circumstance shall the total thickness of finish coat exceed 3/32".

9A-09.10 Application of Base Coats:

9A-09.10.1 Apply nominal 1/4" scratch (first) coat with firm pressure to insure a good key to surface cells of the polystyrene insulation and then scratch to a rough surface. After the scratch coat has set firm and hard and is well dried (about 3 days) apply a nominal 3/8" brown (second) coat, and bring out to grounds. Rod and darby this brown coat to a true, regular and lightly roughened surface ready to receive the finish (third) coat.

9A-09.10.2 It is necessary that these specifications be closely followed to obtain best results. It is extremely important that a tight scratch coat be applied to the polystyrene insulation and allowed to completely and thoroughly dry. This scratch coat serves as a base and gives a surface that has good suction for the brown coat. If the scratch coat is not allowed to completely dry before doubling up with the brown coat, there is a greater risk for random cracks to develop in the finished job.

9A-09.11 Application of Finish Coat: The brown coat shall be moderately dry but not bone dry to receive the finish. The trowel finish shall be applied over the brown coat that has set firm and hard, scratched in thoroughly, laid on well, double back and filled out to a true, even surface, with sufficient troweling to prevent cracks in the finish coat.

9A-09.12 Manufacturer's Instructions: All lathing and plastering over polystyrene insulation shall be in strict accordance with the latest printed instructions of the manufacturer of the installed polystyrene insulation as approved by the Contracting Officer. The Contractor shall make the necessary arrangements with the manufacturer of the polystyrene insulation for a representative of the insulation manufacturer to be available at the job site to instruct the lathers and plasterers in the proper procedures for application of lath and plaster to the polystyrene insulation.

9A-10 CURING: During the application of each coat of plaster, the exterior

openings shall be kept closed until the plaster has set, then adjusted for proper ventilation to regulate the drying and curing of the plaster. If proper ventilation cannot be obtained through exterior openings, suitable mechanical ventilation shall be provided. The plaster shall be protected against "Sweatouts", rapid drying and frost.

9A-11 SOLID PLASTER PARTITIONS

9A-11.1 Form solid plaster partitions to overall thickness indicated on drawings. Construct of vertical channel studs spaced not over 16" on centers, set in floor and top runners, securely anchored to floor slab, ceiling slab or to suspended ceiling as required.

9A-11.2 Fabricate top runners of 26 gauge galvanized steel and floor runners of 20 gauge cold rolled steel, painted black.

9A-11.3 Design and erect top and floor runners to place face of channel studs 3/4" from face of plaster on the lath side.

9A-11.4 Place studs to provide solid backing at all corners; provide additional studs where required. Double studs adjacent to openings and at free ends. Provide metal terminals at free ends, securely wired to studs. Frame out for required openings. Reinforce with 1" x 1/8" flat bars as required. Reinforce heads of openings.

9A-11.5 Secure metal lath on one side only; securely tie to each channel stud at 6" interval.

9A-11.6 Apply scratch, back-up, brown and finish coats to form solid plaster partition of not less than 2" in thickness.

9A-11.7 Apply scratch coat on lath side with sufficient pressure to form good keys, then scratched to a rough surface. Provide temporary bracing on channel side of partition until scratch coat on lath has set.

9A-11.8 Apply back-up coat on channel side, after scratch coat has set firm and hard, in not less than two operations, the first to adequately cover the keys of the scratch coat and a following application to bring the plaster out to grounds; straighten to a true surface with rod and darby and leave rough, ready to receive finish coat.

9A-11.9 On lath side apply brown coat over scratch coat, after the back-up coat on the channel side has set, straightened, rodded, darbied and left rough as specified for back-up coat.

9A-11.10 Apply finish coat to each side. Extend plaster to floor. Fill all spaces between grounds; fill bucks solid. Where possible start plastering at the lower portion of the partition.

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DIVISION 9

SECTION B

CERAMIC TILE

9B-01 SCOPE: This Section covers the requirement for ceramic tile and its installation.

9B-02 GENERAL: For locations and extent of work see drawings and schedules of finishes.

9B-03 CERTIFICATE OF GRADE: Before setting any tile, the Contractor shall furnish the Government with a certificate of grade, in duplicate, properly filled in and signed by the tile manufacturer. The certificate shall state the grade, kind and full quantities of tile and shall give identification marks for all packages of tile furnished under the contract. Packages shall be branded with corresponding shipping marks and shall be subject to inspection by the Government Representative before being opened.

9B-04 SAMPLES: Submit samples of tile, showing sizes, colors and pattern, also samples of primers, sealers, underlayments, grout and dry-set mortars, and sample of adhesive.

9B-05 MATERIALS

9B-05.1 All tile shall be "standard grade" conforming to applicable requirements of the U. S. Department of Commerce "Simplified Practice Recommendations R61-61" and Federal Specification SS-T-308b.

9B-05.2 Ceramic mosaic tile for floor and base shall be selected natural clay ceramic mosaics. Size, color and pattern as indicated on drawings. Include all corners, coves, miters and other trim pieces and accessories required for a complete installation.

9B-05.3 Dry-Set Mortar: Powdered mortar mix complying with requirements of American Standards Association Specification A 118.1-1959 for "Dry-Set Portland Cement Mortar". The powdered mortar may be furnished pre-mixed with Portland cement as a sanded mix, or as a concentrate to be job-mixed with Portland cement, at the Contractor's option.

9B-05.4 Primers, Sealers, Underlayments and Grout: Of type and consistency as recommended by manufacturer of dry-set mortar mix.

9B-06 PREPARATORY WORK

9B-06.1 Inspect all underlying surfaces; test for irregularities, bumps, cracks, dryness and suitability of surfaces to receive work under this Section. Do not proceed until all conditions are satisfactory.

9B-06.2 Remove oil and wax, films or grease, dirt, mortar droppings or other foreign materials from floor and wall surfaces by sanding or suitable solvent.

9B-06.3 Where necessary on surfaces due to roughness or uneveness, install a leveling coat of approved underlayment to level or straighten the surfaces to provide a satisfactory tile installation.

9B-06.4 Do not start any tile work in any area until grounds, anchors, bucks, frames, mechanical and electrical equipment, or other work which is to be installed in or behind tile work, has been installed, tested and approved.

9B-07 PROTECTION AND CLEANING: Tile shall be kept dry while in packages and shall not be allowed to lie upon wet materials or surfaces. No tile work shall be laid in freezing weather, except where proper temperatures are maintained to prevent freezing. All rooms or spaces in which tile floors are being laid shall be closed to traffic, or other work, and shall be kept closed until the floors are completed and the tile firmly set. Upon completion of the grouting, the tile shall be thoroughly cleaned and maintained in clean condition and free from damage until completion of the contract.

9B-08 SETTING TILE:

9B-08.1 Set all tile with dry-set mortar in accordance with American Standards Association Specification A-108.5-1960 "Installation of Ceramic Tile with Dry-Set Portland Cement Mortar".

DIVISION 9

SECTION C

PAINTING AND FINISHING

9C-01 SCOPE: This Section covers the requirement for performing all operations in connection with Painting and Finishing.

9C-02 GENERAL

9C-02.1 For location and extent of work see drawings and Schedules of Painting and Finishes.

9C-02.2 All exterior and interior work, except work specified to be finished by the manufacturer, and work shown or noted to be left unfinished, shall be painted or finished in accordance with this Section and FAA-STD-003.

9C-02.3 Items not primed before delivery shall be primed or sealed as specified for similar items before applying ground coats.

9C-02.4 At completion of work of other trades, painted and finished surfaces shall be touched up and restored where damaged or defaced.

9C-03 WORK NOT INCLUDED: Painting and finishing are not required on the following items:

Corrosion-resisting metal, unless otherwise specified.

Non-ferrous metals (including plating) except zinc coating, unless otherwise specified.

Exterior concrete.

Materials or equipment furnished with a complete factory finish.

Elevator; pipe duct, or cable shafts, unless otherwise indicated.

9C-04 COLORS

9C-04.1 Color Scheme: See drawings and finish schedules for colors and color schemes. Color designations on drawings refer to Federal Standard No. 595, "Colors". Copies of this Standard are obtainable from the General Services Administration, Washington, D.C.

9C-04.2 Color Samples: Finished surfaces shall match colors and finishes

designated. Slight modifications in color, if required, shall be made without additional expense to the Government. Before proceeding with painting, prepare large size sample panels showing colors, finishes, textures and workmanship. All finished work shall match the approved samples and sample panels. Repaint sample panels as required to leave the surfaces in a completed condition.

9C-04.3 Mechanical and Electrical Accessories: Exposed metal accessories in connection with mechanical and electrical work, shall be painted in accordance with finish schedule on drawings, unless otherwise directed.

9C-04.4 Metal Surfaces: Exposed metal surfaces shall be primed and finished in color to match work to which they are attached, unless otherwise directed.

9C-05 SPECIAL APPLICATION

9C-05.1 Do not use paint containing turpentine in telephone equipment rooms; use mineral spirits as thinner in such areas.

9C-05.2 Uniformly sandpaper undercoats on wood or metal to provide a smooth, even surface for finish coats.

9C-05.3 Remove and protect hardware accessories, plates, lighting fixtures and similar items during painting operations; re-position items upon completion of each space. Glass and hardware shall be free of paint.

9C-06 PAINTING OF TRAFFIC CONTROL AND PARKING LINES: Paint traffic and parking lines where indicated with 2 coats Traffic Paint. Federal Specification TT-P-115a. Lines shall be of width indicated, uniform and straight. Asphaltic pavements shall be cured for a minimum of 30 days prior to painting.

9C-07 PAINTING SCHEDULE: Submit for approval by Government Representative a complete schedule of room and space finishes. Indicate on schedule the finishing materials, brand name and applicable Federal Specification of material to be furnished, number and type of coats to be applied and color of each.

9C-08 COLOR CODE PAINTING: Paint piping in Mechanical Equipment Rooms, Engine Generator Rooms and in other spaces where piping, conduit or insulation is exposed to view in color code in accordance with the drawings.

9C-09 EPOXY COATING: Paint concrete floors, stair treads and concrete equipment pads with 2 coats of a 2-compound epoxy-polyamide Chemical and solvent resistant coating conforming to MIL. SPEC-P-23377, similar to Protex-A-Cote's "Porselon #600" or approved equal.

9C-10 PAINTING OF ROOF DECKING: Prime exposed surfaces of galvanized steel. roof decking with one coat zinc dust - zinc oxide primer conforming to Federal Specification TT-P-641, Type III, Class A.

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DIVISION 9

SECTION D

WALL COVERING

9D-01 SCOPE: This Section covers the requirement for wall covering and its installation.

9D-02 GENERAL

9D-02.1 For location and extent of Wall Covering see drawings and applicable details of the Control Cab Stairwell walls and bulkhead.

9D-02.2 Wearing surface shall be synthetic resins or polyvinyl chloride resins with alkali resisting pigments, without adulterants and extenders, processed as a self-supporting sheet, or laminated to a mildew resistant cotton fabric or asbestos felt backing. Coloring and texture configurations shall be integrally processed.

9D-02.3 Finished sheet shall be waterproof, spot, sratch and scuff resistant and shall retain flexibility. After 24 hours there shall be no effect of soil spotting from 5 percent acetic acid, 5 percent sulphuric acid, 5 percent Nitric acid, 5 percent Hydrochloric acid, perspiration, motor oil, gasoline, alcohol, turpentine, milk coffee, orange juice and chocolate syrup.

9D-03 MATERIALS

9D-03.1 Materials shall meet test methods of listed Federal Specifications and ASTM Designations, modified as specified herein.

Total Weight, ounces per square yard.	15
Wearing Surface thickness (exclusive of texture), mils.	10
Seam Shrinkage, after 7 days at 165° F.	None
Abrasive Resistance, wearing surface, average weight loss in grams, per 1000 revolutions; ~~L-P-406b~~, method 1091, 1, CS 17 wheels ~~or~~ CCC-A-700c.	.080 Pass
*Adhesion, wearing surface to backing, lbs, per lin. inch, CC-T-191b, Method 5970	4
Flame Resistance Federal Standard No. 00136b	Classification I
or	
ASTM E84	Not over 25

or CCC-A-700b	Regular fire resistance
Color fastness to light L-P-406b, Method 6021 or ASTM D 620, change after 200 hours	None

*Back-up Type.

9D-03.2 Primers, sealers and adhesives shall be vermin and mildew resisting, and non-staining to the wearing surface.

9D-04 APPLICATION

9D-04.1 Plastered surfaces shall be thoroughly dry, free from lime burns, and all defects corrected. Plaster shall be in place not less than 45 days prior to application of wall covering. A meter shall be used to test moisture content; reading shall be 0.2 minimum.

9D-04.2 Prime or seal all surfaces to be covered. Materials shall be applied in accordance with manufacturer's printed directions.

9D-04.3 Covering shall be applied vertically without horizontal joints. Internal and external angles shall be continuous. Vertical joints shall be lapped and double cut or factory trimmed and butted.

9D-04.4 Finished surface shall be free from air pockets, wrinkles open joints, tears or other defects. Excess adhesive shall be removed.

9D-04.5 Furnish certificates in triplicate from the manufacturers, attesting that materials meet specification requirements and that the adhesives are compatible with the wall covering.

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DIVISION 9

SECTION E

RESILIENT FLOORING

9E-01 SCOPE: This Section covers the requirement for resilient flooring and its installation.

9E-02 GENERAL: For location and extent of work and the type, size, color and pattern of tile and base, see drawings and schedule of finishes.

9E-03 MATERIALS: Materials shall meet requirements of referenced Federal Specifications and Standards, and requirements specified herein.

9E-03.1 Vinyl Asbestos Tile: L-T-00345, 9" x 9" x 1/8" unless otherwise indicated.

9E-03.2 Vinyl Plastic Base: L-F-00450.

9E-03.3 Adhesive, Primer and Underlayment: Water dispersed reclaimed rubber base, heavy bodied type for application of floor coverings. Material shall be suitable for the purpose and the specific structural conditions, delivered in sealed containers bearing manufacturer's label and shall be used without adulteration or reducing. Types for each use shall be approved by the manufacturer of the material.

9E-04 SHOP DRAWINGS AND SAMPLES: Submit for approval shop drawings and schedules showing layouts, sizes, colors and patterns to be used in each space. Submit for approval samples of floor tile and edge strips.

9E-05 PREPARATION

9E-05.1 Surfaces to receive flooring shall be cleaned free of dust, foreign matter and materials not compatible with adhesive. Concrete shall be dry and in suitable condition to receive the flooring. Moisture tests shall be made on all concrete slabs in accordance with the tile and adhesive manufacturer's instructions. Test method shall be submitted to and be approved by the Government Representative.

9E-05.2 Cracks, joints, holes and depressions in floors or walls shall be filled with underlayment, mixed and applied in accordance with flooring and adhesive manufacturer's directions, to required thickness, well compacted and allowed to become hard and dry. Concrete and underlayment surfaces shall be uniform, level with smooth finish, and acceptable to the Government Representative before starting application of flooring.

9E-05.3 All concrete floors shall be given a coat of waterproof primer and sealer of type recommended by the manufacturer of the flooring material.

9E-05.4 A temperature of not less than 70 degrees F. shall be maintained at least 48 hours before, during and 48 hours after laying of flooring. Materials shall be brought into the locations during the initial 48-hour period and allowed to condition at least 24 hours before installation. A minimum temperature of 55 degrees F. shall be maintained thereafter.

9E-06 LAYING

9E-06.1 Lay flooring in accordance with manufacturer's printed directions, to true, straight lines and levels. Flooring tiles for each area shall be laid out from center lines and finished with pieces of uniform shape and size against walls, edge strips and thresholds. Tiles shall be placed squarely against each other with joints symmetrical, and in a manner to insure complete contact and adhesion. Cement extruding onto the face of flooring shall be cleaned off immediately. Surfaces stained or damaged by adhesives shall be replaced with fresh material. Flooring tile shall be thoroughly pressed into place before the cement has set (not later than one hour after flooring is laid). Vinyl asbestos tiles shall not be rolled.

9E-06.2 Laying shall be deferred until all other work in the space that might cause damage to the flooring is completed.

9E-06.3 Flooring in any one continuous area or that used in replacement of damaged flooring in a continuous area shall be from the same lot and have the same hue and shade. Variation in marbling and mottling in the same area shall be kept to a minimum.

9E-07 EDGE STRIPS: Provide vinyl edge strips at exposed edge where flooring is terminated at door openings without thresholds and similar conditions. Strips shall be butt type, beveled on exposed edge, with top surface finishing flush with flooring.

9E-08 LINOLEUM: 1/8" gauge, burlap-backed linoleum conforming to Federal Specification LLL-L-367; color and pattern as approved by the Government Representative. Submit samples for approval. Install linoleum in accord ance with manufacturer's directions using an approved linoleum paste; roll with sufficient pressure to obtain complete adhesion to undersurface and to remove all air bubbles.

9E-09 CLEANING AND PROTECTION: Flooring shall be thoroughly cleaned, buffed and left in condition satisfactory to the Government Representative. Spots shall be removed by means that will not damage the surface. Solvents, wetmopping and washing are prohibited. As soon as flooring is completed in each area, it shall be protected with heavy building paper. Defects which develop, such as damaged, loose, broken or curled tiles, shall be corrected prior to final inspection.

9E-10 MAINTENANCE STOCK: Furnish 50 vinyl asbestos floor tile for maintenance purposes.

DIVISION 9

SECTION F

SPRAYED-ON ACOUSTICAL TREATMENT

9F-01 SCOPE: This Section covers the requirement for a sprayed-on acoustical ceiling and its installation.

9F-02 GENERAL: For location and extent of work see drawings and Schedule of Painting and Finishes.

9F-03 MATERIALS

9F-03.1 Adhesive: Latex based emulsion unaffected by water, condensation, aging or freezing once it has set.

9F-03.2 Fiber: A blend of virgin asbestos fiber, mineral wool and inorganic binders, especially prepared for spraying by the manufacturer. Binder after setting, shall be unaffected by water, moisture and condensation. The mixture shall be entirely inorganic and shall be rated as incombustible under the provisions of Federal Specification SS-S-111 or SS-A-00118. The FIBER SHALL BE FACTORY TREATED TO RENDER THE APPLICATION DUSTLESS.

9F-03.3 Sealer: A pigmented liquid of spray consistency that will prevent flaking or dusting of fiber. Color as designated on drawings.

9F-03.4 Delivery: All materials to be delivered to site in sealed containers or bags and shall bear the Manufacturer's labels.

9F-03.5 Samples: Submit two samples for Contracting Officer's approval before proceeding with any work. Samples to be 12" x 12" and shall show texture and color of pigmented sealer.

9F-04 PREPARATION OF SURFACES: The Contractor shall examine all surfaces to receive Sprayed-On Acoustical Treatment and satisfy himself that the surface is in proper condition for the work and shall clean all surfaces to remove all water, dirt, grease, oil, rust, or any loose particles and shall also remove any condition that would prevent proper adhesion or bond of the fibrous materials. Start of work constitutes acceptance of the surface and that all conditions and surfaces are satisfactory for the carrying out of the work of this Section.

9F-05 WORKMANSHIP: All work shall be installed by an applicator approved by the manufacturer of the materials and under the direct supervision of the manufacturer's trained representative, and shall be carried out by workmen experienced in the application of the sprayed-on materials. No installation shall be made in freezing weather except under conditions approved by the manufacturer.

9F-06 APPLICATION

9F-06.1 Apply primer coat of adhesive sprayed-on to all surfaces to be treated. Apply to only as much surface as can be sprayed with fiber while the primer is still tacky.

9F-06.2 Fiber application shall be of the thickness indicated and shall have a noise reduction coefficient of not less than 0.65. Certified data shall be furnished to establish the Noise Reduction Coefficient.

9F-06.3 Surfaces shall be finished with floats to provide a fine, well tamped, decorative finish matching the approved samples.

9F-06.4 All finished surfaces shall be oversprayed with a pigmented sealer of special color as approved by the Contracting Officer. Apply sealer in accordance with manufacturer's directions.

9F-06.5 Adjacent finished surfaces shall be masked or otherwise adequately protected from deposits of fiber or pigmented sealer.

9F-06.6 The sprayed-on acoustical treatment shall be applied by means of approved spraying equipment which will assure an even, unsegregated distribution of the mix directly onto the surface being treated. Continuity of coverage must be achieved by proper overlapping of spray runs, no gaps or uncovered areas of any sort will be permitted.

9F-07 CLEANING: After completion of work, remove all equipment and protective coverings, and clean up any surface upon which fiber or pigmented sealer has been deposited.

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DIVISION 9

SECTION G

SUSPENDED ACOUSTICAL CEILING

9G-01 SCOPE: This Section covers the requirement for acoustic ceiling tile and suspension system for lay-in grid and their installation.

9G-02 GENERAL: For location and extent of work see drawings and finish schedule.

9G-03 MATERIALS

9G-03.1 Acoustic tile shall conform to Fed. Spec. SS-S-00118 Type III, flame resistance class 25, light reflection value not less than 64%. Noise reduction coefficient shall be 0.70 (grade 3) or better. Tests shall be made at a minimum of 34 decibels and coefficient shall be taken from average of 11 frequencies. Minimum density shall be 0.75 lbs./s.f. Tile for lay-in system shall be 24 in. x 24 in. minimum. Pattern, color, etc. shall be as called for in finish schedule.

9G-03.2 Suspension system shall be fabricated from the following:

9G-03.2.1 Channels shall be 1 1/2 in. cold rolled steel weighing not less than 0.475 lbs./ft. and dip coated with rust inhibiting paint.

9G-03.2.2 H, T or Z bar members shall be not less than 0.020 in. thick with flanges and webs of adequate width to perform their intended function.

9G-03.2.3 Hanger wires shall be 10 gauge galv. steel wire. Hangers shall not support more than 16 s.f. of ceiling.

9G-03.2.4 All exposed to view surfaces of suspension system members shall be painted to match tile.

9G-03.3 Samples of acoustical tile and suspension system members shall be submitted for approval.

9G-04 INSTALLATION:

9G-04.1 Acoustical lay-in units shall be installed with metal suspension system by an approved erector in accordance with the directions of the manufacturer of the acoustical tile units and suspension system to be used. Furring channels and/or other basic suspension members shall be adequately levelled before installation of the suspension system is started.

9G-04.2 No units shall be installed until concrete and masonry are completely dry, windows and doors are in place and glazed. Room temperature shall be approx. 70 degrees F. and relative humidity approx. 55%, for at least 24 hrs. before, during and 48 hrs. after installation.

9G-04.3 Ceiling shall be provided positive support along all four edges of each lay-in acoustical unit. Hold down clips are required for each edge of each lay-in tile. Metal edge moldings, minimum 25 gauge (0.020) sheet steel of approved cross section, shall be installed continuous along perimeter of ceiling units in each room unless otherwise shown.

9G-04.4 Main runners shall be spaced 24 in. o.c. Cross runners shall be spaced 24 in. o.c. and perpendicular to main runners.

9G-05 FIRE RATING: Ceiling shall have a minimum fire rating of two hours in accordance with the requirements of the Underwriters Laboratory, Inc.

9G-06 CERTIFICATION: Contractor shall submit a certificate to the Contracting Officer stating that the material and methods of installation of the lay-in acoustic tile fire proofing used conforms to the Underwriters Laboratory requirement for a two hour fire rating.

9G-07 CLEANING AND REPLACEMENTS: Tile and suspension system shall be cleaned and left free of defects. Damaged or improperly placed units shall be removed and replaced in an approved manner.

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DIVISION 10

SECTION A

METAL TOILET ENCLOSURES
(Baked Enamel Finish)

10A-01 SCOPE: This Section covers the requirement for metal toilet enclosures with baked enamel finish and their installation.

10A-02 GENERAL: For location and extent, arrangement and dimensions, see drawings and applicable details. Include fittings, hardware, fastenings and finish for a complete and satisfactory installation. Enclosures shall be "Floor Supported Type".

10A-03 SHOP DRAWINGS AND CERTIFICATES: Submit for approval shop drawings showing details of construction, metal thicknesses, hardware, fittings and fastenings. Submit certificate from partition manufacturer attesting that enclosures meet specification requirements.

10A-04 SAMPLES: Submit color sample showing base metal and the prime and finish coats of enamel. Color to be as noted on the Color Schedule on the drawings. Submit samples of hardware and accessories.

10A-05 MATERIALS: Materials shall conform to the following requirements:

10A-05.1 Sheet Steel: Metal for partitions, doors and stiles shall be bonderized, galvanized steel, stretcher leveled of not less than No. 20 U.S. gauge for partitions, No. 22 U.S. gauge for doors and No. 16 U.S. gauge for stiles and shall conform to ASTM A-366; zinc coating meeting QQ-Z-325a(1) Class D; phosphate coated in accordance with TT-C-490.

10A-05.2 Cores: Partitions, doors, and stiles shall have corregated fiber filler that will eliminate all metalic sound; use 6 plies for doors and panels and 7 plies for pilasters.

10A-05.3 Fittings: Wall supports, wing brackets and stirrup supports shall be cast or extruded brass; die-cast zinc alloy. Hex Bolts shall be brass with cadmium plating. Pilaster bases shall be Class 302 Stainless Steel.

10A-06 CONSTRUCTION:

10A-06.1 Partitions and doors shall be 1 inch thick and stiles and pilasters 1-¼ inch thick, flush construction, formed of two sheets of 20 gauge steel cemented under pressure to corrugated core. Edges shall be interlocked under tension with 20 gauge binding strips welded at corners. Reinforce doors and pilasters to receive hardware. All reinforcing shall be concealed.

10A-06.2 Pilaster trim shall be adjustable type, not less than 3 inches high, with rounded corners. Secure to pilaster with set screws.

10A-07 FINISH:

10A-07.1 All exposed surfaces, other than hardware and pilaster trim, shall be cleaned and given one coat of rust resisting primer baked on and followed by two coats of a high grade synthetic enamel to produce a semi-gloss finish of color selected. Each coat shall be separately baked on.

10A-08 HARDWARE:

10A-08.1 All hardware, except working parts of gravity hinges, shall be heavy brass, polished chromium plated over nickel plate. Hinges shall be gravity type with concealed stainless steel ball-bearing rollers or self lubricating oil bronze bearings. Hinges shall be adjustable for holding door in open or partly open position when not latched.

10A-08.2 Each door shall have one coat hook with rubber tipped bumper, one slide bar latch and one combination door stop and latch keeper.

10A-09 ERECTION:

10A-09.1 Erect compartments rigid, straight, plumb and level. Secure partitions to walls with not less than 2 stirrups located near top and bottom. Each stirrup shall be through bolted to partition and bolted to wall with two bolts in expansion shields. Keep wall ends of partition panels away from wall approximately 3/4 inch.

10A-09.2 For floor mounted compartments, anchor pilasters to floor with 3/8 inch cadmium plated bolts set in expansion shields and extending at least 2-½ inches into floor construction. Anchors shall be accessible for leveling and tightening and shall be concealed by pilaster base.

10A-09.3 All evidence of drilling, cutting, and fitting of wall, floor and ceiling finish shall be concealed in finished work. Clearance at vertical edge of doors shall be uniform from top to bottom and shall not exceed ⅛ inch. Carefully adjust hardware and leave in perfect working order. Finish surfaces shall be left free from imperfections.

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DIVISION 10

SECTION B

TOILET ROOM ACCESSORIES

10B-01 SCOPE: This Section covers the requirement for toilet room accessories and their installation.

10B-02 GENERAL: For location and extent of work see drawings.

10B-03 SHOP DRAWINGS: Submit shop drawings and catalog cuts indicating construction and methods of installation.

10B-04 MIRROR: Provide mirrors over lavatories in Toilet Rooms. Fabricate of ¼" thick silvering quality plate glass, electrolytically copper-backed, set in frame of stainless steel or chrome plated brass. Form backs of zinc-coated steel applied over corrugated paper backing and plywood or masonite lining. Provide theftproof mountings. Provide stainless steel shelf in combination with mirrors, formed of stainless steel attached to mirrors with stainless brackets. Shelf shall be not less than 5" deep, full width of mirror and finished to match mirror frame; similar to Architectural Metalcraft Industries, Inc. No. 175SS or approved equal.

10B-05 SOAP DISPENSER: Provide individual soap dispenser mounted on lavatory; of chrome plated bronze with stainless steel working parts; plastic container on underside; container refillable from top by unscrewing push button cap without removing container under lavatory; similar to American Dispenser Co.'s "No. 53 Lathurn" or approved equal.

10B-06 TOWEL CABINET: Towel cabinet shall be provided in Toilet Rooms, having a capacity of 350 paper towels, designed to dispense single fold, multi-fold or C-fold towels. Construction of 22 gage stainless steel with No. 4 satin finish. Unit shall be complete with all required hardware; and shall be similar to Architectural Metalcraft Industries, Inc. No. 610 or approved equal.

10B-07 TOILET PAPER HOLDER: Provide polished chrome plated single roll tissue holder for each watercloset, similar to Scott Paper Co.'s No. 964, Architectural Metalcraft Industries, Inc. No. 1030 or approved equal.

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DIVISION 10

SECTION C

BUILDERS HARDWARE

10C-01 SCOPE: This Section covers the requirement for builders hardware and its installation.

10C-02 GENERAL

10C-02.1 Items of hardware not definitely specified herein and necessary for completion of the work shall be provided under this Contract. Such items shall be of type and quality suitable to the service required and comparable to adjacent hardware. Where size or shape of members is such to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required.

10C-02.2 Hardware for the following items of work, except as noted, is included under their respective headings:

Cabinets
Hinged wall panels
Elevator Doors
Metal doors of enclosures and screen partitions in toilet rooms

10C-02.3 All modifications in hardware necessary to meet any special features of the project shall be made to provide the required operative or functional requirements.

10C-02.4 Hardware that will be attached to metal shall be made to standard templates so far as practicable. However, to meet special conditions, special templates or actual samples shall be furnished to the manufacturer of metal items requiring template hardware.

10C-02.5 Insofar as practicable, and unless otherwise specified, all hardware for each function or operation shall be the product of the same manufacturer.

10C-02.6 After the lock and latch sets, including exposed trim and strikes (except hinges), have been fitted, they shall be removed. After the final coat of painter's finish has been applied, the hardware shall be installed

10C-03 APPLICABLE SPECIFICATIONS: The type numbers specified are taken from the following Federal Specifications and all hardware shall conform to the applicable requirements of the specifications cited, except as modified herein:

FF-H-106a (1) - Hardware, Builders; Locks and Door Trim.

FF-H-111a - Hardware, Builders; Shelf and Miscellaneous.

FF-H-116a (1) - Hardware, Builders; Hinges.

FF-H-121c - Hardware, Builders; Door Closing Devices.

10C-04 FINISHES: Exposed surfaces of hardware shall have the following U.S. Standard Finishes, as prepared and recognized by the National Builders Hardware Association, New York, N.Y. Except as otherwise specified:

US26D: Dull chrome - for bronze or brass material.

10C-05 MATERIALS: Materials generally shall be as required by the Government type numbers specified.

10C-06 FASTENINGS: Supplementing the Federal Specifications, hardware shall be attached to concrete, stone or masonry with tampin shields and machine screws, or other approved method; to metal with machine screws and to wood and wood cores with wood screws; all of the same material as the hardware, except as otherwise specified. Screws for door closers and template leaves of hinges shall be of steel, cadmium plated, and with heads finished to match the hardware. So far as practicable, all screws normally exposed shall have countersunk oval heads except for mortise hinges, lock fronts and lock strikes.

10C-07 HINGES: Hinges are specified by type in accordance with Federal Specifications. Generally they are descriptive of the types required. All hinges for the project shall be the product of one manufacturer, and shall be of the flush ball-bearing type. Hinges for interior and exterior doors equipped with locks shall be so constructed that the pins cannot be removed when the door is closed.

10C-07.1 Screws shall be of suitable type and size and finished to match hinges.

10C-07.2 Hinges for exterior doors shall be type T2112, unless otherwise specified.

10C-07.3 Hinges for interior doors shall be type T2106.

10C-07.4 Unless otherwise specified, the number of hinges per opening shall conform to the Federal Specification requirements.

10C-07.5 The sizes of hinges per opening shall conform to Table I, Federal Specifications, unless otherwise specified.

10C-07.6 Spring hinges shall be Type 2331.

10C-08 DOOR CLOSING DEVICES: The devices shall be of suitable sizes applicable for each type as indicated in Federal Specifications, except as herein specified.

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10C-08.1 Where types 3009 closers are scheduled in the nardware schedule, the closer shall have a narrow modern designed body, maximum projection 2" from face of door.

10C-08.2 Corner brackets and soffit brackets shall not be used.

10C-09 KEYS AND KEYING: Provide 3 masterkeys for construction cores in all locks to the Contracting Officer or his representative.

10C-10 LEVER EXTENSION FLUSH BOLTS: Provide type 1045 at top and bottom of standing leaf of double doors having locks or latches. Provide dust-proof strikes, type 1048, except where thresholds occur. Locations for the operating mechanism shall be about six feet from the floor for the top bolt and about 12 inches from the floor for the bottom bolt. Install both bolts in the edge of the inactive leaf of pairs of doors having locks.

10C-11 DOOR HOLDERS: Overhead type door holders shall be furnished to hold doors open at 90° unless otherwise required. Holders shall be proper sizes to conform to the manufacturer's recommendations for size of the opening indicated.

10C-12 LOCKS, LOCKSETS, AND LATCHSETS: Lock and latch sets shall be types 160 and 182 as specified herein. Fronts and strikes of locks and latches shall fit the details.

10C-12.1 All locks shall be provided with seven pin removable and interchangeable cores manufactured by Best Universal Lock Co., Inc., Indianapolis, Indiana.

10C-12.2 Each lock shall be provided with a construction core to be replaced by the Government with a special FAA core.

10C-12.3 Locks and latches for Underwriters' labeled doors shall carry Underwriters' approval for the "Class" required.

10C-12.4 The fronts, strikes, knobs and roses shall be of Bronze or Brass, finished as specified.

10C-12.5 Knobs and rose shall be Cornet Design as manufactured by Best Universal Lock Co., or approved equal.

10C-12.6 Locks, locksets and latchsets of one manufacturer shall have standardized faces, cases and strikes, so that locks with varying functions will be interchangeable . The locksets and latchsets, except as otherwise specified, shall be semi-heavy duty cylindrical locks and latchsets, having operation and function as specified herein.

10C-13 SILENCERS: Type 1337A for hollow metal frames with hollow metal doors, not carrying Underwriters' label.

Three silencers for single doors placed on strike jambs; two for double doors placed on head jamb. Doors less than 5 feet high shall have two silencers.

10C-14 STOPS: Floor stops, types 1330A or 1320E as applicable, shall be provided for all doors.

10C-15 APPLICATION OF HARDWARE

10C-15.1 Where locations of hardware are not indicated on the drawings, the following requirements shall apply.

10C-15.2 Door knobs shall be located 38 inches from the finished floor to the center of the knob.

10C-15.3 The active leaf of pairs of doors will be the LHRB, unless otherwise designed.

10C-16 SAMPLES, SCHEDULES AND GUARANTEE

10C-16.1 Before any hardware schedule is prepared, submit to the Contracting Officer or his designated representative for approval, a complete sample list of each of the different items of hardware, in the required number of copies and prepared in the following manner:

HARDWARE SAMPLE LIST

ITEM: PROJECT SPECIFICATION	:	MFR'S NAME & CATALOG
NO. : Type or Catalog No.	:	NO. OF ITEM FURNISHED

In addition to the sample list, a sample of each different item in the finish required, and properly labeled, shall be submitted. After approval of all samples and sample list, a schedule of hardware showing the quantities, type and location of all items of builders hardware, required for the project, shall be submitted in the quantity of copies required for records. Approval of the hardware schedule is not required; only the sample list. Any hardware provided or installed that does not conform to the specification requirements shall be promptly replaced with the proper hardware.

10C-16.2 Items of hardware shall be guaranteed for a period of two years after acceptance of the building against defects in material and workmanship.

10C-17 COORDINATION

10C-17.1 Door and frame manufacturer shall be supplied with templates at the earliest opportunity.

10C-17.2 The Contracting Officer or his designated technical representative's approval of hardware items necessary for metal door fabrication shall be secured in order to eliminate any delay of doors and frames.

10C-18 HARDWARE SET NUMBERS: The hardware requirements for each door opening are indicated on the drawings be a set number. Note: Numbers for hardware are Federal Specification Numbers.

SET # 1

Butts T 2112
Lockset 160A
Closer 3009 x parallel arm
Threshold under another section

SET #2

Butts T 2106
Lockset 160A
Closer 3009 x parallel arm
Stop 1330A

SET # 3

Butts T-2106
Latch Set 160 N
Closer 3009 x parallel arm
Stop 1330A

SET # 4

Butts T-2106
Lockset 160A
Friction OH Holder T-1164

SET # 5

Butts T2106
Latchset 160N
Friction OH Holder T-1164

SET #6

Butts T2106
Lockset 160L
Closer 3009 x parallel arm
Stop 1330A

SET # 7

Butts T2112
Lockset 160A
Closer 3009 (active leaf)
Flush Bolts 1045 (inactive leaf)
Threshold under another Section

SET #8

Butts T2106
Latch Set 160N
Closer 3009 x parallel F.L.H.O. arm
Stop 1320E

SET #9

Spring Hinges 2331
Deadlatch 182B
Surface Bolts 1061-6"
Pull 459

SET # 10

Butts T2106
Pulls 436A (each side)
Surface Bolts 1061 - 9" (top and bottom each leaf)
Friction OH Holder T-1164

SET # 11

Butts T 2106
Latch Set 160N
Closer 3009 x parallel F.L.H.O. arm
Stop 1330A

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DIVISION 10

SECTION D

EXTERIOR PARTITION

10D-01 SCOPE: This Section covers the requirement for exterior partitions and their installation.

