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CONSTRUCTION SPECIFICATIONS

FOR



25X1A

HEADQUARTERS BUILDING



25X1A

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CONSTRUCTION SPECIFICATIONS FOR [REDACTED] HEADQUARTERS 25X1A
BUILDING, [REDACTED] 25X1A

1. General Intentions:

A. It is the declared and acknowledged intention and meaning to provide and secure the following new facility for a new headquarters building along with a facilities building, garage, power plant, with all necessary appurtenances complete with ready for use.

A-1. Location: The work shall be located at [REDACTED] as shown. 25X1A
The exact location is indicated in drawing number A.1 and will be indicated by construction Engineer, U.S. Government.

A-2. The work includes that of furnishing all material, equipment, other than specified as U.S. Government furnished, and labor to provide the following:

25X1X
A-3. Main Headquarters building will be a two-storey building of approximately 728 M² per floor and will contain space for a vaulted area, general office space, and [REDACTED] lounge and VIP quarters on the second floor provided with toilets and bathrooms as ^{shown} required. The structure will consist of reinforced concrete in the vaulted areas and reinforced concrete framing with ^{brick} plastered curtain walls in the other areas, wooden trusses, corrugated asbestoes cement roofing, concrete columns, beams with Portland cement. Both floors are concrete slab with troweled finish and vinyl tile. Interior partitions of office, [REDACTED] are either of plastered masonry or ^{asbestos} plywood. Basic electrical system is flourescent light and incandescent fixtures along with air conditioning as indicated on the plans. 25X1X

25X1A

A-4. Facilities Structure: Will be a single storey building approximately 546 M² of masonry construction with wood trusses, reinforced concrete framing and corrugated asbestoes roofing, with masonry and asbestoes smooth board partitions. Concrete floor slab with vinyl ^{asbestos} tile with an electrical system consisting of incandescent and flourescent lighting fixtures. Exterior walkways will be screened with fiberglass mosquito screening as provided in sample.

A-5. Power Plant: Will be single storey building of approximately 8 by 15 meters and will contain space for three ea 350KW (Cat model D379) generators, switch gear, office, locker room, and storage. The major structure will consist of reinforced concrete framing with wood trusses and corrugated asbestoes cement roofing, concrete columns, beams and brick masonry walls. Three reinforced concrete foundation pads complete with pre-moulded joint filler around edge of pad, anchor bolts and resilient damper will be provided.

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A-6. Buildings General: All buildings will be painted on interior and exterior with flat coat and finish coat as ^{specified} required. Electrical systems will include all exterior lighting for security precautions as indicated on drawings.

B. Civil Work: Will consist of grading to elevation and filling elevations as shown on prints and as following:

B-1. Fuel Oil storage tanks embankment (dike) shall be compacted laterite approximately 1 meter in height, and shall completely encircle the existing tanks as shown. A 0.30 M x 0.30 M x 0.15 M deep concrete area drain with 2.4 MM thick steel plate cover with 25.5 MM wide x 25.4 MM long slotted holes .75 MM on center will be provided. This will be connected to a drain pipe to drain to daylight. Upon completion the berm will be sprayed to prevent erosion and provide dust control.

B-2. Access Road. Approximately 1000 M² consisting of compacted fill, 15 CM compacted base coarse, covered by double, bituminous surface treatment approximately 2 cm. in thickness will be provided. The shoulders will be 1.50 M wide and shall consist of compacted base coarse material. The new pavement will be warped to meet the existing aircraft parking area and a portion of the existing pad will be cut back to make the connection.

B-3. Water service connection - will consist of tying into the galvanized line pipe in the front of the property. The new line will be 1 1/2 inch galvanized steel pipe and will be connected to the existing asbestos cement pipe main. The service lines from the 1 1/2 inch to other outlets will be 1 inch galvanized steel pipe. 1 inch bronze gate valves fittings and concrete valve boxes will be provided.

B-4. Concrete sidewalks -- Concrete sidewalks will be 1.00 meters wide, 10 CM thick, contraction joints shall be provided at every 1.25 meters intervals.

B-5. Electrical work exterior will be generally locating overhead lines and poles and provide new light fixtures, lines, concrete poles, underground concrete encased ducts and reinforced concrete hand holes.

? too short

B-6. Time of Completing -- The work shall be completed within 120 calendar days after the construction contract is signed or either communication authorization to the contractor to proceed has been given.

C. Drawings accompanying specifications: The following drawings accompany this specification and are part thereof. Drawings are the property of the government and shall not be used for any purpose other than that contemplated by the specifications.

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C-1. Specifications and Standards: Other specifications and standards are referenced to in these specifications and shall govern in all cases where such references occur. In case of difference between such specifications or standards and the accompanying drawings, this specification and the accompanying drawings shall govern to the extent possible.

C-2. The Contractor shall submit for approval -- samples of such materials and equipment as may be required whether mentioned specially herein or not. -- Wire, cable, insulators, paints, paint colors, water piping, aggregates, Portland cement, grounding materials, plumbing fixtures, and electrical fixtures.

C-3. As Built Changes: made during construction shall be recorded by the Contractor on a reproduceable print furnished to him by the Contracting ^{Officer} engineer and submitted to a U.S. Government representative for approval prior ^{to work} ~~to work~~ ^{of the completed facility}.

C-4. Government Furnished Equipment New: The following listed equipment and materials will be furnished by the Government and installed by the Contractor. The contractor shall designate a receiving agent in order to inspect and accept the materials for the contractor. This equipment will be transferred to the contractor at the job site. Any claims for shortages or damages shall be made at the time of transfer and must be noted on the receipt. The contractor shall receive, handle, store, maintain and preserve GFE in a manner that will prevent damage and loss, the contractor shall be solely responsible for such damage to or loss of GFE from the time of transfer to his charge. All unused property shall remain the property of the U.S. Government.

Item	Quantity	Description
1	4	Cubicles - 3 generator and one feeder switch gear with synchronized panel
2	3	3 ea D 379 Cat. 350 KW Generators complete.
3	3	Exhaust <u>?</u> with silencer for outdoor installation for compatible generator
4	60 ea.	Air Conditioner units various horse power ratings installed as per plans. Spare to be stored in Warehouse G

C-5. The Government ~~may furnish and~~ reserves the right to furnish other equipment and materials for installation by the Contractor. The Contractor shall do all work necessary to adapt equipment or materials to the project drawings or shall perform as specifically directed upon notification by the Government.

C-6. Coordination of Construction: The Contractor acknowledges that all construction work be performed, shall be accomplished with minimum inconvenience to the established air base operations. The Contractor shall within five days after receiving the government's approval of his construction schedule, submit a copy of the schedule to the Government engineer coordinating the order and date on which he proposes to start the work and the contemplated date for the completion of same. Full coordination shall be maintained with the Government engineer at all times, and where power and/or water outages are concerned a generous notice shall be given to this effect.

C-7. Restoration and Cleaning Up: Any damage to existing work or property resulting from the contractor's operations shall be repaired by the contractor and shall match adjacent or original work in quality of material and workmanship. Upon completion of the work, or as directed, the contractor shall remove and dispose, in nearby spoil areas, all debris and rubbish resulting from the work.

PART II

TECHNICAL REQUIREMENTS

The following listed under technical specifications incorporated in Part II Technical Requirements form a part of this specification and shall be applicable to the extent required for accomplishment of the General Intention as specified herein before.

Section No.	Title
1	Site Preparation
2	Earth Work
3	Base Power COURSE
4	Double Bituminous Surface <u>TREATMENT</u>
5	Top Soiling & Sprigging
6	Concrete for Structures
7	Masonry
8	Plastering
9	Carpentry
10	Caulking
11	Roofing Asbestos Cement
12	Windows
13	Glass and Glazing
14	Sheet Metal Work
15	Miscellaneous Metal Work
16	Hardware Builders
17	Ventilating System Mech.
18	Diesel Electrical Generator
19	Electrical Work Interior

Section No.	Title
20	Electrical Work Exterior
21	Water Distribution
22	Painting
23	General

SECTION I - SITE PREPARATION

General: The work includes clearing, and grubbing within the grading limits shown, and the disposal of resulting waste material, complete.

Timbering shall consist of felling, trimming, and cutting of trees into sections, except those trees directed to be left standing. Trees selected to remain shall be properly protected, and those required to be removed shall be cut off flush with, or below, the original ground surface.

Clearing: Brush and vegetation shall be cut off flush with, or below, the original ground surface.

Grubbing: Trees stumps shall be removed entirely. Tree roots and matted roots of brush shall be grubbed out to a depth of not less than 30 cm. below the finished subgrade.

Non-Combustible waste and debris shall be gathered and disposed of at assigned locations as directed by the Government.

Combustible waste and debris shall be gathered for burning, except that when permitted, logs and larger stumps may be removed and disposed of without burning at assigned locations as directed by the Government.

Locations for burning shall be in open areas where existing trees or other vegetation will not be harmed, as approved by the Government.

Regulations of the local fire authority shall be complied with regarding burning methods. Fires shall be kept under constant attendance until the fires have burned out or have been extinguished.

Ashes shall be disposed of as non-combustible material.

Private Property: Permission to dispose of waste and debris on private property shall be in writing. A copy of the permit shall be filed with the Government.

Rehandling: When conditions are not suitable for burning operations and waste material interferes with subsequent construction, such material shall be moved or disposed of at assigned locations and times.

- End of Section -

SECTION 2 - EARTHWORK

General Requirements: The work includes excavation, filling and backfilling, preparing embankment areas, formation of embankments, preparation of subgrades, construction of shoulders for roadways, and removal and satisfactory disposal of waste and surplus material, complete.

Weather Limitations: Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained on account of rain or other unsatisfactory field conditions.

Applicable Specifications and Standards: The work shall conform to current issues of the following publications.

ASTM: (American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, Pa.)

- D 698 Methods of test for moisture-density relations of soils, using 5.5-lb. rammer and 12-inch drop (tentative).
- D 1556 Method of test for density of soil in place by the sand-cone method (tentative).
- D 1557 Methods of test for moisture-density relations of soils, using 10-lb. rammer and 18 in. drop (tentative).

Equipment: Any suitable and properly maintained type of equipment may be used. Equipment failing to achieve requirements specified shall be replaced.

Stripping of Original Ground Surface: The entire area within the grading limits shown shall be stripped down to remove heavy sod, grass, decayed vegetable matter, rubbish and any other unsuitable material. Prevent unnecessary displacement of suitable material. Deposit stripped material in spoil areas, where directed by the Government.

Topsoil: Material from the excavations, suitable for topsoil, shall be deposited in piles separate from other excavated material. Piles of topsoil shall be located so that material can be used readily for the finished surface grading, and shall be protected and maintained until needed. Topsoil shall be uniformly spread on the area to be sprigged.

Excavation for Buildings and Structures shall conform to the dimensions and elevations shown, and the excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete for walls and footings is authorized to be deposited directly against excavated surfaces. When concrete or masonry is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to the final grade level

shall not be made until just before the concrete is to be placed. Such grading shall be done as may be necessary to prevent surface water from flowing into excavations.

Excavation for Utility Pipe Lines shall be in straight lines along the alignments and grades shown, and, unless otherwise shown, shall provide a minimum of 15 cm. between the outside of the pipe and the sides of the trench or bracing, with a minimum trench width of 60 cm. The excavation shall be shaped manually and graded to provide uniform bearing on compacted soil, immediately before the pipe is laid. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches.

Excavation for Conduit shall be done as necessary for installation of conduit, boxes, structures and foundations along the alignments and grades shown and with sides approximately vertical. Trenches for conduit shall have a minimum depth of 60 cm. and a minimum width of 30 cm. Trenches shall be in straight lines between cable connections, and bends in trenches shall have a radius of not less than 100 cm. Rock shall be removed to a depth of not less than 7.5 cm. below the conduit depth and the space shall be filled with sand to provide a cushion. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches.

Excavation for Drainage Ditches shall be performed to secure a true to line elevation and cross section. Work shall be performed in the proper sequence with other construction. Intercepting ditches shall be constructed prior to the start of adjacent excavation operations. Where necessary, sufficient openings shall be provided through spoil banks to permit drainage from adjacent areas. Ditches shall be maintained to the required cross section, and shall be kept free from debris or obstructions until the contract is complete.

Excavations for Roadways and Slabs shall conform to the dimensions and sections shown. Stones or rock fragments larger than 10 cm. in their greatest dimension will not be permitted in the top 15 cm. of the subgrade.

On-Site Borrow Excavation is not approved

Off-Site Borrow Excavation shall consist of approved material excavated from borrow areas located outside the site limits. All arrangements for obtaining suitable borrow shall be the responsibility of the Contractor, and all compensation to private land owners for this borrow material shall be at the Contractor's expense.

Over-Excavation: Excavations carried below the depths indicated, without specific directions, shall be refilled to the proper grade with suitable material and compacted thoroughly, except that in excavations for footings the concrete shall be extended to the bottom of the excavations; all additional work of this nature shall be at the Contractor's expense.

Surface Drainage: Temporary drains and drainage ditches shall be installed as necessary to intercept or divert surface water that may affect the prosecution or condition of the work.

Bracing: Excavation shall be braced with members of suitable sizes and arrangement where necessary to prevent danger to persons, caving or erosion. Bracing shall be maintained during the construction operations, and removed as the excavations are backfilled.

Filling and Backfilling Material shall consist of suitable excavated material or borrow of earth, sand, gravel, or other approved materials, and shall be free of roots, wood, scrap material, other vegetable matter and refuse. Moisture content shall be such that proper compaction will be obtained.

Fill or Backfill for Buildings and Structures shall be placed, as far as practicable, as the work of construction progresses. Backfilling against concrete shall be done only when directed by the Government. Backfill shall be placed in horizontal layers not more than 15 cm. thick with each layer thoroughly and evenly compacted.

Fill or Backfill for Utility Pipe Lines shall proceed as rapidly as the construction and testing of the work permits. Backfill shall be placed in horizontal layers not more than 15 cm. thick, each layer thoroughly and evenly compacted, to a depth of 30 cm. over the top of the pipe. The remainder of the trench shall be backfilled in well compacted layers 30 cm. thick, except that for trenches excavated in roads and streets the backfill shall be placed and compacted in 15 cm. layers to the top of the trench.

Fill or Backfill for Conduit: Conduit shall be laid on a 10 cm. thick sand bed and covered with a 10 cm. thick sand blanket to the full width of the trench and not less than 10 cm. on each side of the conduit. Sand shall be clean, hard, mineral aggregate with 100 percent passing a No. 10 mesh sieve and not more than 5 percent passing a No. 100 sieve. Large sharp-edged particles of sand or any other material injurious to the conduit or connections shall not be included in the sandbed. The remainder of backfill shall be placed as specified for utility pipe lines.

Degree of Compaction: Unless otherwise specified, fill under concrete slabs on grade and the upper 15 cm. layer of fill within roadways and paved areas shall be compacted to a density of not less than 95 percent of maximum density. All other fills shall be compacted to a density of not less than 90 percent of maximum density. The maximum density as herein referenced shall be determined in accordance with the requirements of ASTM Designation D 698, Method "D".

Preparation of Embankment Area: Unsuitable material within the top 15 cm. of the area on which embankment is to be placed shall be removed before the embankment is begun.

Depressions or Holes below the original ground surface shall be backfilled with suitable material, and shall be compacted flush with the adjacent ground surface.

Formation of Embankment: Material shall consist of suitable excavated material or borrow or earth, sand, gravel or other approved materials, and shall be free from organic

material and other objectionable matter. The maximum size particle for use in fill shall not exceed two-thirds the compacted layer thickness.

Grade Control: The lines and grade shall be established by the Contractor and shall be maintained by means of grade stakes placed in lanes parallel to the center lines of the areas to be paved and spaced so that the string lines may be stretched between stakes. All lines and grades will be checked by the representative of the Contracting Officer, but such check will not relieve the Contractor of full responsibility for the correctness thereof.

Layers: Embankments shall be formed of suitable materials placed in successive horizontal layers of not more than 15 cm. in compacted depth for the full width of the cross section. Starting layers shall be placed in the deepest portion of the fill. Layers shall be constructed approximately parallel to the finished grade line.

Moisture Content: Wetting or drying of the material and manipulation to secure a uniform moisture content throughout the layer shall be accomplished as necessary. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content.

Compaction: Each layer shall be compacted to not less than 90 percent maximum density at optimum moisture content, except the top 15 cm. which shall be compacted to not less than 95 percent.

Routing: At all times, both when loaded or empty, equipment shall be routed over the layers as they are placed. Travel shall be evenly distributed over the entire width of the embankment. Equipment shall be operated in such manner that hardpan, cemented gravel, clay or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

Stability of Embankments: The top of the embankment shall be kept in such condition that it will drain readily and effectively. Ruts shall be corrected by reshaping and rerolling. The Contractor shall be responsible for the stability of the embankments, and shall replace any portion which, in the opinion of the Government's representative, has become displaced due to carelessness or negligence on the part of the Contractor.

Tolerance for Slabs: In that area where slabs are to be placed, the top of the embankment shall be of such smoothness that when tested with 4-meter straightedge it shall not show any deviation in excess of 1 cm. or shall not be more than 1 cm. from true grade as established by grade hubs or pins. Any deviation in excess of these amounts shall be corrected by loosening, adding or removing materials, reshaping and recompacting by sprinkling and rolling.

Preparation of Subgrades: Unsuitable material within the top 15 cm. of the subgrade area shall be removed.

Depressions or Holes below the original ground surface shall be backfilled with suitable material, and shall be compacted flush with the adjacent surface.

Compaction: The subgrade shall be shaped to line, grade and cross-section, and the top 15 cm. of the subgrade shall be compacted to not less than 95 percent of maximum density obtained at optimum moisture content. Subgrade compaction shall be extended to include an area for a distance of at least 30 cm. beyond the edges of the widths designated for placement of base course material.

Moisture content: Wetting or drying of the material and manipulation to secure a uniform moisture content shall be accomplished as necessary.

Tolerance: The finished compacted subgrade shall be blue topped by the Contractor at not less than 20 meter intervals along both shoulders. Any deviation from true grade in excess of 1.5 cm. shall be corrected by loosening, adding or removing materials, reshaping and recompacting.