10D-02 GENERAL: For location and extent of work see drawings.

10D-03 SHOP DRAWINGS: Submit shop drawing and catalog cuts indicating construction and methods of installation.

10D-04 PANELS: Shall be constructed to conform to the Epco Olympic No. 1 Pattern as manufactured by the Erdle Perforating Co., Inc., 171 York Street, Rochester, N.Y., or equal. Panel sizes shall be 48" wide by 96" long for the east wall and 48" wide by 108" long for the north and south walls. Construction shall be of .063" Aluminum, Aluminum Association Designation 5005-H12. The aluminum shall be pretreated with a chemical conversion coating in accordance with Military Specification MIL-C-5541. The finish paint shall be electro-statically spray coated or reverse roll coated on applicable sheet materials to the pre-treated aluminum and shall be oven baked. The surface shall be commercially smooth and substantially free from flow lines, streaks, blisters or other surface imperfections. The paint coatings shall meet the following performance requirements.

10D-04.1 Gloss at 60°F, 30-40%.

10D-04.2 Withstand 2,000 hours exposure in 100% relative humidity at 100°F in accordance with U. S. Military Specifications JAN-H-792.

10D-04.3 Salt Spray - resist corrosion when exposed to 1,000 hours in 5% salt spray in accordance with ASTM B-117-57T.

10D-04.4 Accelerated Weather Exposure - show no checking, cracking or loss of adhesion after exposure for 1,000 hours in Atlas Type DMC Weather-Ometer operated in accordance with ASTM D822-57T. The color shall be Epco standard Epcolor "Ermine White" or equal. Color swatches shall be submitted for approval by Contracting Officer.

10D-05 STRUCTURAL FRAMEWORK: Shall consist of aluminum "I" beams, channels and angles installed and spaced as shown on drawings. "I" beams shall be 6"x3.330"x.230" and channels used as vertical posts shall be 8"x2.527"x.487". Both shall be manufactured in accordance with Aluminum Association designation 6061-T6 and shall meet Federal Specifications QQ-A-270a-1 and QQ-A-200/8a.

Vertical and horizontal channels used between vertical posts shall be 3.00"x 1.410x 1.70" structural aluminum manufactured in accordance with Federal Specification QQ-A-325a(2). The aluminum angles shall be 1 3/4"x 1 3/4" x 1/8" manufactured in accordance with Federal Specification QQ-A-325a(2).

10D-06 FASTENERS: All fasteners shall be made of stainless steel. Minimum sizes shall be 1/4" diameter for structural framework and 3/16" diameter for securing panels to framework. Flat head fasteners shall be used where heads are exposed to view on outside of partition. Panels shall be secured to framework with no more than 1 foot spacing between fasteners. Submit samples of various types of fasteners to be used for Contracting Officers approval.

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DIVISION 10

SECTION E

MOVABLE OFFICE PARTITIONS

10E-01 SCOPE: This Section pertains to movable office partitions furnished and installed in accordance with these specifications in locations and in accordance with applicable drawings.

10E-02 GENERAL: Partitions shall include doors, frames, and electrical service cut-outs as shown, scheduled, and specified. Anchors, fastenings, accessories, and resilent gasketing shall be included for a complete installation. Partitions shall be ceiling-high type with vertical tight straight line joints between panel units and designed for installation on top of finished floor and against finished ceiling. Fabrication and installation shall be by a specialty subcontractor.

10E-03 SHOP DRAWINGS AND CERTIFICATES

10E-03.1 Submit for approval shop drawings showing details of construction, hardware reinforcement, anchors, fastenings, electrical provisions, gasketing and accessories.

10E-03.2 Submit certificates from partition manufacturer, with complete test reports by recognized independent testing laboratory (N.B.S. test reports may be submitted) attesting that the assembled partitions meet the following requirements:

10E-03.2.1 Sound Control Requirements: STC of 40, or greater, when tested in accordance with ASTM E 90 with test specimen of not less than two full size typical floor to ceiling panel units with all required components, accessories, and specified parts assembled in same manner that will be used in the installation. Field packing and calking of joints or perimeter of specimen will not be permitted.

10E-03.2.2 Fire-Resistance Classification: Fire resistance rating of (one hour) when tested in accordance with ASTM E 119.

10E-03.2.3 Structural Impact Load Test: Certification attesting that a nine foot high panel assembly, identical in construction to that being furnished, tested horizontally with a 60 pound weight dropped from 36 inches height, all in accordance with ASTM E 72 Section 52, meets following requirements: (1) maximum instantaneous deflection is less than 0.56 inches and (2) maximum permanent set is less than .25 inches.

10E-04 MATERIALS

10E-04.1 Materials shall meet requirements of referenced Federal Specifications Standards and the requirements specified herein. Exposed steel shall be cold-rolled sheet, leveled and having smooth, clean surfaces. Concealed structural and reinforcing members shall be rolled, formed or extruded. Face surfaced panels shall be balanced by being surfaced on back side with surfacing material of the same density as the face surfacing material.

10E-04.1.2 Steel: QQ-S-698, QQ-S-700b, QQ-S-741b of type, quality and temper best suited for usage. Sheets shall be stretcher leveled. Following minimum thickensses are given for sheet steel based on Appeddix II, Table X and Appendix III, Table XI of ASTM A 366.

Item	Minimum Thickness
Studs, Vertical Posts, Vertical & Horizontal Channels . . .	0.021 (25 MSG) for roll-formed shapes, or 0.048 (18 MSG) for brake-formed shapes, or Shapes of adequate strength to meet specified structural performance.
Facing for Panels & Base Substrate . .	0.036 (20 MSG) reinforced, or 0.024 (24 MSG) laminated to solid core material.
Reinforcing	0.024 (24 MSG)
Trim shapes	0.039 (22 MSG)

10E-04.2.1 Other metals used in lieu of steel shall be equivalent to minimum thickness specified for steel based on strength properties of shapes or sheets as applicable.

10E-04.3 Aluminum: QQ-A-200b, QQ-A-250c of alloy and temper best suited for usage meeting requirements of appropriate detailed specification.

10E-04.3.1 Finish: AA-C-22A31 when indicated exposed; AA-C12A11 when applied coating is indicated; or AA-M21C22A32 when integral color is indicated.

10E-04.4 Materials, other than metal, constituting more than 10 percent of any panel including its accessories, shall provide fire classification determined in accordance with ASTM E 84, exclusive of surface finishes 0.035-inch thick or less, as follows:

Flame Spread	not over 25
Fuel Contributed	not over 50
Smoke developed	not over 50

10E-04.4.1 Flame spread requirements shall apply to all surfaces including those which would be exposed by cutting through the material in any way.

10E-05 FABRICATION

10E-05.1 Office partitions shall be of design and construction that will provide minimum of 1-1/2 inches of clear internal space to accommodate utilities vertically and horizontally with an overall partition thickness of not less than 2-1/4 inches nor more than 4-1/2 inches.

10E-05.2 Partition components shall be factory fabricated; designed for erection over finish flooring. Panel units shall be in uniform widths not exceeding 40 inch module; interchangeable with door units and glazed panel units. Where panel units and door units are of different widths, the increments shall be maintained to facilitate interchangeability within the 40 inch module. Base and ceiling members shall be designed to permit 1 - 1/2 inches adjustment in overall height. Design shall permit extension two, three, or four ways without removing adjacent units. Provision shall be made for concealed readily accessible electrical wiring.

10E-05.3 Base substrate shall be flush with partition face, continuous without plinths; adjustable to variations in floor level and removable for access to lay-in wiring; of appropriate material and design to comply with the specified performance requirements without field packing. Finish base members shall be vinyl or metal meeting requirements specified under applicable Section and of color and size scheduled, in finished lengths equal to panel width.

10E-05.4 Provide cut-outs and reinforcing for installation of electrical outlet boxes in panel units and posts with provisions for flexible conduit installation. Flexible metallic conduit, wiring, and devices, and fittings other than outlet boxes and device plates, are included under mechanical and electrical sections of this Specification.

10E-05.5 Door frames meeting applicable requirements of Section, HOLLOW METAL, for materials, gauges, and construction shall have adjustable feature to allow for variations in floor level. Jambs and head shall be fitted with continuous sound and light seal of neoprene or similar resilient strip or gasket material. Hardware cutouts and reinforcements shall be provided to suit hardware specified.

10E-05.6 Doors shall be manufacturers' standard flush type, 1-3/4 inches thick, clearances shall be not more than 1/8-inch at jambs, 1/16-inch at heads, and 3/4-inch at bottom of openings without thresholds. (Louver units, where indicated, shall be not more than 1-3/4 inch thick, sight-proof type with inverted "V" or "Y" blade design, fabricated of sheet or extruded metal; size and free area as scheduled; units may be integrally formed with the door)

10E-05.7 Requirements for finish hardware and glazing scheduled for relocatable partitions are specified under the respective sections. Manufacturers' standard glazing members and materials used in his first-line production partitions shall be used for glazed panels wherever required.

10E-05.8 End fillers at walls or columns shall be fabricated as specified for panel units. Filler panels shall fit into channels fastened to wall or column.

10E-05.9 Vertical (wall and column) and horizontal (ceiling and floor) channels shall be continuous in each partition run; flanged not less than one nor more than two inches on each side of partition face. Channels shall be designed to compensate for variations in vertical and horizontal abutting surfaces. Channels shall be set with gaskets of neoprene or similar resilent material to provide a light and sound seal.

10E-05.10 Surfaces shall be thoroughly cleaned, including degreasing of metal surfaces, by total immersion or other approved method and shall be dry before finishing. Before assembly, all metal surfaces shall receive a coat of manufacturers' standard rust inhibitor. All exposed surfaces shall receive a coat of manufacturers' prime coating.

10E-05.11 Partition shall be flush with vertical edges of the panel face formed to continuously engage the supporting post. Vertical edges of panel to panel assembly shall form a flush single line, light and sound tight joint when assembled. Panel units shall be factory laminated unit composed of two face sheets totally enclosing an incombustible rigid core, or of solid construction with edges designed for concealed attachments to engage supporting posts.

10E-05.12 Vertical edges of panels shall be formed to accurately align and position with adjacent panels.

10E-05.13 Bottom member of top rail over glass panels may be telescopic without applied glass stops, or glass may be set with snap-in mouldings without screws.

10E-06 ERECTION

10E-06.1 Partitions shall be erected after floor coverings are in place, scribed and neatly fitted and gasketed to horizontal and vertical abutting surfaces to maintain the integrity of the sound attenuation rating. Units shall be interlocked and aligned at all joints. Doors shall swing freely and hardware shall be carefully fitted and adjusted. Surfaces shall be clean and free from scratches or defects. Completed installation shall be rigid and in straight alignment with floor, walls and ceilings. Horizontal lines shall be straight and true. Joints between trim shall be light and sound tight and shall align.

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DIVISION 11

SECTION A

ERECTION OF CONTROL CAB

11A-01 SCOPE: This Section covers the requirement for performing all operations in connection with assembly of the Control Cab and erection on top of the control tower.

11A-02 GENERAL

11A-02.1 Work Included: For extent of cab assembly and erection see Control Cab Erection Manual.

11A-02.2 Work Specified Under Other Sections

11A-02.2.1 Making all electrical and mechanical connections between Control Cab and control tower structure.

11A-02.2.2 Furnishing and installing acoustical ceiling finish and roofing.

11A-02.2.3 Performing all tests and checking all equipment and facilities for the Control Cab operation.

11A-03 GOVERNMENT FURNISHED ITEMS

11A-03.1 The Government will at its expense deliver to the Contractor, at the Construction site, various components required for the assembly and site erection of the Control Cab, consisting generally of but not limited to the items listed below. This list is furnished for information only. A complete list of items is included in the erection manual with the contract documents.

11A-03.1.1 Templates, inserts, bolts, attachments and connecting devices for building into the control tower.

11A-03.1.2 Sub-assemblies for track, wall panels, metal penthouse and roof hatch, roof panels and shade pockets.

11A-03.1.3 Glass air supply plenums, consoles and instrument turrets.

11A-03.1.4 Washing machine unit including battery operated power unit, cage, interlocks, safeties and battery charging units.

11A-03.1.5 Glass, gaskets, sealants, carpet and window shades.

11A-03.1.6 Roof drain and piping.

11A-03.1.7 Electric fixtures, obstruction lights, signal gun boxes, antenna raceway system including lightning rods, conduit and junction boxes, cab roof exhaust fans, hoist, penthouse ladder, photocell and motorized louver dampers.

11A-03.1.8 Connecting devices and attachments required for the assembly and installation of the Control Cab and its components.

11A-03.1.9 Erection drawings, erection manuals, wiring diagrams and parts lists.

11A-03.1.10 Miscellaneous items as noted on the parts lists.

11A-04 DELIVERY, STORAGE AND PROTECTION

11A-04.1 The Contractor shall advise the Contracting Officer of the latest dates by which he will require delivery of templates, inserts, attachments, and similar items to be furnished by the Government to be built into or coordinated with the control tower structure, also the latest delivery date for the Government furnished Control Cab and its components in order for the Contractor to complete all work at the project site in accordance with approved construction schedule.

11A-04.2 Upon delivery of the Control Cab and its components to the construction site, the Contractor shall unload all crates, cases, package, parcels and parts, and verify number, contents and conditions of all items.

11A-04.3 The Contractor shall provide adequate dry storage space for the Control Cab and its components. Paint, sealants and similar items shall be protected against freezing.

11A-04.4 Contractor shall be held responsible for the Control Cab and its components upon acceptance of delivery at the construction site except for shortages reported immediately to the Contracting Officer or concealed defects.

11A-04.5 The Contractor shall uncrate, unpack, store and protect the Control Cab and its components in such manner as to prevent any damage or distortion to the various parts. Any damage resulting from improper unpacking, storage or on-site protection procedures shall be remedied at the Contractor's expense.

11A-05 FIELD ASSEMBLY AND ERECTION

11A-05.1 The Control Cab and its components has been designed so that they may be assembled on the ground and then hoisted into place as a unit or the various components may be hoisted and assembled on the top of the control tower. Either method may be used at the Contractor's option.

11A-05.2 The Contractor shall assemble and erect the Control Cab in strict accordance with the erection drawings, erection manuals and procedures included with the contract documents.

11A-05.3 The Contractor shall submit to the Contracting Officers Representative a list of the equipment he proposed to use and the procedures he proposes to follow in the assembly and erection of the Control Cab.

11A-05.4 The Contractor shall coordinate the assembly, erection and installation of the Control Cab and its components with the work of all affected trades.

11A-05.5 Upon completion of the work of all trades in connection with the Control Cab, access to the Control Cab shall be restricted to authorized personnel only.

11A-06 HOISTING

11A-06.1 The Control Cab or subassemblies shall not be hoisted when it is raining, snowing or when the wind is more than 10 mph.

11A-06.2 Precaution shall be taken to prevent any damage to the structure during hoisting operations.

11A-06.3 The Control Cab shall not be hoisted except in the presence of the Contracting Officer's Representative.

11A-06.4 Hoisting shall be done with cranes or other suitable equipment. The points of support shall be as shown on the erection drawings.

11A-06.5 If two cranes are used to raise the completed cab in place they shall be arranged to act simultaneously. Hoisting shall be gradual and not sudden. Care shall be taken so that the Cab is horizontal at all times: there shall be no slippage. Travel shall be at a constant speed and the Cab shall not be allowed to sway. If at any time, the lifting procedure fails to proceed as specified, the hoisting equipment shall come to a gradual halt and proper adjustments made before resuming lifting operations.

11A-07 PLACING

11A-07.1 Before lowering track on tower, the bearing surfaces shall be cleaned and properly prepared to receive the item.

11A-07.2 Track shall be held above the bearing surface and positioned so that the receiving holes are vertically above the anchor bolts and leveling plates.

11A-07.3 The track shall be lowered level at all points, without knocking protruding parts.

11A-07.4 Make necessary adjustments in positioning and leveling as required, but in no case shall parts be forced into place. Use instruments to accurately locate track section center lines and connections assuring accuracy to within 1/32" plus or minus.

11A-08 ANCHORING

11A-08.1 Before detaching any hoisting equipment, nuts shall be snugly tightened on the anchor bolts.

11A-08.2 Any gaps between the tower structure and the structural supports for the Control Cab shall be shimmed and dry packed with non-shrinking grout and allowed to harden. Remove shims after grouting and fill shim holes with non-shrinking grout.

11A-08.4 Make all connections in accordance with the erection drawings and erection manuals.

11A-09 GLAZING

11A-09.1 Glass shall be installed using neoprene structural gaskets. Set glass in accordance with manufacturer's instructions. Prior to glazing, remove gaskets from cartons and lay out flat in a clean area to allow the gaskets to recover their shape. Gaskets must be maintained at workable temperatures and preheated when necessary. Use tools and methods for setting gaskets provided and recommended by gasket manufacturer. Perform all work in a neat and workmanlike manner, properly fitted to insure a trouble free installation.

11A-09.2 Allow glass to assume its natural deflection due to the weight and angle of the glass. Do not shore or clamp the glass in order to provide a uniform joint.

11A-09.3 Seal corner joints with sealant. It is essential that all surfaces of the glass to receive the sealant be scrupulously clean, with all traces of grease, fingermarks or dampness removed. Mix and install sealant in strict accordance with the manufacturer's instructions.

11A-10 SEALING

11A-10.1 Sealing of all joints shall be made in accordance with the erection drawings and erection manual using sealants, tapes, gaskets as furnished by the Cab Fabricator or as required to properly seal all joints.

11A-10.2 Apply sealants with approved pressure gun suitable for the sealant to be used.

11A-10.3 Before applying sealants, tapes or gaskets, clean and prime surfaces in accordance with manufacturer's instructions. Sealants shall be driven in with sufficient pressure to completely fill the joints or voids. Exposed surfaces shall be free from wrinkle, be uniformly smooth and be tooled so as to shed water. Remove all excess materials.

11A-10.4 Adjacent materials which have been soiled shall be cleaned immediately before the sealant hardens or stains the adjoining surfaces. Protect surfaces adjacent to exposed joints with not less than 1-1/2" wide masking tape.

11A-11 CARPETING

11A-11.1 Areas to be covered with carpeting shall be vacuum cleaned and damp mopped to remove soil and all construction waste.

11A-11.2 Carpet underlayment shall be laid smooth and stretched with edges butted and cemented to floor, or by other similar approved means of maintaining the carpet underlayment taut while laying.

11A-11.3 Carpet shall be carefully fitted, stretched over the carpet underlayment, with edges secured to tackless stripping. Tackless strips shall be secured to floor with contact cement or other approved method. Carpet to be installed in sectional areas with seams where indicated. Seams shall be formed with latex cement reinforced with a mesh fabric and metal grippers. Exposed edges of carpeting shall be bound off. Upon completion of the carpet installation, remove all waste materials and cuttings, and vacuum clean all carpet.

11A-12 WINDOW SHADES: Install window shades in shade pockets as indicated on the drawings in accordance with the manufacturer's instructions.

11A-13 WINDOW WASHING MACHINE: Install window washing machine unit in accordance with the erection drawings, erection manual, and manufacturer's instructions, complete with power unit, controls, interlocks, safeties, power hookup, battery charger unit and other required accessories.

11A-14 SPRAYED-ON ACOUSTICAL CEILING:

11A-14.1 Another Division will furnish and install Control Cab sprayed-on acoustical ceiling on metal ceiling panels.

11A-14.2 Surface to be covered shall be rigid, clean and free from dirt, grease, loose paint or any other condition preventing good adhesion.

11A-15 ROOF DECK COVERING

11A-15.1 Another Division will furnish and install a built-up roof and integral flashing system over Control Cab roof deck.

11A-15.2 Another Division will furnish and perform all caulking and sealing required at Cab roof panel joints.

11A-15.3 Surfaces to receive roof deck covering shall be smooth, clean and dry.

11A-16 MECHANICAL-ELECTRICAL CONNECTIONS

11A-16.1 Other Divisions of this specification will furnish and install items required to make all electrical and mechanical connections between the Control Cab and the control tower structure.

DIVISION 12

SECTION A

ELEVATOR

12A-01 SCOPE: The work covered by this Section consists in furnishing all plant, labor, equipment and materials and in performing all operations in connection with the installation of the Elevator, complete, in strict accordance with this Section and the applicable drawings.

12A-02 TYPE: Elevator shall be an electric passenger elevator of the worm-geared traction type, with basement machine, special selective collective operation, car leveling device, electric car door and hoistway operators, signal system, hoistway entrances with their doors and special panels, and all other items and accessories required for a complete installation.

12A-03 FEDERAL SPECIFICATIONS: Where Federal Specifications are mentioned herein, the materials furnished shall be in accordance with such Federal Specifications.

12A-04 STANDARDS: Unless otherwise distinctly specified, all elevator material, design, clearances, construction, workmanship and tests shall conform to the requirements of the American Standard Safety Code for Elevators, Dumbwaiters and Escalators; 1960 Edition (A.S.A. 17.1-1960) including errata, interpretations and revisions and hereinafter referred to as the A.S.E. Code. In addition to conforming with the A.S.E. Code, the elevators shall also conform with all applicable local codes or requirements. References in this specification to A.I.E.E. Standards are to be Standard Rules of the American Institute of Electrical Engineers. References in this specification to the N.E. Code are to the National Electrical Code, 1962 edition, including errata, interpretations and revisions.

12A-05 DEFINITIONS: All terms in this specification shall have the meaning defined in the A.S.E. Code.

12A-06 SINGULAR NUMBER: In all cases where a device or part of the equipment is herein referred to in the singular number, such as "the motor", it is intended that such reference shall apply to as many such devices as are required to complete the installation.

12A-07 GENERAL DESIGN: All parts of the elevator equipment shall be of such design, size and material as to satisfactorily function under all conditions of loading and operation within specified rated load and rated speed range, all with a proper factor of safety, maximum mechanical and electrical efficiency and a minimum wear on parts. All parts shall be built to definite standard dimensions, tolerances and clearances so that similar parts of similar machines and devices are completely interchangeable. The mechanical fastenings used throughout the equipment on parts subject to wear and requiring replacement shall be key and seat, nut, screw, or other removable and replaceable type not requiring physical deformation or field

positioning. The use of rivets or similar devices will not be acceptable as mechanical fastenings for such parts. All work specified in this section of the specification shall be furnished and installed by the individuals or concern furnishing and installing the elevators.

12A-08 COMPETENCY: It is imperative that the elevator installation be made by individuals or concerns having successful experience in the manufacturing, installing and servicing of elevators and the Contractor must be able to demonstrate that the elevator will be installed by individuals or concerns in the business of manufacturing, installing and servicing elevators of the grade covered by this specification and must be able to demonstrate that such indivuduals or concerns have installed similar elevators to that specified, which elevators are of a make and type known to the Government Representative to have given satisfactory service and been in successful operation for a reasonable period.

12A-09 MATERIAL: All elevator machines, controllers, and associated equipment shall be in strict accordance with the specification requirements and of high quality and grade. The importance of this building demands that the elevators be of the highest grade, smooth and safe in operation, and it is imperative that the elevators be the product of individuals, firms or corporations regularly engaged in the business of manufacturing high class elevators, who are possessed of sufficient financial ability and of satisfactory business standing and techanical ability, shop equipment and technical organization, etc., and who have demonstrated their ability to design and construct elevators of the grade covered by this specification.

12A-09.1 The controlling apparatus, including motors, motor generators (if used), and control panels must be the product of one manufacturer of established reputation, except that the use of such of the above items in whole or in part which are the products of manufacturers of established reputation will be permitted provided such items are constructed at the direction of, or are based on the specifications of the elevator manufacturer so as to insure proper and coordinated operation of the above mentioned items in connection with the elevators. The shop facilities of the elevator manufacturer whose machinery is proposed to be used must be such as to insure the manufacture of the elevators in sufficient time to insure installation and satisfactory completion within the contract time.

12A-09.2 In the event that the elevator machines and controllers proposed to be used by the Contractor are not known to the Government Representative, the right is reserved to require the Contractor to submit drawings in triplicate, showing details of construction, assembled machine and controller, complete wiring diagrams and detailed description of the action of the controller and also to demonstrate to the satisfaction of the Government Representative that elevator equipment of such manufacture has been in service for a satisfactory length of time and is in strict accordance with the specification. All materials used in connection with this contract are to be new unless otherwise specifically herein specified.

12A-10 GUARANTEE AND MAINTENANCE: The Contractor shall guarantee that the materials and workmanship of the apparatus installed by him under these specifications are first-class in every respect and that he will make good any defects, not due to ordinary wear and tear or improper use or care, which may develop within one year from date of completion. In addition to guarantee requirements specified, upon completion of the installation, the Contractor shall furnish a thorough inspection and normal service of elevators for a period of ninety days. Such inspections shall be made by competent trained employees during the regular working hours and the service provided shall include all necessary adjustment, greasing, oiling, cleaning, supplies and parts to keep the equipment in proper operation, except for damage caused by improper care or by misuse of the equipment. Emergency call-back service shall be available at all times for the ninety day period. The Contractor shall be able to show that he has had successful experience in the complete maintenance of the elevators and employs competent personnel to handle this service.

12A-11 SPACE CONDITIONS: The Contractors' especial attention is called to the space and construction conditions, etc., as covered and provided for by the drawings and as may be existing at the building in connection with the elevator installation as a whole, including all accessories and devices in connection with the elevators. All information regarding space conditions must be obtained from the drawings and from actual measurements taken at the building. Any construction changes or space conditions required by the Contractor to properly install and operate the elevator installation as a whole, including all accessories and devices in connection with the elevators must be arranged for and be obtained by the Contractor subject to approval of the Government Representative. The Contractor will be required to make all such arrangements and pay all costs occasioned by any additional space requirements or construction changes that the Contractor may require or desire to install the elevators or any of his equipment and this work (if any) must be included in the Proposal and it will form a part of this contract. The Contractor must check and verify his own measurements at the building, as he will be held responsible for proper fitting of his work.

12A-12 INSTRUCTION OF EMPLOYEES: This Contractor must provide, without expense to the Government, competent instructors to train the employees of the Government who will have charge of the apparatus, in the care, adjustment and operation of all parts of the equipment. Instructor shall be available for a sufficient length of time after completion and acceptance of the work under this contract, to give adequate instructions. Contractor must forward a statement countersigned by the Government Representative to the Contracting Officer, that this instruction has been furnished. In addition to verbal instruction, written instructions in duplicate relative to the care, adjustment and operation of all parts of the equipment shall be furnished and delivered to the Government Representative, bound in book form.

12A-13 SHOP DRAWINGS

12A-13.1 The Contractor will be required to submit to the Government, for approval, detail drawings of the following:

12A-13.1.1 The complete dimensioned layout of elevator installation in plan and elevation, showing the machine, controller, governor, car, car sling and platform, counterweight, sheaves, supporting beams, guide rails, buffers, reactions at points of support, weights of principal parts, top and bottom clearances and over-travel of the car and counterweight, location and sizes of conduits, junction boxes, etc.

12A-13.1.2 The complete drawings of the elevator hoistway, entrances, door frames, panels and doors showing their method of operation, details of construction, and methods of fastening to the structural members of the building.

12A-13.1.3 The complete drawings of the elevator car showing details of construction, location of car equipment, etc.

12A-13.1.4 Cuts or drawings showing details of signal and car equipment.

12A-13.1.5 And such other drawings hereinafter specified.

12A-13.2 The following additional information shall be indicated on the shop drawings:

12A-13.2.1 The name of manufacturer, type or style designation, and size of hoisting machine.

12A-13.2.2 The name of manufacturer, type or style designation, H.P. and R.P.M. of hoisting machine motor.

12A-13.2.3 The name of manufacturer, type or style designation of controller.

12A-13.2.4 The name of manufacturer, type or style designation, maximum rated load, maximum rated speed of car safety.

12A-13.2.5 The name of manufacturer, type or style designation of governor.

12A-13.2.6 The name of manufacturer, type or style designation of electric power door operator.

12A-13.2.7 The name of manufacturer, type or style designation or hoistway door interlocks and electric contacts.

12A-13.2.8 The name of manufacturer, type or style designation, stroke, certified maximum and minimum loads and certified maximum striking speed of car and counterweight buffers.

12A-14 CAPACITY, SPEED, TRAVEL AND PLATFORM SIZES: The car shall have a capacity to lift a live load (exclusive of the weight of car and cables) at the speed in feet per minute, as specified in the following schedule. The travel, terminal floors, number of stops and openings and the over-all platform sizes are also given in the following schedule. The travel of the elevator, the number of stops and openings as specified in the following schedule are approximately correct. The elevator shall serve the floors with stops and openings in accordance with the requirements indicated on drawings.

12A-14.1 ELEVATOR SCHEDULE

Quantity	One (1)
Type	Electric Passenger
Capacity	1200 lbs.
Car Speed	125 F.P.M.
Travel (Floors)	Basement, Entrance, Top, and intermediate landings when indicated on drawings
Distance	See Drawings
Stops and Openings	Front and Rear; See Drawings for locations and quanitites
Platform Size	4'-8" wide x 4'-0-1/2" deep, approx.
Operation	Special Selective Collective; Entrance Level stop on Key operation
Control	Resistance with leveling
Machine Type	Basement Traction
Roping	1:1
Machine Location	Below Basement
Motor-Maximum RPM	1800
Traction Sheaves Minimum Diameter	20"
Hoisting Ropes	1/2"
Governor Ropes	3/8"
Buffers	Spring
Car Safety	Roll Type
Car Door and Hoistway Entrances	Doors 2'-10" x 7'-0" Center opening; hoistway doors and panels weatherproof type. Side panels and transom panel at Basement and Entrance Levels. Transom panel and hinged doors to Cable Shaft at Top
	Elev. Landing. Doors and panels 3 hr. labeled construction.

ELEVATOR SCHEDULE (cont.)

Emergency Access Doors	Locations as indicated on drawings.
Car Enclosure (Cab)	In accordance with design on drawings.
Door Operators	Electric, front and rear
Car Indicators	Electric car position indicator over car operating panel
Hall Indicators	Electric hall position indicator over landing button at top and bottom

12A-14.2 Electrical Operating Characteristics: At 3 phase, 208 volts, motor maximum full load running current shall not exceed 26.5 amperes, the maximum starting current shall not exceed 53 amperes. Where the Contractor elects to supply equipment having requirements which exceed these current limits, his equipment will be considered for approval only if it satisfies all specified requirements and if, in addition, he agrees to bear all costs for required changes to elevator feeder and associated electrical work, at no additional cost to the Government.

12A-15 FINISHES: Samples of the finish of enamels, lacquers, metals, plastic laminate, cab flooring, etc., where specified in connection with elevator, signal equipment and cab equipment, shall be submitted to the Government Representative, for approval.

12-16 ELECTRIC CURRENT: The latest data indicates that the current available is 3 phase, 60 cycles, 208 volts, alternating current for power and single phase, 60 cycles, 120 volts, alternating current for lighting. The exact current characteristics at the building must be determined by the Contractor. Failure of Contractor to determine current characteristics will not relieve him of the responsibility for the complete and satisfactory operation of his equipment. In case it is found that the current characteristics are different from those above stated, furnish motors and other equipment suitable for operation on the current available.

12A-17 PERMITS AND INSPECTIONS: The Contractor shall obtain and pay for the necessary Municipal State inspection and permits for the elevator only and make such tests as are called for by the regulations of such authorities. These tests shall be made in the presence of the authorized representative of such authorities.

12A-18 CERTIFICATES: Before final acceptance, the Contractor shall furnish certificates of the Board of Fire Underwriters' and the Building Department and other City and State Departments having legal jurisdiction.

12A-19 ELECTRIC FEEDERS: The electric feeders for elevator power, signal and car lighting service will be provided under another Section of the Specification. The exact desired point of termination of feeders to controller panel and the exact desired location of lighting junction box shall be indicated on elevator shop drawings.

12A-20 TRAVELING CABLES: All conductors to the car shall consist of flexible traveling cables, Type E, conforming with the requirements of the N.E. Code, except that the minimum conductor sizes shall be as hereinafter specified under "Conductors". Traveling cables shall run from a junction box on the bottom of car to a junction box in the hoistway and from these points conductors shall be run to various required locations. Each traveling cable conductor shall have a distinctive color coded outer covering for identification of the individual conductors. Each traveling cable shall have at least two spare conductors. Junction boxes on car bottom and in hoistway shall contain approved terminal blocks for connection of traveling cable conductors. Terminal blocks shall have indelible identification numbers for each terminal connection. All connections to terminal blocks shall be made with terminal eyelets set on the conductor with a special setting tool.

12A-20.1 Traveling cables shall be so suspended, anchored and run that the strain on individual cable conductors will be reduced to a minimum, connections to terminal blocks will be free from all strain, and the cables will always be free from contact with the hoistway construction, car, counterweight or other equipment. The outer cable covering must remain intact between junction boxes and abrupt bending of cable producing distortion of cable will not be permitted.

12A-20.2 Traveling cables exceeding 100 feet in length shall have steel supporting fillers and shall be suspended directly by steel supporting fillers without snubbing over other supports. Traveling cables 100 feet or less in length shall have non-metallic fillers and shall be suspended by looping cable around supports of porcelain spool type (or equivalent).

12A-21 CONDUCTORS: The Contractor shall furnish and install all wires and cables necessary for the proper connection and operation of all equipment installed under the elevator contract. The minimum size of conductors (exclusive of conductors which form an integral part of the control devices) shall be No. 14 for lighting circuits and No. 18 for operating, control and signal circuits, except for traveling cable lighting circuit conductors, No. 16 conductors may be used in parallel to provide a current carrying capacity equivalent to at least that of No. 14 conductors. The conductor size shall be such that the maximum current carried will not exceed limits prescribed by the N.E. Code. Conductors shall have the distinctive marking of the manufacturer.

12A-21.1 Unless otherwise herein specified, all conductors used for external wiring between the various items of elevator equipment, exclusive of the traveling cables, shall be in strict accordance with the requirements of either Federal Specification J-C-103 for Type R, stranded; or Federal Specification J-C-129a for Type TW, stranded, except that the minimum size permitted shall be No. 18 in lieu of No. 14. Conductors for control

board wiring, including wiring between main circuit resistors and control boards, shall comply with N.E. Code requirements.

12A-21.2 No joints or splices will be permitted in wiring except at outlets. All wiring must test free from short circuits or grounds and the insulation resistance between conductors, and between conductors and ground, shall be not less than one megohm.

12A-21.3 Terminal connections for all conductors used for external wiring between the various items of elevator equipment shall be solderless pressure wire connectors (cable lugs) as specified in Federal Specification W-S-610b, except that for conductors No. 10 or smaller, the terminal connections may be made with either approved terminal eyelets set on the conductor with a special setting tool, or with approved pressure type terminal blocks.

12A-21.4 All conductors, unless otherwise specified, shall be run in rigid steel conduit, electrical metallic tubing, or metal wireways, except (a) such conductors between controllers and machine motors, machine brakes and motor generator sets as may be so short as to be self supporting, (b) traveling cable connections to the car, (c) short connections (not exceeding 18 inches in length) between risers and limit switches, interlocks, push button boxes, door operator motors and similar devices, which may be run in flexible metal conduit when such connections are so located as not to be susceptible to oil damage, and (d) flexible hard service cord, Type SO, used between fixed car wiring and switches on car doors.

12A-21.5 Self supporting connections shall be taped or corded together, have taping or cording coated with insulating paint, and shall be fully protected from abrasion or other mechanical injury. Auxiliary gutters may be used in elevator machine rooms between controllers, starters and similar apparatus. Installation of conductors shall comply with applicable requirements of the N.E. Code.

12A-22 CONDUIT, ETC.: Rigid steel conduit, conduit fitting, electrical metallic tubing and flexible steel conduit shall comply with the following applicable Federal Specifications which are referred to by symbol:

Conduit, steel, rigid, zinc coated	WW-C-581d
Fittings, cable and conduit	W-F-406a
Tubing, electrical, metallic	WW-T-806b
Conduit, steel, flexible	WW-C-566b

Fittings for electrical metallic tubing shall be approved watertight fittings. Wireways and auxiliary gutters shall comply with the N.E. Code requirements.

12A-22.1 All conduit connecting the various items of elevator equipment in the elevator machine room shall be run in concealed positions insofar as practicable. Metal wireways and auxiliary gutters shall be run exposed in readily accessible locations and be so arranged as to not obstruct working space around equipment.

12A-22.2 All raceways completely embedded in concrete slabs or floor fill shall be rigid steel conduit. At all other locations any of the other types of raceways specified may be used subject to conditions specified hereinbefore. Raceway terminal fittings must provide conductor passageways free from burrs, shoulders or other projections which will reduce internal passage area or cause abrasion of conductors being pulled through.

12A-23 WIRING DIAGRAMS: Complete and legible field wiring diagrams and straight line diagrams showing the electrical connections, functions and sequence of operation of all apparatus connected with the elevator (including door operators) both in machine room and in hoistway, together with photographs or cuts of controller repair parts with part numbers, listed, shall be furnished in duplicate. One set shall be suitably framed under glass and be mounted in machine room where directed, and the other shall be assembled in bound form and be delivered to the Government Representative. In lieu of mounting under glass the above photographs or cuts and list of repair part numbers, these may be assembled in bound form in duplicate for each type of controller and delivered to the Government Representative.

12A-23.1 Each device on wiring diagram shall be properly identified by name, letter or standard symbol identical with markings on devices or controller panel. A list of all devices, together with identifying markings, therefore, shall be provided on the wiring diagrams.