Shoulder Construction for Roadways: Shoulders shall be constructed with suitable approved materials. Shoulders shall be formed and compacted as soon as possible after the adjacent surfacing is complete. The entire shoulder area shall be uniformly and thoroughly compacted. The completed shoulders shall be true to alignment and grade, and shaped in conformity with the section shown, or as directed.

Acceptance of Subgrade or Embankment: Each lift of embankment material placed by the Contractor shall be subject to approval by the Government. No surface course material shall be placed on a prepared subgrade or on an embankment without the prior approval of the subgrade or embankment by the Government's representative.

Tests: All tests required by the Contractor to control the quality of the work, shall be made by the Contractor under the supervision of the Government's representative, by and at the expense of the Contractor.

- End of Section -

SECTION 3 - BASE COURSE

General: The work includes the providing of a crushed gravel or crushed stone base course for bituminous roadways, a laterite base course (suitable for use as a wearing surface) for roadways, and a crushed gravel, or crushed stone or laterite base course (select material) suitable for use under concrete slabs, complete.

Applicable Specifications and Standards: The work shall conform to current issues of the following publications:

- ASTM: (American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, Pa.)
- C 117 Standard method of test for amount of material finer than No. 200 sieve in aggregates (tentative).
 - C 131 Method of test for abrasion of coarse aggregate by use of the Los Angeles machine.
 - C 136 Standard method of test for sieve analysis of fine and coarse aggregates (tentative).
 - D 75 Methods of sampling stone, slag, gravel, sand, and stone block for use as highway materials.
 - D 423 Standard methods of test for liquid limit of soils (tentative).
 - D 424 Standard methods of test for plastic limit and plasticity index of soils.
 - D 698 Method of test for moisture-density relations of soils, using 5.5-lb. rammer and 12-in.
 - D 1557 Methods of test for moisture-density relations of soils, using 10-lb. rammer and 18-in. drop (tentative).

Materials: Crushed rock and crushed gravel shall be free from vegetable matter, lumps of clay or other objectionable matter, and shall be durable and sound. That portion of the material retained on a No. 4 sieve shall be known as coarse aggregate, and that passing a No. 4 sieve shall be known as binder material.

Coarse Aggregate conforming to the requirements above, shall have a percentage of wear not to exceed 50 percent after 500 revolutions, as determined by ASTM designation C 131.

Binder Material shall consist of sand, screenings, or other finely divided mineral matter,

obtained from approved sources, or naturally combined with the coarse aggregate. It shall be free from vegetable and other objectionable material.

Gradation of Composite Mixture: The composite of coarse aggregate and binder material shall conform to the following gradation, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine. Both before and after compaction, aggregate shall conform to the following when sampled in accordance with ASTM designation D 75 and tested in accordance with ASTM designation C 136 and C 117.

Percentage (By Weight)

Passing the Square Mesh Sieve

<u>Sieve Designation</u>	<u>Percentage Passing</u>
1-1/2 inches -----	100
3/4 inch -----	70 - 100
No. 4 -----	35 - 65
No. 40 -----	15 - 30
No. 200 -----	5 - 15

Liquid Limit and Plasticity Index: That portion of the aggregate passing a No. 40 sieve in the gradation specified above shall have a liquid limit of not more than 25 and a plasticity index of not more than 6 when determined in accordance with ASTM designations D 423 and D 424 respectively.

Laterite Aggregate shall be in natural combination with finely divided mineral matter. Additional sand, screenings or other finely divided mineral matter shall be added, if necessary, so that the composite material shall conform to the gradation specified.

Gradation of Aggregate: The aggregate shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine. Both before and after compaction, aggregate shall conform to the following when sampled in accordance with ASTM designation D 75 and tested in accordance with ASTM designation C 136 and C 117.

Percentage (By Weight)

Passing Square Mesh Laboratory Sieves

<u>Sieve Designation</u>	<u>Percentage Passing</u>
2 inch -----	100
No. 4 -----	30 - 60
No. 200 -----	8 - 25

Liquid Limit and Plasticity Index: That portion of the aggregate material passing a No. 40 sieve shall have a liquid limit of not more than 40 and a plasticity index of not more than 14 when tested in accordance with ASTM designation D 423 and D 424 respectively.

Equipment: All plant, equipment, tools, and machines shall be suitable for the use intended, properly maintained and subject to approval.

Weather Limitations: Base courses shall not be constructed when weather conditions detrimentally affect the quality of the work in progress. Areas damaged by weather shall be aerated (if required), reshaped and recompacted.

Preparation of Sub-Grade: The previously constructed sub-grade shall be cleaned of all foreign substances and the surface approved for compaction and surface tolerances prior to constructing the base course.

Grade Control: The lines and grades shall be established by the Contractor and shall be maintained by means of grade stakes, placed in lanes parallel to the center lines of the areas to be paved when applicable, and spaced so that string lines may be stretched between stakes.

Placing Base Course Materials: The material shall be deposited, spread and compacted in layers, each not greater than 15 cm. thick. Areas of segregated material shall be removed and replaced with the specified material, or shall be remixed.

Compacting and Shaping: Each loose layer shall be rolled. Rolling shall progress from sides to the center. Each successive track shall lap the preceding by at least 30 cm. Water shall be added, if necessary, in such manner and quantity that free water will not reach the underlying layer or sub-grade. Rolling shall continue until the material is thoroughly set and stable, and the layer is compacted through the full depth. Material shall not be rolled when the sub-grade is soft, yielding or when the rolling causes a wave-like motion in the layer. Rolling and blading shall be done alternately as necessary to obtain a smooth, even and uniformly compacted layer.

Hand Tamping: Areas inaccessible to rollers shall be compacted with hand tampers weighing not less than 22 kilograms and with a face area of not more than 650 square centimeters.

Smoothness: Areas having surface deviations in excess of 10 mm. when tested with and at right angles to the center line of the areas to be paved or covered with a concrete slab, shall be corrected by loosening, adding and/or subtracting material, reshaping, watering (if necessary), and compacting the area involved, all as specified herein.

Thickness shall be measured at intervals in such manner that there will be a depth measurement for at least each 10 meters of completed course. Measurements shall be made by test holes at least 7.5 centimeters in diameter through the course. Where the base course deficiency is more than 1.25 centimeters, the Contractor shall correct such areas by scarifying, adding material, reshaping, watering (if necessary), and compacting the area involved, all as specified herein. Where the measured thickness is more than 1.25 centimeters thicker than shown, it will be considered as the required thickness plus 1.25 centimeters for determining the average. The average thickness shall be the average depth measurement, and shall not vary from the thickness shown by more than 0.6 centimeter.

Density: The completed crushed gravel or crushed stone base course for bituminous roadways shall be compacted through the full depth to not less than 100 percent of maximum density at optimum moisture in accordance with ASTM designation D 1557, Method "D". The completed laterite base course (suitable for use as a wearing surface) for roadways and the crushed gravel or crushed stone or laterite base course (select material) suitable for use under concrete slabs shall be compacted through the full depth to not less than 95 percent of maximum density at optimum moisture in accordance with ASTM designation D 698, Method "D".

- End of Section -

SECTION 4 - DOUBLE BITUMINOUS SURFACE TREATMENT

General: The work includes a bituminous prime coat on a previously constructed base course, an application of bitumen covered with mineral aggregate than compacted, followed by another application of bitumen covered with mineral aggregate, then compacted.

Applicable Specifications and Standards: The work shall conform to current issues of the following publications:

Federal Specifications:

SS-A-671b (GSA-FSS)	Asphalt, (Petroleum Cut-Back for Road-work).
SS-A-674c (GSA-FSS)	Asphalt, Paving, Emulsion

Materials:

Mineral Aggregate shall consist of crushed stone, or crushed gravel, free from adherent film of clay and shall be of such nature that a thorough coating of the bituminous material used in the work will not strip off upon contact with water. The moisture content of the aggregate shall not be sufficient to prevent it from being readily coated with the bituminous material.

Stripping Test: The aggregate will be subjected to the following stripping test. A test sample consisting of the aggregate and the bitumen to be used will be mixed at the temperature specified for the bitumen application. The sample will then be spread in a loose, thin layer and allowed to air-season for 24 hours before testing. A portion of the sample, not over 1/2 the capacity of the jar, will be placed in a glass jar and covered completely with distilled water. The jar will be fitted with a tight screw cap and allowed to stand for a period of 24 hours. The jar will be shaken vigorously for a period of 15 minutes, and the sample of the mixture will then be examined for stripping. If stripping occurs, the asphalt shall be treated in a manner such that the aggregate-asphalt mixture will meet the foregoing test.

Crushed Gravel: At least 70 percent of weight, of the particles retained on the No. 4 sieve shall consist of fractured angular pieces.

Size of Aggregates: The grading of the aggregates shall conform to the following:-

Percentage (By Weight)

Passing Square Mesh Laboratory Sieves

<u>Sieve Designation</u>	<u>1st Application</u>	<u>2nd Application</u>
3/4 inch	100	
1/2 inch	90 - 100	
3/8 inch	40 - 55	100
No. 4	0 - 10	85 - 100
No. 8	0 - 5	10 - 40
No. 16	-	0 - 10
No. 50	-	0 - 5

Bituminous Material for Surface Treatment:

Rapid Curing Cut-Back Asphalt shall conform to Federal Specification SS-A-671b., grade RC-3, RC-4 or RC-5, as applicable. The temperature-viscosity relationship of the asphalt shall be furnished. Application temperature shall be as directed within the range of 140 - 210 degrees F for RC-3. 175 to 250 degrees F. for RC-4, and 200 to 275 degrees F. for RC-5. Application viscosity shall be between 25 and 100 seconds, Saybelt Furel.

Quick-Setting Emulsified Asphalt shall conform to Federal Specification SS-A-674c, type RS-1 having a viscosity in excess of 100 at 77 degrees F. Application temperature shall be as directed within the range of 75 - 130 degrees F.

Bituminous Material for Prime Coat shall be medium-curing cut-back asphalt conforming to Federal Specification SS-A-671b grade MC-0 or MC-3, as applicable. Application temperature shall be directed within the range of 70 to 140 degrees F. for MC-0 and 150 to 200 degrees F. for MC-3.

Equipment: All plant equipment, tools, and machines shall be suitable for the use intended, properly maintained and subject to approval.

Bitumen Distributor: If used, the distributor shall have pneumatic tires of such width and number that the load produced on the base surface shall not exceed 650 pounds per inch of tire width. It shall distribute the bituminous material uniformly at even heat on variable widths of surface at readily determined and controlled rates from 0.2 to 6.0 liters per square meter, with a pressure range of 1.75 to 5.25 kg/cm and with an allowable variation from any specified rate not to exceed five percent. Distributor equipment shall include independently operated bitumen pump, tachometer, pressure gauges, volume measuring devices, thermometer for reading the temperature of tank contents and hose attachment suitable for applying bituminous material to spots missed by the distributor. The dis-

tributor shall be equipped for circulation and agitation of the bituminous material during the heating process.

Heating Equipment: The equipment for heating bituminous material may consist of steam coils and equipment for producing steam, designed so that steam will not be introduced into the material. If storage tanks are used, an armored thermostat with a range from 100 degrees F. to 300 degrees F., shall be fixed to the tank so that the temperature of the bituminous material may be determined at all times. The bituminous material may be heated by other means, as approved by the Government.

Mechanical Spreaders shall be adjustable and capable of spreading aggregate at controlled amounts per square meter. Aggregate may be spread by other means, as approved by the Government.

Power Rollers shall be self-propelled tandem or three-wheel type rollers and shall be suitable for rolling bituminous pavements. The wheels of the rollers shall be equipped with adjustable scrapers. The rollers shall be equipped with water tanks and sprinkler apparatus, which will be used when necessary to keep the wheels wet, preventing sticking of the bituminous mixture.

Hand Tampers shall weigh not less than 11.3 kilograms and shall have a tamping face of not more than 323 square centimeters.

Broom Drags shall consist of brooms of the street type, mounted in a frame in such manner as to spread the aggregate uniformly over the surface of the area to be treated. The drags shall be equipped with tow plates for towing. Towing equipment shall be rubber-tired. Other means for spreading the aggregate may be used, as approved by the Government.

Power Blowers and Power Brooms shall be suitable for cleaning the surface to be paved. Other means may be used for cleaning the surface to be paved as approved by the Government.

Preparation of Base Course: The previously constructed base course shall be cleaned of all foreign substances, and the surface approved for compaction and surface tolerances prior to application of the prime coat.

Quantity of Material Applied shall be within the following limits:

<u>Application</u>	<u>Quantity Limits</u>
Bitumen, liters per square meter; Prime coat	0.90 - 2.30
Bitumen, liters per square meter; 1st application	1.6 - 2.0
Aggregate, 1st spreading, kg. per square meter	19.5 - 24.4
Bitumen, liters per square meter; 2nd application	0.9 - 1.1
Aggregate, 2nd spreading, kg. per square meter	9.8 - 14.6

The rates of application of actual bitumen, as tabulated, are based on the bitumen content of the asphalt used. The kg of aggregate, indicated herein, are based on an apparent specific gravity of 2.65. For aggregate having an apparent specific gravity other than 2.65, adjustment in kg shall be made to insure constant volume per square meter.

Prime Coat shall be applied only when the base course is dry or contains moisture not in excess of that which will permit uniform distribution and the desired penetration. The bituminous material shall be applied uniformly, at even heat within a pressure range of 1.76 kg/cm² to 5.27 kg/cm² and with an allowable variation from the specified rate not exceeding 5 percent. Following the application of the bituminous material, the surface shall be allowed to dry for a period not less than 48 hours without being disturbed, or for such additional period of time as may be necessary to attain proper penetration and evaporation of the volatiles.

Surface Treatment:

First Application of Bitumen shall be uniform, and at a temperature and rate within the specified limits, as directed.

First Spreading, Brooming and Rolling of Aggregate: Immediately following the first application of bituminous material, aggregate shall be spread uniformly within the specified limits. Trucks spreading aggregate shall be operated backwards, so that the bituminous material will be covered ahead of the truck wheels. Back-spotting or sprinkling of additional aggregate over areas having insufficient cover shall be done whenever necessary. The surface shall be rolled immediately after sufficient aggregate is spread to prevent pick-up of the bituminous material. The surface shall be broom dragged immediately after the surface has set sufficiently to prevent excessive marking. Broom dragging, rolling, and backspotting shall be continued until no more aggregate can be worked into the surface, and the surface is cured and rolled sufficiently to key and set the aggregate. In all places not accessible to the rollers, the aggregate shall be adequately compacted with tampers. Any aggregate that becomes coated or mixed with dirt or any other foreign material shall be removed, replaced with clean aggregate, and rerolled, as directed by the Government. All surplus aggregates shall be swept off the surface and removed prior to the second application of bituminous material.

Second Application of Bitumen shall follow within 24 hours after the construction of the first course, weather permitting. If the treated surface is excessively moistened by rain within this period it shall be allowed to dry, as directed, before the second coat of bituminous material is applied. The second application of bituminous material shall be applied in the same manner as the first and at a rate within the limits specified.

Second Spreading, Brooming and Rolling of Aggregate: Immediately following the second application of bitumen, aggregate conforming to the specified grading shall be spread uniformly over the bituminous material in amounts within the specified limits, and

as directed. The aggregate shall then be rolled and broom-dragged until a smooth, even textured surface is produced.

Maintenance: The Contractor shall protect the treated areas from traffic for at least 24 hours after the second rolling and Brooming.

- End of Section -

SECTION 5 - TOPSOILING AND SPRIGGING

General: The work includes the providing of topsoiling and sprigging complete, in all unpaved areas within the grading limits shown and on areas disturbed by construction.

Materials:

Topsoil shall be a natural friable clay or sandy loam soil having the characteristics of representative soils of the vicinity that produce grass or other vegetation. It shall be free from sub-soil, brush, objectionable weeds, stones, roots, and other objects larger than 5 cm. in diameter. Topsoil from earthwork operation may be utilized, or may be obtained from approved off-site locations that are naturally drained.

Sprigs shall be the healthy living stem and roots of local grasses capable of growing into a complete ground coverage mat. Unless otherwise shown, sprigs shall be obtained from heavy thickly matted sod in approved off-site locations having similar growing conditions. Sprigs shall be free of weeds or undesirable plants. When sprigs are cut, grass height shall not exceed 12 cm. Sprigs shall have soil adhering to the roots when planted.

Water shall be free from oil, acid, alkali, salt, and other substances harmful to plant growth. The source shall be subject to approval prior to use.

Inspection and Tests: Topsoil, and sprigs will be inspected to determine their suitability, for use in the work. No material shall be placed without the Government's representative's prior approval.

Topsoil Placing: Topsoil shall be uniformly distributed to a thickness not less than 10 cm. thick. Excessively compacted areas shall be loosened to a depth of not less than 5 cm. Spreading shall be performed in such manner that planting can proceed without additional soil preparation. Topsoil shall not be placed when subgrade is excessively wet or extremely dry. Topsoil shall be fine graded to lines indicated, and free of depressions where water will stand. Surface undulations or irregularities shall be leveled before the sprigging operation is begun.

Sprigging:

Harvesting of Sprigs: Method of harvesting shall be as approved by the Government. Sprigs may be collected or bunched for loading by rake or by hand. Sprigs shall be watered in small piles as soon as harvested, and shall be kept in shade and moist until planted.

Sprigging: Sprigs shall be planted within 24 hours after cutting. Sprigs shall be planted in shallow furrows not over 5 cm. deep. Furrows shall be made parallel with the

contours of the slopes, not more than 20 cm. apart, and sprigs shall be planted in clusters (each having not less than 3 viable sprigs) not more than 10 cm. apart in the furrow. Roots shall be covered with soil immediately after placing in the furrow in such manner that the surface is left even at the designated grade.

Water shall be applied to the sprigged areas as closely after planting operations as reasonably possible, with approved equipment capable of wetting the soil to a depth of at least 5 cm.

Contractor's Responsibility: The Contractor shall protect the planted area during the time when vegetation is becoming established. If objectionable weeds or other undesirable growths threaten to smother the planted species, such vegetation shall be removed from the area.