12A-24 ELEVATOR TESTS: When the elevator work included in the contract is fully completed, the Contractor shall demonstrate, to the entire satisfaction of the Government Representative, the proper operation of every part of the equipment and compliance thereof with contract requirements, including compliance with all applicable requirements of the A.S.E. Code. The inspection procedure outlined in the American Standard Practice for the Inspection of Elevators, Inspectors' Manual A.S.A. A17.2-60 will form a part of the final inspection.

12A-24.1 No shop test of elevator motors and motor generators and no certified test sheets will be required. The heating, insulation resistance, etc., of the motors will be determined under actual conditions after installation.

12A-24.2 The Contractor shall furnish all test instruments and materials required at the time of final inspection to determine compliance of the work with the contract requirements. Materials and instruments furnished shall include standard 50 pound test weights, "Megger", alternating current

voltmeter and ammeter, direct current voltmeter and ammeter (when generator field control is specified), centigrade calibrated thermometers, spirit level, stop watch and a direct reading tachometer.

12A-24.3 The following tests shall be made at the time of final inspection:

12A-24.3.1 Full Load-Run Test: The elevator shall be subjected to a test for a period of one hour continuous run, with full specified rated load in the car. During the test run the car shall be stopped at all floors in both directions of travel for a standing period of 10 seconds per floor.

12A-24.3.2 Speed Test: The actual speed of the elevator car shall be determined in both directions of travel and with full contract load and no load in the elevator car. Speed tests shall be made before the full load run test and also after the full load run test. Speed shall be determined by applying a tachometer to the car hoisting cables. The actual measured speed of elevator car with full load in UP direction shall be within 5 percent of specified rated speed for an elevator with generator field control and 10 percent of specified rated speed for an elevator with alternating current rheostatic control. The maximum difference in actual measured speeds obtained under the various conditions outlined shall not exceed 10 percent of specified rated speed for an elevator with generator field control and 25 percent of specified rated speed for an elevator with alternating current rheostatic control.

12A-24.3.3 Temperature Rise Test: The temperature rise of the hoisting motor, exciter and booster shall be determined during the full load test run. Temperature shall be measured by the use of thermometers inserted into the various windings, etc., and shielded by cotton waste. Under these conditions the temperature rise of the equipment shall not exceed 50 degrees centigrade above ambient temperature. Test shall be started only when all parts of equipment are within 5 degrees centigrade of the ambient temperature at time of starting test.

12A-24.3.4 Car Leveling Test: Elevator car leveling device shall be tested for accuracy of landing at all floors with no load in car, balanced load in car and with full load in car, in both directions of travel. Accuracy of floor landing shall be determined both before and after the full load run test.

12A-24.3.5 Insulation Resistance Test: The complete wiring systems of elevator shall be free from short circuits and grounds and the insulation resistance of systems shall be determined by use of a "Megger". The systems shall have an insulation resistance of not less than one megohm.

12A-24.3.6 Car Safety and Governor Tests: The car safety and governor shall be tested as outlined in Rule 900.2 of the A.S.E. Code.

12A-25 TOOLS: A complete set of tools necessary for making all adjustments on every part of the elevator installation shall be furnished for elevator machine room and delivered to the Government Representative. Tools shall include necessary special tools or wrenches and must include, among others, two adjustable 15-degree end wrenches, one 6 inches and the other 12 inches in size. In the event equipment with grease gun connections is installed, a high-pressure type grease gun (or guns) shall be provided also.

12A-25.1 A hardwood or formed steel tool board shall be furnished and installed in elevator machine room where directed. Tool board shall have suitable clips or other fastenings for mounting tools thereon.

12A-26 CYLINDER LOCKS: Cylinder locks herein specified shall have a bronze cylinder with not less than five pin tumblers. Provide three (3) white bronze keys (paracentric type) for each lock and deliver same to the Government Representative. Provide a brass identification tag on each key with stamped legend as directed.

12A-27 KEY OPERATED SWITCHES: Key operated switches herein specified shall be of the cylinder lock key operated type.

12A-28 LUBRICATION: Suitable and approved means shall be provided for lubricating with oil or grease all bearing surfaces in connection with the elevator installation. Grease gun fittings, when used, shall be suitable for a high-pressure gun and all grease gun fittings furnished shall preferably be of the same type to fit the same gun. Grease cups, when used, shall be of automatic feed compression type. All points of lubrication shall be easily visible and accessible.

12A-29 OMITTED

12A-30 GUARDS: In addition to guards for sheaves, etc., hereinafter specified under the various Articles of this Specification, particular attention is directed to the requirements of the A.S.E. Code, Section 104, relative guarding of exposed gears, sprockets, tape or rope sheaves or drives of selectors, floor controllers or signal machines and the ropes, chains or tapes for driving same in machine rooms and secondary machinery spaces.

12A-31 HOISTWAY ACCESS SWITCHES: A hoistway access switch shall be provided for the elevator at the top terminal landing and at emergency access to shaft. In addition, the bottom terminal landing shall be provided with a hoistway access switch if the hoistway door at this landing is the only means of pit access. Hoistway access switches shall be of the key operated cylinder lock type meeting all requirements of the A.S.E. Code.

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12A-32 TOP OF CAR OPERATING DEVICE: The elevator shall be provided with an operating device mounted from or on the car crosshead which will permit slow speed (50 feet per minute or less) operation of the car for purposes of adjustment, inspection; maintenance and repair. The device shall comply with requirements of the A.S.E. Code. A transfer switch shall be provided in the top of car operating device fixture which shall permit the disconnecting of hoistway access switch or switches and render top of car operating device operative. Separate additional means for operation of power door operators and automatic car-leveling devices are not required.

12A-32.1 The operating device shall be mounted in a metal box and shall be rigidly secured in a position conveniently accessible to workmen on top of the car. Operating buttons, etc., shall be shrouded or otherwise protected in an approved manner to prevent accidental movement.

12A-33 AUXILIARY EMERGENCY STOP SWITCHES: In addition to the emergency stop switch specified to be installed in the elevator car operating panel, auxiliary emergency stop switches shall be provided (1) on top of the elevator car and (2) in the elevator pit. Emergency stop switches shall conform with the requirements of the A.S.E. Code. The emergency stop switch on top of the car shall be mounted in a common fixture with the top of car operating device. The emergency stop switch in elevator pit shall be mounted 4 feet 0 inches above the pit floor level and adjacent to pit access ladder.

12A-34 PAINTING AND FINISHING OF ELEVATOR EQUIPMENT

12A-34.1 The following items are included under this article:

12A-34.1.1 Finish of all elevator equipment, conduits and miscellaneous iron and steel work located within the machine room, the hoistway or elsewhere, including the elevator machines, motors, sheaves, door operators, gage operators, unfinished surfaces of guide rails, car frames and platforms. safety planks, etc.

12A-34.1.2 Painting of elevator doors and panels is specified under "Hoistway Entrances".

12A-34.2 All surfaces are to have not less than one priming coat and two finishing coats.

12A-34.3 The priming coat is to be applied at the factory where possible. The finish coats may be applied either at the factory or after installation of the equipment, except that governors are to be painted only at the factory.

12A-34.4 Surfaces of motors, machines, gear cases, castings, etc., having holes or other surface imperfections are to be treated at the factory with machine filler and be smoothed off to remove surface inequalities, and then shall be painted with the required priming coat.

12A-34.5 The colors of the finish are to be in accordance with the Contractor's standard practice, except where other colors are specified.

12A-34.6 Surfaces exposed to oil and those requiring a hard and tough finish are to have finishing coats of enamel or varnish or they may be painted with one coat of enamel followed by a coat of varnish. Lead and oil paint may be used for finishing coats where suitable.

12A-34.7 All concrete bases shall be painted to match the machines.

12A-34.8 A landing identification numeral or letter (4 inches high) shall be provided for each landing served located on the hoistway wall approximately 6 inches below the sill level.

12A-34.9 Identification markings for machines, controllers, etc., shall be provided at locations where directed. The numbers for hoisting machines shall be 4 inches high and the numbers for controllers, selectors and other auxiliary equipment shall be 2 inches high.

12A-34.10 The identification numerals or letters for floor landings, machines, etc., may be either neatly stencil painted or decalcomania type of a color which will contrast with color of the surface to which the marking is applied. Decalcomania type markings shall have a coat of clear varnish after application.

12A-34.11 The paint, enamel and varnish used shall be high grade brands produced by reputable manufacturers. All materials shall be proportioned in accordance with the standard practice for first class work.

12A-34.12 At the completion of the work, all finished surfaces shall be thoroughly cleaned. They shall be touched up and restored where damaged during shipment or installation, and shall be free from blemishes. The finishing coats shall cover thoroughly and shall show no unevenness of tone.

12A-35 OMITTED

12A-36 ELEVATOR MACHINE BEAMS, ETC.: All necessary structural steel beams or other steel members required for support of elevator machine, sheaves, rope hitches, governor, buffers, grating, etc., and other elevator equipment, shall be furnished and installed. Bearing plates, anchors, etc., shall be provided as required to mount beams, etc., securely in place. In the event it is necessary to change the level of machine or sheave beams from that contemplated by the project drawings, the Contractor shall provide all additional steel, concrete work, etc., as necessary and required to locate the beams at such a level as will permit adequate overhead clearance and retain adequate headroom above machine or sheave beams.

12A-37 MACHINE LOCATION AND FOUNDATION: The elevator machine shall be located on the Machine Room Floor, adjacent to the hoistway upon a concrete foundation installed under another section of the specifications. The foundation shall be of sufficient size and weight to accommodate the machine. The Contractor shall provide heavy foundation bolts for incorporation in the foundation in accordance with template, and these bolts, together with necessary nuts and washers, shall permit the machine to be securely anchored in place.

12A-38 TEMPLATES, FORMS AND SLEEVES: All required forms, templates, and sleeves shall be furnished by the Contractor to insure that the openings in concrete machine (and secondary, where provided) slabs over the hoistways are of the proper size and location to suit the hoisting ropes and other equipment. The Contractor shall be held responsible for the fit and location of openings. The Contractor shall provide metal sleeves projecting 2 inches above the concrete slab for all hoisting rope and governor rope, selector rope or tape, and other similar openings. Sleeves shall be not less than No. 12 U.S.S. Gage and shall have inside of sleeves sloped same as the ropes, tapes, etc.

12A-39 GEARED ELEVATOR HOISTING MACHINE: Hoisting machine shall be of the worm geared traction type with motor, brake, worm gearing and sheave mounted on a common bed plate.

12A-40 MOTOR: The hoisting machine motor shall be as hereinafter specified in conformity with the type of control required by the project specification.

12A-41 BEDPLATE: The bedplate shall be of cast iron or steel in one piece, either separate, or integral with the machine frame, or may consist of heavy structural steel shapes welded othether. The bedplate shall be heavily ribbed or reinforced to provide the rigidity required to maintain accurate alignment of parts. Accurately machined surfaces shall be provided to seat all parts secured to the bedplate or machine frame. The use of brackets or other extensions bolted to the bedplate as supports for principal parts will not be permitted. All parts shall be bolted in place with finished bolts or cap screws. Tapered dowels shall be used to accurately locate parts where necessary to insure the proper positioning of parts. The bedplate shall be provided with a raised lip at edge to prevent oil dripping off, or suitable drip pans shall be provided wherever oil drip occurs.

12A-42 BEARINGS: The bearing pedestals shall be rigidly fastened to, or be integral with the main structure of bedplate or the machine frame. The bearing mounting and method of machining and assembly must be such as to insure accurate bearing alignment. Bearings shall be either of the anti-friction bearing metal sleeve type or of the ball or roller bearing type. The bearings and lubricant reservoirs shall be virtually dust tight and shall incorporate effective lubricant seals or other means to prevent lubricant leakage. The outer ends of bearings shall be closed with a removable oil tight plate or cap.

12A-42.1 Bearings of the anti-friction bearing metal type shall be provided with automatic self-lubrication, oil reservoirs, capped filler openings, drain plug or cocks and oil gauges. The bearing pressure for babbitt bearings shall not exceed 400 pounds per square inch, and for bronze bearings shall not exceed 800 pounds per square inch.

12A-42.2 Roller and ball bearings shall be either immersed in oil or subject to oil flood lubrication, or shall be arranged for grease lubrication and be fitted with grease gun connection and drain plugs.

12A-42.3 Plain cast-iron bearings will be permitted for worm shaft bearings provided the bearing pressure does not exceed 300 pounds per square inch, and same are immersed in oil or subject to oil flood lubrication.

12A-43 THRUST BEARING: The machine shall have the highest grade, double-acting thrust bearing of the ball or roller type. Bearing preferably shall have two sets of balls or rollers arranged to eliminate back lash. Thrust bearing shall be removable without dismantling machine.

12A-44 WORM: Worm shall be accurately cut from a solid steel forging or heat-treated steel bar stock integral with worm shaft.

12A-45 WORM GEAR: The worm gear shall have an accurately machined bronze rim of such composition that the gear will not show appreciable wear after one year's service. The worm gear shall be of such diameter relative to that of sheave so that the maximum pressure between worm gear and worm will not exceed a safe value. The worm gear shall operate without appreciable noise and shall cause no appreciable vibration in the car. The worm gear rim shall be shrunk or pressed on a cast iron or cast steel center or spider and shall be bolted thereto by means of tightly fitted turned bolts, in reamed holes, with the bolt nuts positively secured in an approved manner. Bolt holes through the outer peripheral joint of center and the rim will not be permitted. Worm gear center may either be integral with the traction sheave center or may be pressed on and keyed to the sheave shaft. Integral traction sheave and worm gear centers shall either be pressed on the sheave shaft or be fitted to bearings on sheave shaft. The use of worm gear and sheave centers cast on the sheave shafts will not be permitted.

12A-46 GEAR CASE: The case for enclosing the worm and worm gear shall be constructed of cast iron of ample strength arranged to hold a body of oil. The gear case shall have gasketed hand holes which shall permit inspection of worm gear face, worm gear and worm contact, and worm gear mounting bolts. Worm shaft openings in gear case shall be provided with an effective oil seal, stuffing box or other approved means to prevent oil leakage. If a stuffing box is used it shall be arranged to prevent rattling at all compressions of packing and a suitable receptacle fitted in place to collect dripping oil. The complete assembly of gear case, with worm gear, centers, sheave shaft, etc., shall be so arranged to effectively prevent oil leakage from the gear case.

12A-47 SHEAVES: All hoisting rope sheaves shall be of hard alloy cast iron, semi-steel or cast steel of approved composition, with true running, smooth turned grooves and flanges. Sheaves shall be free from cracks, and sand holes or other imperfections. Traction, deflector, overhead idler and two to one idler sheaves shall be of suitable diameter for the hoisting ropes provided and, in any event, not more than 40 times the diameter of the hoisting ropes.

12A-47.1 Traction sheave center shall be mechanically coupled to worm gear center in a positive manner as hereinbefore specified. Traction sheave shall be suitably grooved to produce required traction and shall be thick enough to provide for future groove wear.

12A-47.2 Deflector sheaves shall be securely mounted below the machine beams in proper alignment with the traction sheave. Two to one idler sheaves shall be securely mounted in counterweight head frame or car crosshead respectively. Overhead idler sheaves shall be securely mounted on overhead sheave beams in proper alignment with traction sheave and car and counterweight rope hitches or sheaves. The rope grooving for deflector and idler sheaves shall be semi-circular at the bottom to provide a smooth rope bed.

12A-47.3 Deflector and idler sheave bearings shall be the same as specified for the hoisting machine, except that only permanently lubricated ball or roller bearings may be used for deflector sheaves and overhead sheaves used with machine mounted below, and two to one car and counterweight idler sheaves.

12A-48 DRIP PANS: Drip pans constructed of No. 26 U.S.S. gauge galvanized sheet steel shall be provided below all deflector and idler sheave bearings to catch lubricant drippings, except for sheave bearings of the grease lubricated ball or roller type which are fitted with effective approved grease seals.

12A-49 BRAKE: Brake drum preferably is to be the face of coupling between motor and worm shafts. In any event, the brake drum must be keyed or shrunk direct to the worm shaft. The brake must be in two sections of the shoe type, and must be so designed as to be effective to the extent of stopping and holding the car under all conditions of loading or operation. Brake shoes are to be applied by springs under compression and the pressure must be adjustable.

12A-49.1 The brake drum must be carefully balanced and have the wearing surface and edge of flange turned smooth and the wearing surface must run true within a maximum variation of .005 inch.

12A-49.2 The brake shoes are to be lined with a suitable fireproof friction material shaped to the shoe so that the drum will run free with a normal clearance.

12A-49.3 Brake to be released by an electro-magnet. A D.C. brake magnet shall be provided and be so designed that the release will be quick. The brake application must be automatically controlled to obtain noiseless, smooth and gradual stops with either light or loaded car. The circuit of the brake magnet must be opened by the several safety devices, so as to apply the brake at both limits of travel; when car attains excessive speed, when stop is initiated by car operating device, when safety switch is opened, and on failure of current.

12A-49.4 The brake shall be provided with a manual release to permit the elevator machine to be manually turned with a removable crank once the brake has been manually lifted. This operation shall only be done by authorized persons in the event of power failure.

12A-50 OMITTED

12A-51 GEARED ELEVATOR HOISTING MACHINE - RHEOSTATIC CONTROL: The motor shall be of the alternating current reversible induction type of a design adapted to the severe requirements of elevator service. The motor shall be capable of developing the required high starting torque with a low starting current.

12A-51.1 The motor shall be rated in accordance with the standards of the A.I.E.E. for 50 degrees C., 30-minute rating motors, and shall have sufficient capacity to operate elevator with rated contract load at rated contract speed without overheating. Motor shall be tested as specified in this specification. The motor shall be two-speed with ratio of not less than three to one between high synchronous speed and low synchronous speed. Two-speed motors shall be of either the tandem slip ring squirrel cage type, or the double wound stator squirrel cage type.

12A-51.2 The insulation of all windings shall be impregnated and baked to prevent the absorption of moisture and oil. The insulation resistance between motor frame and windings shall not be less than one megohm. The motor windings shall stand a dielectric test of twice the normal voltage plus 1000 R.M.S. volts of 60 cycle alternating current for one minute. Insulation shall be Class A as defined by A.I.E.E. Standards.

12A-51.3 The motor bearings shall be either of the anti-friction bearing metal sleeve type with oil reservoirs, automatic self lubrication, oil gauges, capped filler openings and drains, or of the ball or roller type arranged for grease lubrication and fitted with grease gun connections and drain plugs. The bearings and lubricant reservoirs shall be virtually dust tight and shall incorporate effective lubricant seals or other means to prevent lubricant leakage.

12A-51.4 The design of frames, end bells, etc., shall be such as to insure perfect alignment of bearings and minimize vibration. The end of motor shaft shall be arranged to receive a crank; or other provision shall be made to permit turning motor shaft by the application of a suitable tool. One crank or tool shall be furnished for this purpose.

12A-51.5 If the Contractor elects, generator field control, including motor generator unit and direct current elevator machine motor and all necessary equipment, may be used and will be acceptable (subject to the approval of the Government Representative) in lieu of the two-speed alternating current motor and control equipment, in which case the equipment used must be of the proper sizes, types, etc., for the duty and as recommended by the manufacturers of the equipment and as required for a satisfactory installation. This Contractor must make all necessary provisions in the building construction for supports and foundations for the equipment, as may be required.

12A-51.6 The elevator machine shall be fitted with a removable crank which can be used to manually trun the machine once the brake has been manually lifted. This operation shall be done by authorized persons in the event of power failure.

12A-52 ELEVATOR CONTROLLER: The elevator controller shall be designed to provide operation as specified and as hereinafter outlined.

12A-53 PANEL: The panel or panels used for the mounting of controller switches, relays and other items of control equipment shall be made of an approved moisture resisting dielectric material having dielectric and structural properties suitable for its intended usage. The material must be incapable of supporting combustion. The panel thickness shall be adequate to provide rigid support for all components mounted thereon and, for individually replaceable small panels, to withstand field removal and installation without damage. The panel may be either one piece, sectional or an assembly of small panel individually mounted controller components. The panels shall be secured to panel frame with bolts, screws, or other approved demountable means. The front of all panels shall be in the same plane, and all edges shall be smooth.

12A-54 PANEL FRAME: The panel frame shall be of rigid steel construction arranged to provide a firm mounting for panel or panels secured thereto. Panel frames supporting controller switches which operate in such a manner as to produce a perceptible panel frame vibration shall be provided with an approved vibration absorbing mounting.

12A-55 SWITCHES: All switches and relays shall be mounted on the front of panels. Resistors in excess of 10 watt capacity and all connections shall be mounted on the rear of panels. Small electronic components such as tubes, rectifiers, small resistors, capacitors, etc., may be mounted on the front of panels. All wiring on the panels shall be neatly formed and securely fastened in place. All equipment on the panels shall be readily accessible and easily renewable. All controller switches shall be magnet operated with contacts of such design and material as to insure long life and reliable operation without overheating or excessive wear. Auxiliary control devices, such as multiple pole throwover switches, timing devices, reverse phase relays, etc., may be motor operated. All switches and relays shall be opened by gravity when power is interrupted, except those switches or relays which are magnetically or mechanically latched closed. Dash pots will be permitted in connection with operation of switches on controller panels, but must be constructed so dust or dirt will not interfere with their operation and they will not throw oil. All A.C. magnets shall be designed so residual magnetism will not interfere with proper operation.

12A-56 RESISTANCES: Starting and accelerating resistances shall be of either cast-iron grids or resistance wire. If cast-iron grids are used, they shall be insulated with an approved material equal to mica, and shall be assembled with a suitable device to maintain constant pressure at all temperatures. If of wire, the material used must be capable of withstanding frequent heating and cooling without excessive oxidation or crystallization and must not be affected by atmospheric conditions. Wire shall be wound on noncombustible forms or be rigidly supported by strips of such material.

12A-56.1 Fine resistances used in connection with solenoids, etc., are to be wire wound on noncombustible forms of insulating material and the whole unit mounted so as to be easily renewable.

12A-57 TERMINAL CONNECTIONS: Wiring for the various external control and operating circuits shall be brought to a terminal board and then shall continue to the various switches, solenoids, etc., on the controller panel. Terminal board may be an integral part of panel or a separate panel mounted adjacent to same panel or terminal blocks mounted on the panel. Each terminal is to have suitable indelible means of identification to facilitate testing of the various controller circuits. All connections of wires to terminal boards from external circuits shall be made with solderless pressure type wire connectors (cable lugs), except that for conductors less than No. 8 B. and S. gauge in size, terminal connections may be made either with approved terminal lugs (or eyelets) set on the wire with a special pressure type setting tool or with approved pressure type terminal blocks. Washers shall be provided between nuts and lugs (or eyelets) on terminal studs. When a number of external connections are made to the same terminal, stud washers shall be provided between lugs (or eyelets) to insure uniform seating and contact.

12A-58 IDENTIFICATION MARKINGS: Each device on the controller panels shall be properly identified by name, letter or standard symbol which shall be neatly stencil painted (or otherwise marked) in an approved indelible and legible manner on the device or panel. The identification markings shall be coordinated with identical markings used on the wiring diagrams.

12A-59 RHEOSTAT CONTROL SYSTEM: Rheostat control system for elevator shall consist of operating device or devices electrically connected with controller magnets or motor operated switches which make the various connections governing selection of fast or slow speed (where two speed motor is specified), direction of travel, acceleration, running, retardation, and stopping. Control system must be suitable for the type of motor used and the type operation specified. The controller and brake may operate on direct current obtained from an approved dry rectifier or an auxiliary motor generator set.

12A.59.1 The controller, whether for slip ring or squirrel cage motor, shall incorporate direction switches, reverse phase protection over current protection, phase failure protection and other devices required to effect the specified operation. In addition, where required to provide smooth acceleration, controller shall incorporate a suitable accelerating device. In any event, controller must have an accelerating device where the controlled motor is of the single speed type with a rating of 7-1/2 H.P. or more, or where the rated elevator car speed is 60 F.P.M. or more.

12A-59.2 Direction switches must make and break circuits and reverse motor. Switches shall be interlocked mechanically and electrically. Power must be applied to and removed from brake and motor simultaneously. Controller shall be arranged so elevator may be reversed rapidly without damage to motor or other equipment.

12A-59.3 Reverse phase relay shall be arranged to prevent starting the elevator motor on the reversal of any phase, except that on controllers where direction switches are operated by a polyphase reversible torque motor, or when an auxiliary polyphase motor driven direct current generator is used to supply brake and controller circuits, the reverse phase relay may be omitted.

12A-59.4 The controller shall be arranged to prevent starting of elevator motor after a failure in any phase except that on controllers where protection against phase failure is an inherent feature of controller, separate provisions therefor need not be made. In the event an auxiliary polyphase motor-driven direct current generator is used to supply the brake and control circuits, the auxiliary motor also shall be provided with protection against overload and single phase operation.

12A-59.5 Accelerating device shall cut out resistance in series with rotor or stator circuit so that the elevator will start, accelerate, retard and stop smoothly. Accelerating devices used in connection with two speed motors having a rating of 7-1/2 H.P. to 15 H.P. shall have not less than two steps of accelerating resistance for the low speed winding and at least one step of accelerating resistance for the high speed winding. Two speed motors having a rating in excess of 15 H.P. shall have at least two steps of accelerating resistance for each of the two speeds. When switching from high to low speed winding or vice versa, the motor must not be disconnected from the line at full voltage.

12A-59.6 Overcurrent protection shall be of the manually reset magnetic or thermal type arranged to effectively prevent hoisting motor damage due to overload current. Two speed motors shall be provided with overcurrent protection for both motor windings.

12A-59.7 All electric connections at elevator hoisting motor shall be made in suitable conduit connectors, or to suitable enclosed terminal blocks, securely fastened to the machine frame. In the case of self supporting conductors between motor and associated controllers, the machine leads may be extended from a brushed motor opening to controller terminals.

12A-60 OPERATION AND CONTROL: The operation shall be a special selective collective operation with the following features.

12A-60.1 A single key operated landing call switch shall be provided the Entrance Level. A Entrance Level call switch is provided in the console located in the Control Cab.

12A-60.2 A single push button landing call switch shall be provided at the Top Elevator Landing.

12A-60.3 The car operating panel shall contain push buttons for the Entrance Level and Top Elevator Landing. Provide a key operated button for intermediate landing for elevator in Tower H-3.

12A-60.4 A person or persons entering the elevator at the Entrance upon operating the Top Elevator landing button shall cause the car and hoistway doors to close, and when the doors are closed, the car shall be dispatched to the top landing.

12A-60.5 Operating the landing call button at the top level shall cause the car to travel to the top landing and the car and hoistway doors to open or remain open if the car is at the landing.

12A-60.6 The key operated button at the Entrance Level shall call car to this level and open the car and hoistway doors.

12A-60.7 Car and hoistway doors shall remain open for a short adjustable period of time and car shall be parked at its last call with both car and hoistway doors closed.

12A-60.8 The car operating panel shall contain, in addition to the two (2) landing push buttons, an emergency stop switch, an emergency call button, key operated light and fan switches, a key switch for both top-of-car and in-car maintenance operation, plus any other buttons or switches required for normal maintenance or special service. Provide key operated intermediate landing button for elevator in Tower H-3.

12A-60.9 Inspection operation shall consist of placing the in-car key switch on special operation and using special "up" and "down" buttons for constant pressure up and down operation. These buttons shall be located in the car and on top of the car. From in the car only, release of pressure on either of the buttons shall cause the car to stop and the car door at the (top landing) side to open.

12A-61 ELEVATOR CAR LEVELING DEVICE: The elevator car leveling device shall be of an approved two-way automatic maintaining type which will automatically bring the car to a stop with the car floor within 1/2 inch of exactly level with any landing floor for which a stop has been initiated (within a definite range of distance in advance of the landing) regardless of load or direction of travel. The car leveling device shall automatically correct over-travel as well as undertravel and shall maintain the car floor within 1/2 inch of exactly level with the landing floor regardless of the change in load affecting the stretch of the hoisting ropes. In case the car leveling device furnished functions through the medium of vacuum tubes or photo-electric tubes, the Contractor shall deliver to the Government Representative a complete set of all tubes for replacements for each elevator so equipped. Such tubes shall be delivered in their original sealed and labeled cartons.

12A-62 ELEVATOR GUIDE RAILS: The car and counterweight guide rails shall be of planed steel, standard T-section conforming in all respects with the requirements outlined in the A.S.E. Code.

12A-62.1 Generally the guide rails shall be supported by brackets secured to the hoistway framing at each floor. The guide rails shall be securely fastened to the brackets or other supports by approved heavy rail clamps. All necessary guide rail backing or additional supports shall be provided by the Contractor as required to prevent guide rail deflection and stresses exceeding the limits prescribed by the A.S.E. Code.

12A-62.2 Guide rails shall extend from the pit floor to the top of the hoistway. Guide rails shall be erected plumb and parallel with a minimum deviation of 1/8 inch. All shimming required shall be of metal securely held in place. Splice plates shall be located so as not to interfere with supporting clamps and brackets. Each splice plate bolt shall be fitted with a split spring steel lock washer. The guide rail anchorage at pit floor must be arranged to avoid puncturing of waterproofing.

12A-62.3 The finished surfaces of guide rails shall be coated with a corrosion preventive compound which shall be maintained until car is ready for operation. Before the car is placed in operation, the corrosion preventive coating shall be removed and the guide rails shall be thoroughly cleaned and smoothed. When the car is tested the guide rails shall be clean, free from rust and any signs of abrasion.

12A-62.4 When concrete beams or concrete walls are used for the support of guide rail brackets, fastenings shall be made to suitable concrete inserts. The concrete inserts and all information relative to their location shall be furnished by the Contractor. The concrete inserts will be placed in the concrete forms under another section of this specification.

12A-62.5 The open sides at the bottom of counterweight runway shall be provided with a counterweight pit guard conforming with A.S.E. Code requirements.

12A-63 ELEVATOR CAR SAFETY AND GOVERNOR: The car shall be provided with a governor actuated mechanical safety device mounted under the car platform and securely bolted to the car sling. The car safety shall be one of the following type conforming with the A.S.E. Code, identification and classification of car safety device namely:

Type A: Instantaneous type safety.

12A-63.1 The car safety shall be actuated by a speed governor (upon a predetermined overspeed downward from any cause) in such a manner as to grip both sides of each guide rail with substantially the same compressive force and thus stop and hold the car,

12A-63.2 Car safety marking plate shall be of corrosion resistant metal and, in addition to the data required by the A.S.E. Code, shall indicate the manufacturer's name and manufacturer's catalog designation number for safety.

12A-64 TYPE A INSTANTANEOUS SAFETY: Attention is directed to the A.S.E. Code requirements relative to required inertia application of safety under free fall conditions.

12A-65 SPEED GOVERNOR: The car safety shall be operated by a speed governor, located overhead, driven by a governor rope suitably connected to the governor rope releasing carrier. The proper tension in the governor rope shall be maintained by a weighted tension sheave located in the pit. The governor shall be equipped with rope grip jaws designed to clamp the governor rope so as to actuate the car safety upon a predetermined overspeed downward. The governor shall be set to trip at an overspeed not less than 115 percent of specified rated car speed and not more than the maximum governor tripping speed specified in Rule 206.2 of the A.S.E Code for the specified rated car speed. The rope jaws must be positively tripped within the permitted range of speeds. Rope grip jaws directly coupled to the governor mechanism so as to float with governor movement will not be permitted. Centrifugal type governors shall trip and set rope grip jaws within 60 degrees of governor sheave rotation after reaching rated tripping speed.

12A-65.1 Governor sheave shall be of hard alloy cast-iron, cast steel or semi-steel of approved composition with true running machine finished groove and flanges. Sheave shall be free from cracks, sandholes or other imperfections.

12A-65.2 The governor sheave shaft bearings shall be anti-friction type fitted with grease cups, grease gun connections or other equivalent means of lubrication. Suitable bearings and means of lubrication shall be provided for all other rotating parts, link pins, etc.

12A-65.3 Governor rope gripping device shall be so designed that no appreciable damage to or deformation of the governor rope shall result from the stopping acting af the device in operating the car safety. The rope grip jaws for a governor used with a Type B safety shall be of the parallel jaw type, or equivalent, of such shape and length that pull through action of governor rope as required by A.S.E. Code will result in a minimum amount of rope abrasion.

12A-65.4 The governor, governor rope and weighted idler tail sheave shall be mounted in such locations as to minimize danger of accidental injury to the equipment. Substantial metal guards shall be provided to protect the governor rope, gears, and rope gripping device from accidental fouling by maintenance personnel.

12A-65.5 Speed governor overspeed switches shall conform with A.S.E. Code requirements. The switches shall be so located and enclosed that excess governor lubricant will not enter switch enclosure.

12A-65.6 Governor parts (with the exception of finished bearing surfaces, screw threads, etc.) shall be finished at the factory with machine enamel. No painting of governor parts at the building will be permitted.

12A-65.7 The governor rope weighted tension sheave in pit shall operate in steel guides which shall permit free vertical movement of sheave while maintaining a uniform pre-determined governor rope tension. Tension sheave shall be similar to governor sheave and shall be provided with anti-friction bearings. Grease gun connections for sheave bearings shall be so located as to permit lubrication to be introduced while the sheave is in motion.

12A-66 CAR SAFETY AND GOVERNOR TESTS: The requirements for field tests on car safety and governor shall be as hereinbefore specified in ELEVATOR TESTS.

12A-67 HOISTING ROPES: Unless otherwise specified in the project specification, the hoisting ropes shall be 8 by 19 wire rope, traction steel, uncoated, fiber core. Wire rope shall conform to the applicable requirements of Federal Specification No. RR-R-571A, for the particular type of wire rope suitable for the service. The hoisting ropes shall be of such size and number as will insure adequate traction for the range of loads carried with a factor of safety not less than that required by the A.S.E. Code.

12A-67.1 The ends of hoisting ropes shall be properly secured to the car and counterweight headers (or to dead end hitch plates as the case may be) with adjustable rope shackles having individual tapered babbitted sockets. Each hoisting rope shackle shall be fitted with a suitable shackle spring, spring seat washers, shackle nut and lock nut and shackle end cotter pin.

12A-67.2 Hoisting rope data tag shall be of corrosion resistant metal.

12A-67.3 The Contractor must indicate on his shop drawings the number and size of hoisting ropes proposed to be used, the name of manufacturer, type, ultimate strength in tons, and the factor of safety.

12A-68 ROPE GUARDS: Where hoisting ropes run around a sheave or sheaves on car and counterweight, suitable guards shall be provided as hereinbefore specified.

12A-49 GOVERNOR ROPES: The governor rope shall be 6 by 19 or 8 by 19 wire rope, iron or traction steel, uncoated, fiber core conforming to applicable requirements of Federal Specification No. RR-R-571a for the particular type of wire rope suitable for the governor furnished. A governor rope data tag shall be provided securely attached to governor rope releasing carrier. Data tag shall be of corrosion resistant metal and shall bear the same data for governor rope as is required by A.S.E. Code on hoisting rope data tag.

12A-70 ELEVATOR COUNTERWEIGHT: A counterweight shall be provided for the elevator equal to approximately the weight of the complete car and 40 percent of the specified rated load. The counterweight shall be of the structural metal frame type conforming with all requirements of Section 202 of the A.S.E. Code. Tie rods shall pass through holes in each subweight and through holes in frame members above and below subweights in such a manner as to securely hold subweights in place. Cracked or broken subweights will not be accepted. Guide shoes shall be as hereinafter specified.

12A-71 ELEVATOR CAR AND COUNTERWEIGHT BUFFERS: Suitable spring buffers with necessary blocking and supports shall be provided under the elevator car and counterweight. The buffers shall comply in all respects with the requirements of the A.S.E. Code. Buffers must be suitable for installation in the space conditions available. Buffer anchorage at pit floors must be arranged to avoid puncturing of waterproofing. Buffer marking plates shall be of a corrosion resistant metal with the data required by A.S.E. Code. The Contractor must indicate on the elevator shop drawings the name of buffer manufacturer, buffer stroke, certified maximum and minimum loads, and certified maximum striking speed.

12A-72 ELEVATOR - NORMAL AND FINAL TERMINAL STOPPING DEVICES: Normal and final terminal stopping devices shall be provided for elevator conforming with A.S.E. Code requirements. Terminal stopping devices located in hoistway or on the car and operated by cams shall be fitted with rollers having a rubber or other approved composition tread to provide practically silent operation when actuated by the cam. Normal terminal stopping device for elevator may be mounted in hoistway, on top of the car, or in the machine room.

12A-73 ROLLER GUIDE SHOES: Roller guide shoes shall be furnished, securely bolted to the car and counterweight frames at top and bottom. Each roller guide shall consist of a set of three sound reducing wheels, not less than 3-3/4" in diameter, to run on the three finished rail surfaces. The wheels shall be mounted in precision type ball bearings and held in contact with the rail surfaces by means of adjustable cushioning devices. Roller guides shall run on dry unlubricated guide rails.

12A-74 CAR FRAME AND PLATFORM: The car frame and car platform shall conform with the requirements of the A.S.E. Code. The car frame shall be constructed of structural steel members. The car platform shall consist of a steel frame with necessary steel (or wood where permitted by class of loading) stringers all securely riveted, bolted or welded together. The frame and platform shall be so braced and reinforced that no strain will be transmitted to the elevator car. Platform shall be provided with a two-ply wood or steel sub-floor. The underside of wood platform and exposed surfaces of wood platform stringers shall be covered with not less than 27 U.S.S. gage sheet steel with all exposed joints and edges folded under.

12A-74.1 The platform shall be equipped with cast nickel silver (nickalun) threshold plates with necessary grooves for the car door. The platform shall be mounted on rubber pads to isolate it from the car frame.

12A-74.2 Sheet vinyl flooring, .090" thick, conforming to Federal Specification L-F-00475, shall be securely cemented to the flooring. A semi-saturated flooring felt shall be provided over wood subfloors. Color and pattern of flooring shall be as noted on the Color Schedule on the drawings.