- End of Section -

SECTION 6 - CONCRETE FOR STRUCTURES & VAULT, COLUMN, FLOOR SLABS,
BEAMS ETC.

General: The work includes providing concrete work for structures, and sidewalk,
complete.

Applicable Specifications and Standards: The work shall conform to current issues of
the following publications:

Federal Specification:

SS-A-281b (1)	Aggregate; (for) portland-cement concrete.
SS-C-192d	Cement; portland
UU-P-269a	Paper, concrete-curing, waterproofed (kraft).

ASTM: (American Society for Testing and Materials, 1916 Race Street, Philadelphia
3, Pa.)

A 184	Fabricated steel bar or rod mats for concrete reinforcement.
A 184	Welded steel wire fabric for concrete reinforcement (tentative).
C31	Method of making and curing concrete compression and flexure test specimens in the field.
C39	Method of test for compressive strength of molded concrete cylinders.
C40	Method of test for organic impurities in sands for concrete.
C136	Method of test for sieve or screen analysis of fine and coarse aggregates. (Tentative).
D88	Method of test for saybolt viscosity.
D92	Method of test for flash and fire points by Cleveland open cup.

Materials: The following materials shall conform to the respective specifications and
other requirements stipulated below:

Cement shall be Portland cement conforming to Federal Specification SS-C-192d,
Type I or Type II, and shall be dry and free from lumps and caking and, when packaged,
shall be in canvass bags or other strong and well-made packages, each of which shall be
plainly marked with the manufacturer's name and brand. A bag of Portland cement shall
contain 50 kg. net. Approximately one percent of each shipment, may be selected at
random and checked for weight. Bags varying more than 5 percent from the specified

weight may be rejected. Suitable accurate scales and necessary labor for checking the weight of bagged cement shall be furnished by the Contractor. Cement salvaged by cleaning bags mechanically or otherwise, or from discarded bags of cement, shall not be used in the work.

Corrective Additions to remedy deficiencies in aggregate grading, cement replacements and admixtures desired for any other purposes may be used only with prior written approval.

Fine Aggregate: Fine aggregate shall consist of either natural sand, manufactured sand, or a combination of natural and manufactured sand, and shall be composed of clean, hard durable particles. If the fine aggregate is a combination of separately processed sizes from the same or different sources, or a combination of natural and manufactured sands, the different components shall be batched separately or blended prior to delivery to the batching plant under conditions as approved by the Government.

Particle Shape: Particles of the fine aggregate shall be generally aspherical or cubical in shape.

Grading: Grading of the fine aggregate as delivered to the mixer shall conform to the following requirements when tested in accordance with ASTM Designation C136, using a minimum 1000 gram sample obtained by quartering. Sample shall be dried and weights determined with a balance sensitive to 1.1% of the weight of the sample tested.

<u>Sieve Designation</u> <u>U.S. Standard Square Mesh</u>	<u>Cumulative Percentage by Weight</u>	
	<u>Passing</u>	<u>Retained</u>
3/8	100	0
No. 4	95 - 100	0 - 5
No. 8	80 - 100	0 - 20
No. 16	50 - 85	15 - 50
No. 30	25 - 60	40 - 75
No. 50	10 - 30	70 - 90
No. 100	2 - 10	90 - 98

In Addition the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.3 nor more than 3.10. If the fineness varies by more than 0.20 from the value assumed in selecting proportions for the concrete, the fine aggregate shall be rejected at the option of the Contracting Officer's representative unless suitable adjustments are made in concrete proportions to compensate for the difference in grading.

Deleterious Materials in the fine aggregate shall not exceed the following limits:

<u>Material</u>	<u>Percentage by Weights</u>
Clay lumps	1.0
Material finer than No. 200 sieve:	
Concrete subject to abrasion	3.0
All other concrete	5.0
Coal and Lignite:	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

Organic Impurities:

(a) Fine Aggregate shall be free from injurious amounts of organic impurities. Except as hereinafter provided, aggregates tested in accordance with ASTM Standard C40 and producing a color darker than the standard shall be rejected.

(b) Fine Aggregate failing in the test may be used provided that the discoloration is due principally to the presence of coal, lignite, or similar discrete particles and provided further that the percentage of these materials is within the specified limits for deleterious materials.

(c) Fine Aggregate failing in the test may be used provided that, when tested for mortar-making properties, the mortar develops a compressive strength of 7 and 28 days of not less than 95 percent of that developed by a similar mortar made from another portion of the same fine aggregate which has been washed in a 3 percent solution of sodium hydroxide followed by thorough rinsing in water. Care should be taken not to lose fine material. The treatment shall be sufficient to produce a color lighter than standard with the washed material.

Soundness: When subjected to 5 cycle of the soundness test, the loss in weight of fine aggregate, weighed in accordance with the grading of a sample complying with the limitations hereinabove specified, shall not exceed 10 percent when magnesium sulfate is used, except as hereinafter provided.

(a) Fine Aggregate failing to meet the above requirements for soundness may be accepted provided that concrete of comparable properties, made from similar aggregate from the same source, has given satisfactory service when exposed to weathering similar to that to be encountered.

Coarse Aggregate: Coarse aggregate shall consist of either gravel, crushed gravel, crushed stone, or a combination thereof, suitably processed and approved.

Quality: Aggregate, as delivered to the mixers, shall consist of clean, hard, un-weathered and uncoated particles. Where necessary, dust and other coatings shall be removed from the coarse aggregates by adequate washing. Any aggregate representative of a material which has disintegrated or weathered badly under exposure conditions similar to those which would be encountered by the work under consideration shall not be used.

Particle Shape: Particles of the coarse aggregate shall be generally spherical or cubical in shape. The percentage of flat and elongated particles in any size group shall not exceed 20. For the purposes of these specifications, a flat particle is one having a ratio of width to thickness greater than three; an elongated particle is one having a ratio of length to width greater than three.

Size and Grading: The maximum nominal size of the coarse aggregate shall be 1-1/2 inch. The coarse aggregate shall be well-graded within the limits specified, and shall conform to the following grading requirements as delivered to the batching hoppers.

<u>Sieve Size, U. S. Standard Square Mesh</u>	<u>Percent by Weight Passing Square Mesh Sieves</u>		
	<u>3/4 inch To No. 4</u>	<u>1 inch To No. 4</u>	<u>1-1/2 inch To 3/4 inch</u>
2 inch			100
1-1/2 inch		100	90 - 100
1 inch	100	95 - 100	20 - 55
3/4 inch	90 - 100		0 - 15
1/2 inch	-	25 - 60	
3/8 inch	20 - 55		0 - 5
No. 4	0 - 10	0 - 10	
No. 8	0 - 5	0 - 5	

Before delivery to the batching hopper the Contractor shall store the coarse aggregate in separate stock piles in the following manner:

1-1/2 inch Maximum Nominal Size of Aggregate:

All coarse aggregate retained on the 1 inch square mesh sieve shall form one stock pile and all aggregate passing this sieve shall form the second stock pile.

1 inch Maximum Nominal Size of Aggregate:

All coarse aggregate retained on the 1/2 inch square mesh sieve shall form one stock pile and all aggregate passing this sieve shall form the second stock pile.

3/4 inch Maximum Nominal Size of Aggregate:
 All coarse aggregate retained on the 3/8 inch square mesh sieve shall form one stock pile and all aggregate passing this sieve shall form the second stock pile.

Deleterious Materials in the coarse aggregate shall not exceed the following limits:

<u>Sieve Designation</u>	<u>Percentage By Weight</u>
Clay lumps	0.25
Material finer than No. 200 sieve	1.0
Coal and lignite:	
Where surface condition of concrete is of importance	0.5
All other concrete	1.0
Soft particles	5.0
Chart which will readily disintegrate in five cycles of soundness, or that has a specific gravity, saturated-surface-dry, of less than 2.35	
Severe Exposure	1.0
Mild Exposure	5.0

Soundness: When subjected to 5 cycle of the soundness test, the loss in weight of coarse aggregate, weighed in accordance with the grading of a sample complying with the grading requirements specified, shall not exceed 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used, except as hereinafter provided. Coarse aggregate failing to meet the above requirements may be accepted, provided that concrete of comparable properties made from similar aggregate from the same source has given satisfactory service when exposed to weathering similar to that to be encountered.

Resistance to Abrasion: Coarse aggregate, when tested for abrasion shall have a loss of not more than 50 percent.

Water for Washing Aggregate and for mixing and curing concrete shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.

Curing Materials may be either burlap or cotton or other approved fabric mats, or membrane. Membrane curing compounds shall be pigmented type which, when tested, shall exhibit the following characteristics: The unit moisture loss through the membrane shall not be more than 0.03 gram per square cm. after 7 days exposure to a 25 kph. current of air at 32 C. and a 30 percent R.H., when the compound is applied in amounts not to exceed 20 sq. m. per gal. Resistance to early rainfall shall be attained in not more than

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3 hours. The membrane film shall not be ruptured, broken, or removed by moderate abrasion at an age of 24 hours. The compound shall be sprayable at temperatures above 40°F. The flash point shall not be less than 24°C. The compound shall contain a fugitive organic dye, which shall produce a temporary coloration which shall disappear completely within 78 hrs. after application and leave the concrete free of objectionable discoloration. The performance in use on the project shall be satisfactory as indicated by sprayability, uniformity of color, tendency to soften, run or sag, and general distribution of the membrane film and the appearance or absence of cracking of the concrete surface.