12A-75 DATA AND LUBRICATION PLATES: The data and lubrication plates secured to car crosshead (or located in car for underslung elevator) shall be of a corrosion resistant metal.

12A-76 CAR AND HOISTWAY DOOR OPERATORS: A motor driven electric operator shall be provided to open and close the proper set of car doors and hoistway doors when the car is at a landing. The car door and hoistway door at any landing shall be opened and closed simultaneously. Door movements shall be cushioned or checked at both limits of travel. An electro-mechanical interlock shall be provided at each opening to prevent the operation of the elevator unless all doors, including emergency access doors to shaft are closed and locked. An electric contact shall be provided on the car doors to prevent the operation of the elevator unless the car door is closed.

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12A-76.1 The door operator shall be so arranged that, in case of interruption of failure of electric power from any cause, the doors can be readily operated by hand from within the car. Emergency devices and keys for opening the doors from the landing shall be provided as required by the local codes.

12A-76.2 The doors on the proper side shall open automatically when the car has reached the respective landing, and shall again close after a predetermined time interval has elapsed. A "Door Open" button shall be provided in the car, the momentary pressure of which shall reverse the motion and reopen the doors.

12A-76.3 Each car door panel shall be provided with a protective device extending the full height and projecting beyond the front edge of the door. This device shall be so arranged that should it touch a person or any obstruction in its patch while the car door is closing, it shall automatically cause both the car door and the hoistway door to return to the open position. The doors shall remain open until the expiration of a time interval and then close automatically. The pressing of a car button, once the doors are fully open, shall cause the doors to close immediately. The protective devices shall retract when the door is fully opened to provide the maximum clear entrance and shall automatically advance as the door starts to close. Upon actuation of the protective device, the doors shall open fully and start to close after an adjustable delay of about 1/2 second.

12A-77 DOOR HANGERS AND TRACKS: Furnish and install for each hoistway entrance necessary hangers and tracks complete. Hangers shall be of the sheave type arranged for two-point suspension of the doors. Hanger brackets shall be integral with the door or applied. Sheaves and rollers shall be of steel and shall include ball bearings properly sealed to retain grease lubrication. Adjustable ball bearing rollers shall be provided to take the up-thrust of the doors. Tracks shall be cold drawn or cold rolled steel of smooth surface and working section and shall be cleaned and oiled with wick type lubricators. Suitable means shall be used to transmit motion from one door panel to the other.

12A-78 CAR ENCLOSURE: The Contractor shall provide the elevator with a car enclosure (cab) complete with car doors, light fixture, certificate frame, capacity plate and other required accessories. The canopy and ceiling shall be sufficiently reinforced to withstand the distributed weight of two men. Provide emergency exit as detailed. The cabs shall be approved construction in accordance with the details indicated on the drawings. Provide each elevator cab with stainless steel pad hooks and a set of pads with cut-out at controls.

12A-78.1 Car doors shall be of the center opening horizontal sliding type with flush surfaces. Panel rigidity shall be obtained by suitable steel reinforcement. The car side surface of the doors shall be stainless steel. Doors shall be hung on rubber tired sheave hangers, with sheaves not less than 3-1/4" diameter running on a polished steel track and guided at the bottom by non-metallic shoes sliding in a smooth threshold groove.

12A-78.2 A combination electric heater and electric fan shall be provided mounted on the car top. The heater shall be of 1000 watt capacity and be thermostatically controlled. The fan shall have a capacity of 400 c.f.m.

12A-79 HOISTWAY ENTRANCES: Hoistway entrances shall be furnished in accordance with details indicated on drawings and shall consist of stainless steel frames, center opening flush doors, side panels, transom panels, hinged panels, sills, plates, hanger supports, struts and closer angles, hanger cover plates, tracks and hangers, hardware and all other accessory items required for a complete installation.

12A-79.1 Frames: Fabricate from 1/4" thick stainless steel bar stock, in accordance with details, securely fastened to sills and header except Top Elevator Landing frames, which shall be of bent stainless steel plate as detailed on drawings.

12A-79.2 Doors and Panels: Doors shall be center opening type to provide jamb opening as indicated on drawings. Doors and panels shall be flush door construction and shall contain suitable material for sound deadening. Unless otherwise indicated, sliding doors shall be 1-1/4" thick; side panels and transom panels 1-1/2" thick, and hinged doors to Cable Shaft 1-3/4" thick. Panels shall be formed of not lighter than #16 gauge furniture steel, with all joints welded, and reinforced with continuous interlocking stiffener members. Sliding door panels shall be reinforced as required for hangers, interlock, door closer or operator and keyways. Hinged doors shall be reinforced for hardware. Bottom of sliding doors shall be provided with removable non-metallic sill guides to run in the sill slots with minimum clearance. All doors and panels shall be of weatherproof construction and bear 3 hr. label. Construction of doors and panels shall conform to the requirements of the Underwriters' Laboratories, Inc.

12A-79.3 Sills: The sills shall be cast nickel-silver (nickalun) with approved non-slip wearing surface. Grooves for the door guides shall have minimum clearance for the guides. The sills shall be supported on steel anchors securely fastened to the floor construction.

12A-79.4 Toe Guards: Toe guards, made of #14 gauge steel, shall be supplied at all landings and they shall be beveled to the wall as detailed.

12A-79.5 Hanger Supports or Headers: Hanger supports shall be 3/16" thick formed steel sections securely bolted to the strut angles or closer support angles.

12A-79.6 Struts and Closer Angles: Structural steel angles shall be furnished of sufficient size to accommodate the door closers. Angles to be continuous and securely bolted to the sills and the building structure above.

12A-79.7 Hanger Cover Plates: Hanger cover plates shall be made of #14 gauge steel and shall extend the full travel of the doors. Covers shall be made in sections for convenient access when servicing the hangers. The sections above the door openings shall be removable from within the elevator car. Hanger cover plates shall be beveled to the wall as required.

12A-79.8 Hardware: Sliding hoistway entrance doors shall include service or emergency keyways to meet code requirements. Hinged doors to Cable Shaft at Top Elevator Landing shall be provided with ball bearing hinges and heavy duty mortise cylinder lockset, exposed portions to be chrome plate, dull finish.

12A-79.9 Finish

12A-79.9.1 Doors and Panels: Baked enamel finish, both sides, in color as noted on the Color Schedule on the drawings.

12A-79.9.2 Stainless Steel Frames: No. 4 satin finish.

12A-79.9.3 Hanger Covers and Toe Guards: Standard black finish.

12A-79.9.4 Structural Parts: Shop coat of rust inhibiting black paint.

12A-79.9.5 Baked Enamel Finish: "Bonderized" rust inhibitive base and 7-coat baked-on enamel finish.

12A-79.10 Emergency Access Doors to elevator shaft for Tower H-2 will be furnished under another Section of the Specifications and shall be equipped under this Section with approved type interlocks for emergency use only, openable only by a special key operated lock for inspection purposes from either the corridor or hoistway sides. The Government waives any code requirements which restricts the use of these entrances.

12A-80 CERTIFICATE FRAME: A glass or clear plastic faced, metal framed, certificate holder shall be provided in the elevator car. The certificate measuring 8 inches wide by 5-1/4 inches high, and having a legend 7-3/8 inches wide by 4-1/2 inches high.

14A-81 ELECTRIC SERVICE, ETC.: The elevator signal system shall either be adapted to the electric service at the building, or necessary transformers or motor generators shall be provided in the elevator machine room to change current characteristics to suit the signal equipment. In all cases where lamps are used a voltage of 110-120 volts must be provided. Suitable overload protection shall be provided for transformer or motor generator (if used).

12A-81.1 Transformers or motor generators (if used) shall have sufficient capacity to carry the signal system load under all conditions of operation with a temperature rise of not exceeding 50 degrees C., above the temperature of surrounding atmosphere.

12A-81.2 Motor generators, if used, shall have self-lubricated bearings, a rated speed of not exceeding 1800 R.P.M., and suitable vibration isolating mounting provisions.

14A-82 SIGNAL CONTROLLER: The signal controller shall be so located as to be protected against possible mechanical injury. The contact machine may be driven either mechanically or electrically but, if driven by shaft, chain, or similar means requiring its definite location relative to the elevator machine, it is to be placed in a location to insure against possible mechanical injury, or is to be provided with suitable metal guards.

12A-83 CAR EMERGENCY SIGNAL BELL: The car emergency signal bell shall be of the monitor type suitable for outlet box mounting and shall have a six (6) inch diameter gong. The bell shall be arranged to sound when emergency signal push button in the car operating panel is pressed and also when emergency stop switch in the car operating panel is operated. The bell shall be energized by a suitable signal transformer connected through fuses to a signal electric service source. The emergency signal bell shall be mounted in elevator hoistway at lower main terminal.

12A-84 LANDING CALL BUTTON FIXTURES: The landing call button fixture face plates shall be of corrosion resisting (stainless) steel with buttons as required by the type of signal system or operation specified.

12A-85 HOISTWAY DOOR INTERLOCK: Each elevator hoistway door, including emergency access doors to elevator shaft, shall be equipped with an approved hoistway unit system, hoistway door interlock. The interlock shall prevent the operation of the elevator driving machine by the normal operating device unless the hoistway door is locked in the closed position (as defined by the A.S.E. Code), except when the car is in the landing zone and is either stopped or being stopped, or the hoistway access switch at that landing is operated. The interlocks shall also prevent the opening of a hoistway door from the landing side unless the car is within that landing zone and is either stopped or being stopped. Retiring cams used to actuate interlocks shall be securely fastened to car construction and shall be designed to operate without objectionable noise, shock or jar. Interlocks shall be so located that they are not accessible from the landing side when the hoistway doors are closed.

12A-86 CAR DOOR ELECTRIC CONTACTS: The elevator car door shall be equipped with an approved electric contact which will prevent the operation of the elevator driving machine by the normal operating device unless the car door is in the closed position (as defined by the A.S.E. Code), except when the car is in the landing zone and is either stopped or being stopped, or the hoistway access switch at that landing is operated. Car door contacts shall be so located that they are not readily accessible from the inside of the car.

12A-87 CAR TOP EMERGENCY EXIT ELECTRIC CONTACTS: Car top emergency exit shall be equipped with an electric contact conforming with requirements hereinbefore specified for car door contact.

12A-88 TEST REQUIREMENTS: No type of hoistway door interlock, car door contact, or car top emergency exit contact will be accepted unless it has met all applicable functional and engineering tests requirements of the A.S.E. Code. The Contractor will be required to submit for approval engineering test reports showing that the hoistway door interlocks, car door electric contacts, or car top emergency exit electric contacts proposed to be used meet the requirements of the A.S.E. Code and have been so certified by the National Bureau of Standards, Washington, D.C., or other competent approved laboratory.

12A-89 ELECTRICAL INTERFERENCE SUPPRESSION: The Contractor shall include an allowance of $500 to cover the cost of testing the complete elevator plant, after installation for radio frequency interference with other equipment and to take the necessary remedial measures required for the suppression of such interference.

12A-90 CAB INTERCOM: The cab intercom system is specified under the Electrical Section of the Specifications. Under this Section provide openings, including necessary supports to receive the intercom system and all required wiring between the hatch junction box and the elevator cab.

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DIVISION 13

GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK

13-01 SCOPE: This section of the specifications applies to and forms a part of those sections covering the plumbing, heating, ventilating, air conditioning, and electrical systems.

13-02 GENERAL AND SPECIAL CONDITIONS: Attention is specifically called to those sections covering General Conditions and Special Construction Conditions, which contain instructions and procedures applying directly hereto.

13-03 PLANS:

13-03.1 Drawings numbered with an "M", "E", or "ME" prefix show the extent of the work contemplated by the plumbing, heating, ventilating, air conditioning, and electrical specifications.

13-03.2 Exceptions and inconsistencies in plans and specifications shall be brought to the attention of the Contracting Officer before contract is signed; otherwise, the Contractor shall be responsible for any and all changes and additions that may be necessary to accommodate his particular apparatus.

13-03.3 The plans are intended to show the general arrangement and the extent of the work contemplated. The exact location and arrangement of all parts shall be determined after equipment has been approved by the Contracting Officer, as the work progresses, to conform in the best possible manner with the surroundings, and as directed by the Contracting Officer.

13-03.4 Figured dimensions shall be followed without regard to scale; where no figures or notations are given, the plans shall be followed.

13-04 SYMBOLS: Symbols for the various outlets, piping, and wiring systems are noted on the plans, and shall be strictly adhered to in connection with all work. Should the Contractor be in doubt regarding the real meaning and intent of the various symbols used, he shall confer with the Contracting Officer for interpretation, whose decision shall be final.

13-05 MATERIALS AND WORKMANSHIP:

13-05.1 All materials shall be new and the best of their respective kinds, and shall bear the label of the NBFU, ASME Code, AGA, etc., where such standard has been established for the particular item of equipment used.

13-05.2 All materials shall be manufactured in the United States of America, unless otherwise specifically indicated.

13-05.3 All workmanship shall in all respects be of the highest grade, and all construction shall be done according to the best practice of the trade.

Work shall be done by mechanics experienced and skilled in the trade involved. All work shall be completed to the entire satisfaction of the Contracting Officer.

13-05.4 Naming a manufacturer, brand, or model number as part or all of the description of manufactured items shall be deemed to include any description or specifications of such items in that manufacturer's catalogues, advertisements or other representatives. Should there be contradictions or variations in that manufacturer's literature currently available, the better quality or greater quantity of material or workmanship described shall be furnished under this contract. Indication on drawings and/or naming in specifications of model numbers of a particular manufacturer shall not be construed as excluding from consideration similar and essentially equivalent items produced by other manufacturers, subject to the procedure outlined below and to the following provisions:

13-05.4.1 Each item of equipment shall fit the plan and space allowed, shall conform to the surrounding conditions, and shall fulfill completely the functions for which it is intended as well as or better than the item named on the drawings or in the specifications.

13-05.4.2 Full and complete catalogue illustrations, specifications, and descriptive data defining in detail each item shall be submitted for approval as outlined herein, before placing any order for such item.

13-05.5 The availability of equipment and service personnel representing the manufacturer in the area will be a factor for consideration of the submittals. Manufacturer's service organization and stock of replacement parts at a reasonably close location (within a sixty (60) mile radius of the project) will be required.

13-06 SHOP DRAWINGS AND SUBMITTAL DATA: Detailed shop drawings, manufacturers' catalogue data, and certified capacity data shall be submitted in accordance with the procedures set forth in the General Conditions Section, for all items of mechanical and electrical materials and equipment to be furnished under this contract.

13-07 ORDINANCES, PERMITS, FEES, AND CERTIFICATES:

13-07.1 All labor and materials shall be in strict conformance with the rules and recommendations of the National Board of Fire Underwriters, municipal and state codes and regulations, local electric, telephone, and gas companies, American Gas Association, National Electrical Code, or any other authorities that may have lawful jurisdiction pertaining to the work.

13-07.2 Contractor shall procure all necessary permits, licenses, or inspections to carry out his work and shall pay the lawful fees therefor. Contractor shall procure and pay for all necessary certificates of approval, which must be delivered to the Contracting Officer before final acceptance of the work.

13-08 INTERFERENCES: The plans are generally diagrammatic, and the Contractor shall harmonize the work of the different trades so that interferences between the mechanical and electrical work and the architectural and structural work will be avoided. All piping, ductwork, and electrical raceways shall be installed as close as possible to walls, floors, columns, ceilings, and beams, and offsets or special fittings shall be installed in lines as required to accomplish this end whether or not shown on plans.

13-09 PRECEDENCE: The mechanical and electrical work shall have precedence over each other in the following sequence.

(1) Soil, waste, vent, and drain piping
(2) Steam and condensate return piping
(3) Condensate drain piping
(4) Hot water heating piping
(5) Refrigerant piping
(6) Fuel oil piping
(7) Electrical cable tray
(8) Ductwork
(9) Plumbing water piping
(10) Electrical, except cable tray

13-10 LARGE EQUIPMENT: Large pieces of equipment which are to be installed in the building, and which are too large to permit access through doorways, stairways, or shafts, shall be brought to the job by the Contractor and placed in the spaces before the enclosing structure is completed. Where existing walls, etc., must be removed to permit installation of large equipment removal work and replacement shall be handled in the same manner as specified for CUTTING AND PATCHING. Equipment shall be cribbed up from the floor by the Contractor and covered with tarpaulins or other protective covering where necessary or directed.

13-11 PROTECTION OF WORK AND MATERIALS:

13-11.1 All work, materials, and equipment, whether incorporated in the building or not, shall be protected at all times against the weather (rain, windstorms, frost, ice, or heat) so as to maintain them free from injury or damage. At the end of each day's work, all work likely to be damaged shall be covered.

13-11.2 Building openings shall be covered to protect the building from the weather.

13-11.3 Finished floors, step treads, Government owned or furnished equipment, and all finished surfaces, exterior or interior, shall be protected against damage by workmen or equipment during the work. Wherever materials are hoisted to roof or carried into building, surfaces must be covered with a layer of heavy building paper.

13-11.4 Equipment shall be kept in out of the weather, and shall be kept covered. Where work is to be done above equipment, the Contractor shall provide full and solid wood platforms above such equipment, to prevent its being damaged or soiled.

13-11.5 Any and all equipment, piping, motors, insulation, etc., which in the opinion of the Contracting Officer becomes damaged, abused, inundated, or otherwise harmed beyond normal and minor repair, shall be replaced with new equipment or material at no additional cost to the Government.

13-11.6 The Contractor shall be proportionately and representatively responsible for all damage done to Government property or adjacent properties during the construction. The above protection shall be maintained while the work is being done, and in no case shall dirt or grit be ground into floor finishes or floor coverings.

13-12 STORAGE OF MATERIALS:

13-12.1 The Contractor shall be responsible for the transportation of his materials to and on the job, and shall provide space for storage of his materials and equipment at ground level. Roof surfaces shall not be used for storage of materials or equipment. Any storage within the building shall be approved by the Contracting Officer prior to use of the space.

13-12.2 Pipe, fittings, or other materials stored outside of buildings shall be set on wood or steel racks or platforms at least 12" above grade. All necessary provisions shall be made to keep water and debris away from such stored material. Ends of pipes and valves shall be kept sealed until used.

13-12.3 Equipment subject to rusting shall be kept warehoused until just prior to setting.

13-13 TEMPORARY USE OF EQUIPMENT FOR CONSTRUCTION PURPOSES:

13-13.1 The permanent equipment installation shall not be used for temporary purposes by the Contractor without express permission in writing signed by the Contracting Officer.

13-13.2 Temporary use shall not be construed as to mean "bumping" of electric motors on equipment to verify rotation direction nor short time operation of systems for test purposes, operation of fuel oil burners and boilers to set temperature controls, operation of refrigeration systems for short periods to adjust controls and temperature regulation, or the operation of fans for air balance tests.

13-13.3 Where the use of the permanently installed heating, ventilation or air conditioning systems is used for extended periods to maintain ventilation, heating or cooling in the building for the purpose of comfort of workmen in

accordance with established trade union regulations, such use shall be strictly governed in accordance with the provisions contained in the General Conditions made part of this specification.

13-14 UTILITIES: The Contractor shall connect all mechanical and electrical utilities at the manholes or other points indicated on the drawings, and extend such utilities to the building and to all equipment or facilities requiring same.

13-15 EXCAVATING AND BACKFILLING:

13-15.1 All excavating and backfilling necessary for the installation of work is specified under another Division. The Contractor shall shore, bail, and pump all trenches for lines laid in ground and shall maintain said trenches dry until the work has been tested and approved. After piping has been approved, trenches shall be immediately backfilled.

13-15.2 All trenches shall be backfilled in such a manner as to secure a stable surface, with clean earth or sand, rammed down, soaked with water, and made solid. All surplus excavating material shall be disposed of.

13-15.3 Where graveled or paved areas are disturbed, the expense of repairing same, in a manner suitable to the Contracting Officer shall be included in the contract.

13-16 LOCATION OF OUTLETS:

13-16.1 The location of all pipes, outlets, appliances, etc., shown on plans, if not specifically dimensioned are approximate only, and understood to be subject to such minor revision as may be found necessary or desirable at the time work is installed. With regard to electric outlets in particular, the Contracting Officer reserves the right to move any outlet as much as six feet horizontally and/or vertically without additional charge, until such time as the outlets have been roughed in.

13-16.2 Generally, all outlets shall be properly centered in rooms, panels, and other finished work, and shall not interfere with outlets or equipment of other trades, and shall meet the dimensioned or large scale architectural and structural drawings.

13-17 CUTTING AND PATCHING:

13-17.1 The Contractor shall be responsible for all cutting required for the proper installation of his work, and shall obtain permission from the Contracting Officer before doing any cutting. Cutting shall be done in such a manner that the surrounding work will be restored to its original condition.

13-17.2 NO STRUCTURAL MEMBER MAY BE CUT WITHOUT WRITTEN PERMISSION FROM THE CONTRACTING OFFICER.

13-17.3 When cutting and patching is done in occupied spaces within the building, the Contractor shall provide a dust-tight enclosure and any other necessary protection around his operation in order to protect equipment and finishes.

13-17.4 Openings cut through the roof or exterior walls shall be provided with a temporary watertight cover during construction or until equipment installation or repair has been made.

13-17.5 The Contractor shall provide chases as indicated on the drawings. The Contractor shall also be responsible for coordinating and obtaining from all Subcontractors the correct sizes and locations of all such chases, slots, etc., in sufficient time that they may be built in as the building construction progresses.

13-18 PRECAUTION AGAINST NOISE AND VIBRATION:

13-18.1 The Contractor shall take the utmost precautions in the installation of his equipment, piping, and systems to prevent noise and vibration transmission.

13-18.2 Equipment that would tend to cause noise or vibration shall be isolated to prevent noise transmission to the building or to other equipment.

13-18.3 Piping, conduit, etc., connected to equipment shall be isolated. The Contractor shall be responsible for the prevention of noise and vibration transmission through his connections to equipment.

13-19 PIPING, HANGERS, SUPPORTS, ETC., GENERALLY:

13-19.1 All piping, electrical raceway, ductwork, etc., except electrical raceway where run concealed, shall be installed parallel or perpendicular to the lines of the building, unless distinctly shown or noted on plans otherwise. Spacing of lines shall be such as to provide not less than 1/2" clearance between finished coverings on the various services.

13-19.2 The Contractor shall furnish all foundations or supports for the work installed. All bell and spigot soil pipe shall have hangers not more than 5' on centers. All other piping less than 2" shall have hangers spaced not more than 5' on centers, and all piping over 2" shall have hangers spaced not more than 10' on centers.

13-19.3 Supports to walls, other than poured concrete, shall be made with "Molly" bolts.

13-19.4 Perforated strap hangers shall not be used for any work.

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13-19.5 Insulation protection saddles shall be used at each hanger for all insulated refrigerant or chilled water lines. All saddles shall be not less than 14 gauge galvanized steel jackets, covering at least the lower half of the insulation and not less than 10" long. Saddles shall be secured with copper or aluminum wire.

13-19.6 Hangers for piping shall be adjustable split ring malleable iron similar and equal to "Fee & Mason" #199, with threaded rod and turnbuckle in rod where hanging height permits. Except for insulated refrigerant or chilled water lines, hangers shall be sized to fit the pipe.

13-19.7 Exposed electrical raceway shall be supported with hangers same as specified for piping, except that hangers may be solid-ring type similar and equal to "Fee & Mason" #198. Concealed electrical raceway not in concrete shall be supported as best suited by conditions with steel or cast iron supporting hangers or wall clips secured to construction.

13-19.8 Trapeze hangers may be used for multiple parallel piping runs where specifically indicated on the plans, or elsewhere with permission of the Contracting Officer.

13-19.9 All piping shall be installed so as to allow for expansion and contraction using offsets, swing joints, etc., as shown or as may be required to prevent undue strain on piping.

13-19.10 Pipe shall be cut accurately to fit. No bending or springing of pipe will be permitted.

13-19.11 All water piping shall be arranged for draining through fixtures, or to floor drains where necessary, by means of 1/2" lockshield valves.

13-20 PIPE JOINTS:

13-20.1 Joints in cast iron soil pipes shall be caulked joints made with picked oakum and molten lead, 12 ounces of which shall be used for each inch in diameter of the pipes, at each joint, and must be poured in at one time. The lead to be used for this purpose shall be soft "pig" or "bar". After cooling and shrinking, the lead shall be thoroughly caulked and the joints made impermeable to gases and liquids and also be capable of withstanding the tests applied. The face of the lead joints shall be left without putty, paint, or cement. Wherever joints are made on the floor or surface, they shall be recaulked after being placed in position.

13-20.2 Joints in cast iron water piping shall be made up in a similar manner to those in cast iron soil pipe, except that packing shall be square braided or hard twisted fiber hemp or jute. Mechanical joints of the stuffing box type, using a suitable gasket, cast iron gland, and bolts will be acceptable.

13-20.3 Joints in threaded piping shall be made only with best linseed oil and graphite or with "Jointite" applied on the male thread only. The ends of pipes shall be square cut, reamed, and wiped clean before being made up into fittings.

13-20.4 Joints in clay pipe shall be made with picked oakum caulked into place and sealed with hot poured bituminous compound, equal to "GK" sewer joint compound.

13-20.5 Joints in copper piping, except refrigerant piping, shall be "sweated" with 50-50 solder. Before making up joints, all copper shall be cleaned to bright metal with emery cloth, and treated with "NoKerrode" or equal flux. Joints in copper refrigerant piping shall be made up with silver solder, "Silfos", or equal.

13-20.6 The openings of all pipe shall be capped during construction. All steel pipe, before installation, shall be stood on end and pounded to remove dirt and scale, and shall be properly reamed before joints are made up.

13-20.7 Where lead connections are made to soil pipe, brass ferrules of same size as pipes shall be used, and the joints shall be wiped.

13-20.8 All ferrous to non-ferrous pipe connections shall be made with approved dielectric couplings or flange union isolating joints, to prevent any electrolytic action between dissimilar metals.

13-20.9 All connections between threaded pipe and cast iron soil pipe shall be made using tapped openings, or shall be caulked with lead and oakum. When joints are caulked, the end of the screwed pipe shall be fitted with a ring or part of a coupling screwed on to form a spigot.

13-20.10 Any piece of threaded pipe 8" or less in length shall be considered a nipple. All nipples with unthreaded portion 1½" or less shall be extra-heavy; all other nipples shall be of weight corresponding to balance of pipe line and fitting connected. Only shoulder nipples shall be used; close nipples will not be acceptable.

13-21 UNIONS:

13-21.1 No unions are to be placed in any pipe in a location which will be inaccessible after completion of the building unless specifically shown on plans or specified otherwise.

13-21.2 Unions shall be installed on each side of all special valves, regulators, etc., and one side of all check valves, thermostatic traps and at all pieces of equipment such as pumps, heating units, tanks, etc., so that such equipment may be readily disconnected.

13-21.3 Where joints are made up with bolted flanges, separate union fittings as such will not be required.

13-22 SLEEVES:

13-22.1 The Contractor shall provide sleeves for all lines passing through walls, floors, beams, foundations, and roof slabs, subject to approval of the Contracting Officer.

13-22.2 All sleeves through suspended floors and slabs shall be constructed of 26 gauge, zinc-coated, sheet iron or 22 gauge aluminum. All sleeves in walls, beams, and foundations shall be black, standard weight steel pipe, or cast iron soil pipe.

13-22.3 All sleeves through below-grade or exterior building surfaces shall be thoroughly caulked and waterproofed. All sleeves shall be installed with ends flush with the finished surfaces, except floor sleeves shall project 1" above finished floor.

13-23 FLOOR AND CEILING PLATES: All exposed piping and electrical raceway passing through walls, ceilings, and floors shall be provided with set-screw held, floor and ceiling plates. Plates shall be chrome plated brass.

13-24 ELECTRIC MOTORS AND CONNECTIONS, GENERALLY:

13-24.1 Unless otherwise noted, all motors shall be of the squirrel cage, 40 degree C. continuous rated, standard frame type, and the horsepower, speed, phase, and voltage hereinafter specified. Motors shall be "Wagner", "Century", "Allis Chalmers", "Electro-Dynamic", or equal.

13-24.2 Motors shall be furnished and installed under the specification section calling for such motor. The furnishing of motors shall include the furnishing of all starting and control equipment, except that specifically noted to be furnished as an integral part of electrical switchgear, motor control centers, or motor starter panelboards. Each and every motor shall have a starter with overload and undervoltage protection.

13-24.3 The erection and connection of all switches, starting and control equipment, including the furnishing and installing of disconnect switches as indicated or required, shall be done under the Electrical specification section. Conduits from controllers to motors shall be flexible for not over three feet, and shall be attached to the terminal housing of the motor.

13-24.4 All motor horsepower ratings called for on the plans or in these specifications are minimum acceptable ratings based on the original design and on the use of the equipment exactly as detailed or specified. Any change in motor size brought on directly or indirectly by substitution of equipment having characteristics peculiar to iteself requiring such change shall be the responsibility of the Contractor furnishing the motor, unless the substitution was initiated by the Government.

13-24.5 The responsibility of the Contractor as mentioned in the previous paragraph shall include the furnishing and installing of the proper size motor

and drive, subject to the approval of the Contracting Officer and free of any additional cost to the Government. It shall also include responsibility for any increase in electrical equipment and installation costs, over and above that required to comply with the original design.

13-25 MOTOR STARTERS AND CONTACTORS:

13-25.1 Starters for single phase non-electrically interlocked motors shall be flush mounted single or double pole switches as required, with red filament type pilot lights and stainless steel face plates, equal to "Allen-Bradley" #62P or "Cutler-Hammer" #9101.

13-25.2 Starters for single phase electrically interlocked motors, and three phase 208 or 220 volt motors up to 15 horsepower, shall be one, two, or three pole, 60 cycle, 600 volts, across the line magnetic contactors, with general purpose enclosures, thermal overload protection for each phase, and with undervoltage protection when used with momentary contact pilot devices or undervoltage release when used with maintained contact pilot devices.

13-25.3 Starters for 208 or 220 volt 3 phase motors larger than 15 horsepower shall, unless otherwise noted, be Wye-Delta type, 60 cycle, part-winding, reduced in-rush, increment magnetic contactors, with general purpose enclosures, thermal overload protection on each phase, and undervoltage protection when used with momentary contact pilot devices or undervoltage release when used with maintained contact pilot devices. Starters shall contain a definite adjustable time-delay relay to transfer from start to run connection.

13-25.4 Contactors for lighting or other non-motor use shall be one, two, or three pole, 60 cycle, 240 volt, across the line magnetic contactors, specifically rated for tungsten, fluorescent, or mercury arc lamp loads, either mechanically or electrically held, as indicated on the drawings. Contactors shall have general purpose enclosures and thermal overload protection for each phase.

13-25.5 Starters or contactors requiring electrical interlock contact points shall be so furnished as indicated or required.

13-25.6 Starters or contactors installed outside the building, or otherwise exposed to the weather, shall be furnished with weather-resistant NEMA Type 3 enclosures in lieu of general purpose enclosures.

13-25.7 Starters or contactors installed in hazardous locations or as otherwise indicated, shall be provided with Class I, Groups C or D, NEMA Type 7 enclosures, in lieu of general purpose type.

13-25.8 All starters or contactors of any one type furnished under this contract shall be of the same manufacture.

13-25.9 Starters or contactors furnished as integral parts of factory-assembled pre-wired equipment shall conform in general to the above requirements, as they may be applicable in the opinion of the Contracting Officer.

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13-26 PUSHBUTTON STATIONS:

13-26.1 All magnetic contactors shall be provided with heavy-duty type pushbutton station, rated for 10 amperes continuous load at 600 volts or less.

13-26.2 Enclosures shall be general purpose NEMA Type 1, except that push-button stations installed outside the building or otherwise exposed to the weather shall be dust and weathertight, NEMA Type 4, and those installed in hazardous areas shall be explosion-proof, NEMA Type 7. Enclosures shall be provided for surface mounting, except as otherwise indicated.

13-26.3 Pushbutton stations for non-interlocked contactors shall be momentary-contact type with start button, stop button, and red indicator light. Where required for delayed "seal-in" or where otherwise noted, push-buttons shall be maintained-contact type.

13-26.4 Pushbutton stations for electrically interlocked contactors shall be provided with "hand-off-automatic" selector switches, and both red and green indicator lights.

13-26.5 Pushbutton stations requiring other special features shall be provided as required or otherwise indicated.

13-27 ACCESS PANELS:

13-27.1 The Contractor shall furnish and install a steel access door for each of his valves, group of valves, or other controlling mechanism which would otherwise be concealed in the building construction.

13-27.2 Access doors in walls shall be similar and equal to "Milcor" steel access doors and shall be Type "M" for masonry and Type "K" for lath and plaster, as the condition requires. Each door shall be furnished with a flush screwdriver-operated lock and shall be furnished with one prime coat of gray rust inhibitive paint. Each access door shall be approximately 12" wide and 18" high.

13-27.3 Access doors in ceilings shall be similar and equal to "Milcor", Type "A", 24" x 24", and otherwise similar to those for walls.

13-28 CLEANING, TESTING, AND ADJUSTING, GENERALLY:

13-28.1 The Contractor shall at his own expense, during the progress of the work, or upon its completion make such tests of his work as are hereinafter specified under the various specification sections, or as required by the Contracting Officer and/or local or state bureaus having jurisdiction, and under their supervision.

13-28.2 The Contractor shall furnish and pay for all necessary labor, fuel, electricity, water, apparatus, piping, etc., as required for tests. Contractor shall take all precautions necessary to prevent damage to the building during the tests, and shall be liable and pay for all damage incurred during the tests.

13-28.3 All leaks and defects discovered by the tests shall be immediately repaired or replaced and tests conducted over until tests prove the systems are satisfactory. No caulking of threaded piping or any accelerated rusting of any piping will be permitted to stop leaks.

13-28.4 The Contractor shall remove from building, lot, sidewalks, streets, and alleys, all rubbish, dirt, and debris as it accumulates during process of work. At completion of the work all areas inside shall be broom cleaned, and all obstructions and surplus materials shall be removed.

13-29 THERMAL INSULATION, GENERALLY:

13-29.1 The Contractor shall cover all piping and apparatus, as specified hereinafter, with insulation as manufactured by "Johns-Manville", "Keasby & Mattison", "Armstrong Cork Company", "Owens Corning", "Gustin-Bacon", "Ehret Magnesia Mfg. Co.", or equal.

13-29.2 All sectional covering shall finish round and smooth without lumps or depressions, and all ends and joints shall butt evenly and tightly together and to the covered surface. No damaged or broken sections shall be used. When covering is formed from blocks, they shall be carefully and evenly applied, securely wired in place, and joints shall be closed with cement insulation.

13-29.3 All insulated lines passing through walls or floors shall be provided with metal sleeves large enough to pass a full thickness of insulation.

13-29.4 After being painted as hereinafter specified, any insulation showing signs of coming loose or tendencies of the canvas pulling shall be removed and reapplied.

13-29.5 The application of all insulation shall be made strictly in accordance with the manufacturer's directions and by experienced craftsmen in a neat, careful, and workmanlike manner.

13-30 PAINTING, GENERALLY:

13-30.1 All finished painting will be performed under another Division, except for standard factory finishes.

13-30.2 Where standard equipment factory finishes have been damaged or scratched, the damaged area shall be repainted by the Contractor to match original finish.

13-30.3 The Contractor shall thoroughly clean by wire brushing or use of cleaners, all rust, scale, cement, and dirt from all equipment, piping, etc., and leave ready for finish painting.

13-31 IDENTIFICATION OF EQUIPMENT:

13-31.1 All items of major mechanical equipment, such as boilers, refrigeration machines, pumps (all types), air handling units, fans, compression tanks, etc., shall be neatly and clearly stenciled in letters not less than 1" high, with the same designation as appears on the drawings. Location and color of such stenciling shall be appropriate for ready identification, and/or as directed by the Contracting Officer. One set of compatible metal interlocking stencil letters and numbers shall be turned over to the Government at the completion of the job.

13-31.2 All motor starters and contactors shall be provided with engraved laminoid nameplates, listing the name, horsepower, voltage, and/or phase of the equipment served. Nameplates shall be bolted to the face of the enclosure, and names shall correspond to those used on the drawings.

13-32 PIPE CODING: All piping, raceway, etc., both insulated and bare, shall be color-coded, and banded or stenciled as to service and characteristic on 20' centers and/or as directed. Directional arrows not less than 1/2" wide and not less than 6" long, shall be permanently stenciled or affixed to each line at each code band or stencil location. Arrows and stenciling shall be so located as to be clearly visible by a man standing on the floor or adjacent service platform.

13-33 VALVE IDENTIFICATION:

13-33.1 The Contractor shall wire onto the handle of each valve installed under his contract a bronze or brass disc not under 1" diameter, stamped with the prefix "P" or "AC" followed by an identifying number not less than 1/2" high.

13-33.2 The number, location, and purpose corresponding to each valve shall be listed in sequence, properly typewritten on a schedule sheet and submitted to the Contracting Officer for approval. The approved schedule shall be framed under glass and mounted on the mechanical room wall, where directed.

13-33.3 Valve tags and schedule sheets shall be as manufactured by "Seton Name Plate Company", New Haven, Conn., or equal.

13-34 SPECIAL TOOLS: All special tools required for proper operation or maintenance of any mechanical or electrical equipment provided under this contract shall be delivered to the Contracting Officer at the completion of the contract.

13-35 GUARANTEES:

13-35.1 In addition to the guarantees on the individual items of equipment, the Contractor shall guarantee all equipment and work performed under his contract to be free from defects in material and workmanship for a period of twelve (12) months from the date of final acceptance by the Government.

13-35.2 If within the guarantee period, such equipment or work performed under this contract is found to be defective in material or workmanship, it shall be replaced or repaired free of any additional charges.

13-36 FINALLY: It is the intention that this specification shall provide a complete mechanical and electrical installation. All accessory construction and apparatus necessary or advantageous to the operation and/or testing of the work shall be included. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

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DIVISION 13

SECTION 13A

PLUMBING

13A-01 SCOPE OF WORK:

13A-01.1 This section of the specifications includes all labor and materials required for the complete and finished installation of plumbing fixtures, equipment, facilities, and systems.

13A-01.2 Involved in the classification of plumbing work above are the following systems:

General sanitary drainage
Storm water drainage
Cold water supply and distribution
Chilled water generation and distribution
Plumbing fixtures, equipment, and accessories

13A-02 REFERENCE: PARTICULAR ATTENTION IS CALLED TO THE "GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK" PRECEDING THIS SECTION OF THE SPECIFICATIONS WHICH COVERS CERTAIN IMPORTANT PROCEDURES, MATERIALS, AND LABOR APPLYING DIRECTLY TO THE PLUMBING SECTION OF THE SPECIFICATIONS.

13A-03 ELECTRIC MOTORS, GENERALLY:

13A-03.1 All motors, motor starters, and control equipment, unless otherwise specifically noted elsewhere on the plans or in these specifications, shall conform to the requirements set forth in the "General Requirements for Mechanical and Electrical Work", and to the following:

13A-03.1.1 Over 1/2 horsepower:
208 Volt
Three (3) Phase
60 Cycle

13A-03.1.2 1/2 Horsepower and Smaller:
120 Volt
Single Phase
60 Cycle

13A-04 SUMP PUMP:

13A-04.1 Furnish and install where indicated on the plans, in a sump provided by another Division, a "Chicago" Type 5U, "Weil" Type SE, or equal submersible pump complete with motor, control and accessories to make a completely automatic unit. The pump and motor shall be unit built by the pump manufacturer with common shaft of stainless steel. The motor shall be hermetically

sealed, with upper and lower ball bearings, double shielded and sealed with grease to provide lubrication for continuous operation and protection for the bearings when the pump is idle. The maximum temperature rise in the windings shall be 40°C when operating the pump under full load continuously.

13A-04.2 Pump shall be controlled by a remote, adjustable, float operated switch, mounted on the pump discharge pipe above floor level. The switch unit shall be supplied with 10 feet of 3 conductor heavy-duty power cable terminating with grounded plug, and shall have a manual pushbutton for pump test purposes.

13A-05 ELECTRIC WATER HEATERS:

13A-05.1 Each water heater shall be complete with adjustable thermostat, high temperature shut-off, insulated glass lined steel tank, magnesium alloy anti-corrosion rod, copper cold water dip tube, dual electric heating elements, and steel exterior jacket with baked enamel finish.

13A-05.2 Each water heater shall be "Day & Night" Model JRD or equal, with not less than the minimum gallons storage capacity and g.p.h. recovery scheduled on the plans. Heating elements shall be 208 volt, single phase, of wattages indicated on the plans.

13A-05.3 Each water heater shall be furnished with a "Watts Co." or equal pressure and temperature relief valve, size as recommended by water heater manufacturer.

13A-06 WATER CHILLER:

13A-06.1 Water chilling unit shall be a factory packaged, self-contained, air cooled, electric driven unit for use with a remote dispenser, "Filtrine" Model M-4-BW or equal, installed as indicated on the plans.

13A-06.2 Unit shall be complete with field-serviceable hermetic refrigeration system, automatic controls, hot dip galvanized extra heavy steel tank, insulation, twin-cartridge purifier, and ventilated steel casing with enamel finish. Storage capacity shall be not less than four (4) gallons, and recovery capacity shall be not less than seven (7) g.p.h. when cooling water from 80°F to 50°F in an ambient air temperature of 90°F.

13A-07 SANITARY DRAINAGE SYSTEMS:

13A-07.1 The Contractor shall furnish and install the various systems of sanitary drainage indicated on the plans. Each shall be a complete soil, waste, and vent system for all closets, lavatories, sinks, urinals, drinking fountains, electric water coolers, floor drains, etc. Waste and vent piping shall be sized as shown on the plans, and arranged to give proper drainage and venting for each fixture. All work shall be done in strict accordance with the local and national plumbing codes, which shall be followed in case of conflict with the plans.

13A-07.2 Soil, waste, drain, and vent piping shall be given a uniform grade of 1/4" per foot wherever possible, but in no case less than 1/8" per foot. All exterior piping shall be laid 6" below frost line, minimum. Contractor shall verify levels between building and main sewer at the beginning of the job, and if the specified grade cannot be maintained, the Contracting Officer shall be so informed before proceeding with the work.

13A-07.3 All soil, waste, and drain pipes shall be extended full size as vent pipes to above the roof lines or as otherwise shown. Where so indicated, or elsewhere with the approval of the Contracting Officer, two or more vent risers may be connected in roof space and vents extended through roof. Each riser extended through roof shall project 15" above roof line and shall be thoroughly flashed with 4 lb. sheet lead flashing turned down inside vent stack, and extended under roofing not less than 12" in all directions from vent pipe. Vent risers smaller than 2" shall be provided with approved brass vent caps in lieu of turning flashing down into pipe.

13A-07.4 The soil, waste, drain, and vent piping shall be provided with cleanouts to make all sections of the system accessible. Cleanouts shall be provided at the ends and at points of change in direction of all drain, soil, and waste pipes and branches thereof, at the foot of each riser, at all offsets, in all horizontal runs at approximately 50' intervals, and at other points where indicated on the drawings or where required.

13A-07.5 All trenching for soil, waste, or drain lines shall be graded so that the pipe rests on undisturbed soil, where practicable. If piping is installed on fill dirt, dirt shall be tamped to the satisfaction of the Contracting Officer. Trenching shall have bell holes at each joint, to allow body of pipe to rest on ground and to provide space for joint makeup.

13A-08 STORM DRAINAGE SYSTEMS:

13A-08.1 The Contractor shall furnish and install the various systems of storm drainage, as indicated on the drawings.

13A-08.2 Installation requirements regarding cleanouts, grading, depth of cover, excavation, etc., shall be the same as specified for sanitary drainage systems.

13A-09 DOMESTIC WATER SYSTEMS:

13A-09.1 The Contractor shall furnish and install the various domestic hot, cold, and chilled water systems as indicated on the plans. Systems shall be complete from points of connection with City water mains through the various equipment items and to points of connection with all plumbing fixtures or other outlets requiring same.

13A-09.2 All piping shall be graded for gravity drainage toward main supply risers or to fixture connections, to allow complete drainage of all parts of the system.

13A-09.3 Underground piping shall be laid not less than 6" below the frost line.

13A-10 UTILITY CONNECTIONS:

13A-10.1 The Contractor shall, before commencement of the job, verify the exact location, depth, size, pressure and/or grade of all existing or proposed new main water, sanitary sewer, or storm sewer lines to which he is to make connections for services to this project. If for any reason conditions should appear that will adversely affect the proper installation and operation of the systems proposed for installation, such conditions shall be reported to the Contracting Officer in writing for his decision.

13A-10.2 All charges for connections, extensions, temporary services, cutting and patching of paving, etc., as may be required for connection to the various utility lines shall be included in the bid.

13A-11 EQUIPMENT FURNISHED BY OTHERS:

13A-11.1 Certain items of equipment will be furnished and set in place as specified under separate sections of these specifications or by the Government under a separate contract.

13A-11.2 The Contractor shall rough in and make final connections to such equipment as indicated on drawings and as directed. All water connections to equipment shall be provided with gate valves. All direct waste connections shall be provided with P-traps or drum traps as required.

13A-11.3 Exact rough-in locations and requirements for all such equipment shall be verified before starting work.

13A-12 WATER METER: The Contractor shall furnish and install a water meter as indicated on the plans. Water meter shall be AWWA approved, and shall conform to all requirements of the local water department.

13A-13 PIPE AND FITTINGS:

13A-13.1 Piping for the various systems shall conform to the following:

13A-13.1.1 Waste, Drain, and Vent Piping:

13A-13.1.1.1 Below or within five (5) feet of paved areas, or inside building and out to points five (5) feet beyond building lines (except as otherwise noted) - extra heavy cast iron soil pipe, reinforced hub type, coated inside and out with coal tar varnish, manufactured to ASTM Standard Specification for Cast Iron Soil Pipe and Fittings.

13A-13.1.1.2 Outside building (except that under or within five (5) feet of paved areas) and up to points five (5) feet outside of building walls - same as above, except service weight.

13A-13.1.1.3 Any size, exposed within a finished room or installed in locations not having sufficient space to conceal completely all parts of cast iron pipe and fittings - Type "L", "M", or "DWV" hard drawn copper tubing (one grade only, throughout project).

13A-13.1.1.4 Vent piping under 2" in diameter - Type "L", "M", or "DWV" hard drawn copper tubing (one grade only, throughout project).

13A-13.1.2 Storm Drain Piping:

13A-13.1.2.1 Inside buildings, down to points 1" above finished ground floor lines - Schedule 40 black steel.

13A-13.1.2.2 Inside buildings, from 1" above finished ground floor lines out to points five (5) feet outside building lines, or outside building below and out to points five (5) feet on either side of paved areas (except as otherwise noted) - service weight cast iron soil pipe, otherwise the same as for sanitary waste piping.

13A-13.1.3 Domestic Hot, Cold, and Chilled Water Piping:

13A-13.1.3.1 Service lines outside buildings and up to points 4" above finished ground floor lines - Type "K" hard drawn copper tubing.

13A-13.1.3.2 All other - Type "L" hard drawn copper tubing; OR standard weight galvanized genuine wrought iron pipe (Contractor option, except as otherwise noted or specified).

13A-13.2 Fittings for the various systems shall conform to the following:

13A-13.2.1 Waste, Drain, and Vent Piping:

13A-13.2.1.1 With cast iron pipe - cast iron soil pipe hub and spigot fittings, of same weight, class, and coating as respective pipe.

13A-13.2.1.2 With copper pipe - sweat joint type drainage fittings, of not less than the same class as the respective pipe.

13A-13.2.2 Storm Drain Piping:

13A-13.2.2.1 With steel pipe - welded standard weight black steel.

13A-13.2.2.2 With cast iron pipe - same as for waste, drain, and vent piping.

13A-13.2.3 Domestic Hot, Cold, and Chilled Water Piping:

13A-13.2.3.1 With cast iron pipe - Class 150 AWWA cast iron hub and spigot fitting, OR Class 150 AWWA cast iron mechanical joint fittings, stuffing box type, with suitable gasket.

13A-13.2.3.2 With copper pipe - wrought copper tubing fittings.

13A-13.2.3.3 With wrought iron pipe - screwed galvanized malleable iron, standard weight.

13A-13.3 Contractor's attention is directed to the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK for various required methods and practices involving piping and pipe joints.

13A-13.4 Welded fittings as specified above shall include all elbows, tees, laterals, reducers, etc., which shall be "Tube-Turn", "Ladish", or "Taylor-Forge", full radius type; except that tees may be formed for lines 4" and larger connecting to lines 6" and larger, by saddling branch into side of main; and connection of lines 2" and smaller into lines 2½" and larger may be made with "Threadolets". All welding shall be done in accordance with standard practice, utilizing only fully qualified welders. All joints shall be smoothly fitted before welding, and welding rod shall be specifically suited to the pipe material. Flanges shall be welding neck type, class to match valve or equipment connection, except 150# minimum.

13A-14 CLEANOUTS:

13A-14.1 Cleanouts, except at traps and fittings on horizontal branches, shall be of same size as pipe up to 4" and 4" size for all larger pipe. Cleanouts shall be installed in such manner as to provide easy accessibility for removal and clearance for rodding, at least 18" clearance for sizes 3" and larger and at least 12" clearance for smaller lines. Should piping installation and building construction conflict so as to prohibit proper installation of a specified flush type cleanout, Contractor shall secure the Contracting Officer's approval of another type of cleanout.

13A-14.2 Cleanouts in steel piping shall consist of a threaded drainage fitting with an extra heavy cast brass or bronze raised head screw plug, "Josam" #Y-10 or equal. Where concealed behind finished wall surfaces, a cast nickel-bronze round flush cleanout access cover with polished top, anchor lugs, and vandal-proof cover securing screws, "Josam" #Y-80-BB or equal, shall also be provided.

13A-14.3 Cleanouts in cast iron piping not occurring in finished floors or walls shall be constructed with wye fittings and extra heavy cast iron caulking ferrules having extra heavy cast brass or bronze raised head screw plugs, "Josam" #Y-50 or equal. Where clearance is limited, or where otherwise permitted by the Contracting Officer, such cleanouts may be extra heavy cast iron tapped tee branch type, with extra heavy cast brass or bronze raised head screw plug, "Josam" #Y150 or equal.

13A-14.4 Cleanouts in cast iron piping in finished walls shall be constructed with an extra heavy cast iron caulking ferrule with extra heavy cast brass or bronze raised head screw plug, and cast nickel-bronze round flush access cover with polished top, anchor lugs, and cover plate secured to plug by countersunk vandal-proof screw, "Josam", #Y-110-B or equal.

13A-14.5 Cleanouts in cast iron piping in finished floors shall be "Josam" #Y-70-BB or equal cast nickel-bronze round flush cleanout, with flanged rim, scoriated spanner type flanged screw plug, anchor lugs, and inside caulk connection.

13A-14.6 Exterior cleanouts, unless otherwise specifically noted shall be brought up flush with paving in paved areas, and in an 18" x 18" x 6" reinforced concrete pad flush with grade in unpaved areas, and terminated with an extra heavy cast iron caulking ferrule having an extra heavy cast brass or bronze countersunk head screw plug, "Josam" #Y-60 or equal.

13A-15 TRAPS AND DRAINS:

13A-15.1 P-traps shall be placed under all floor drains, area drains, safe-wastes and at other points indicated on the drawings or otherwise required. P-traps shall be extra heavy cast iron hub and spigot pattern. Where so noted, traps shall be "deep seal" type, with seal not less than 4" for 2" size or not less than 5" for larger sizes.

13A-15.2 Floor drains in mechanical equipment rooms shall (except as otherwise specifically noted) be "Josam" Series 5420, "Zurn" Z-540, or "Wade" W-1660 cast iron round drain, with double drainage flange, weep holes, inside caulk bottom outlet, flashing clamps, loose set heavy duty nickel-bronze grate, and removable sediment bucket.

13A-15.3 All other floor drains shall be "Josam" Series 300, "Zurn" Z-415, or "Wade" W-1100 cast iron floor drains with double drainage flange, weep holes, inside caulk bottom outlet, and adjustable nickel-bronze round strainer.

13A-15.4 All roof drains shall be cast iron, adjustable collar, torrential type with extra deep sump, anchor flange, roof flange, deck clamp, integral flashing clamp and gravel stop, secondary flashing clamp, and I.P.S. outlet, "Josam" Series 4570 or equal.

13A-16 FERRULES: All ferrules shall be of the best quality, extra heavy cast brass not less than 4" long and of weight and size as follows:

I.D.	LENGTH	WEIGHT
2 1/4"	4 1/2"	1#- 4 oz.
3 1/4"	4 1/2"	1#-14 oz.
4 1/4"	4 1/2"	2#- 8 oz.

13A-17 VALVES, STRAINERS, AND UNIONS:

13A-17.1 All valves and strainers shall have the name or trademark of the manufacturer and the guaranteed working pressure cast or stamped on the body, and all valves of any one type shall be of the same manufacture.

13A-17.2 Unless otherwise specified or shown on the drawings, all valves shall be 125 p.s.i.g. S.W.P., with sizes 2" and smaller screw end, bronze body, and sizes 2½" and larger flange end, iron body, bronze trimmed.

13A-17.3 Valves, stop cocks, waste cocks, connections, etc., shall be provided wherever shown on drawings, or required for controlling the various portions of the work. Each and every fixture shall have controlling valves easily accessible from rooms or through access panels.

13A-17.4 Manufacturers' references given in the following table are to indicate a minimum standard of quality and design only

	BRASS BODY	IRON BODY
Gate Valves		
Crane	Fig. 438	Fig. 461
Walworth	Fig. 4	Fig. 719F
Globe Valves		
Crane	Fig. 1	Fig. 351
Walworth	Fig. 58	Fig. 906F
Swing Check Valves		
Crane	Fig. 34	Fig. 373
Walworth	Fig. 406	Fig. 920F
Plug Valves, Water*		
Crane	Fig. 250	
Walworth	Fig. 554	Fig. 655F
Lubricated Plug Valves*		
Nordstrom	Fig. 142	Fig. 143
Homestead	Fig. 623	Fig. 602

* A total of two (2) operating handles for each size and/or type valve required shall be furnished for this project.

13A-17.5 Strainers shall be iron body with 20 mesh monel screens for water service. Strainers shall be wye pattern, similar and equal to "Crane" #988½ with screw ends for 2" size and smaller, and "Crane" #989 with flanged ends for sizes larger than 2".

13A-17.6 Unions 2" and smaller shall be 300 psig S.W.P. black malleable iron screw end, with bronze seat ring, similar and equal to "Crane" Fig. 198E, or "Walworth" Fig. 7716. Unions 2½" to 4" size shall be 300 psig S.W.P., and 5" and larger 200 psig S.W.P. three-part flanged unions, with self-seating bronze to iron ball joints, similar and equal to "Walworth" Fig. 8301.

13A-18 WALL HYDRANTS AND HOSE BIBBS:

13A-18.1 All outside wall hydrants shall be 3/4" cast bronze, non-freeze type with galvanized wall sleeve, loose-key operators and threaded outlets, similar and equal to "Josam" No. 1400-N. Finish shall be polished nickel-bronze. Hydrants shall be placed 18" above the finished outside grade.

13A-18.2 All hose bibbs shall be 1/2" C.P. brass female flanged bibbs, with lockshield, composition disc, loose-key handle and 3/4" hose end, similar and equal to "Repcal" No. B-47HLK. Except as otherwise indicated, all hose bibbs shall be installed 15" above finish floor line.

13A-19 CLEANING, TESTING, AND ADJUSTING:

13A-19.1 Cleaning, testing, and adjusting shall conform to the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK. The following tests of all work performed under this contract will be required by the Contracting Officer unless otherwise directed, and shall be made in the presence of the Contracting Officer or his authorized representative.

13A-19.1.1 The drainage and vent piping systems throughout shall be tested upon the completion of the rough work and without fixtures or traps connected. All openings, except at the top of stack shall be tightly closed by screw plugs or equivalent devices, and the system shall be entirely filled with water which shall stand without leak or loss of level for a period of four (4) hours.

13A-19.1.2 All hot, cold, and chilled domestic water piping, prior to being insulated, shall be tested in place to a hydrostatic pressure of 125 pounds per square inch at the ground floor level, which pressure shall be maintained without pumping for a period of one (1) hour.

13A-19.1.3 The Contractor shall conduct operating tests of equipment and other apparatus installed by him to demonstrate the satisfactory operation of same and the fulfillment of the specified requirements. He shall make any additional tests that may be required by other authorities.

13A-20 STERILIZATION OF ALL WATER LINES: Before being placed in service, all water piping systems shall be sterilized with a solution of HTH, or as otherwise required by the local Department of Public Health.

13A-21 INSULATION:

13A-21.1 Insulation application shall conform to the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK.

13A-21.2 All cold and hot water lines, interior downspout lines (except lines underground or exposed chrome-plated piping) shall be insulated with a molded sectional glass fiber insulation of not less than 4½ lbs./cu. ft. density, with a heavy white outer bleached kraft paper jacket, laminated to a vapor barrier facing of aluminum foil. Section shall be applied to clean dry pipe, and all

joints firmly butted together and all joints and seams lapped and sealed with a white vapor barrier lap cement. Fittings shall be insulated with white hydraulic setting cement to a thickness of the adjoining insulation, sealed with white vapor barrier lap cement, and covered with 4 oz. canvas. Insulation shall be further secured with factory-made aluminum bands, applied 3 per section. Insulation shall be "Fiberglas" "Low-Pressure" pipe insulation or equal, and thickness shall be not less than 1/2".

13A-21.3 All chilled water lines shall be insulated with 1/2" thick seamless foamed plastic pipe insulation, similar and equal to "Armstrong Armaflex 22". Insulation shall be slipped on piping without cutting side seams wherever possible. All joints shall be sealed with "520" or equal adhesive. No taping of insulation will be permitted.

13A-22 PAINTING:

13A-22.1 All concealed canvas covered work shall be painted two coats of "Talcote" #070, or equal asphalt emulsion damproofing.

13A-22.2 All exposed canvas covered work, including that in the mechanical rooms, shall be painted one coat of approved size in preparation for finish painting.

13A-22.3 All uncovered work in concealed spaces above ground floor line, such as pipe chases or attics above ceilings, shall not be painted.

13A-22.4 All other painting or preparation therefor shall be as called for in the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK.

13A-23 PLUMBING FIXTURES:

13A-23.1 The Contractor shall furnish and install, complete, all fixtures shown on the plans and/or hereinafter specified.

13A-23.2 All fixtures shall be new and best of their respective kinds. They shall be non-absorbent throughout, and free from waves, kiln marks, or discoloration.

13A-23.3 All surfaces coming in contact with surfaces of other fixtures shall be factory ground truly flat, and shall be bedded with fine dental plaster.

13A-23.4 All fixtures shall have concealed vent and concealed air chambers. Air chambers shall be of the same diameter as the supply pipes, and 12" long on both hot and cold water branches, or as otherwise detailed on the plans.

13A-23.5 All supplies shall be rigid, I.P.S. brass.

13A-23.6 Traps (except those integral with fixtures or otherwise specified) shall be three piece cast brass with cleanout, I.P.S. tailpiece, and pipe nipple to wall.

13A-23.7 All escutcheons on supplies and wastes shall be heavy cast brass set-screw type.

13A-23.8 All exposed finish metal parts shall be heavily chromium plated, except rough-bodied parts shall be heavily nickel plated.

13A-23.9 All enameled iron ware shall be acid resisting.

13A-23.10 All fixtures shall be protected with not less than two thicknesses of tough building paper, pasted on, and fully covering all surfaces, using paste as recommended by the fixture manufacturer. Job must be turned over to the Government with all fixtures clean and free from damage.

13A-23.11 The Contractor shall provide proper support for fixtures and piping. Wall hung fixtures not provided with chair carriers shall be hung with 2" x 4" oak backup piece inside chase, with bolts extending through wall to fixture hangers.

13A-23.12 Lavatories shall be secured from the bottom in addition to standard hangers, either by toggle bolts through the wall and perpendicular to the wall, or by brackets secured to the wall under the lavatories. Mounting heights shall be 31" from finished floor to rim of lavatory, unless otherwise indicated on the plans.

13A-23.13 All trim shall be first line quality, and shall be clearly marked for corroborative identification. Trim, unless otherwise noted, shall be manufactured by the same manufacturer as the respective fixture; or if manufactured by others, shall be trim regularly furnished with the fixture and fully guaranteed by the fixture manufacturer.

13A-23.14 The following fixtures (with options listed) shall be the basis of the bid:

13A-23.14.1 Fixture Type "A" (Water Closet): White vitreous china, siphon jet, elongated bowl, 1½" top spud; with vitreous china tank, flush valve, float valve, trip lever, and wall supply; "Church" #9500, "Beneke" #527-CH, or "Olsonite" #95 open front black seat with check hinges less cover; china bolt caps.

"Standard" #F-2050 "Compact"
"Crane" #3-207 "Santon"
"Kohler" #K-3675-EBA "Bolton"

13A-23.14.2 Fixture Type "B" (Lavatory): White vitreous china, 20" x 18" wall-hung lavatory with back, concealed hanger and wall screws; hot and cold water combination supply fitting with spray face and indexed handles; 3/8" I.P.S. stops with handles; open strainer; 1¼" P-trap; right hand extra drilling for soap dispenser included in another specification section.

Manufacturer	Lavatory	Supply	Drain	Stop	Trap
"Standard"	F-351	N-2098	R-2532	R-2601	R-7004
"Crane"	1-195-V	8-2065	8-5222	8-5000	8-5272
"Kohler	K-2022	K-7408	K-7714	K-7600	K-9004

13A-23.14.3 Fixture Type "C" (Urinal): White vitreous china, 18" wide, wash-out type wall-hung urinal, with integral shields, flushing rim, strainer and trap with cleanout, 3/4" top spud and 2" I.P.S. female outlet connection, "Sloan" #185-FYV Royal flush valve with vacuum breaker; "Josam" #C-230 or equal chair carrier.

"Standard" F-6500 "Washbrook"
"Crane" 7-67 "Correcto"
"Kohler" K-4981-T "Bardon"

13A-23.14.4 Fixture Type "D" (Service Sink): White acid-resisting porcelain-enameled cast iron, 24" x 20" service sink; 3" enameled inside trap standard with cleanout and strainer; stainless steel rim guard on three (3) sides; wall-mounted service sink fitting with 3/4" hose end, bucket hook, wall brace, vacuum breaker, and loose-key integral stops.

Manufacturer	Sink	Supply	Trap
"Standard"	P-7706	HB95406 VB	P-7798
"Crane"	7-566	8H2770	7-620
"Kohler"	K-6718	K-8904	K-6673

13A-23.14.5 Fixture Type "E" (Electric Water Cooler): "Halsey Taylor" #R[illegible]-10-A-1 or equal, hermetically sealed 1/5 Hp air cooled condensing unit; wall-mounted; semi-recessed; 10 g.p.h. cooling capacity, 80°F to 50°F at 90°F ambient temperature; tinned copper tank; tinned C.P. brass self-closing stop, integral automatic stream regulator; adjustable thermostat; stainless steel top; stainless steel cabinet.

* * *

DIVISION 13

SECTION 13B

HEATING, VENTILATING, AND AIR CONDITIONING

13B-01 SCOPE OF WORK:

13B-01.1 This section of the specifications includes all labor and materials required for the complete and finished installation of heating, ventilating, and air conditioning equipment, facilities, and systems.

13B-01.2 Involved in the classifications of heating, ventilating, and air conditioning work above are the following systems:

Hot Water Heating
Electric Heating
Direct Expansion Refrigeration
Forced Air Summer-Winter Air Conditioning
The Various Exhaust and Ventilating Systems
Installation of Government Furnished Equipment
Miscellaneous, as indicated on the plans

13B-02 REFERENCE: ATTENTION IS CALLED TO THE "GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK" PRECEDING THIS SECTION OF THE SPECIFICATIONS WHICH COVERS CERTAIN IMPORTANT PROCEDURES, MATERIALS, AND LABOR APPLYING DIRECTLY TO THE HEATING, VENTILATING, AND AIR CONDITIONING SECTION.

13B-03 ELECTRIC MOTORS, GENERALLY:

13B-03.1 All motors, motor starters, and control equipment, unless otherwise specifically noted elsewhere in these specifications, shall conform to the requirements set forth in the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK, and to the following:

13B-03.1.1 Over 1/2 Horsepower:
208 Volt
Three Phase
60 Cycle

13B-03.1.2 1/2 Horsepower and Smaller:
120 Volt
Single Phase
60 Cycle

13B-03.2 All starting and control equipment and all wiring and interlock diagrams (after being submitted to the Contracting Officer for approval) shall be furnished under this section of the specifications (see Automatic Control Equipment specification). Installation of starting and control equipment and final electrical connections in accordance with the approved diagrams will be furnished under the Electrical section.

13B-04 AIR COOLED CONDENSING UNITS:

13B-04.1 Air cooled condensing units shall each be complete with hermetically sealed refrigeration compressor(s); air cooled condenser(s) with copper tubes and aluminum or copper fins; liquid refrigerant receiver (if recommended by the manufacturer); condenser fan(s); resiliently mounted electric motor(s); crankcase heater; high and low pressure controls; time delay starting relay; and all necessary interconnecting piping, wiring, controls, etc., required, mounted within a weatherproof casing of hot dip galvanized steel, or bonderized steel with baked enamel finish, and having air inlet and discharge screens and access panels.

13B-04.2 Condensing units shall be vertical air discharge type, and shall be provided with automatic, factory installed, control components for capacity reduction and proper operation at ambient air temperatures as low as 40°F.

13B-04.3 Capacities and operating conditions shall be as scheduled on the plans. Units shall be "Carrier" Type 38AB, "Trane" Type RA, or equal.

13B-05 LOW PRESSURE STEAM BOILER:

13B-05.1 The low pressure steam boiler unit shall consist of a steel multi-pass firetube boiler, boiler fittings, burner equipment and automatic controls. The boiler (with all piping and wiring) shall be completely factory assembled on a structural steel base as a self-contained unit. Both boiler and burner must be the product of the same manufacturer, or regularly catalogued as a jointly rated assembly.

13B-05.2 Boiler design and construction shall be in accordance with the ASME Code for 30 p.s.i.g. S.W.P. The complete unit shall bear Underwriters' Laboratories Label "B", and shall be Factory Mutual approved. Unit shall also meet requirements of all state and local code regulations.

13B-05.3 Boiler shall be horizontal firetube "Scotch marine" type with a centrally located furnace, with return tubes evenly spaced and arranged for free circulation on the water side and equalized flow of combustion gases at the rear tube sheet and return tubes. Adequate handholes shall be provided for access to the water side of the boiler. A handhole or cleanout opening shall be provided at the lower part of one tube sheet so that the entire bottom of the boiler may be cleaned. Hinged or davited doors shall be provided at both front and rear of boiler to provide access to furnace and all return tubes without removal of door plates, baffles or refractories. Door frames shall be of tongue and groove construction with asbestos rope gasket, and shall be gas tight. Arrangement and fastening of doors shall permit quick opening of both front and rear by one man. Rear door shall be fitted with an observation port to give a clear view of the furnace when burner is firing. All necessary refractories shall be installed in the boiler. Boiler shall be covered with 2" fiber glass insulation and metal jacket with primer and finish coat of paint.

13B-05.4 Safety valves shall be ASME approved side outlet type. Their size and number shall be in accordance with Code requirements and set to blow at 17 p.s.i.g. Safety valves shall be piped to floor drains.

13B-05.5 Water column shall be piped to the boiler at the factory complete with gauge glass, three try-cocks, and drain valve. Water column shall also include the primary low water cut-off to shut-off burner operation automatically when the water falls below a predetermined level.

13B-05.6 Steam pressure gauge shall be mounted on front of boiler complete with shut-off cock, siphon, and test connection.

13B-05.7 Feed water stop and check valves shall be piped at factory in line to an internally baffled feed connection in boiler shell.

13B-05.8 Bottom blowoff piping shall conform to the ASME and/or State Code with regard to materials, pressure ratings and arrangement; the blowoff valves shall be completely piped.

13B-05.9 A flue gas thermometer shall be mounted at the breeching collar.

13B-05.10 Burner shall be forced draft type equipped with fuel arrangement for firing light fuel oil not heavier than commercial grade No. 2 (CS-12-48) or diesel 28-40API. Equipment shall include a fuel pump unit complete with strainer and pressure regulating valve, burner nozzle and ignition assembly. Burner motor shall be standard base mounted 1750 RPM.

13B-05.11 Blower shall be fitted with an air inlet silencer to insure quiet operation.

13B-05.12 Burner location and firing method to be such that combustion takes place within the water-backed furnace of the boiler. Vital burner parts such as fuel nozzles, flame scanner and ignition assembly are to be enclosed in a protective steel housing.

13B-05.13 Burner controls shall be full modulating type with low fire start, and are to include the following:

13B-05.13.1 Pressure limit control for automatic start and stop of burner operation.

13B-05.13.2 Pressure actuated potentiometer control to vary firing rate in relation to steam demand.

13B-05.13.3 Dual low water cut-off control to cause shut-down of unit when water level drops to minimum safe level.

13B-05.13.4 Air safety switch to prevent operation until sufficient combustion air is assured.

13B-05.13.5 An electronic type combustion flame safeguard and programming unit providing pre-purge and post purge cycles with full protection against flame failure. Safety shutdowns shall require manual reset.

13B-05.13.6 Burner motor controller with thermal overload and undervoltage protection.

13B-05.13.7 Control circuit fuses.

13B-05.13.8 Indicator lights for low water and flame failure.

13B-05.14 All controls shall be panel mounted and so located on the boiler as to provide ease of servicing the burner and boiler without disturbing the controls; and also to prevent possible damage by water, fuel, or heat of combustion gases. Controls connected to water or fuel shall be installed outside the main boiler control panel. All controls shall be mounted and wired according to Underwriters' Laboratories and National Electrical Code requirements.

13B-05.15 Factory boiler inspection shall include a hydrostatic test in the presence of an inspector having a National Board Commission. He shall certify a Data Report which shall be delivered with the boiler as evidence of ASME Code compliance. In addition to ASME symbol, the boiler shall bear a National Board Registration number.

13B-05.16 Performance test shall be rendered on the complete unit with the specified fuel prior to shipment from factory, with operational adjustment of controls, check of all safety devices, recording of stack temperature and analysis of flue gases. A certificate of this test shall be furnished with the unit.

13B-05.17 Instructions for installation, operation, and maintenance of the boiler shall be contained in a manual provided with each unit. Record of fire tests shall be included in this manual. A complete water test kit shall be provided.

13B-05.18 Supervision of startup and instruction of operating personnel shall be provided by a factory trained engineer. Instruction shall consist of not less than one (1) normal 8 hour day, and shall include water analysis, control system operation, flame analysis and adjustment, maintenance procedures, and trouble shooting techniques. The instruction period shall be scheduled by the Contracting Officer.

13B-05.19 Boiler units shall be "Cleaver Brooks", "Kewanee", or "Continental". Capacity shall be as scheduled on the plans, and shall be for job-site altitude.

13B-06 CONDENSATE RETURN UNIT:

13B-06.1 Condensate return unit shall be a duplex type, furnished with two bronze-fitted, bronze impeller centrifugal pumps specifically designed for

pumping hot water, motors, flexible couplings, cast iron or steel base, cast iron or steel receiver with sight glass, float-operated makeup valve, inlet strainer, interconnecting piping, etc., as required for a complete unit.

13B-06.2 Pump operation shall be in response to a float switch on the receiver and unit shall have an electric alternator which shall alternate or combine operation of the two pumps as required.

13B-06.3 Unit capacity shall be as scheduled on the plans. Unit construction shall be "Skidmore" Type HS, "Chicago", or "Aurora".

13B-07 CONVERTER:

13B-07.1 Converter shall be a "Taco" Model SW, "Bell & Gossett" Type SU, or "Patterson-Kelly" Type DS, with steel shell, bronze or copper-silicon head, seamless copper U-tubes, bronze or copper-silicon tube sheet, nonferrous spacer plates, and steel or cast iron support cradles.

13B-07.2 Unit shall be rated for 15 p.s.i.g. steam side working pressure and 125 p.s.i. water side working pressure, and shall be ASME labeled.

13B-07.3 Converter shall be steam to water type, with capacity as scheduled on the plans.

13B-08 HOT WATER PUMP:

13B-08.1 Hot water circulating pump shall be a horizontal split case, double suction centrifugal type; "Allis-Chalmers" Type KS, "Aurora" Type O, "Pacific" Type KP, "Chicago" Type DS or DP, "Buffalo", "Worthington", or "Ingersoll-Rand". Pump shall be mounted on a cast iron drain base and direct connected to a drip-proof, ball bearing, 1750 rpm motor through a heavy-duty flexible coupling. Pump casing shall be cast iron, and impeller shall be bronze. Pump shall be fitted with stainless steel shaft, or steel shaft with stainless steel sleeves, and renewable bronze casing wear rings and packing gland shaft seals. Where the manufacturer has designed the pump casing to accommodate several impeller diameters, the pump furnished shall have an impeller diameter not in excess of ninety per cent (90%) of the maximum impeller size for the case.

13B-08.2 Capacity of pump shall be not less than that scheduled on the plans. Pump motor shall be not smaller than that indicated on the plans, and in no case as small as to draw more than 110% of its rated horsepower at any point along the corresponding impeller curve. Pump selection shall be such that there is not less than ten per cent (10%) of total head rise to shut-off above selection point.

13B-09 AIR HANDLING UNITS:

13B-09.1 Air handling units shall be "Carrier", "McQuay", "Buffalo", "Worthington", "Trane", or "American-Standard", factory-assembled fan and coil units.

13B-09.2 Single zone air handling unit shall be draw-through type, complete with centrifugal blower(s); motor with base and drive; direct expansion cooling coil and hot water heating coil; face and by-pass dampers; drain pan; drain connections; and internally insulated heavy gauge steel casing.

13B-09.3 Multizone fan and coil unit shall be blow-through type, complete with centrifugal blowers, motor with base and drive; direct expansion cooling coil and hot water heating coil; zone mixing dampers; drain pan; drain connections; and internally insulated heavy gauge steel casing.

13B-09.4 Cooling and heating coils shall be of copper tube and aluminum finned construction, with not less than 7 nor more than 10 fins to the inch of tubes, and rated for 200 p.s.i.g. working pressure for water coils and 300 p.s.i.g. working pressure for refrigerant coils.

13B-09.5 Drive motors shall be ball bearing type, open frame, 1750 rpm, and mounted externally. Each motor shall be provided with an adjustable sound isolating motor base, and adjustable pitch V-belt drive with guard.

13B-09.6 Fan shafts shall be dynamically balanced, and sized so that maximum rpm is well below first critical speed. Bearings shall be sealed, self-aligning, lubricated type, with proper lubrication fittings (and extended lubrication lines where bearings are not fully accessible), and furnished with initial factory lubrication.

13B-09.7 Centrifugal blowers may be forward curved, backward curved or inclined, or airfoil type, and shall be double inlet style. Wheels shall be statically and dynamically balanced, and shall have the proper number of blades to insure quiet and efficient operation. Construction classification shall be not less than that recommended by NAFM for the duty involved.