Water Proof curing paper shall conform to Federal Specification UU-P-264a.

Forms shall be of a good grade of lumber not less than 2.5 cm. in thickness.

Form Oil: An approved colorless mineral oil, free of kerosene, with a viscosity of not less than 70 seconds nor more than 110 seconds (Saybolt Universal) at 100 degrees F., except that when used on hardboard forms, the viscosity shall not be less than 250 seconds at 100 degrees F. Flash point shall be not less than 300 degrees F. (open cup). Viscosity and flash point shall be determined in accordance with ASTM Standard D-88 and D-92 respectively.

Form Ties: An approved design, fixed or adjustable in length and free of devices that will leave a hole larger than 7/8 inch in diameter in surface of concrete.

Reinforcing Steel shall consist of round bars rolled from new billet stock. Steel shall have a minimum tensile strength of 3,7000 kgs./sq. cm. and a minimum yield point of 2,320 kgs./sq. cm. specimens of all bars shall be capable of being bent cold through 180° around a pin of the same diameter as the bar without cracking. Bars shall be free of scale, oil, dirt and structural defects.

Samples and Testing: When required by the Contracting Officer's representative, the Contractor shall furnish samples of the materials for testing. Sample will be tested at the expense of the Contractor under the supervision of the Contracting Officer's representative.

Mix Design: Mix proportion and six cylinders of the proposed mix shall be submitted for approval not less than 30 days prior to the expected use in the structure.

Storage:

Immediately upon receipt at site of work cement shall be stored in a dry, weathertight, properly ventilated structure, with adequate prevention of moisture.

Aggregates shall be stored at the site of the work in such manner as to prevent the inclusion of foreign material in the concrete. Sufficient aggregate shall be maintained at the site at all times to permit continuous placement and completion of any lift of concrete started.

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All Fine Aggregate and the smallest size group of the coarse aggregate shall remain in free-draining storage at the site for at least 72 hours immediately prior to use.

Forms: Forms shall be constructed to conform to shape, form, line, and grade required, and shall be maintained sufficiently rigid to prevent deflection of form material and subsequent waviness in surface of concrete.

Design: Form joints shall be sufficiently tight to prevent leakage of grout during placing, and shall be arranged vertically or horizontally to conform to the pattern of the design. Forms placed in successive units for continuous surfaces shall be fitted to accurate alignment to assure a smooth completed surface free from irregularities. In long spans, where intermediate supports are not possible the anticipated deflection in the forms due to weight of fresh concrete shall be accurately figured and taken into account in the design of the forms, so that finished concrete members will have a true surface conforming accurately to desired lines, planes, and elevations. If adequate foundation for shores cannot be secured, trussed supports shall be provided. Temporary openings shall be arranged in wall and column forms and where otherwise required, to facilitate cleaning and inspection. Lumber once used in forms shall have nails withdrawn, and surfaces to be exposed to concrete carefully cleaned before reuse. Forms shall be readily removable without hammering or levering against the concrete.

Form Ties: Form ties shall be suitable design and adequate strength for the purpose. Wire ties will not be permitted where concrete surface will be exposed to weathering, or where discoloration of the finished surface would be objectionable. Bolts and rods for temporary internal ties that are to be completely withdrawn shall be coated with grease. Upon removal of forms, no metal shall be left within one inch of any concrete surface.

Corners: Corners of girders, beams, curbs and other exposed joints in more than one plane, subject to damage during construction operation, shall be beveled or chamfered by moldings placed in the forms.

Coating: Before placing concrete, the contact surfaces of the forms shall be coated with oil as specified hereinbefore. Mineral oil shall not be used on forms for surfaces to be painted. For surfaces not exposed to view in the finished structure sheathing may be wetted thoroughly with clean water.

Removal: Forms shall be removed only after approval, and in a manner to insure complete safety of the structure after the following conditions have been met. Where any part of the structure is supported on shores, the forms for the beam and girder sides and for similar vertical formed surfaces may be removed after 24 hours, provided concrete is sufficiently hard not to be injured thereby. Supporting forms or shoring shall not be removed until structural members have acquired sufficient strength to support their own weight safely, and any construction and storage load to which they may be subjected, but in no case shall

they be removed in less than 6 days, nor shall forms used for curing be removed before expiration of curing period, except as specified hereinafter. Care shall be taken to avoid spalling the concrete surfaces.

Control Tests: Results of suitable control tests will be used as evidence that concrete has attained sufficient strength to permit removal of supporting forms. Cylinders required for control tests shall be provided in addition to those otherwise required by this specification. Test specimens shall be removed from molds at end of 24 hours and stored in the structure as near points of sampling as possible. The test specimens, shall receive, insofar as practicable, the same protection from the elements during curing as is given those portions of the structure which they represent, and they shall not be removed from the structure for transmittal to the laboratory prior to expiration of three-fourths of the proposed period before removal of forms. In general, supporting forms or shoring shall not be removed until strength of control test specimens has attained a value of at least 2,000 pounds. Newly unsupported portions of the structure shall not be subjected to loading.

Clamps: Tie-rod clamps to be entirely removed from the wall shall be loosened 24 hours after concrete is placed, and from ties, except for a sufficient number to hold forms in place, may be removed at that time.

Filing Tie-Rod or Bolt Holes: Within 12 hours after removal of forms, holes left by bolts or tie rods shall be filled solid with cement mortar proportioned 1 part of cement to 2 parts of graded sand by weight and blended to match adjacent surface.

Placing Reinforcing Steel: Reinforcing steel, fabricated to shapes and dimensions shown, shall be placed where indicated on drawings, or where required to carry out the intent of the drawings and specifications. Before being placed, reinforcing steel shall be thoroughly cleaned of loose or flaky rust, mill scale, or coating, and of any other substance that would reduce or destroy the bond. Reinforcing steel reduced in section shall not be used. After any substantial delay in the work, previously placed reinforcing steel left for future bonding shall be inspected and cleaned. Reinforcing steel shall not be bent or straightened in a manner injurious to the steel. Bars with kinks or bends not shown on drawings shall not be placed. The use of heat to bend or straighten reinforcing steel will be permitted only if the entire operation is approved. In slabs, beams, and girders, reinforcing steel shall not be spliced at point of maximum stress. Splices in adjacent bars shall be staggered.

For Slabs on Grade: Bars shall be supported on precast concrete blocks, spaced at intervals required by size or reinforcement used, to keep reinforcement the minimum height specified above the under side of slab or footing.

Concrete Protection for Reinforcement:

- (a) The reinforcement of footings and other principal structural members in which the

concrete is deposited against the ground shall have not less than 3 inches of concrete between it and the ground contact surface. If concrete surfaces after removal of the forms are to be exposed to the weather or be in contact with the ground, the reinforcement shall be protected with not less than 2 inches of concrete for bars larger than #5 and 1-1/2 inch for #5 bars or smaller.

(b) The concrete protective covering for reinforcement at surfaces not exposed directly to the ground or weather shall be not less than 3/4 inch for slabs and walls, and not less than 1-1/2 inch for beams, girders, and columns. In concrete joist floors in which the clear distance between the joists is not more than 30 inches, the protection of reinforcement shall be at least 3/4 inch.

Strength Requirements: Concrete of the various classes required shall be proportioned and mixed for the strengths as shown.

Proportioning of Concrete Mixes: Concrete shall be proportioned by weight.

Measurements: (a) Cement: A bag of Portland cement will be considered as 50 kilograms in weight.

(b) Water: One liter of water will be considered as 1 kilogram in weight.

(c) Aggregate: Fine and coarse aggregate shall be measured by weight in accordance with Federal Specifications SS-A-281b(1). Coarse aggregate shall be used in the greatest amount consistent with required workability.

Workability: The consistency of the mixture shall be that required for the specific conditions and methods of placement. The slump shall fall within the following limits using a standard slump cone.

<u>Slump for Vibrated Concrete</u>	
<u>Minimum</u>	<u>Maximum</u>
5.0 Centimeters	7.5 Centimeters

Batching and Mixing: Concrete mixing equipment shall be power operated and in good mechanical condition. Hand mixing will not be permitted. Provisions shall be made for introducing cement, aggregate and water into the mixer in the proper quantities.

A Suitable Scale for weighing aggregate and cement shall be provided. The scales shall be checked for accuracy as directed and required adjustments made before further use.

Mixers shall not be charged in excess of rated capacity nor be operated in excess of rated speed. Excessive mixing, requiring addition of water to preserve required consistency,

will not be permitted. The entire batch shall be discharged before recharging.

Mixing Time shall be measured from the instant water is introduced into the drum containing all solids. All mixing water shall be introduced before one fourth of the mixing time has elapsed. Mixing time for mixers of $3/4$ cu.m. or less shall be $1-1/4$ minutes; for mixers larger than $3/4$ cu.m. mixing time shall be increased 15 seconds for each additional $1/2$ cubic meter or fraction thereof.