13B-09.8 Casings shall be fully braced and rated for the total static pressures imposed, and so arranged that all internal parts are fully accessible by convenient removal of panels, access doors, etc. Casings shall be bonderized or phosphatized and finished prime coat, OR may be mill galvanized.

13B-09.9 Casing insulation shall be waterproof, not less than 1" thick, and with a "K" factor not higher than .25. Drain pan insulation shall be similar to casing insulation in thickness and "K" value, and shall be protected by a complete sheet steel inner pan to which the drain connections attach; OR may be a homogeneous, waterproof sheet of expanded plastic material of equivalent thermal insulating capability, without the inner pan liner; OR may be rigid heavy density fiber glass board insulation fully protected with heavy, homogeneous coating of bitumastic waterproofing material to points well above maximum water line. Inner steel pan liner shall be galvanized or otherwise suitably protected against corrosion.

13B-09.10 Capacities and operating limitations shall conform to the schedule on the plans, and unit arrangements shall be as indicated.

13B-09.11 Contractor's attention is called specifically to the space limitations involved. Otherwise acceptable units with physical dimensions requiring more space than the limiting dimensions indicated on the drawings, or which would otherwise hinder proper maintenance procedures, will not be considered.

13B-10 HOT WATER UNIT HEATERS:

13B-10.1 Hot water unit heaters shall each be furnished with a bonderized or phosphatized steel casing (18 ga. minimum) with factory baked enamel finish; copper tube and copper or aluminum fin hot water heating coil rated at 200 p.s.i.g. working pressure; permanent split-capacitor motor with sound and vibration isolating mounting arrangements; and three-speed fan switch.

13B-10.2 Units shall be horizontal discharge type, each complete with direct-connected propeller type fan and adjustable discharge louvers. Units shall be "Modine" Type H, "Trane" Type H, "Warren Webster" Type H, or "American-Standard" Type H.

13B-10.3 Mounting details and capacity data shall be as indicated on the plans.

13B-11 ELECTRIC HEATING UNITS:

13B-11.1 All electric heating units shall be listed by Underwriters' Laboratories, Inc., and shall bear the appropriate UL label. Unit capacities and mounting arrangements shall be as indicated on the plans.

13B-11.2 Electric Unit Heaters:

13B-11.2.1 Each electric unit heater shall be a "Chromalox" Type LUH or equal, ceiling mounted, horizontal blow, with adjustable discharge louvers (vertical adjustment) and mounting brackets.

13B-11.2.2 Heating coils shall consist of multiple, metal-sheath, finned electric heating elements. Each element shall be wired to a built-in, line voltage, automatic reset, thermal overheat protector.

13B-11.2.3 Motors shall be of the totally enclosed continuous fan-duty sleeve bearing type, equipped with built-in thermal overload protection. Each unit shall be equipped with a combination fan guard/motor support resiliently mounted to absorb any motor vibration. The fan motor shall be wired within the unit heater to the electric heating coil power supply.

13B-11.2.4 Fans shall be broad bladed aluminum direct connected to fan motor, dynamically balanced and designed specifically for unit heater application.

13B-11.2.5 All metal surfaces of the casing shall be bonderized to resist corrosion, and finished in baked enamel.

13B-11.2.6 On-Off type operation shall be provided by interrupting the heating bank power supply with a magnetic contactor of size as noted on the plans. The contactor holding coil shall in turn be operated by a wall mounted thermostat, as hereinafter specified.

13B-11.3 Electric Duct Heater:

13B-11.3.1 Electric duct heater shall be a "Chromalox" Type FTR "Fintube Airduct Heater" or equal, with factory built-in relay section.

13B-11.3.2 All frame-members, terminal-box, terminal-box cover, splice box and similar associated sheet metal parts shall be heavy gauge, die formed steel with integral corrosion-resisting coating. Assembly into a rigid structure shall be by means of spot welding or threaded fastenings.

13B-11.3.3 Heating bank shall be composed of individually flanged-mounted finned heating elements having highest quality alloy coiled resistors centered within the tubes and embedded in compacted insulating refractory material. Flanges and fins shall be permanently furnace brazed to elements for rigid support and rapid heat transfer. Each element and fins shall be continuously coated with a heavy layer of ceramic material, fired at not less than 1500°F and capable of continuously resisting corrosion from high-humidity without cracking, checking, or spalling under all operating conditions. Heating-banks shall be connected for either single phase or 3 phase operation as noted, and clearly marked leads from each element or bank shall be brought into the splice-box.

13B-11.3.4 Heater shall be equipped with a UL listed automatic reset, snap-action limit control with 250V rating, designed to protect the equipment from overheating from any cause. When heater bank rating does not exceed capacity of limit control, control shall be factory-connected to heater bank. Otherwise, leads from limit control shall be brought into splice box and suitably marked for contactor-connection to contactor holding coil.

13B-11.3.5 Duct heater shall be equipped with splice-box not less than 3" x 4" x 6½", with standard factory mounting at one end of terminal-box cover, and having not less than two knockouts for 1¼" conduit and one knockout for 1/2" conduit. Splice-box shall be capable of being relocated in the field, either by rotating 180° so knockouts face away from heater centerline or by mounting on end of terminal box, knockouts facing away from heater.

13B-11.4 Electric Baseboard Heater:

13B-11.4.1 Electric baseboard heater shall be "Chromalox" Type BBCC or equal, with integral thermostat section.

13B-11.4.2 Baseboard shall be complete with all necessary heating elements, brackets, end closures, splice plates, interior and exterior corners, all to be installed in accordance with the recommendation of the manufacturer. The base-board enclosure shall deliver both convected and radiant heat. Removable front

panel shall be not less than 18 gauge steel, with front and top supported at least every six inches of length.

13B-11.4.3 Heating elements shall consist of steel sheath enclosed strip heaters without fins. Elements shall be approximately 1½" wide x 3/8" thick and designed for operation on 208 volt, single phase power supply. Terminal box shall be designed to permit supply wiring from bottom, right, left, or back as desired. Heating element shall be mounted with terminal end fixed and the other end swing supported in order to provide for expansion. Element shall be free from expansion noises and shall not produce 60 cycle hum.

13B-11.4.4 Thermostat shall be SPST, snap-acting type, rated not less than 22 amperes at 208 volts.

13B-12 FANS:

13B-12.1 The various exhaust, return air, and ventilating fans shall be provided and arranged as indicated on the plans. Capacities shall be as scheduled.

13B-12.2 Roof Mounted Fans:

13B-12.2.1 All roof mounted exhaust or ventilation fans shall be low-silhouette type, with aluminum weatherproof housings, backwardly inclined centrifugal blowers, self-acting louvers, aluminum bird screens, disconnect switches, resiliently mounted motors, drives (direct or V-belt as indicated on plans), etc., as required for complete units. Belt-driven fans (except as otherwise noted) shall have the driving motor mounted at one side, and with the shaft vertically upward to minimize height of unit. Fans shall be "Penn Domex", "Carnes" Type DI or BE, "Jenn" Type CR or BCR, "Power Line" Type DRE or BEL, or equal.

13B-12.2.2 Fan bases shall be sound attenuating, self-flashing type, with extruded aluminum curb, 4" minimum width serrated mounting flange, neoprene rubber top gasket, and not less than 1½" thick acoustical lining material. Fans shall be installed on bases in such manner as to facilitate convenient access to the self-acting louvers.

13B-12.2.3 Fans shall be factory finished in a dark brown or black color.

13B-12.3 Return Air Fan: Return air fan shall be "Loren Cook" Type CV, or equal vane-axial, straight-through, all-aluminum construction, direct connected centrifugal blower, complete with non-overloading air foil blade wheel, resiliently mounted T.E.F.C. motor, anti-spin vanes, mounting bracket, and flanged duct connections.

13B-12.4 Ceiling Mounted Fan: Ceiling mounted toilet exhaust fan shall be a "NuTone" Model 8310 or equal single inlet, horizontal discharge, direct driven unit, complete with aluminum bladed fan, adjustable plaster ring, chrome plated ceiling inlet grille, plug-in electrical receptacle, and built-in back-draft damper.

13B-13 AIR FILTERS:

13B-13.1 Air filters shall be provided for all air handling units and/or other locations as indicated on the plans.

13B-13.2 Filters shall be high velocity flat type, "Continental" Type HA and JA, "Farr" Type 44, "American Air Filter" Type HV, "Air-Maze" Type K-2, "Air-Sen" Type W, or equal, permanent cleanable, all metal, impingement type air filters, sized as noted or otherwise required, but not less than 2" thick in the direction of air-flow. Filter media shall be constructed of several layers of crimped galvanized steel screen, arranged so that there are no "through" air passages, yet without restricting air flow at any point. Media shall be encased in galvanized steel frames of not less than 16 gauge. Pressure drop of clean filters shall not exceed .12" at 500 fpm face velocity. All filters shall be provided with suitable galvanized steel holding frames, not less than 16 gauge, and arranged for easy removal, as indicated or required.

13B-14 COMPRESSION TANK: Compression tank shall be cylindrical steel type, built to ASME Code and so labeled, and suitable for 125 p.s.i.g. Tank shall be fitted with a gauge glass, air charging valve and connections as detailed, and shall be sized as scheduled.

13B-15 FUEL OIL STORAGE TANKS:

13B-15.1 Separate underground cylindrical fuel oil storage tanks shall be furnished and installed for operation in conjunction with the steam boiler and with the Government furnished diesel engine generator. Each tank shall be provided with the tappings and fittings noted on the drawings, and with individual gauging rods to indicate the number gallons of oil in the tank. All pipe connections to tanks shall be extra-heavy welded full couplings.

13B-15.2 Each oil storage tank shall be made of steel or wrought iron and shall comply with the "Standard for Design and Construction of Underground Storage Tanks of the Underwriters' Laboratories, National Board of Fire Underwriters" and shall be so labeled. Size of each tank shall be as noted on drawings.

13B-15.3 Each tank shall be painted two coats of red lead at the factory and two coats of black asphaltum at time of installation. Tanks shall be electrically grounded in an approved manner.

13B-15.4 Tanks shall be securely anchored to reinforced concrete pads and saddles as detailed on drawings. All anchor bolts, hold-down straps, tie rods, and mat inserts shall be furnished as required. A sand cushion shall be provided for each tank as detailed, and backfill over tanks shall be properly compacted as directed on job.

13B-16 INSTALLATION OF GOVERNMENT FURNISHED MATERIAL:

13B-16.1 This Contractor shall install the Government furnished diesel engine generator, generator radiator, and related accessories as indicated on the drawings, complete and ready for operation. Installation and connection of the automatic transfer switch, battery rack, and engine starting control panel will be provided under the Electrical section of the specifications.

13B-16.2 The Government furnished control cab will be set under another section of the specifications. Roughing in for and final connections to this or related equipment shall be provided under this section, as indicated on the drawings and as directed.

13B-16.3 Exact rough-in locations for all Government furnished equipment shall be verified with the Contracting Officer before starting work.

13B-17 STEAM AND CONDENSATE RETURN SYSTEM:

13B-17.1 A complete system of steam and condensate return piping shall be furnished and installed as indicated on the plans, interconnecting boiler, converter, condensate return unit, etc.

13B-17.2 Steam and condensate return piping shall be graded downward not less than 1/8" per ten (10) feet in direction of flow, except where otherwise specifically indicated on the plans.

13B-18 HOT WATER PIPING SYSTEM:

13B-18.1 A complete system of hot water piping shall be furnished and installed as indicated on the plans, interconnecting coils in air handling units, compression tank, converters, etc.

13B-18.2 Hot water mains shall be pitched upward not less than 1/8" per ten (10) feet in the direction of flow, unless specifically noted otherwise on the drawings. Branch connections to mains shall be taken out of bottoms of mains at an angle of not less than 45 degrees down, and are to pitch up to mains not less than 1/2" per foot. The high points of each main, and other points indicated on the plans or where required for removal of air from the system, shall be automatically vented in an approved manner. Vent valve discharge lines shall be run to the nearest floor drain, or otherwise as directed.

13B-19 REFRIGERATION PIPING SYSTEMS:

13B-19.1 The various complete systems of refrigerant piping shall be furnished and installed as indicated on the plans, interconnecting the air cooled condensing units, air handling units, etc.

13B-19.2 Should refrigerant circuit characteristics of the particular type of refrigeration equipment furnished by the Contractor require modifications to the piping systems indicated on the plans, such modifications as approved by the Contracting Officer, shall be provided at no additional cost to the Government.

13B-20 MAKEUP AND DRAIN PIPING SYSTEMS:

13B-20.1 All water makeup or service connections required for equipment furnished under this section of the specifications will be provided under the Plumbing section, including stop valves at points of connection. Such additional incidental piping involved in the installation of various specialties between such stop valves and the equipment proper shall be provided under this section.

13B-20.2 All drain lines from equipment furnished under this section of the specifications to floor drains, etc., as indicated on the plans or otherwise required, shall be provided under this section.

13B-21 OIL PIPING SYSTEMS:

13B-21.1 Two complete systems of oil piping, interconnecting the oil storage tanks with the respective boiler-burner and emergency engine-generator day tank, as indicated on the drawings and as required.

13B-21.2 All oil piping shall be installed in accordance with the details on the plans, and graded evenly back to the tanks at not less than 1/8" per foot.

13B-22 RADIATOR PIPING SYSTEM: The piping system interconnecting the engine-generator with its radiator section shall be provided as indicated on the drawings and/or as required.

13B-23 DIESEL ENGINE EXHAUST SYSTEM: The system of diesel engine exhaust piping shall be provided as indicated on the drawings and/or as required. Certain items of Government furnished material shall be incorporated into this system as noted on the plans.

13B-24 PIPE AND FITTINGS:

13B-24.1 Piping for the various systems shall conform to the following:

13B-24.1.1 Steam piping - Schedule 40 black steel.

13B-24.1.2 Steam condensate return piping - Extra-strong black wrought iron.

13B-24.1.3 Hot water piping - Schedule 40 black steel.

13B-24.1.4 Refrigerant piping - Type K hard drawn copper.

13B-24.1.5 Water makeup piping - Standard weight galvanized wrought iron.

13B-24.1.6 Drain piping - Type L hard drawn copper.

13B-24.1.7 Oil piping - Extra heavy galvanized wrought iron.

133-24.1.8 Radiator piping - Standard weight galvanized wrought iron.

133-24.1.9 Diesel engine exhaust piping - Schedule 40 black steel

133-24.2 Fittings for the various systems shall conform to the following:

133-24.2.1 Steam piping:

133-24.2.1.1 2" and smaller - Screwed cast iron, standard weight, steam pattern.

133-24.2.1.2 2½" and larger - Welded, standard weight steel.

133-24.2.2 Steam condensate return piping:

133-24.2.2.1 2" and smaller - Screwed cast iron, steam pattern, extra heavy weigh

133-24.2.2.2 2½" and larger - Welded, extra-strong wrought iron.

133-24.2.3 Hot water piping:

133-24.2.3.1 2" and smaller - Screwed malleable iron, standard weight.

133-24.2.3.1 2½" and larger - Welded, standard weight steel.

133-24.2.4 Refrigerant piping - Wrought copper, sweat joint.

133-24.2.5 Water makeup piping - Screwed galvanized malleable iron, standard weight.

133-24.2.6 Drain piping - Wrought copper, sweat joint.

133-24.2.7 Oil piping - Screwed galvanized malleable iron, extra heavy weight.

133-24.2.8 Radiator piping - Screwed galvanized malleable iron, standard weight.

133-24.2.9 Diesel engine exhaust piping - Welded, standard weight steel.

133-24.3 Contractor's attention is directed to the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK for various required methods and practices involving piping and pipe joints.

133-24.4 Welding fittings as specified above shall include all elbows, tees, laterals, reducers, etc., which shall be "Tube-Turn", "Ladish", or "Taylor-Forge" full radius type; except that tees may be formed for lines 4" and larger when connecting to lines 6" and larger, by saddling branch into side of main; and connection of lines 2" and smaller into lines 2½" and larger may be made with "Threadolets". Flanges shall be welding neck type, class to match valve or connection, except 150# minimum. All welding shall be done in accordance

with standard practice, utilizing only fully qualified welders. All joints shall be smoothly fitted before welding, and welding rod shall be specifically suited to the pipe material.

138-25 VALVES, STRAINERS, AND UNIONS:

138-25.1 All valves and strainers shall have the name or trademark of the manufacturer and the guaranteed working pressure cast or stamped on the body, and all valves of any one type shall be of the same manufacture.

138-25.2 Unless otherwise specified or shown on the drawings, all valves shall be 125 p.s.i.g. S.W.P., with sizes 2" and smaller screw end, bronze body, and sizes 2½" and larger flange end, iron body, bronze trimmed.

138-25.3 Manufacturers' references given in the following table are to indicate a minimum standard of quality and design only.

	BRASS BODY	IRON BODY
Gate Valves, Non-Rising Stem		
Crane	Fig. 438	Fig. 461
Walworth	Fig. 4	Fig. 719F
Gate Valves, Rising Stem		
Crane	Fig. 428-UB	Fig. 465½
Walworth	Fig. 2	Fig. 726F
Globe Valves		
Crane	Fig. 1	Fig. 351
Walworth	Fig. 58	Fig. 906F
Swing Check Valves		
Crane	Fig. 34	Fig. 373
Walworth	Fig. 406	Fig. 920
Plug Valves, Water*		
Crane	Fig. 250	
Walworth	Fig. 554	Fig. 655F
Lubricated Plug Valves*		
Homestead	Fig. 623	Fig. 602
Nordstrom	Fig. 142	Fig. 143
Balance Cocks*		
DeZurik	Fig. 102	Fig. 101 or 118
Homestead	Fig. 623	Fig. 602
Nordstrom	Fig. 142	Fig. 143
Crane	Fig. 2250-SB	Fig. 2214-SB

* A total of two (2) operating handles for each size and/or type required shall be furnished for this project.

13B-25.4 The use of rising stem gate valves shall be limited to steam boiler and header valves.

13B-25.5 Where indicated on the plans, valves shall be provided with chain operators and chain loops to the six (6) foot level. Chain operated valves other than gate or globe pattern shall be furnished with gear or screw operating devices.

13B-25.6 Strainers shall be iron body with 20 mesh monel screens for water service and 40 mesh monel screens for steam service. Strainers shall be wye pattern, similar and equal to "Crane" #988½ with screw ends for 2" size and smaller, and "Crane" #989½ with flanged ends for sizes larger than 2". Each strainer 2" and larger shall be provided with a blow-off valve piped to a floor drain; 3/4" for up to 3" size; 1½" for 4" to 6" size; 2" for 8" or larger sizes.

13B-25.7 Unions 2" and smaller shall be 300 p.s.i.g. S.W.P. malleable iron screw end, with bronze seat ring, similar and equal to "Crane" Fig. 198E or "Walworth" Fig. 7716. Unions 2½" and to 4" size shall be 300 p.s.i.g. S.W.P., and 5" and larger 200 p.s.i.g. S.W.P. three-part flanged unions, with self seating bronze to iron ball joint, similar and equal to "Walworth" 8301.

13B-26 STEAM AND CONDENSATE SPECIALTIES:

13B-26.1 Float and thermostatic traps shall be "Sarco" Type FTL or equal, with bronze or semi-steel body and cover; stainless steel seats; stainless steel or bronze renewable heads; copper floats; and brass mechanisms.

13B-26.2 Inverted bucket traps shall be "Sarco" Type B, with bronze or semi-steel body and cover; stainless steel seat, linkage, bucket and strainer; copper seat gasket and graphite asbestos cover gasket.

13B-26.3 Each float and thermostatic trap or inverted bucket trap shall be preceded by a scale pocket, gate valve, and strainer and followed by a gate valve.

13B-26.4 Thermostatic traps shall be "Sarco" Series 9 or equal, with brass or bronze body, phosphor bronze or monel bellows, stainless steel valve head, and renewable stainless steel seat.

13B-26.5 All traps shall be full line size, with capacities not less than 1½ times the specific load imposed, or as otherwise indicated.

13B-26.6 Steam and condensate specialties shall be rated for operation with 15 p.s.i.g. steam.

13B-27 HEATING WATER SPECIALTIES:

13B-27.1 Makeup line to compression tank shall be fitted with an adjustable pressure reducing valve, factory set for 12 p.s.i.g. and a pressure relief

valve with 30 p.s.i.g. maximum setting. Valves shall be "Bell & Gossett" B-3 and A-3 respectively, or "Taco" Type 312.

13B-27.2 High points on hot water lines shall be fitted with a "Crane" No. 976, or equal, automatic air vent valve. A copper tubing overflow line shall be run from valve to nearest floor drain, or as noted.

13B-27.3 Specialties shall be rated for not less than 60 p.s.i.g. working pressure.

13B-28 REFRIGERATION SPECIALTIES:

13B-28.1 Line valves shall be "Henry" Type 626 or equal bronze alloy, solder end, packless line shut-off valves.

13B-28.2 Sight glasses shall be "Sporlan" "See-All" or equal moisture and liquid indicator, with forged brass or copper-plated bronzed steel and copper body, solder ends and optically ground sight glass sealed with neoprene or rubber and "Teflon" gaskets.

13B-28.3 Line strainers shall be "Sporlan" "Catch-All" or equal high capacity, angle pattern, replaceable molded porous core type filter-drier, with steel shell and ODS connections, sized to suit capacity of machine.

13B-28.4 Vibration isolators in refrigerant piping shall be "Flexonics Corp." "Vibra-Sorbers", or equal, installed at locations indicated on drawings.

13B-28.5 Solenoid valves shall be 115 volt, direct acting, packless type, "Alco" Type M, "Sporlan" Type S, or equal, with solder body, positive closing spring and manual operating stem. Solenoid valves shall have a capacity to handle not less than required tons of refrigeration at a 2 pound pressure drop with the refrigerant involved.

13B-28.6 Thermostatic expansion valves shall be "Alco" Series TK TCL, TJL, or TER, "Sporlan" Type FE or equal, with external adjustments, external equalizers and solder connections. Capacity of each valve shall be not less than the required tons of refrigeration at a 100 pound pressure drop, with the refrigerant involved.

13B-29 THERMOMETERS AND THERMOMETER WELLS:

13B-29.1 At the inlet and outlet of the converter, the Contractor shall furnish and install a "Weksler" Type AA "Adjust-Angle" or equal 9" scale, cast bronze or aluminum case, separable socket, red-reading mercury-filled industrial type thermometer, with totally enclosed hinge assembly and lock screw, range as indicated on the drawings. Additional thermometers shall be provided as noted.

13B-29.2 All thermometers shall be installed, adjusted and locked in such locations and/or angular positions that they may be easily and accurately read by a man standing on the floor.

13B-29.3 At the inlet and outlet of each air handling unit heating water coil, the Contractor shall furnish and install a "Weksler" or equal bronze thermometer well with screw cap and chain, sized to extend through the insulation for tests with a portable industrial thermometer.

13B-30 GAUGES, GAUGE COCKS, AND METERS:

13B-30.1 At the inlet and outlet of each heating water coil, the Contractor shall furnish and install a 1/4" "Weksler" or equal brass gauge cock, mounted on a steel pipe nipple of sufficient length to extend through the insulation.

13B-30.2 There shall be installed at the inlet and outlet of the hot water pump a "Weksler" Type 900 or equal 4½" dial, cast aluminum case, pressure gauge with red set hand, 1/4" brass gauge cock, and pressure "snubber". Ranges of gauges shall be as indicated on the plans.

13B-30.3 Each oil storage tank shall be provided with a dial type fuel oil tank gauge complete with all fittings, piping, and appurtenances required for operation. Each gauge shall be a "Liquidometer" or equal, designed for automatic compressed air use, and with a scale range appropriate for the tank reading directly in U. S. gallons. Gauges shall be wall mounted where indicated on the drawings and as directed by the Contracting Officer.

13B-31 WATER TREATMENT:

13B-31.1 Chemical water treatment services, including the installation of certain treating equipment and chemicals, will be provided by the Government under a separate contract.

13B-31.2 This Contractor shall provide the following equipment and connections to facilitate these services:

13B-31.2.1 Boiler Water Treatment: A by-pass type briquette feeder, designed for 300 p.s.i.g. W.P., shall be installed as indicated on the drawings. Feeder shall have a capacity of not less than eight (8) gallons, and shall be "Dearborn" Model B or equal.

13B-31.2.2 Heating Water Treatment: A 1" valved connection shall be provided in the hot water supply and return lines as directed by the Contracting Officer.

13B-32 BOILER STACK:

13B-32.1 Boiler stack and breeching shall be 10 gauge black sheet steel, all welded construction.

13B-32.2 Boiler stack shall be extended through the roof, provided with a rain cap and ventilated thimble properly flashed and counterflashed, and guyed to the building as indicated or required.

13B-33 DUCTWORK:

13B-33.1 The Contractor shall furnish and erect all supply, return, and exhaust air ventilating ducts, risers, branches, elbows, dampers, etc., necessary to make the complete systems, in accordance with recommendations of the 1966 A.S.H.R.A.E. Guide as to gauges, transverse joint connections, bracing, and as indicated on the drawings. All ductwork shall be constructed of mill-bonderized galvanized steel sheets. Such ductwork as is hereinafter specified to be painted, shall be constructed of steel sheets equal to "Zincgrip-Paintgrip".

13B-33.2 All horizontal ducts shall be rigidly supported by means of 18 gauge strap hangers spaced not more than 6'-0" on centers, securely fastened into the construction above. All vertical ducts shall be supported with angles riveted to the duct fastened to wall or partition on not over 6'-0" centers. All ductwork shall be left clean inside.

13B-33.3 All rectangular duct panels 12" or larger, not internally lined or externally insulated, shall be cross-broken.

13B-33.4 All seams and joints in ductwork installed below the first floor line shall be soldered air tight.

13B-33.5 Where square elbows are indicated on the plans, or are otherwise necessary, turning vanes equal to "Tuttle & Bailey Ducturns" shall be installed. Shop built double-vane turning vanes, constructed to SMACNA duct manual Standards, will be acceptable.

13B-33.6 At each branch from a main duct, and at each sweeping take-off to an air outlet, there shall be provided a splitter damper with an adjusting device. At all other take-off boots to air outlets of any type there shall be provided "Santrols", "Deflectrols", or equal air straightening devices with felted leading edges.

13B-33.7 Splitter and volume dampers shall be shop-constructed of same materials as ductwork. Damper rods shall be square steel rods with "U" bolts, "Young" Type CRS No. 660 or equal. End bearings shall be equal to "Young" No. 654, 5, 6, or 9.

13B-33.8 Damper regulators in concealed areas or above accessible ceilings shall be equal to "Young" "Valcolox" key-locking lever handle regulators, fitted to the duct. REGULATORS IN EXPOSED AREAS SHALL BE EQUAL TO "YOUNG" FLUSH MOUNTED, ADJUSTABLE COVER, C.P. CONCEALED TYPE, NO. 315, 6, 7, OR 8.

13B-33.9 Fire dampers shall be provided in all locations indicated on the plans or otherwise required, and shall be single-bladed or multiple-interlocked-blade type to suit the conditions. All fire dampers shall be constructed to standards of NBFU Pamphlet #90-A and supplements, and each shall be fitted with a 160° fusible link. Access doors for inspection and/or resetting shall be provided in ducts, walls, and/or ceilings as required. Fire dampers shall be equal to "Dowco" Fig. F-6V, F-6H, F-7V, F-7H, F-8V, or F-8H, depending upon the application.

13B-33.10 Ducts shall be installed to leave sufficient head room in all cases, and where it becomes necessary to change the size or shape of a duct to conform to structural or architectural conditions, the Contracting Officer shall be consulted for resizing or rerouting.

13B-33.11 Where ducts pierce roof to terminate in cowls, fans, ventilators, etc., adequate flashing and counterflashing shall be provided to exclude any rainwater from entering building through duct roof penetrations.

13B-33.12 All forced air inlets or outlets from the building shall be provided with 18 gauge galvanized steel wire screens, in suitable removable frames of same material as the outlet or inlet.

13B-33.13 Access Doors in Sheet Metal Work:

13B-33.13.1 Wherever necessary in ductwork, there shall be provided suitable access doors and frames to permit inspection, operation and maintenance of all valves, controls, fire dampers, filters, bearings, traps or other apparatus concealed behind the sheet metal work. All such doors shall be of double construction of not less than No. 20 gauge sheet metal and shall have sponge rubber gaskets around their entire perimeter.

13B-33.13.2 Doors in insulated ducts shall have rigid fiberglass insulation between the metal panels.

13B-33.13.3 In no case shall access to any items of equipment requiring inspection, adjustment, or servicing require the removal of nuts, bolts, screws, wing nuts, wedges, or any other screwed or loose device. It is the intention of this specification that all access doors be hinged with heavy brass flat hinges and latched with clinching type brass latches.

13B-33.13.4 Access doors in ducts shall not be smaller than 18" x 18", except as otherwise noted.

13B-33.14 Ductwork noted to have acoustical lining has been sized to allow for acoustical lining thickness.

13B-34 SOUND ABSORPTION:

13B-34.1 All supply and return ductwork from each air handling unit shall be internally insulated for a distance of 15 feet developed length from the air unit, or as otherwise indicated on the drawings.

13B-34.2 Sound absorption material shall be 1" thick neoprene coated glass fiber insulation, similar and equal to "Fiberglas" PF-313 coated duct liner.

13B-34.3 Duct liner shall be applied with neoprene coated side toward the air stream. Attachment to the bottom and sides of duct shall be made with adhesive. Top shall be attached with adhesive and sheet metal screws and 1½" diameter caps. Screws shall be 1/2" longer than insulation thickness. All joints and breaks shall be pointed up to a smooth surface with mastic.

13B-35 FLEXIBLE CONNECTIONS:

13B-35.1 A flexible connection shall be furnished and installed between all fan units and connecting ductwork.

13B-35.2 Flexible connections shall consist of a clean 2" break between metal ducts, jointed by a waterproof and fire-resistant canvas fabric, weighing not less than 20 ounces per square yard, and similar and equal to "Ventfab". Fabric shall be fastened to ductwork with 1" x 1/8" band iron and sheet metal screws.

13B-36 AIR INTAKES AND DISCHARGES:

13B-36.1 Air intake and discharge louvers shall be furnished and installed under another Division of this specification.

13B-36.2 Roof top discharge unit shall be a "Penn" Type DR or equal spun aluminum weatherproof relief unit with bird screen. Base shall be pre-fabricated type as specified for roof mounted fans. Unit shall be factory finished in dark brown or black color.

13B-37 EQUIPMENT BASES:

13B-37.1 Equipment bases outside of the building will be provided under another section of the specifications.

13B-37.2 There shall be provided under this specification section, as indicated on the plans or otherwise required, the various interior equipment bases. Unless otherwise noted, all floor mounted equipment shall be furnished with a concrete base in addition to any required vibration isolation.

13B-37.3 Equipment bases in general shall be reinforced concrete, having #3 steel reinforcing bars on 12" centers both ways, located approximately half-way between the top and bottom of the base. Outside dimensions shall be such that the concrete base extends approximately 4" beyond the equipment mounting base, unless otherwise specifically shown on the plans. Base depth shall be 4", or as otherwise noted. All corners shall be chamfered 1".

13B-37.4 Mounting bolts shall be set in pipe sleeves, with 6" x 6" anchor plates, and shall be grouted in after mounting equipment.

13B-38 VIBRATION AND NOISE CONTROL:

13B-38.1 Transmission of preceptible vibration, structure-borne noise, or objectional air-borne noise to occupied areas by equipment installed under this contract will not be permitted. The Contractor shall submit for approval data showing disturbing frequency, supported weight, static deflection or natural frequency and efficiency for each isolator and damper he proposes to use.

13B-38.2 All isolation material selections shall be based on laboratory, published or factory certified data, proving that all such materials and usage comply with these specifications. After installation, and before acceptance by the Government, the Contractor, in company with the Contracting Officer or his designated representative, shall inspect all isolation materials furnished by him. A written report shall be made to the Contracting Officer noting any discrepancies or maladjustments so found. Should any noise or vibration be objectionable to the Contracting Officer, field instrumentation tests and measurements must be made by the Contractor to determine the source, cause, and path of such disturbance. Any variance or non-compliance with these specification requirements are to be corrected by the Contractor in an approved manner. Concrete foundations, inertia pads and floating slabs, associated with isolators or isolation material are to be sized considering requirements and limitations set out herein and shown on the plans. Contractor's shop drawings shall show size and location of anchor bolts for isolators and equipment thereon. Reinforcing for such foundations and pads shall comply with requirements as set out in applicable sections of these specifications.

13B-38.3 The hot water pump shall be mounted with its driving motor and base plate on a concrete block which in turn shall be mounted on vibration isolators to prevent vibration and structure-borne noise transmission to the building. The concrete block shall weigh not less than the weight of all equipment mounted on it, and shall be reinforced as previously specified. Concrete blocks shall in turn be mounted on 1" sound pads, loaded to more than 40 per cent, but less than 75 per cent of factory rating.

13B-38.4 The control air compressors shall each be mounted on a concrete pad equal in weight to not less than the compressor and tank unit. The concrete pad shall in turn be supported by spring steel isolators selected for a minimum of 1" static deflection. Isolators shall in turn be mounted on 1/4" sound pads.

13B-38.5 The boiler and diesel engine generator shall each be mounted directly on 1" sound pads, resting on a concrete base, which pads shall be loaded to more than 40 per cent, but less than 75 per cent of factory rating for the operating weight. Boiler mounting bolts shall be completely isolated from any metal-to-metal contact, and generator shall be set without bolts. Isolation pads shall be thoroughly coated with a waterproofing compound.

13B-38.6 All piping as set out herein shall be resiliently isolated from the building. Isolation hangers shall consist of a steel housing or retainer with the springs in compression, and shall have a fabric or neoprene isolator washer in series with the spring. Floor mounted supports shall be the same type of isolator or media as is used for the nearest isolated equipment connected to the piping. In general, all piping shall be shimmed or blocked in place until all connections are made and systems filled with water, then isolators adjusted to support the weights, and then shims and blocks removed. The first support point from a piece of isolated equipment shall provide not less than the static deflection of the equipment isolators. All springs supporting piping shall be capable of an additional 1" deflection

without becoming solid, and springs supporting vertical risers shall have provisions for limit stops.

13B-38.6.1 All steam, condensate return, and hot water lines in the mechanical equipment room shall be isolated with steel springs with a minimum of 1" static deflection.

13B-38.6.2 First three (3) supports (or all supports for 25 feet developed length, whichever is farther) for all other piping, including overhead drains, from any piece of equipment specified to be isolated, shall incorporate steel springs with not less than 1" static deflection.

13B-38.6.3 Converter and compression tank shall be considered part of piping system and be isolated with steel springs with a static deflection of not less than 1".

13B-38.6.4 At points where hot water and refrigerant lines pass through walls, resilient sleeves, as recommended by the manufacturer, shall be used.

13B-38.7 Flexible connectors shall be manufactured by a firm regularly engaged in the manufacture of such equipment and which can provide published ratings and construction details of items being considered. Flexible connections shall be bronze or stainless steel with MPT ends for 2" and smaller and ASA flanges for $2\frac{1}{2}$" and larger. For water service less than 125°F and 50 p.s.i. working pressure, reinforced rubber with full face integral flanges may be used, with no friction type clamps or fittings being permitted. Lengths shall be not less than those recommended by the manufacturer for the intended service, and in all cases, shall be arranged for lateral movement only. Flexible connections, as set out elsewhere in these specifications, shall be provided in addition to the following.

13B-38.7.1 Flexible connections shall be installed in the connections of the hot water pump.

13B-38.7.2 Flexible connector shall be installed in the discharge of each control air compressor tank.

13B-38.8 All air handling units and the return air fan shall be isolated from the building structure. In all cases, care must be taken to insure that all connections to the unit be sufficiently resilient to allow full undamped functioning of the unit isolators. This includes electrical raceway, ducts, drains, piping, etc. Units shall be isolated as follows:

13B-38.8.1 Air handling units shall be mounted directly on steel spring isolators. Steel spring isolators shall consist of two or more channel or angle iron rails extending from the front to back of the unit and resting on unhoused stable springs with leveling devices. Springs shall be spaced to prevent excessive deflection of the rail and shall rest on 1/4" sound pads. Springs shall have a minimum of 1" static deflection.

13B-38.8.2 Return air fan shall be isolated from the building structure by means of steel spring isolators with a minimum of 2" static deflection.

13B-38.9 Vibration isolation media incorporated in the various manners described herein shall be as manufactured by "Korfund", "Amber-Booth", "Vibration Mountings, Inc.", or equal.

13B-39 GRILLES, REGISTERS, AND OUTLETS:

13B-39.1 Each supply, return, exhaust, or other duct terminal shall be provided with a grille, register, or outlet as noted on the plans and/or specified herein.

13B-39.2 Round ceiling diffusers shall be "Barber-Colman" Type VJR, "Tuttle & Bailey" Type PA, "Carnes" Type DA5 (Form 1), "Anemostat" Type C-2, or equal adjustable pattern unit with opposed blade volume control.

13B-39.3 Square ceiling diffusers shall be "Barber-Colman" Type SAS, "Tuttle & Bailey" Type DA, "Carnes" Type KSA-40, "Anemostat" Type EA-1, or equal four-way blow, surface mounted, adjustable discharge pattern unit, with loose-key opposed blade volume control.

13B-39.4 Return grilles in walls shall be "Barber-Colman" Type GMR, "Tuttle & Bailey" T-70D, "Carnes" 500H-45, "Waterloo" SRC35HD, or equal. Blades shall be horizontal, set at a 35° to 45° angle down, and at not more than .67" spacing.