Construction Joints: All concrete in vertical members, such as columns and walls, shall have been in place not less than 4 hours before any concrete is placed in the girders, beams, or slabs directly over such columns or walls. Before placing is resumed, all excess water and fine materials which have risen to the top shall have been removed and the concrete shall be cut away, as may be necessary, to insure a strong, dense concrete at the joint. The surface shall be cleaned and roughened and shall be broomed with neat cement grout immediately before the new concrete is deposited. Construction joints in beams and slabs shall be vertical and shall be located close to the center of the span, unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. The Construction joints in beams and girders shall be made with a tongue and groove at the center of the depth and with reinforcement near each face (top and bottom) of the member; where reinforcement is lacking in either face of the member cut by the construction joint, additional bars, 120 diameters in length and of the same size and number as the stress bars indicated in the opposite face shall be provided to span the joint. Where construction joints are made in plain and reinforced concrete of monolithic construction other than beams and girders, a tongue and groove joint and reinforcement bars equal in area to not less than 0.25 percent of the surfaces to be connected and 120 diameters in length shall be provided; unless otherwise shown on the contract drawings. At horizontal construction joints which will be exposed, the concrete shall be struck off level at the top of the form sheathing or shall be carried about $1/2$ inch (12 mm.) above the underside of a strip set level on the form. Strips shall be removed about an hour after the concrete is placed and all irregularities in the joint line shall be leveled with a screed. Beams, girders, brackets, column capitals, and haunches shall be considered part of the floor system and shall be placed monolithically therewith. Where new concrete is to be bonded to existing concrete, the existing surface shall be cleaned and roughened thoroughly, all loose particles removed, and surface flushed thoroughly with neat cement grout immediately before the new concrete is placed. At all horizontal construction joints, the coarse aggregate shall be omitted from the concrete to provide a mortar cushion about 1 inch (2.5 cm.) thick over the neat-cement-grouted hardened-concrete surface.

Expansion Joints shall be filled completely with preformed expansion-joint filler. The top of the joints exposed to the weather shall have the space above the preformed filler cleaned out after the concrete has been cured, and when dry; the space shall be filled with joint-sealing filler.

Embedded Items: Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings or as directed. All embedded items shall be thoroughly cleaned and free from oil and other foreign matter such as loose coatings of rust, paint and scale.

Preparation for Placing:

Water shall be removed from excavation before concrete is deposited. Hardened concrete, debris and foreign materials shall be removed from interior of forms and from inner surfaces of mixer and conveying equipment. Reinforcement shall be secured in position, inspected and approved before placing of concrete. Runways shall be provided for wheeled handling equipment.

Concrete Footings shall be placed upon undisturbed clean surfaces, free from mud, and water. When the foundation is on dry soil or pervious material, waterproof sheathing paper shall be laid over surfaces to receive concrete.

Placing Concrete:

The use of Belt Conveyors, Chutes or Other Similar Equipment shall not be permitted without written approval. Concrete shall be handled from mixer or transport vehicle to place of final deposit in a continuous manner, as rapidly as practicable, and without segregation or loss of ingredients until the approved unit of operation is completed. Concrete that has attained its initial set or has contained its mixing water for more than 45 minutes shall not be placed in the work. Placing will not be permitted when the sun, heat, wind or limitations of facilities prevent proper finishing and curing of the concrete. Forms or reinforcement shall not be splashed with concrete in advance of pouring. Concrete shall be placed in the forms as nearly as practicable in final position. Immediately after placing, concrete shall be compacted by thoroughly agitating it in an approved manner. Tapping or other external vibration of forms will not be permitted. Concrete shall not be placed on concrete sufficiently hard to cause the formation of planes of weakness within the section. Concrete shall not be allowed to drop freely more than 1.5 m. in unexposed work not more than 1 m. in exposed work.

No Concrete shall be placed without the presence of the Contracting Officer's representative, nor prior to his approval of forms. In no case shall approval relieve the Contractor of responsibility for the work.

Compaction: Concrete shall be placed in layers not more than 30 cm. deep. Each layer shall be compacted by hand spading and rodding or by mechanical vibrators. Compaction shall continue until all voids are filled but care shall be taken to prevent segregation of materials.

Vibrators shall in no case be used to transport concrete inside forms. Use of form vibrators will not be permitted, interval vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete. (At least one spare vibrator or sufficient parts for repairing vibrators shall be maintained at the site at all times). Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing objectionable segregation.

Miscellaneous Grouting: Grout for miscellaneous uses, such as grouting of base plates, anchor bolts, dowels and the like shall be equal parts of sand and Portland cement by weight, with sufficient water to produce the required consistency. Grouting shall be performed by approved methods which will insure the solid setting of base plates and embedment of anchor bolts.

Bending: Before depositing new concrete on or against concrete that has set, existing surfaces shall be thoroughly roughened and cleaned of laitance, foreign matter and loose particles, then thoroughly moistened.

Concrete Surface Finishes (Other Than Floors and Slabs): All exposed formed concrete surfaces for the building shall have fins and other projections carefully removed and off-sets leveled.

Concrete Surface Finishes for Floors and Slabs: Concrete slabs shall be finished as hereinafter described. The dusting of wearing surfaces with dry materials will not be permitted. In preparation for finishing, floor slabs shall be struck off to the required level at or below the elevation or grade of the finished floors, as shown on the drawings. Floors shall be level with a tolerance of 3 mm. in 3 m. except where drains occur, in which case the floors shall be pitched to the drains as indicated on the drawings or as directed.

Trowelled Finish: Trowelled finish shall be obtained by tamping the concrete with special tools to force the coarse aggregate away from the surface, then screeding and floating with straightedges to bring the surface to the required finish level shown on the drawings. While the concrete is still green but sufficiently hardened to bear a man's weight without deep imprint, it shall be woodfloated to a true even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood floats to bring moisture to the surface. The concrete shall then be hand-trowelled to produce a smooth impervious surface free from trowel marks. An additional trowelling shall be given the surface for the purpose of burnishing. The final trowelling shall produce a ringing sound from the trowel. The concrete floor of the building shall have a trowelled finish.

Wood-Float Finish: Wood-float finish shall be obtained by tamping with special tools to force coarse aggregate away from the surface, then screeding with straightedges to bring surface to the required line as shown on the drawings. While the concrete is still green but hardened sufficiently to bear the cement finisher's weight, the surface shall be wood-floated to a true uniform plane with no coarse aggregate visible. The concrete

slab for the transformer and the sidewalk shall have a wood-float finish.

Curing: Curing shall be accomplished by preventing loss of moisture, rapid temperature change, and mechanical injury from rain or flowing water for a period of 7 days when normal Portland cement has been used, or 3 days when high early strength Portland cement has been used. Curing shall be started as soon after placing and finishing as free water has disappeared from the surface of the concrete. Curing may be accomplished by any of the following methods or combinations as approved by the Government.

Moist Curing: Unformed surfaces shall be covered with burlap, cotton, or other approved fabric mats, or with sand and shall be kept continually wet. Forms shall be kept continually wet and, if removed before the end of the curing period, curing shall be continued as on unformed surfaces, using suitable material.

Waterproof Paper Curing: Surfaces shall be covered with waterproof paper lapped 7.5 cm. at edges and ends and sealed. Paper shall be weighted to prevent displacement, and tears or holes appearing during the curing period shall be immediately repaired by patching.

Field Control, Concrete Cylinders: The control test cylinder forms shall be durable and be made of steel and constructed in such manner that repetitive use can be accomplished. The control cylinder forms shall be 15 cm. in diameter and 30 cm. high, inside dimensions. Sufficient forms shall be furnished to meet the requirements of paragraph entitled "Sampling, Curing, Shipping and Testing" below.

Sampling, Curing, Shipping and Testing: Three (3) test cylinders shall be taken from each and every 150 cubic meters, or less, of concrete placed each day. Preparation and curing of the test specimens shall be in accordance with ASTM Designation C39. The preparation, curing and testing of test specimens shall be accomplished by the Contractor under the supervision of the Government's representative, at the Contractor expense.

- End of Section -

MASONRY

General: The work includes providing masonry work, complete.

Applicable Specifications: The work shall conform to current issues of the following publication:

Federal Specification:

SS-C-192d

Cement: Portland

Materials:

Anchors and Ties:

Nails shall be galvanized, 6 inches long, 9 gage (Steel Wire Gage), with 5/16 inch diameter head.

Wire shall be of steel or iron heavily galvanized, not less than 0.12 inch in diameter, and looped at the ends.

Strips shall be of steel or iron not less than 0.03 inch thick and 7/8 inch wide.

Brick: Common, shall be sound, durable, properly burned, free from defects that will affect serviceability or strength, and of local manufacture.

Block: Concrete; shall be made of a plastic mixture of Portland cement, water and aggregates such as sand, gravel, and crushed stone or an approved substitute, properly molded and cured to produce units that are sound and free of cracks or other defects that would interfere with the proper setting of the units or impair the strength or permanence of the construction. Units shall have shape, and aligned holes, as indicated. The thickness of the solid part between holes and exterior surfaces shall not be less than 3 cm.

Cement: Portland, shall be Type 1 in accordance with Federal Specification SS-C-192d.