13B-39.5 Return registers in walls shall be "Barber-Colman" Type GMR-G00V, "Tuttle & Bailey" T-78, "Carnes" 500H-45, "Waterloo" Type 35HMVD, or equal with loose-key face-operated opposed blade register. Blades shall be horizontal, set at 35° to 45° angle down, and at not more than .67" spacing.

13B-39.6 Exhaust grilles and registers shall be the same as return grilles and registers, except when ceiling mounted shall be furnished with straight face blades.

13B-39.7 Floor type return air registers shall be "Barber-Colman" Type TCC extruded aluminum, removable bar, flush mounted type, with loose-key, face operated, opposed blade volume control.

13B-39.8 All return air or exhaust register units shall be furnished with spring closers and replaceable fusible links for automatic closure at temperatures above 140°F.

13B-39.9 All steel supply, return, and exhaust grilles and registers shall be furnished with removable cores, or with a "Tuttle & Bailey" No. 45R, "Carnes" No. 1000, "Waterloo" Type XPF, or equal mounting frame.

13B-39.10 All extruded aluminum registers shall be furnished in natural anodized finish. All steel wall and ceiling units or grille cores shall have baked enamel finish; aluminum for walls and off-white for ceilings. Units shall not be installed until building painting is complete.

13B-39.11 All mounting frames shall be furnished with a gray prime coat finish and shall be installed in time to be painted out with the building surfaces, under another specification Division.

13B-39.12 Door grilles will be furnished and installed under another Division of these specifications.

13B-40 CLEANING, TESTING, AND ADJUSTING:

13B-40.1 It is the intent of this section of the specifications to provide for all necessary tests during and at completion of the job to insure tight piping and correctly balanced systems. The Contractor shall perform such tests, and shall do any and all work required to accomplish this end.

13B-40.2 All diesel engine exhaust lines shall be subjected to an air pressure test of 100 p.s.i.g. and made tight at that pressure.

13B-40.3 All refrigerant lines shall be subjected to an air pressure test of 300 p.s.i.g., made tight at this pressure, and leak tested with "Halide" torch.

13B-40.4 Before installation of pipe covering or final connection of units, all hot water piping, steam piping, steam condensate return piping, and radiator valve piping shall be tested under a hydrostatic pressure of 125 p.s.i.g. at the lowest point in the system, with all air freed from the lines, which pressure shall be maintained without pumping for a period of one (1) hour. Control valve elements, instruments or other equipment that might be damaged by this pressure shall be removed from the system before testing. After completion of this test, the system shall be drained and final connections made to the units.

13B-40.5 All makeup piping, and all drain piping shall be subjected to a 125 p.s.i.g. hydrostatic test and made tight at this pressure.

13B-40.6 Prior to being covered up or backfilled, all fuel oil piping shall be subjected to an air pressure test of 125 p.s.i.g. for a period of 30 minutes and made tight at that pressure. All fuel oil suction lines shall also be tested under a vacuum of 20 inches of mercury for a period of 20 minutes and made tight under said condition.

13B-40.7 After hot water system has been completely connected, it shall be filled with water, completely vented, and drained. System shall then be re-filled, re-vented, and operated for 48 hours continuously with circulating pump running. System shall then be drained completely, re-filled, re-vented, and balanced to scheduled gpm quantities.

13B-40.8 After radiator water system has been completely connected, it shall be filled with water and drained. It shall then be re-filled and drained, and process repeated until drain water is clear and clean.

13B-40.9 Boiler shall be cleaned and blown down in accordance with the boiler manufacturer's instructions. Boiler controls shall be adjusted and checked for proper operation under flame failure, power failure, high pressure and low-water conditions. Breeching and/or inlet dampers shall be regulated for proper combustion and locked at proper settings.

13B-40.10 Blowing down and cleaning out all portions of the steam and condensate return system under steam pressure shall be done in the following manner:

13B-40.10.1 Remove all thermal members from traps and provide same with blank caps.

13B-40.10.2 Wash out entire system with clean water, and waste water to sewer or outside of building.

13B-40.10.3 Disconnect condensate return line at receiver. Fire boiler to 5 p.s.i.g., and waste all condensate into sewer or outside of building for four hours, adding water as required to make up for condensate wasted.

13B-40.10.4 Re-connect condensate receiver and boiler feed pumps; then valve off and test system at 15 p.s.i.g.

13B-40.10.5 Valve boiler off from system, and raise pressure to test safety relief valve settings.

13B-40.10.6 After system has been cleaned and proven tight, replace all thermal members in the traps, and operate the entire system at 15 p.s.i.g. boiler supply pressure, to determine heating ability and quietness of operation.

13B-40.11 All strainers and filters shall be cleaned after pressure testing and system cleaning operations, and prior to final filling of systems.

13B-40.12 All motors, bearings, etc., on all equipment shall be correctly oiled and/or greased with the proper lubricant before the equipment is operated, and again at completion of the job.

13B-40.13 The external static pressures specified in connection with the various fans and/or air handling units may vary somewhat with job conditions and the various types of air distribution which may be employed, and thus may not be exactly correct for the installed systems. The Contractor shall test and adjust the completed systems as necessary to produce the specified air quantities, including the changing of fan speeds and the furnishing of new drives where required.

13B-40.14 Air distribution balance for specified cfm delivery at the various individual outlets shall be achieved by temperature testing and by use of anemometer or velometer. Such balancing shall be performed in conjunction with temperature regulation adjustments specified under "Automatic Control Equipment".

13B-40.14.1 Provide to the Contracting Officer six (6) copies of air balance test data obtained for each balanced air handling system. Test data shall include the following:

System No.
Fan No.
Date of Test
Name of Individual Certifying Test
Design Air Quantities (CFM)
Actual Air Quantities (CFM)
Design S.P. (Inches W.G.)
Actual S.P. (Inches W.G.)
Motor H.P.
Fan Brake H.P.
Motor Amps (Nameplate)
Motor Amps (Measured)
Line Volts (Measured)
Motor RPM
Fan RPM
Air Filter Resistance (Inches W.G.)

13B-40.15 Control Cab Air Balance:

13B-40.15.1 The Contractor shall be required to complete the air balancing and adjustment of the completed control cab heating and air conditioning system. The control cab air system shall be properly adjusted to achieve actual air quantities to within plus or minus three (3) per cent of the values shown on the cab design drawings. Air velocities, throw, air volume per linear foot of grille length, and final air temperatures leaving the heating grilles are critical for the control cab glass supply system performance.

13B-40.15.2 In performing the air balance and adjustment work, the Contractor shall use carefully calibrated instruments as approved by the Contracting Officer.

13B-40.15.3 Submit to the Contracting Officer a complete test log of the control cab system final performance including all air volumes, static pressures, grille velocities, temperatures, damper settings, supply, return and spill air quantities.

13B-40.15.4 Balance and adjust the capacity and performance of the control cab emergency exhaust fans located in the cab penthouse to the plan requirements.

13B-40.15.5 The control cab system shall not be considered completely adjusted and balanced until approved and accepted by the Contracting Officer or his authorized representative.

13B-40.16 On completion of the installation, the Contractor shall test and adjust the entire system for proper operation for the season (summer or winter) in effect at the time. At the beginning of the next ensuing season (winter or summer), the Contractor shall return to the job and readjust where necessary.

13B-40.17 The Contractor shall operate the entire plant for five (5) working days of eight (8) hours each, and shall leave the entire plant in perfect operating condition. During this period, he shall also instruct the Government's representatives in the proper operation and maintenance of all equipment and systems.

13B-40.18 The Contractor shall furnish the Contracting Officer with three typed sets of complete operating instructions and maintenance schedules. Operating instructions shall first be submitted to the Contracting Officer for approval. Maintenance schedules shall include, but not be limited to, complete lubricating instructions designating all oiling and greasing points for all equipment and designating type of lubricant to be used.

13B-41 INSULATION:

13B-41.1 All heating water supply and return, steam, and steam condensate return (gravity or pumped) lines shall be insulated with molded sectional glass fiber pipe insulation of not less than 7#/c.f. density, with factory applied 4 oz. canvas jacket, similar and equal to "Fiberglas" PF. Flanges, valves, and fittings shall be insulated with mitered segmental pipe covering, smoothed up with a 1/4" coat of "Simco" #9 1-coat cement, and finished with 6 oz. canvas jacket pasted in place; except that fittings on lines 2½" or smaller may omit the mitered pipe covering and be built up to adjacent insulation thickness entirely with "Simco" #9 1-coat cement and finished with 6 oz. canvas jacket pasted in place. Insulation thickness fo lines up to 6" size shall be 1", and for sizes above 6" shall be 1½".

13B-41.2 All refrigeration suction lines shall be insulated with 1/2" thick seamless foamed plastic pipe insulation, similar and equal to "Armstrong Armaflex 22". Insulation shall be slipped on piping without cutting side seams wherever possible. All joints shall be sealed with "520" adhesive. No "taping" of insulation will be permitted. Insulation exposed to the weather shall be finished with two (2) coats of "Armstrong" "Weatherproof Plastic" or equal reinforced with a layer of glass mesh embedded in the first coat while wet.

13B-41.3 All radiator piping shall be insulated the same as for hot water piping, except thickness shall be 2". Insulation exposed to the weather shall be provided with a weatherproof jacket consisting of two layers of 50 lb. asphalt saturated roofing felt, "Johns-Manville Double Flextone" or equal, lapped not less than 2" at joints and seams, and sealed with "Johns-Manville Laptite" or equal asphaltic cement. Finished jacket shall be banded with stainless steel bands 18" on centers.

13B-41.4 All interior diesel engine exhaust piping shall be insulated the same as for hot water piping, except that thickness shall be 1½".

13B-41.5 Converter, boiler breeching, and boiler stack within the building shall be insulated with 1½" thick magnesia or calcium silicate blocks wired on, with 1/2" thick hard finish insulation cement applied in two (2) coats, reinforced with mesh wire, and finished with 8 oz. canvas pasted on.

13B-41.6 Boiler and air handling units will be factory insulated and will require no further field attention.

13B-41.7 All interior exposed supply, return, and outside air ductwork, including that in mechanical rooms or equipment areas, shall be insulated with 1" thick semi-rigid glass fiber board (4.0#/c.f. min. density) with a factory applied vapor-barrier of asphalt and kraft paper, similar a d equal to "Fiberglas" "Vapor-Seal Duct Insulation". The insulation shall be applied with galvanized sheet metal screws and tin coated steel discs, spaced to afford a minimum of one screw for two square feet of insulation. All joints, screw-discs, and breaks in facing shall be sealed with 1/2" thick troweled-on vapor resistant mastic. Mastic at corners and joints shall be reinforced with open mesh glass cloth or tape.

13B-41.8 All interior concealed supply, return, and outside ductwork shall be insulated with 2" thick flexible fiberglass (1.0#/c.f. min. density) insulation, with reinforced, aluminum foil-faced flame-retardant kraft paper facing, equal to "Fiberglas" PF-336. Insulation shall be applied in sections long enough to wrap around duct and meet securely without stretching and shall be adhered to ducts with 6" wide strips of MMM FC-890 adhesive on 12" centers. All pieces shall butt tightly at joints, and be sealed with 2" wide overlap of facing material and adhesive or continuous strips of 4" "Permacel" adhesive tape.

13B-41.9 Ductwork which may be left uninsulated is as follows:

13B-41.9.1 Supply and return ductwork having 1" thick interior acoustic lining, as specified under SOUND ABSORPTION, except that all supply and return ductwork within mechanical rooms must be externally insulated regardless of internal lining.

13B-41.9.2 All exhaust air ductwork.

13B-41.10 Heating water pump, heating water compression tank, return air fan, and diesel exhaust flexible connector shall not be insulated.

13B-42 PAINTING:

13B-42.1 All concealed canvas covered work shall be painted two coats of "Talcote" #070, or equal asphalt emulsion damproofing.

13B-42.2 All exposed canvas covered work, including that in the mechanical rooms, shall be painted one coat of approved size in preparation for finish painting.

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13B-42.3 All uncovered work in concealed spaces above ground floor line, such as pipe chases or attics above ceilings, shall not be painted.

13B-42.4 All other painting or preparation therefor shall be as called for in the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK.

13B-43 AUTOMATIC CONTROL EQUIPMENT:

13B-43.1 A system of automatic control for the various items of equipment shown on the plans or specified herein shall be furnished and installed by an approved Automatic Control Subcontractor, and shall be complete with all controlling elements, tubing, control valves, dampers, damper motors, relays, etc., incidental to a finished job.

13B-43.2 The Subcontractor under this heading shall furnish all labor and equipment, material, and services necessary for the proper installation of a pneumatic system or systems of automatic temperature control.

13B-43.3 Basic control equipment shall be manufactured by "Robertshaw", "Johnson Service Company", "Honeywell", or "Powers Regulator Company". Certain other items manufactured by other control companies shall also be furnished as noted.

13B-43.4 All power and interlock wiring for the control system shall be shall be furnished and installed as a part of and in accordance with the requirements of the Electrical section of the specifications. Any electronic or low voltage wiring required for control equipment shall be furnished and installed in conduit as a part of the control system. Control panels shall be internally factory prewired to properly identified terminal blocks.

13B-43.5 Compressed Air Piping:

13B-43.5.1 All compressed air piping throughout the building shall be seamless, hard drawn copper tubing, either single tube or multiple tube bundles, with sweat type fittings, except that final connections within panels or to control devices (up to two feet in length) may be soft drawn copper or virgin polyethlyene plastic tubing; OR compressed air piping may be virgin polethlyene plastic tubing in its entirety. Number of tubes per bundle shall depend upon job requirements.

13B-43.5.2 Polyethylene tubing shall be single or multitube bundled, shall have an ambient temperature range of not less than -100°F to +175°F and an operating temperature capability of not less than +120°F for continuous operation. Pressure ratings shall be not less than 600 p.s.i. burst pressure and 160 p.s.i. working pressure at 72°F operating temperature. Tubing shall be capable of meeting the requirements of ASTM D1693 test (modified) for thermal and environmental characteristics. Testing reports of batch samples shall be submitted to the Contracting Officer if so requested before or during job progress. Bundled tubing shall consist of multiple tubes, wrapped together with "Mylar" tape, and covered with not less than a .062 inch jacket of polyvinyl chloride to provide further mechanical protection.

13B-43.5.3 All compressed air piping shall be run concealed in the building construction wherever possible, but whether concealed or not shall be run parallel to the building construction in a neat, careful, and workmanlike manner, subject to the approval of the Contracting Officer. Piping system shall be tested at 30 p.s.i.g. for a period of 24 hours, during which the pressure drop (ambient temperature conpensated) shall not exceed 2 pounds.

13B-43.5.4 Compressed air piping shall be supported at not more than eight feet on centers, and at each loop and offset. Concealed piping shall be supported by wall clips, and an approved type of power driven concrete nails and fasteners. Exposed piping shall be supported by standard pipe straps and approved screw type fasteners, and where multiple pipes are run across open areas between control devices, same shall be strapped and/or banded together to give a presentable appearance. Proper precautions shall be taken to prevent damage to piping during or after completion of construction. In piping around building obstructions and/or other pipes, ducts, or conduits, no loose sags or bends in the air piping will be permitted.

13B-43.6 Control System Air Supply:

13B-43.6.1 The control system shall be furnished with two (2) high pressure motor driven air compressors, each sized for full system operation when running not more than 33-1/3% of the time. Each compressor shall be equipped with and mounted upon a cylindrical steel ASME storage tank. Each unit shall be complete with high and low pressure gauges, pressure switch, pressure relief valve, intake air filter, and all other necessary accessories. Each tank shall be of sufficient size to permit not less than a ten (10) minute off cycle for a ten (10) p.s.i.g. differential.

13B-43.6.2 Both tanks shall be piped to a mechanical refrigerated air drier, and valved for service or repair isolation. Tanks and drier shall be properly and individually trapped for automatic condensate drain. All necessary pressure reducing or other accessories shall be provided as indicated or required. Both air compressor motor starters shall be wired to an automatic electric alternator actuated by adjustable pressure switches sensing tank pressure. The alternator shall automatically operate either compressor upon the intentional shut-down or failure of the other unit.

13B-43.6.3 The control system main air and each tank operating pressure shall be indicated on the main control panel. Each tank shall be equipped with an alarm pressure sensing device wired to pilot lights mounted adjacent to the respective tank pressure indicator. On a fall in pressure the alarm shall be actuated.

13B-43.7 All automatic control valves and all automatic control dampers other than A/C unit zone or face and by-pass dampers shall be furnished by the Temperature Control Manufacturer and installed under his supervision by the Contractor.

13B-43.8 Automatic control of equipment shall be provided as follows:

13B-43.8.1 Air Handling Units No. A/C-1 and A/C-2:

13B-43.8.1.1 Ventilation Dampers: Each air handling unit shall be provided with motorized dampers for the control of outside air, return air, and exhaust air, as indicated on the plans. Operation of these dampers shall be in response to the respective unit operation, as determined by actuation of individual unit "Heating-Ventilation", "Cooling", and "Automatic" selector switches as follows:

13B-43.8.1.1.1 "Heating-Ventilation": When the selector switch is in the "Heating-Ventilation" position, and the unit fan motor is energized, the outside air damper and exhaust damper shall open to a minimum position as determined by the setting of the minimum position switch located on the main panel. When the fan stops, the dampers shall close. The return air damper shall operate inversely to the outside air, and exhaust dampers. A controller located in the mixed air shall, on a rise in temperature above its setting, override the minimum switch relay and modulate the outside air and exhaust air dampers open to maintain a mixed air temperature in accordance with its setting. A controller in the outside air shall override the mixed air thermostat returning the outside air damper to its minimum position on a rise in temperature above its setting. The minimum setting of the outside air and exhaust dampers shall be adjustable and continuously indicated on the main control panel. Ventilation Fan #V-1 shall be electrically interlocked with Air Handling Unit A/C-2 for concurrent operation at exhaust damper settings beyond the minimum open position.

13B-43.8.1.1.2 "Cooling": When the switch is placed in the "Cooling" position, the outside air and exhaust dampers shall close to the adjustable minimum position and remain while the unit is in operation.

13B-43.8.1.1.3 "Automatic": When the switch is placed in the "Automatic" position, the dampers shall function as described above in response to an outside air controller. On a rise in outside air temperature above its setting, the system shall function as in "Cooling". On a fall in outside temperature the system shall function as in "Heating-Ventilation".

13B-43.8.1.2 Freeze Protection:

13B-43.8.1.2.1 A duct thermostat with an averaging sensing element, installed in each fan inlet plenum, shall prevent opening of the respective outside air damper if air temperature there is below 38°F.

13B-43.8.1.2.2 A safety aquastat shall be mounted on the outlet pipe of each heating coil which shall prevent the respective fan from starting if no hot water is present in the coil.

13B-43.8.1.2.3 Freeze protection safety controls specified above shall be bypassed by a third controller any time outside air dry bulb temperature is above 38°F.

13B-43.8.1.3 Filter Indication: A differential pressure sensing device shall be located across each air handling unit filter section. A clogged filter condition shall actuate the device and initiate an alarm condition on the main panel.

13B-43.8.1.4 Temperature and Humidity Control, Unit A/C-1: Space temperature and relative humidity shall be maintained by transmitter controllers located on the control panel in the Control Cab as follows:

13B-43.8.1.4.1 When the space temperature is below the temperature set point, the unit face damper shall be open and the by-pass damper closed. The heating coil 3-way valve shall be in the full flow to the coil position. On a rise in temperature the face damper shall modulate towards the closed position and the heating coil valve towards by-pass to the coil.

13B-43.8.1.4.2 On a further rise in temperature above the controller setting, the action of the face damper shall be reversed, and it shall begin to modulate open. The heating coil valve shall remain in the full-bypass position.

13B-43.8.1.4.3 On a further rise in temperature, the refrigeration solenoid valve #1 shall be energized, followed by refrigeration solenoid valve #2 on a further rise.

13B-43.8.1.4.4 On a rise in space humidity the humidity transmitter controller shall index the air unit to full cooling by opening the face damper and energizing both DX coils. Space comfort conditions shall be maintained by the space temperature controller modulating the heating coil control valve providing system reheat.

13B-43.8.1.5 Temperature Control, Unit A/C-2:

13B-43.8.1.5.1 Space temperatures shall be maintained by zone room thermostats modulating zone mixing dampers. The zone stat sensing the least satisfied condition in heating shall, through a selector relay, modulate the heating coil 3-way valve. When all zones are as much as 80% satisfied for heating, the valve shall be modulated to the full by-pass position. On a further rise the zone controller (Zones 1 through 6) sensing the overheat condition shall, through a selector relay, index a pressure-electric switch, energizing refrigeration solenoid valve #4. Zone 7 thermostat, serving the radar equipment area shall, on a call for cooling, index a pressure-electric switch energizing refrigeration solenoid valve #3.

13B-43.8.1.5.2 An electric duct type reheat coil serving a portion of Zone 7 shall be controlled by a room thermostat actuating a pressure-electric switch wired to the duct heater control contactor.

13B-43.8.2 System Auto-Manual Change-Over: The "Heating-Ventilation", "Cooling", and "Automatic" selector switches specified for each air handling unit shall also function for over-all system control as follows:

13B-43.8.2.1 Automatic Position:

13B-43.8.2.1.1 Heating: The system master change-over thermostat shall energize the hot water pump control circuit and de-energize both condensing units at an adjustable predetermined outside air temperature (approximately 40° and below).

13B-43.8.2.1.2 Heating-Cooling: The system master change-over thermostat shall energize the hot water pump and both of the condensing unit control circuits between two adjustable predetermined outside air temperatures (approximately 40° to 80°).

13B-43.8.2.1.3 Cooling: The system master change-over thermostat shall energize both condensing unit control circuits and de-energize the hot water pump at an adjustable predetermined outside air temperature (approximately 80° and above).

13B-43.8.2.2 Heating-Ventilation Position: The system shall be indexed to function as described above under automatic position "Heating", regardless of outside air temperature.

13B-43.8.2.3 Cooling Position: The system shall be indexed to function as described above under automatic position "Cooling" regardless of outside air temperature.

13B-43.8.3 Exhaust, Ventilation and Return Air Fans:

13B-43.8.3.1 Ventilation Fan V-1 shall be interlocked to run concurrently with Air Handling Unit A/C-2 at any time such unit is admitting more than minimum outside air to the building. There shall also be provided a "Hand-Off-Automatic" selector switch to permit local operation of Ventilation Fan V-1, regardless of Air Handling Unit A/C-2 operation.

13B-43.8.3.2 The return air fan shall be interlocked to run concurrently with Air Handling Unit A/C-1.

13B-43.8.3.3 Ventilation Fan V-2 and Exhaust Fans EF-1 and EF-2 shall be locally switched.

13B-43.8.4 Unit Heater Control:

13B-43.8.4.1 Each hot water unit heater shall be furnished with a normally open modulating, pneumatic, globe pattern hot water valve, controlled by a room type thermostat. On a rise in space temperature, the valve shall be modulated towards the closed position. On a fall in temperature, the sequence shall be reversed.

13B-43.8.4.2 Electric unit heaters shall each be controlled by a room thermostat actuating a pressure-electric switch wired to the unit control relay.

13B-43.8.4.3 Electric baseboard heater will be furnished by the manufacturer with an electric thermostat, and will require no further attention from the Automatic Control Subcontractor.

13B-43.8.5 Steam Heating Boiler: Steam heating boiler will be furnished with the necessary safety and operating controls by the boiler manufacturer. Steam pressure settings will be made at the boiler. Boiler shall be interlocked for automatic starting at any time the hot water pump is running.

13B-43.8.6 Converter:

13B-43.8.6.1 The converter shall be furnished with two steam control valves, which shall modulate in sequence to control leaving water temperature at the converter. One valve shall have capacity of 2/3, and the other shall have capacity of 1/3 of the rated flow in lbs. of steam per hour. Valve pressure drop at full flow shall not exceed 3 p.s.i. Each valve shall be furnished with a positive-positioner.

13B-43.8.6.2 When the hot water pump is de-energized, the valves shall be positively closed. When the hot water pump is energized, the valves shall be controlled by a sub-master controller with the sensing element in the converter hot water discharge. The sub-master control point shall be inversely reset by an outside air master controller, with its sensing element on the north side of the building. The reset ratio of these controllers shall be adjustable by a gradual switch on the main control panel.

13B-43.8.7 Air Cooled Condensing Units: The air cooled condensing units will be furnished by their manufacturer with self-contained capacity and head pressure controls. Condensing units shall be interlocked for automatic operation as herein specified.

13B-43.8.8 Control Panels: The Automatic Control Subcontractor shall furnish and install the various control panels indicated on the drawings or herein specified.

13B-43.8.8.1 Main Control Panel:

13B-43.8.8.1.1 Panel construction shall be structural steel or aluminum frame with bonderized, enamel finished steel side, back, top, and bottom panels, arranged for wall mounting. Front panel shall be full piano-hinged, and finished in anodized aluminum or formica faced steel. All switches, lights, etc., shall be mounted on this hinged panel.

13B-43.8.8.1.2 All control panel internal electrical wiring shall be 600 volt type, pre-wired to numbered terminal strips. A wiring diagram of the panel as finally approved, with device and terminal strip identification shall be permanently affixed within the panel enclosure.

13B-43.8.8.1.3 All start-stop pushbuttons shall be maintained or momentary contact type, as approved, to perform the desired functions. Use of a momentary contact switch requiring prolonged manual operation to complete an interlocked circuit will not be acceptable. All pushbutton stations shall be flush mounted, industrial grade, 110 volt type, 1" diameter, red for "off", green for "on".

13B-43.8.8.1.4 All indicating lights shall be flush mounted, industrial grade, 110 volt "transformer" type with 6 volt incandescent lamp, 1" diameter color lens. ALL indicating lights shall be wired to a master "LAMP TEST" switch.

13B-43.8.8.1.5 All switches, indicating lights, or control devices shall be identified with bolt-on engraved lamacoid nameplates having white lettering on black background, except that engraving may be an integral part of formica faced panel fronts.

13B-43.8.8.2 Control Cab Panel:

13B-43.8.8.2.1 The Automatic Control Subcontractor shall replace the control cab panel furnished with the Government furnished cab with a revised panel as indicated on the drawings. Extreme care shall be taken to match exactly the adjacent shape, color, and texture within the cab proper.

13B-43.8.8.2.2 Wiring and device requirements shall be the same as for the Main Control Panel, except that no wiring diagram need be affixed within the panel.

13B-43.8.8.3 Sub-Panels: Control devices for each item of equipment to be controlled shall be mounted on a common sub-panel adjacent to the item of equipment, and constructed of front-engraved formica and/or 12 gauge (min.) steel. Devices, wiring, nameplate, and other construction features shall be the same as for the Main Control Panel, except sub-panels need not be enclosed nor furnished with wiring diagrams.

13B-43.8.9 Firestats: A firestat shall be furnished and installed at each air handling unit, ventilating fan, and exhaust fan. Firestats shall be adjustable, with manual reset, and shall stop respective fans when return or exhaust air temperature exceeds 120°F.

13B-43.9 All room thermostats shall have loose key adjustment, without thermometers or other cover plate indications.

13B-43.10 Air pressure gauges shall be provided on both main air and controlled air lines at all control devices, except room thermostats. Grouped control devices may be provided with a single main air gauge.

13B-43.11 Temperature Control Subcontractor shall submit through the Contractor to the Contracting Officer for approval, shop drawings of the entire control system before starting work, which shall include diagrammatic layouts of the control systems specified herein. Layouts shall show all control equipment, and the function of each item shall be indicated for the different seasons.

13B-43.12 After completion of the installation, the Automatic Control Subcontractor shall regulate and adjust all thermostats, control valves, motors and other equipment provided under his contract. He shall place them in complete operating condition, subject to the approval of the Contracting Officer.

13B-43.13 The control system herein specified shall be free from defects in workmanship and material under normal use and service. If within twelve (12) months from date of final acceptance by the Government, any of the equipment herein described is found to be defective in workmanshi: or material, it shall be repaired free of charge.

13B-43.14 The Control Subcontractor shall, after compl:tion of the original tests of the installation and final acceptance by the Government, provide any service incidental to the proper performance of the control system on the guarantees outlined for the period of one (1) year.

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DIVISION 14

ELECTRICAL

14-01 SCOPE OF WORK:

14-01.1 This section of the specifications includes all labor and material required for the complete and finished installation of the various electrical equipment, facilities, and systems.

14-01.2 Involved in the classifications of electrical work above are the following systems:

Wiring in conduit for lighting and power
Grounding systems
Lightning protection system
Intercommunication system
Telephone and communication system (rough-in)
Installation of Government furnished material
Miscellaneous, as indicated on the plans

14-02 REFERENCE: PARTICULAR ATTENTION IS CALLED TO THE "GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK" PRECEDING THIS SECTION OF THE SPECIFICATIONS, WHICH COVERS CERTAIN IMPORTANT PROCEDURES, MATERIALS, AND LABOR APPLYING DIRECTLY TO THE ELECTRICAL SECTION.

14-03 ELECTRICAL SERVICE AND CHARACTERISTICS:

14-03.1 Secondary service to the building shall be 120/208 volts, 60 cycle, single phase and three phase, four wire, A.C., "Wye".

14-03.2 Included under this section of the specifications is the furnishing and installation of underground secondary feeders from the building to the exterior Power Pad, as indicated on the drawings (not including final connection to transformers), and all electrical work on the load side of this point. Sufficient lengths of feeder shall be left at the Power Pad end of the run for proper connection to the transformers without splicing.

14-04 PANELBOARDS:

14-04.1 Panelboards shall be of the dead-front type and shall be in accordance with Underwriters' Laboratories, Inc., standard for panelboards and enclosing cabinets, and so labeled.

14-04.2 Panelboards shall be designed for connection to the electric services specified above, and service connection made at the top or bottom as indicated on the plans. The neutral bar (solid neutral) shall be mounted at the opposite end of the structure from the mains and shall have numbered terminals for connection of neutral wires.

14-04.3 Each panelboard box shall be fabricated from galvanized sheet steel. A turned edge shall be provided around the front of the box for rigidity and attachment of the front. Wiring gutters shall be in accordance with the National Electrical Code.

14-04.4 Each panelboard front shall consist of a flat piece of sheet steel. Lighting and distribution panelboard fronts shall have an opening to which the panelboard door is attached by means of semi-concealed steel hinges. The door shall have a cylinder tumbler-type lock. On doors more than 48" high, a combination three-point catch and lock shall be provided. A circuit directory shall be provided on the inside of the door. Locks to all doors shall be keyed alike. Other panelboards shall have openings providing access to switch handles. Fronts shall be finished in gray enamel over a rust inhibitor, and shall be designed for flush or surface mounting as indicated on the plans.

14-04.5 Interiors shall be of the unit type, mounted on a back plate, properly reinforced by flanging providing a rigid assembly to protect against damage during handling or installation. Structures shall be so designed that units may be easily removed without disturbing adjacent units, bus structure, or insulation. A removable dead-front shield shall be provided for easy access to the wiring. Panel busing shall be arranged to maintain sequence phasing throughout, that is, adjacent poles shall be of unlike polarity and rotated in sequence.

14-04.6 Main Panel:

14-04.6.1 The main panel shall consist of individual quick-make, quick-break fusible interrupter switch units assembled into a single interior unit mounted in a sheet-steel enclosure, consisting of a box and front, designed to be placed against a wall or partition. Space within the panel shall be provided for the installation of local power company metering current transformers.

14-04.6.2 The mains shall be provided with main lugs only or main fusible switch as indicated on the plans, and with solderless lugs.

14-04.6.3 Branch circuit-protective devices shall be interrupter switches of the quick-make, quick-break type and shall have sufficient load-break capacity to coordinate properly with the time-current characteristics of high-current-limiting fuses to provide an integrated switch and fuse device. The interrupter switches shall have a load-break capacity in excess of the normal horsepower rating. The number of poles and ampere ratings of the switches to be included shall be as listed on the drawings. The short-circuit interrupting ratings of the branch circuit switch-fuse combination shall be not less than 100,000 RMS asymmetrical amperes.

14-04.6.4 Each unit shall be housed in a painted steel enclosure and shall be front operable by means of a cast-metal handle. The enclosure shall have a hinged cover which shall provide access to the fuses and wiring terminals only. Each hinged cover shall engage a spring latch with provision for padlocking and shall have markings to coincide with the ON and OFF positions of the switch handle. Means shall be provided for padlocking the operating handle in the ON or OFF position.

14-04.6.5 The hinged cover shall be so interlocked that it may not be opened when the switch is in the ON position, except that the interlock shall be tool releasable by a qualified person.

14-04.6.6 Switching contacts shall be visible when the switch is in the OFF position and the unit cover is open.

14-04.6.7 Units of all sizes shall be interchangeable and shall be convertible to lower current fuse capacities.

14-04.6.8 Each pole unit of a switch shall have a quick-make, quick-break mechanism with grid plate arc quenchers. Multiple grid plates shall break up, cool, and extinguish the arc.

14-04.6.9 Each pole unit of a switch shall have silver-alloy contact tips and silver-plated copper parts for low-temperature-rise operation. The movable contact arm shall be spring-reinforced to provide constant contact pressure and long operating life. The entire switch mechanism shall be supported by mechanically strong, insulating bases.

14-04.6.10 Each switch unit shall be identified with an engraved lamacoid nameplate having white lettering on black background. Identification shall indicate circuit name of equipment served, and not circuit number.

14-04.6.11 Switch units shall be "General Electric" Type QMR, "Square D" Type QMB Saflex, "Bulldog" Vacubreak, "Westinghouse" Type FDP, "Federal Pacific" Type QMQB, or equal.

14-04.7 Distribution Panelboards:

14-04.7.1 Distribution panelboards shall each consist of automatic short-circuit and overcurrent protective devices of the circuit-breaker type, assembled into a single interior unit which shall be mounted in a sheet-steel enclosure, consisting of a box and front designed to be placed in or against a wall or partition.

14-04.7.2 The mains of each panelboard shall be provided with main lugs only, or main circuit breaker as indicated on the plans, and with solderless lugs.

14-04.7.3 Branch circuit-protective devices shall be of the molded case circuit-breaker type consisting of the number of poles, ampere ratings, and interrupting rating as listed on the drawings.

14-04.7.4 The breakers shall have quick-make and quick-break toggle mechanism, inverse-time trip characteristics, and shall be trip-free on overload or short circuit. Automatic release is to be secured by a bimetallic thermal element releasing the mechanism latch. In addition a magnetic armature shall be provided to trip the breaker instantaneously for short-circuit currents above the overload range. Automatic tripping shall be indicated by handle position between the manual OFF and ON positions.

14-04.7.5 The individual breakers shall be calibrated and sealed to eliminate tampering or unauthorized changes in calibration. Breakers shall be interchangeable and capable of being operated in any position.

14-04.7.6 Multiple-pole branch circuit breakers shall be common-trip type.

14-04.7.7 Each circuit breaker unit shall be identified with an engraved lamacoid nameplate having white lettering on black background. Identification shall indicate circuit name of equipment served and not circuit number.

14-04.7.8 Distribution panelboards shall be "General Electric" Type CCB, "Square D" Type ML, "Bulldog" Type CDP, "Westinghouse" Type CDP, "Federal Pacific" Type CDP, or equal.

14-04.8 Branch Circuit Panelboards:

14-04.8.1 Branch circuit panelboards shall each consist of "bolt-in" automatic short-circuit and overcurrent protective devices of the circuit-breaker type; assembled into a single interior unit which shall be mounted in a sheet-steel enclosure, consisting of a box and front designed to be placed in or against a wall or partition.

14-04.8.2 The mains of each panelboard shall be provided with main lugs only, or a main circuit breaker as indicated on the plans, and with solderless lugs.

14-04.8.3 Branch circuit-protective devices shall be of the molded case circuit-breaker type consisting of the number of poles, ampere ratings, and interrupting ratings as listed on the drawings. "Plug-in" or "twin" breaker units will not be acceptable.

14-04.8.4 The breakers shall have quick-make and quick-break toggle mechanism inverse-time trip characteristics, and shall be trip-free on overload or short circuit. Automatic release is to be secured by a bimetallic thermal element releasing the mechanism latch. In addition, a magnetic armature shall be provided to trip the breaker instantaneously for short-circuit currents above the overload range. Automatic tripping shall be indicated by handle position between the manual OFF and ON positions.

14-04.8.5 Multiple-pole branch circuit breakers shall be common-trip type.

14-04.8.6 The individual breakers shall be calibrated and sealed to eliminate tampering or unauthorized changes in calibration. Breakers shall be interchangeable and capable of being operated in any position.

14-04.8.7 Branch circuit panelboards shall be "General Electric" Type NLAB, "Square D" Type NQOB, "Bulldog" Type NLAB, "Westinghouse" Type NQC, "Federal Pacific" Type NBLP, or equal.

14-04.9 All panelboards shall be provided with engraved lamacoid nameplates, having letters not less than 1/4" high, identifying each panel with the same designation utilized in the Panelboard Schedule and including voltage and phase involved. Nameplates shall be bolted to the face of the panel door, or at the top of the panel face as directed.

14-05 MOTOR CONTROL CENTER:

14-05.1 The Contractor shall furnish and install where indicated on the drawings a Motor Control Center, NEMA Class 1, Type B, as manufactured by "General Electric", "Square D", "Bulldog", "Westinghouse", "Federal Pacific", or equal.

14-05.2 Control Center shall be totally enclosed, free-standing type, with structures joined together to form one assembly. The structure units shall consist of not less than 1/8" thick fabricated steel, formed into standardized units. Each structure shall be so designed that units may be readily removed or future structures added as required. Each structure shall be provided with two horizontal wiring troughs, one at top and the other at the bottom, which will line up with adjacent units to form convenient troughs the entire length of the Control Center. In addition, each structure shall have vertical wiring troughs for unit wiring.

14-05.3 A main horizontal bus shall be provided across the top of each structure with minimum capacity as noted. Bus bars shall be of rectangular cross section and supported in each structure by means of Micarta or equal bus supports. Each structure shall also be complete with vertical bus to distribute incoming power to each circuit breaker and starter in the structure.

14-05.4 Standardized removable circuit breaker and combination starter units shall be interchangeable in even multiples of height. Each starter unit shall be removable and provided with line connections to the vertical bus which will automatically disconnect the line connections when the unit is removed from the structure. Unit starter design shall be such that when the unit has been removed, its door may be closed to cover the opening from which the starter has been removed. The supporting enclosure of the unit starter shall be such as to provide isolation and baffling of one unit from the others. Means shall be provided in the structure for supporting and aligning the unit starter during its removal or replacement. Any unused spaces shall be covered by blank plates and all spaces shall be available for future use.

14-05.5 Each circuit breaker shall be manually operated, trip-free from the handle, and provided with inverse-time thermal element overload protection and instantaneous magnetic short-circuit protection. The Control Center shall be capable of interrupting a fault current of not less than 25,000 RMS amps. The operating handle shall clearly indicate whether the breaker is "ON", "OFF", or "TRIPPED". Means shall be provided to lock each circuit breaker handle in the "OFF" position and to close the cover.

14-05.6 Starters shall be circuit breaker combination full voltage magnetic type. If thermistor motor protection is not indicated, the starter shall have 3 external manual-reset thermal overload relays. If thermistor type overload relay is shown, it shall be "Guardistor" or approved equal. Starters shall be for operation on 208 volts, 3 phase, 60 cycles. Where control transformers are indicated, each starter shall contain a 208 volt to 120 volt fused transformer with sufficient capacity for all the devices shown in the schematic.

14-05.7 Where a control device is shown in the schematic and is not specifically designated as being elsewhere, the device shall be installed in the Motor Control Center, with the corresponding starter and/or in a grouped control section as indicated. Where control switches, pushbuttons, or indicating lights are not specifically designated as being elsewhere, they shall be installed on the door of the Motor Control Center. All controls and lights shall be heavy duty oil-tight construction. Indicator lights shall be 1" diameter, "push-to-test" type.

14-05.8 Each circuit breaker or starter shall be provided with an individual numbered terminal board, completely accessible from the front. The control wiring shall be NEMA type I B.

14-05.9 Each circuit breaker, combination circuit breaker-starter, control device, and indicating light shall be provided with an engraved lamacoid bolted-on nameplate. Identification data shall conform to that indicated on the drawings, including name of motor, horsepower, voltage, and phase, and shall be as approved by the Contracting Officer.

14-05.10 Each structure shall be thoroughly cleaned inside and out after fabrication and shall be then given a primer coat prior to two coats of gray enamel inside and outside.

14-06 SAFETY AND DISCONNECT SWITCHES:

14-06.1 Safety and disconnect switches shall conform to governing industry NEMA standards, and shall be listed by Underwriters' Laboratories, Inc., where applicable.

14-06.2 Switches shall be "heavy-duty" side operated, single throw, quick-make, quick-break type rated for not less than 240 volts for double pole switches and not less than 600 volts for 3 pole switches. Switches shall be fused with standard fuse clips or unfused as required, and shall be furnished with general purpose NEMA Typelenclosures, except that switches installed outside the building or otherwise exposed to the weather shall be provided with raintight NEMA Type 3R enclosures. Switches in hazardous areas shall be heavy-duty type, with dust-tight NEMA Type 5 enclosures. Raintight enclosures shall be equipped with non-releasable cover interlock.

14-07 FUSES:

14-07.1 Main switchboard fuses shall be current limiting type, conforming to NEMA Standard FU1-1959. Fuses shall be 600 volt A.C. type, NEMA Class J or L,

with short-circuit interrupting rating of not less than 200,000 RMS symmetrical amperes. Elements shall be pure silver, terminals shall be silver plated, and construction shall be "General Electric" Type CLF, "Federal Pacific" Econolin, or equal.

14-07.2 All other fused circuits shall be protected by cartridge fuses, except as otherwise specifically noted on the plans. Fuses shall be standard "one-time", dual-element "Bussmann Fusetron", "Federal Pacific Econ", or equal.

14-07.3 All fuses shall bear the label of Underwriters' Laboratories, Inc., and shall be properly stored and protected until installed.

14-07.4 Spares amounting to one complete duplicate set of each and every fuse installed under this contract shall, upon completion of the project, be turned over to the Contracting Officer in a neat metal box with hinged cover.

14-08 FEEDER, BRANCH, AND CONTROL CIRCUITS:

14-08.1 The Contractor shall furnish and install such wiring as is required for a complete electric wiring system for light and power, including feeders, subfeeders and branch circuits, making proper connections to switches, panelboards, motors, and controllers and to each outlet in the building.

14-08.2 From the main panel, feeders shall be run and connected to the panels and switches throughout the project as shown on the riser diagram. Feeders shall be of sizes and types of wire as shown on drawings, and shall be installed in steel conduit supported by hangers secured to structural beams and slabs. No wire shall be used for the support of conduits.

14-08.3 Wherever practical, feeder conductors shall be continuous without splices between terminals. All conductors of a circuit shall be contained in the same raceway, except where indicated as multiple parallel runs.

14-08.4 The installation of wires and cables shall include all splicing of these wires and cables to each other and connecting them to switchboards, receptacles, switches, control boxes, lighting fixtures, motors, and all other electrical apparatus installed or re-connected under this contract.

14-08.5 Where solid conductors are to be connected directly to the devices without the use of lugs, such as occurs at lighting switches and plug receptacles, the wires shall be formed into a loop to fit around the screws.

14-08.6 Where wires and cables are connected to metallic surfaces, the coated surfaces of the metal shall be polished before installing the mechanical connector. The lacquer coating of the conduits shall be removed where a ground clamp is to be installed.

14-08.7 Where single phase, 3-wire or 4-wire combinations are used for branch circuit distribution, the "hot" conductors must be of different phases; otherwise, a separate neutral will be required for each hot wire.

14-08.8 An overall automatic control system is being provided under another Division for the purpose of controlling and monitoring mechanical installations. Except for line voltage and power supply circuits for the centralized equipment of this system, and for 110 volt or higher motor control circuit extensions to devices on this system, no work in connection with the process control system shall be considered as being included as part of the Electrical Division work.

14-08.9 Although it is the intent of the drawings and specifications to delineate fully the motor control circuit wiring required for all permanent motorized equipment being provided at the project, the possibility of variations from the drawings and specifications is anticipated due to differences between manufacturers of mechanical equipment and other such conditions. No notes, wiring diagrams or specifications shall be interpreted as limiting the scope of the motor control circuit wiring work. The electrical work shall include the responsibility for providing complete motor control circuit wiring required for the permanent equipment furnished under other Divisions in the project, without introducing any additional costs to the Government, regardless of the indications in the drawings and specifications.

14-09 UNDERGROUND RACEWAY:

14-09.1 The Contractor shall provide underground duct and conduit of the size and quantity as required by the applicable drawings. If not indicated otherwise all duct and conduit shall be 4 inches inside diameter.

14-09.2 Duct and fittings shall be made of 75% hard coal tar pitch and 25% fiber, shall be watertight, resistant to acid and alkaline reactions, sewer gases, salt water, oil and greases, and shall be unaffected by electrolytic action. The inside surfaces shall be smooth and free of sharp edges. The duct and fittings shall be Orangeburg Standard Fiber Conduit Type 1 or equal, and shall meet or exceed the requirements of Federal Specification WC-581 (2).

14-09.3 All underground duct and conduit shall be sloped at least 3 inches in 100 feet towards the lower manholes, or from the building towards the manholes.

14-09.4 All duct and conduit shall be securely fastened in place during construction and all ends shall be plugged or capped to prevent seepage of water and dirt. Plugs and caps shall be of a material that will not swell and damage the duct when wet. All duct and conduit shall be demonstrated as being open, continuous, and clear of debris. A tight fitting swab or brush shall be used to clear all duct and conduit and a 6 inch long mandrel of wood or metal 1/2 inch smaller in diameter than the conduit shall be pulled through. All conduit terminations shall be made with end bells. A minimum size No. 14 AWG copper weld wire shall be installed in each spare conduit.

14-09.5 Unless otherwise noted on the drawings, all duct and conduit with concrete envelopes shall be installed at such depths that the top of the conduit will be at least 18 inches below finished grade, except when crossing

under roadways, driveways, or parking areas where the top of the conduit shall be not less than 36 inches below the finished grade. When crossing under ditches or drains the top of encased conduits shall be at least 18 inches below the bottom of the ditch or drain. All joints in adjacent conduits shall be staggered a minimum of 24 inches apart and shall be made completely waterproof prior to concreting.

14-09.6 Concrete envelopes shall be at least 3 inches thick around the exterior of the duct or conduit system and 2 inches between adjacent ducts or conduits. Interlock spacers shall be used every 5 feet minimum to insure a uniform spacing between ducts or conduits. All bottom spacers shall be secured to 1 inch by 3 inch boards to prevent sinking and overturning. Standard conduit expansion joints shall be used in all lengths greater than 150 feet and shall be spaced a maximum of 200 feet apart. Where a complete length of concrete envelope cannot be poured at one time, the Contractor shall provide 3 foot-long wire mesh sleeves around each duct or conduit at the end of a concrete pour. Half the length of each sleeve shall be embedded in the wet concrete.

14-09.7 Metallic conduit for use outdoors or underground shall be rigid steel, galvanized both inside and outside. Where conduit is buried directly in earth, its outer surface shall receive two coats of asphaltum which shall be thoroughly dry before installation. All conduit entering the building shall be duct sealed. Minimum depth shall be 24".

14-09.8 Spare conduits inside the manholes located within the property limits shall be plugged and made water tight. All other ducts leading to the field for the above structures shall be duct sealed and made water tight.

14-10 CONDUITS:

14-10.1 Conduit raceway system shall be complete from point of origin to all outlets shown or specified. Installation shall be such that conduits will be concealed in all finished parts of the building, and where conduits are exposed, they shall run parallel with the building lines in a neat and workmanlike manner. Location of exposed runs will be subject to the approval of the Contracting Officer. No diagonal runs will be permitted.

14-10.2 Conduits of size 2" and smaller may be electric metallic tubing, except as specified below. Couplings and box connections for E.M.T. shall be of the watertight compression type made up tight. Conduits of size 2½" and larger and all feeder conduits regardless of size shall be galvanized, rigid steel, as shall be all conduits subject to mechanical injury, or underfloor, or embedded in poured concrete. Use of aluminum conduit will not be allowed.

14-10.3 Flexible conduit shall be of galvanized steel conforming in all respects to the latest Underwriters' Laboratories standards. Ends shall be square cut with a hacksaw and carefully reamed. Terminations at boxes, cabinets, etc., shall be made only with approved fittings. Runs shall be continuous between terminations without couplings, and bends shall be such that inner radius is not less than five (5) times the trade size.

14-10.4 Conduit sizes not shown on the drawings shall be in accordance with NEC rules. No conduit shall be less than 3/4" trade size, except that flexible conduit may be as small as 1/2" trade size.

14-10.5 Where conduit is placed in slabs, it must be done as soon as forms are in place, and in such manner as not to impair the strength of the slabs.

14-10.6 Underfloor steel conduits shall be painted with two heavy coats of asphaltum paint before burial, and shall be at least 18" below finished grade.

14-10.7 Horizontal runs of conduit shall be so installed, if possible, to provide a natural drain for condensation, without pockets, or traps where moisture can collect.

14-10.8 Homerun circuits may be combined in a common conduit wherever advantageous, provided all requirements of the NEC are met.

14-10.9 Wiring noted to be run exposed in finished rooms shall be run in "Wiremold" or equal surface raceway, or in conduit, as directed.

14-10.10 From each flush mounted panelboard, there shall be run two (2) 1" empty conduits to the attic or joist space above, and two (2) 1" empty conduits to crawl or ceiling space below (except slab on fill), and terminated in flush junction boxes for future extensions from the spare circuits on the panel.

14-11 JUNCTION AND PULL BOXES:

14-11.1 The Contractor shall provide properly sized junction and pull boxes where indicated in the drawings and specifications, or where necessary for compliance with code requirements for cable installation, and as required to produce neat, functional, workmanlike wiring installations.

14-11.2 Junction and pull boxes for use under normal electric work conditions shall be manufactured from galvanized code gauge sheet steel, and shall be furnished with flat screw covers.

14-11.3 Where boxes are set flush in walls and ceilings, cover screws shall be flat head type properly countersunk. Arrange covers to completely cover openings in the building finish.

14-11.4 Where suitable, standard outlet boxes may be used as junction and pull boxes.

14-11.5 If required by the building construction, provide junction and pull boxes in special sizes and shapes determined from field measurements in order to make neat and workmanlike installations.

14-11.6 Should the local utility company or any other agency require barriers between groups of feeders in pull boxes, they shall be provided at no additional cost to the Government.

14-11.7 If feeders and other wiring following the same routing are indicated on the plans as running through separate pull boxes, it shall be understood that it is intended to maintain a segregation of the wires and cables, and thereby to prevent the spreading of arcing faults between separate supplies to essential building services.

14-11.8 Where a junction or pull box is installed in a furred ceiling or space, and where due to building finish, the sheet metal cover of the box exposed to view is not acceptable to the Contracting Officer, there shall be provided an approved access panel with suitable frame and supports in the finished surface in front of the box cover.

14-12 OUTLET BOXES:

14-12.1 There shall be provided and installed at every outlet a standard hot galvanized outlet box of approved design and construction and of such form and dimension as best adapted to the specific location, kind of fixture or device to be used, and the number, size, and arrangement of conduits connecting thereto.

14-12.2 Unless otherwise specified or directed, outlet boxes shall be set with edges flush with the finished surface, and their position shall be carefully checked and corrected previous to final finishing.

14-12.3 Outlet boxes shall be firmly anchored in place, and shall be provided with approved 3/8" fixture studs, where required. Fixture studs shall be applied to boxes from rear and securely bolted to box. Only such holes as are to be used for entering conduits shall be open; all other holes must be properly closed.

14-12.4 On exposed work, approved cast outlets, junction boxes or fittings shall be used, of such forms and dimensions as best adapted to the specific location or purpose.

14-12.5 Four-inch boxes shall not be used where more than one switch or receptacle is installed, but solid gang boxes (up to 4-gang maximum) with suitable covers shall be used. Exterior outlet boxes shall be approved marine type of cast iron with threaded bosses for conduit, and gasketed cover plate.

14-12.6 All outlet boxes which require covers shall be provided with same, and they shall be of such construction and design as to fit and match exactly the outlet box on which they are installed. Switch boxes, etc., shall have covers aligned with the walls, floors, and trim. All outlet boxes to which no fixture or device is to be attached shall be fitted with blank covers. All outlet box covers of all types (except exposed work) shall match in design and color.

14-12.7 Special outlet boxes may be required where space conditions limit the use of standard boxes, and where explosion-proof boxes are required by the NEC.

14-12.8 Unless otherwise shown, specified, or directed, outlet boxes, etc., shall be located with their center lines at the following elevations above the finished floor line:

Wall Switches (Toggle Type)	4'-6" (Above Floor)
Duplex Wall Receptacles	1'-0" (Above Floor)
Duplex Wall Receptacles (Appliances)	4'-6" (Above Floor)
Clock Outlets	7'-6" (Above Floor)
Telephone Outlets	1'-0" (Above Floor)
Intercommunication Outlets	1'-0" (Above Floor)

14-12.9 Other special outlets shall be installed as shown or specified on the drawings.

14-13 CABLE TRAYS:

14-13.1 The Contractor shall furnish and install as indicated on the drawings a system of rigid aluminum tray-type supports for certain runs of telephone company cables and other communications systems cables. These cables will be provided by the Government under other contracts.

14-13.2 Trays shall have four-inch high, 0.080 (min.) inch thick, extruded "Z" or "U" shape sides with turned down lip; bottoms shall be widths as noted, not less than 0.050 inches thick, with punched openings on approximately 6" centers spanning the tray width and having support areas approximately three inches wide between openings. Openings shall have turned down edges with at least 1/8 inch radius at each edge. Bottoms and sides may be fastened together by rivets or spot-welding 6 inches on centers, or may be formed from one piece.

14-13.3 Tray runs shall be supported from structural members at intervals not exceeding four feet, using structural aluminum or steel bridging elements where necessary. Tray strengths shall be such that mid-span deflections for all widths shall not exceed 0.300 inch with a cable load of 100 pounds per linear foot. All sections shall be fastened together rigidly so that adjacent sections cannot move with respect to one another. All isolated tray elements and continuous runs shall be bonded together to provide a low-resistance path to ground not exceeding 25 ohms from any point on any tray element. The tray system shall be grounded to the supply side of the building cold water service entrance valve.

14-13.4 Cable tray system shall be "T. J. Cope" Series 190,000, "Husky", "Ventrib", or equal cable trough.

14-14 WIRE AND CABLE:

14-14.1 All wire and cable for feeders and branch circuits, unless otherwise specified, shall be 600 volt thermoplastic insulated of the heat-resistant (75°C. operating temperature) and moisture-resistant THW type, shall conform to all of the latest requirements of the National Electrical Code, and shall meet all specifications of the ASTM. Conductors shall be soft drawn copper. Wire shall be Underwriters' Laboratories, Inc. approved.

14-14.2 Branch circuit wire #10 and smaller, except that run in or through lighting fixture enclosures, may be 600 volt thermoplastic insulated of the moisture-resistant TW type, of soft drawn copper, and otherwise similarly conforming to NEC and ASTM requirements and specifications.

14-14.3 Wiring run within or through lighting fixture enclosures shall be rated for 90°C. operating temperature, and otherwise similar to branch circuit wire previously specified.

14-14.4 Any copper wire or cable in which the insulating material contains free sulphur (e.g., rubber compounds) shall have the conductor thoroughly tinned.

14-14.5 All sizes of wire and cable shall be factory color-coded, with a separate insulation color for each phase and neutral used consistently throughout. The neutral wire of all branch circuits shall have a white cover. Grounding conductors shall have a green cover. The name of the manufacturer, insulation type, voltage rating, and wire size shall be clearly and permanently imprinted throughout the length of each conductor.

14-14.6 Wire and cable shall be delivered to the site of the project in original packaging or on factory reels, fully identified with tags or labels, indicating the manufacturer's name and the date of manufacture. Date of manufacture shall not be more than six months prior to delivery at the project site.

14-14.7 The minimum size wire for lighting or power shall be #12.

14-14.8 All branch circuits more than 100 feet in length shall be #10 for entire distance up to the first outlet. Control circuits shall be #14, except for runs exceeding 300 feet, where they shall be #12.

14-14.9 Wire sizes #14 to #8 shall be solid, except as otherwise indicated. Wire sizes #6 and larger shall be stranded. All sizes called for in the specifications or shown on the contract drawings are American Wire Gauge sizes. No wire of any type smaller than #14 will be permitted on the job.

14-14.10 Splices of wires up to No. 8 AWG may be made with approved steel spring "wire nut" type connectors, or may be soldered joints. All wire larger than No. 8 AWG shall be spliced with soldered joints.

14-14.11 Soldered joints shall be made by securely twisting the wire ends together, and thoroughly soldering the joint in an approved manner. Joints shall then be insulated by means of half-lapped layers of rubber tape with an outer layer of friction tape, or half-lapped layers of plastic electrical insulating tape. Tape shall be applied to approximately twice the thickness of the original insulation. Splices and joints shall occur only at accessible outlets or junction boxes.

14-14.12 Lugs for cables No. 4 AWG and larger shall be bolted by not less than two (2) bolts through the lug tongue. Pressure indent or crimp type lugs, or lugs and connectors requiring the cutting short of wires or cables to accomplish their removal, will not be accepted.

14-15 POWER AND CONTROL CABLE IN UNDERGROUND DUCT AND CONDUIT:

14-15.1 The Contractor shall install and connect all Contractor and Government furnished power and control cables in underground duct and conduit as required by applicable drawings. The duct and conduit shall be provided under this specification and applicable drawings or it shall be existing. Cables shall be installed in duct and conduit designated on the drawings or as directed by the Contracting Officer. In general, high voltage cables shall be assigned to the lower outside ducts or conduits while low voltage cables shall be assigned to the upper layers of ducts or conduits in the interior of the bank. Any given cable shall be installed in the same duct or conduit position throughout its run. In no event will control or telephone cable be pulled in the same duct or conduit with power cables.

14-15.2 The cables shall be installed in such manner and by such method to insure against harmful stretching of the conductor, injury to the insulation, or damage to the outer protective covering. No splice or joint will be permitted to be drawn inside duct or conduit. Where more than one cable is to be installed in the same duct or conduit, all shall be pulled in at the same time. If necessary to relieve strain on cable during pulling, a lubricant approved by Underwriters' Laboratories, Inc. for that type of cable shall be used. Petroleum grease type pulling lubricant shall not be used.

14-15.3 All cables with the exception of lead covered cables, shall be sealed with moisture seal tape and varnish prior to pulling into conduit and shall be left so sealed until ready for termination. Lead covered cables shall be sealed with wiping solder at each end of the cable.

14-15.4 The reels shall be so set up that the cable will run in a smooth curve through the manhole opening without making a reverse bend. The cable may be pulled by a hand winch or a power winch. The pulling-in rope should be attached to cables using cable grips designed for the job. Guide pulleys and sleeves shall be used to prevent the cable from rubbing against the frames and to prevent its unrolling faster than it is being pulled into the duct or conduit. A man experienced with cable handling shall be posted constantly at the reel while cable is being pulled. In addition to braking reel, etc., he shall immediately report any irregularities observed in the cable. Cables will not be handled or installed when the ambient temperature is below the minimum working temperature for the cable involved.

14-15.5 In manholes and handholes all cables shall be carefully racked on cable racks provided with porcelain insulation and unless otherwise specified, looped horizontally at least one and one-half times the inside diameter of the manhole unless otherwise specified. Provide any necessary additional ground rods or racking facilities as directed by the Contracting Officer. All

splices shall be supported on cable racks in such manner that movement of cable, due to temperature changes or magnetic forces, shall not place strain on the splices nor cause splice to slip from racks.

14-15.6 Power and control cables shall be installed in separate manholes or handholes unless otherwise indicated on the drawings. However, where control cables are required to be installed in the same manhole or handhole as power cables, they shall be installed on the opposite side of the manhole or handhole from the power cables, or if this is not practicable, they shall be separated as far as possible from the power cables. In addition, the entire length of all power cables within the manhole or handhole shall be fireproofed using arc proofing tape, "Minnesota Mining and Manufacturing", "Irvington" tape No. 7700 or approved equal. The tape shall be applied in accordance with manufacturer's instructions.

14-16 IDENTIFICATION AND TAGGING:

14-16.1 In addition to the nameplate requirements for equipment as specified herein, the Contractor shall properly identify all feeders, panel bus bars, separately mounted switches, etc.

14-16.2 All incoming power and control cables installed in duct and conduit shall be tagged and identified in all manholes, handholes, field boxes, etc., with one tag at each exit and each termination. Tags above ground shall be brass 22 gauge 1" x 3" (Minimum dimensions) and shall be marked with steel lettering dies one-fourth inch minimum size, or with an equivalent engraving process. In location below ground level the tags shall be made of monel metal. Cable designations shall be in accordance with the drawings or as directed by the Contracting Officer. The tags shall be securely attached to the cable with a #14 AWG type TW copper wire.

14-16.3 All other feeders or cables shall be properly identified at each end, and in each wiring gutter, pull box, or junction box, with engraved fiber tags suitably fastened with twine.

14-16.4 Toggle switches, pilot lights, etc., whose function is not readily apparent, shall be provided with engraved lamacoid nameplates bolted to the device plate, suitably describing the equipment controlled or indicated.

14-16.5 Before fabricating any nameplates or engraved faceplates, the Contractor shall submit to the Contracting Officer for his approval a complete list of such items showing the proposed legend, letter size, nameplate size, mounting method, nameplate material and cross-reference to identify equipment on which each nameplate will be mounted.

14-16.6 Phase identification letters shall be stamped into the metal bus bars of each phase of the main busses of each panelboard, switchboards, motor control center, etc.

14-17 VOLTAGE DROP AND LOAD BALANCING:

14-17.1 Feeders and subfeeders shall be of such size that the total voltage drop from the service entrance to any panelboard will not exceed 1.5%.

14-17.2 Branch circuit wires shall be of such size that at connected load, the voltage drop does not exceed 2% at the last outlet.

14-17.3 The various branch circuits served from the panelboards vary in loading. The Contractor shall carefully balance the load on each phase when connecting the various branch circuits in each panelboard. When all load is turned on and the system is operating at 100% demand, the total unbalance shall not exceed ten per cent (10%).

14-18 WIRING DEVICES:

14-18.1 The wiring devices as shown in symbol list on the drawings and/or as specified herein shall be furnished and properly installed in their respective outlets.

14-18.2 Switch, telephone, and receptacle plates shall be .040 satin finish stainless steel arranged as indicated on the plans.

14-18.3 Flush switches shall be tumbler Type "T" rated, unless otherwise noted on the plans. Switch mechanism shall be completely enclosed in stable composition or ceramic housing. Terminal screws or connectors shall be designed to accommodate and firmly terminate up to #10 solid conductors.

14-18.4 Switches controlling lighting or heating loads up to 1800 watts shall be rated at not less than 20 amperes.

14-18.5 Switches controlling or disconnecting motor loads less than 1/4 Hp shall be Hp rated, thermal overload type and approved for motor control or disconnect service.

14-18.6 Switches shall be single pole, double pole, 3-way or 4-way, as indicated by the symbol. Where tumbler switches operate vertically, single or double pole switch shall be "on" in the upper position. If operated horizontally, single or double pole switches shall be "on" in the left position.

14-18.7 Certain switches shall be key operated, as noted on drawings.

14-18.8 Devices shall be one of the following makes and types, or approved equal:

	MANUFACTURER AND CATALOGUE NUMBER		
	ARROW	P & S	HUBBELL
Switches:			
S.P.----------20A	1991-I	AC201-IV	1221-I
D.P.----------20A	1992-I	AC202-IV	1222-I

		MANUFACTURER AND CATALOGUE NUMBER		
		ARROW	P & S	HUBBELL
3-Way----------20A		1993-I	AC203-IV	1223-I
4-Way----------20A		1994-I	AC204-IV	1224-I
Despard----------20A		QST-91-I	ACD201-IV	
S.P. Key Op---------20A		3933-L		
3-Way Key Op--------20A		8916-L		
4-Way Key Op--------15A		1416-L		
Receptacles:				
Duplex, Grounding---15A	125V	5252-I	5252-I	5252-I
Outdoor----------15A	125V	5252-WP		
3W, Pol. Gr.--------50A	250V	7990-C		7512-G

Electrical Floor Outlets: "NEPCO" #800 with #803GC duplex service fitting.

Telephone Floor Outlets: "NEPCO" #800 with #804C service fitting.

Clock Hanger Outlets: "P & S" #1544, 15A, grounding, recessed plug.

14-19 LIGHTING

14-19.1 Lighting Fixture Schedule: Fixtures furnished shall be similar in design and equal to those as listed in schedule on the drawings, complete with all lamps as noted.

14-19.2 The Contractor shall do all necessary assembling, wiring, and installation which may be required to place all fixtures in satisfactory operation.

14-19.3 All lamps installed in fixtures and lamp holders shall be first line quality, as manufactured by "General Electric", "Westinghouse", "Sylvania", or equal. Unless otherwise noted, all fluorescent lamps shall be "standard cool white" type, with an initial lumen output of not less than 3100 lumens.

14-19.4 Fluorescent fixture ballasts shall be high power factor, C.B.M., E.T.L. rated ballasts, having thermal overload protection. All fluorescent fixtures shall be provided with radio interference suppressors.

14-19.5 Ceiling mounted fixtures shall be supported from the ceiling suspension system or other structural members, and not from the ceiling material alone.

14-20 EQUIPMENT FURNISHED BY OTHERS:

14-20.1 Certain items of equipment (to the extent indicated on the plans) will be furnished and installed under another specification Division or by the Government directly or under separate contracts. It shall be the responsibility of this Contractor to verify the size and location of all such equipment from time to time as the job progresses and to rough in for and make final electrical connections to such equipment, as required and/or shown on plans. Such electrical connections shall include all wiring, conduit, disconnect switches, outlet boxes, etc., as required for the same throughout the project.

14-20.2 Control Cab:

14-20.2.1 The control cab contains and includes electrical systems, equipment, and circuiting whose correct functioning is dependent upon their connection to other electrical work described in this Division of the work and shown on the drawings.

14-20.2.2 Under this Division, the Contractor shall provide all connections between the work of this Division and the control cab.

14-20.2.3 The Contractor shall provide all raceways in Columns #4 and #8 and their connections to junction and outlet boxes at both ends, and all raceways and outlet boxes for Type "R" lighting fixtures and the traffic signal guns. Antenna raceway from the penthouse antenna mast-mount pipe to within 12" of Column #2 shall be provided.

14-20.2.4 The Contractor shall provide all wiring and connections for all systems fed or controlled through Columns #4 and #8, and all wiring and connection in the consoles for receptacles, lighting fixtures, and for power and control circuits related to work under this Division.

14-20.2.5 The Contractor shall receive and install special lightning protection system air terminals and provide all other work required for the lightning protection system.

14-20.2.6 The Contractor shall receive and install Type "R" and Type "S" lighting fixtures in the cab ceiling and on the penthouse exterior corners, and provide and install lamps for all lighting fixtures in the cab in the penthouse, and on the roof.

14-20.2.7 The Contractor shall provide and connect the intercom master station in the console turret.

14-20.2.8 The Contractor shall receive, install, and connect the battery charger associated with the window-washing case.

14-21 GROUNDING:

14-21.1 The Contractor shall provide two (2) separate continuous cable type grounding systems, exclusive of the lightning protection system, for independent grounding of the building electrical equipment and the electronic equipment. Installation details shall be in accordance with NEC rules and as indicated on the drawings. Use of metallic raceway or enclosures as the sole ground path will not be acceptable.

14-21.2 The thermoweld process, or approved equal method, shall be used for bonding connections required in the grounding systems.

14-21.3 Electronic grounding system conductors shall be installed so as to be exposed horizontally (except where concealment above hung ceilings is called for) and vertically in cable shafts, and kept entirely separate from grounding conductors associated with any other system, except at the building cold water service

14-22 LIGHTNING PROTECTION SYSTEM:

14-22.1 The Contractor shall furnish and install a complete lightning protection system as specified, as shown on the drawings, and in accordance with NFPA No. 78 "Lightning Code". A certificate of compliance with U.L. "Master Label" requirements shall be furnished to the Contracting Officer upon completion of the work.

14-22.2 The system shall include, but not be limited to, air terminals, stranded and twisted copper loop and down conductors, ground rods, clamps, supports, welded connections, and other accessories and work as required. Special air terminals will be furnished under another Division for installation and connection under this Division.

14-22.3 The loop or down conductors shall be bonded to all masses of metal such as structural members, conduits, ductwork, etc., that lie within six feet of any portion of the lightning protection system. Except for such bonding, system conductors shall generally be run concealed. The cast-in-construction method shall be used wherever possible, including the system down conductors.

14-22.4 The work of this system shall be carefully coordinated with correlated work provided under other Divisions of the specifications in order to avoid interferences in the upper part of the tower.

14-22.5 The thermoweld process, or approved equal method shall be used for all bonding required in this system.

14-23 INTERCOMMUNICATION SYSTEM:

14-23.1 The Contractor shall furnish and install an intercommunication system as specified herein and indicated on the drawings. System shall be made up of an operations section installed under this contract, and a separate maintenance section which shall be roughed in for only. Both sections shall be run through a common terminal cabinet.

14-23.2 Each staff station shall be capable of calling only its master station, receiving calls from its master station, and permitting two-way conversation without use of handsets. Depressing a pushbutton on the staff station shall illuminate an annunciator light and sound an audible signal in its respective master station. Two-way conversation shall then be possible without any further manipulation of station equipment. Similar operations at a master station shall illuminate the light at its staff station and establish a circuit for two-way conversation.

14-23.3 Master station shall be flush mounted in an opening cut under another Division at a turret position in the control cab. Trim shall be non-overlapping, with a hairline seam. Master station shall be capable of originating calls to and receiving calls from not less than nine (9) staff and/or master stations, and shall give audible and (9) visual indications of incoming calls, with annunciator light for each calling-in position Suitable nameplates shall be provided on the master station identifying the respective staff and master stations which are connected to it; and with the unused positions labeled "SPARE". Each calling-in position shall be operable with a three-position switch. Master station shall have, in addition, the following:

14-23.3.1 Volume controls and power "OFF-ON" switch and pilot light.

14-23.3.2 Dynamic speaker with Alnico V magnetic and minimum $3\frac{1}{2}$" diameter cone.

14-23.3.3 Built-in vacuum tube amplifier and power supply circuitry operating from 120V, 60 cycle, AC source.

14-23.3.4 Built-in applique unit for connection to zero level lines.

14-23.3.5 Minimum audio power output of $2\frac{1}{2}$ watts at each station output.

14-23.3.6 Terminal facilities for all connections including activation of spare positions.

14-23.3.7 Input and output transformers.

14-23.4 Each staff station shall be flush-mounted with speaker-microphone construction consisting of dynamic speaker with Alnico V magnet, and shall have calling-in pushbutton device and signal pilot light mounted on faceplate. Each interior station shall have 5" diameter speaker cone capable of handling 5 watts audio-power with minimum distortion mounted in 8" x 2" galvanized steel backbox with perforated steel faceplate. Exterior station shall be similarly provided, except with a weatherproof switch and faceplate, and as noted.

14-23.5 System master station shall be "Webster Electric Teletalk" 1600 Series Bulletin TT91-5, as modified, or approved equal. System staff stations shall be "Webster Electric" 5K45 Series."Teletalk" Speakers Bulletin TT5-10 with switch and light, or approved equal.

14-23.6 All interconnecting shielded and/or unshielded wiring necessary for the proper operation of each system shall be furnished and installed in conduit as indicated on the plans and as otherwise required. Minimum conduit size shall be 3/4". Wiring methods and materials shall be as specified herein.

14-23.7 As part of the Electric work, the services of the local service department of a duly authorized service agent of the equipment manufacturer must be made available to the Government free of charge for a period of 12 months from date of final acceptance of installation.

14-24 TELEPHONE SYSTEM ROUGH-IN:

14-24.1 The Contractor shall furnish and install a complete telephone raceway system for telephone company use, including conduit, outlet boxes, and fittings as required and/or shown on the plans. Installation shall employ the same methods and material as for lighting circuits under these specifications.

14-24.2 Minimum size of conduit for telephone use shall be 3/4", and all conduit shall be left with #14 bare pull wires installed.

14-24.3 Panels for telephone company use shall have closure construction as specified for panelboards, 4" deep and with plywood backs.

14-25 INSTALLATION OF GOVERNMENT FURNISHED MATERIAL:

14-25.1 Installation of the Government furnished diesel engine generator, radiator, and related mechanical accessories will be provided under another specification Division.

14-25.2 Included in the Electrical work shall be the receiving and installation of the following items of Government furnished material in connection with the generator:

14-25.2.1 Automatic transfer switch.

14-25.2.2 Battery rack and storage batteries.

14-25.2.3 Load-bank unit and control cubicle.

14-25.2.4 By-pass switch.

14-25.2.5 Diesel engine starting and control panel.

14-25.3 Installation details shall be as indicated on the drawings. All electrical wiring, conduit, accessory items, etc., not specifically indicated to be Government furnished shall be Contractor furnished and installed as required.

14-25.4 The battery racks shall be assembled and installed where shown on the drawings. The batteries shall be installed on the racks and connected up properly. Battery cells shall be filled with the correct amount and type of electrolyte as indicated in Government furnished instructions. Engine starting circuits shall be connected as required by the Government furnished connection diagrams. CAUTION: Be certain that the emergency stop and lockout switch is in the "OFF" position before connecting battery circuits.

14-25.5 Before connecting the plant to the normal power source, the engine cooling system shall be filled with the proper quantity of cooling solution consisting of 60% inhibited Ethylene Glycol and 40% water. The Ethylene Glycol shall conform to Federal Specification O-A-548a(1), latest edition.

14-25.6 The conductors from the by-pass switch to the load terminals on the automatic transfer switch shall be left disconnected until the correct phasing and rotation of the generator have been established.

14-25.7 The engine generator shall not be started by the Contractor at any time. The Contracting Officer shall be notified at least two weeks in advance of the date the plant will be available for startup. Startup and run-in of the engine generator shall be performed by Government personnel with a Contractor's representative present to observe the procedure and results.

14-26 TESTING:

14-26.1 As soon as all electrical work is complete, the various systems and equipment shall be subjected to the following tests.

14-26.1.1 All systems shall be tested to insure freedom from short circuits or other faults.

14-26.1.2 Cable tray system shall be tested to insure that the maximum resistance value specified has not been exceeded.

14-26.1.3 All motors shall be tested for proper starting and direction of rotation.

14-26.1.4 All lighting circuits shall be operated.

14-26.1.5 All other electrically operated equipment shall be operated for verification of proper performance.

14-26.2 The Contractor shall make all other tests as may be required by the Contracting Officer to prove the integrity of his work, and shall leave the complete electrical installation in first class condition and ready for operation. All defects or deficiencies in any of the Electrical work shall be corrected in an approved manner without additional cost to the Government, and to the satisfaction of the Contracting Officer.

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14-26.3 The Contractor shall furnish to the Contracting Officer two (2) dated copies of all test readings, including the nameplate record of test instruments and the name and title of the person or persons who performed the test.

14-27 PAINTING: All painting or preparation therefor shall be as called for in the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK.

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331/332-BK (All)