Lime: Hydrated, shall be a commercially available product; the total unhydrated calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product shall not exceed 8 percent.

Sand shall be sharp, fine granules, composed of hard, strong, durable, uncoated particles free from clay or earthy materials, and shall be well-graded.

Water shall be clean, fresh, and free from injurious amount of mineral and organic substances.

Samples of the following shall be submitted to the Government for approval.

Brick; Common	6 each
Block; Concrete	3 each
Sand	1 cubic feet
Lime; Hydrated	1 pound

Mortar for Common Brick and Concrete Block shall not be mixed in advance of the time it is to be used. Mortar that is not used within one hour shall be discarded. Re-tempering of mortar in which cement has started to set will not be permitted. Proportions shall be as follows:

Cement; Portland	1 part (by volume)
Lime; Hydrated	1 part (by volume)
Sand	4 parts (by volume)
Water	Sufficient to make a plastic mix that can be troweled and will develop a complete bend.

Laying Masonry: Masonry shall be laid plumb, true to line level and in accurately spaced courses.

Wetting: Brick shall be wetted prior to laying, and shall be damp when laid. Units having a surface film of water shall not be laid.

Bond in Brickwork shall be running type with stretchers breaking joints with the course below. Wherever possible, full size brick shall be used in lieu of cut or broken bricks. No piece of brick shorter than 4 inches shall be used at any vertical corner or jamb.

Joints shall be approximately one centimeter thick.

Anchors: Masonry shall be tied to adjoining columns by anchors sufficiently long to extend into the masonry not less than 4 inches and spaced at 35 cm. center to center or every sixth course whichever is less.

Built-in-Work: All chases, grounds, frames, sleeves, and other appurtenances and provisions for the work of other trades shall be built in previously to the work of other trades.

Cutting and Patching: Masonry shall be carefully cut for installation of electrical outlets and conduits, plumbing lines, fixtures and other mechanical installations, and shall be to the minimum extent possible. Patching shall provide proper bond, and shall be neat.

Unfinished Work: In joining to existing masonry work, all loose mortar shall be removed and the existing work wetted before laying new work thereon.

Preparation for Plaster Surfacing: Bricks upon which plaster is to be applied shall have joints raked slightly to provide proper bond.

Curing shall be accomplished by spraying the masonry surface with water to keep it moist for a period of 10 days, or until the surface receives a plaster finish.

Protection: Surfaces of masonry not being worked on shall be properly protected. When rain is imminent and the work discontinued, the top of the brick masonry shall be covered and water-proofed in a manner that will protect the completed work. No load shall be applied on brick masonry during the first 24 hours after completion.

- End of Section -

8. PLASTERING

General: The work includes plastering on exterior and interior masonry walls, complete.

Applicable Specifications: The work shall conform to current issues of the following publications:

Federal Specifications:

SS-C-00192e (COM-NBS)	Cement; Portland
SS-L-00351a (COM-NBS)	Lime, Hydrated (for) Structural purposes

Delivery and Storage of Materials: All manufactured materials shall be delivered to the job site in unbroken, original packages, containers and bundles, bearing name of the manufacturer and the brand. Building material shall be stored off the ground under water-tight cover and away from sweating walls or other damp surfaces until required for use.

Materials:

Cement shall be Portland cement conforming to Federal Specification SS-C-00192e (COM-NBS), Type 1, and shall be dry and free from lumps and caking and, when packaged, shall be in strong and well-made packages each of which shall be plainly marked with the manufacturer's name and brand.

Fine Aggregate shall be clean, hard and durable and free from oil, organic matter and other deleterious substances. Grading requirements shall conform to the following:

<u>Square Mesh Sieve Designation</u>	<u>Percentage by Weight Passing Square Sieve</u>
4	100
8	80 - 98
16	60 - 90
30	35 - 70
50	10 - 30
100	0 - 10

The amount of sand that will pass a No. 200 square sieve shall not exceed 6 percent of the total amount of sand.

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Lime: Lime shall be hydrated lime, Type M, conforming to Federal Specification SS-L-00351a (COM-NBS). The total unhydrated calcium (CaO) and magnesium oxide (MgO) in the hydrated product shall not exceed 8 percent by weight, calculated on the as-received basis.

Water: Water for mixing shall be clean, fresh and free from any deleterious substance such as oil, acid, alkali or vegetable matter.

Preparation: Surfaces to receive plaster shall be clean and free from defects, oil, grease, acids, organic and other injurious matter. Masonry surfaces to receive plaster shall be damp when the plaster is applied. Where plaster terminates against wood such as windows or door bucks the Contractor shall provide a wood stop before application, unless otherwise shown.

Type of Finish: Surfaces to receive plaster shall receive three coats; scratch, brown and finish coats.

Proportioning: Portland cement plaster three-coat-application shall have each coat proportioned by volume as follows:

1 part Portland cement
3 parts sand
1/10 part hydrated lime

Mixing: Select aggregates for mixing of uniform moisture content to avoid bulking. Mix materials to a uniform color before water is added; then wet-mix them to the desired consistency.

Application:

Scratch Coat shall be about 1 cm. thick and carried the full length of the wall or to natural breaking points like doors or windows. Before the scratch coat hardens cross-scratch it to provide mechanical key for the brown coat. Keep this coat moist for not less than 24 hours and allow it to set before applying brown coat.

Brown Coat: Before starting to apply the brown coat, dampen the surface of the scratch coat. The brown coat shall be about 1.3 cm. thick. It shall be brought to a true, even surface; then roughened with a wood float or lightly cross-scratched to provide bend for the finish coat. Keep this coat moist for 48 hours and then allow it to dry out.

Finish Coat shall not be applied until the brown coat has seasoned for 7 days. Just before application of the finish coat, the brown coat shall again be wetted evenly. The finish coat shall be about 0.6cm. thick. Cement plaster shall be given a sand float finish of a uniform texture, as approved. The finish coat shall be kept moist for at least 2 days, and thoroughly cured.

Patching: Plaster containing cracks, blisters, pits, checks, or discoloration will not be acceptable. Such plaster shall be removed and replaced with approved plaster. Patching of defective work will be permitted only when approved and such patchwork shall match existing work in texture and color.

Clean-Up: Upon completion of the plaster work, all debris arising from the work shall be removed and all surfaces defaced during the progress of the work shall be cleaned and restored as required by the Government.

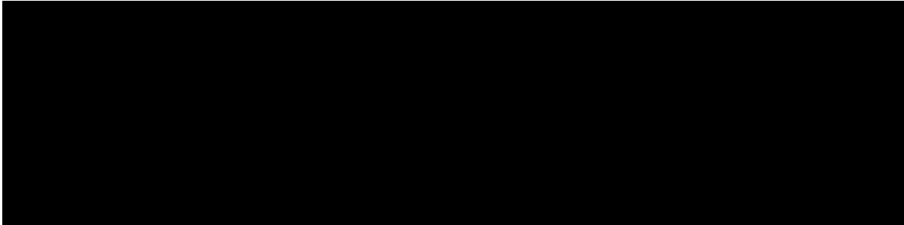
- End of Section -

SECTION 9 - CARPENTRY

General: The work consists of providing carpentry work, complete.

Materials (Lumber): All lumber shall be hardwood.

Hardwood shall consist of any one of the following listed species.



25X1A

Gradation shall be as follows:-

Select Grade shall be defined as selected lumber, generally clear, high quality, of good appearance, and suitable for use without waste and for natural finish.

Common Grade shall be defined as unselected lumber, sound tight medium knots not larger than 1-inch (2.5 cm.) in diameter medium imperfections, without an excess of sapwood, without decay, without insects, without holes, without serious checks, of uneven texture, and suitable for use with some waste and for paint finish.

Moisture Content: Hardwood shall not have a moisture content in excess of 20 percent at the time of installation in a structure.

Dimensions: Unless otherwise shown, lumber shown not be shorter than 10-feet (3.3 meters) in length. All lumber shall be surfaced and planed. All structural lumber, after planing, shall not be less than the thickness indicated on the drawings. All finish lumber, after planing shall not vary from the indicated thickness by more than 10 percent, thickness and width of lumber shall be uniform throughout length.

Storage: Lumber shall be carefully piled off the ground in such a manner as to insure proper drainage, ventilation and protection from both weather and insects.

Materials (Other than Lumber):

Asbestos Cement Sheets shall be composed of asbestos fiber and Portland cement. Sheets shall be dense and tough. Weather side shall be relatively smooth. Units shall be the largest size available for the use intended; thickness shall be as shown. Chipped, cracked or broken sheets shall not be used in the work.

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Bolts and Nuts (Machine) shall be of steel having a yield point of not less than 33,000 p.s.i. (2,300 kg/sq. cm.). Unless otherwise shown, bolts shall be square head, unfinished type. Nuts shall be square unfinished type also. Threads shall be in accordance with the American coarse thread series.

Brads; Common, shall have brad head, diamond point, smooth or mechanically deformed, and shall be galvanized or cadmium coated steel.

Nails shall be of the proper type, and of adequate size to secure the work. Unless otherwise shown or required, nails shall be new wire, galvanized or cadmium coated for exterior work and bright for interior work.

Plywood shall conform to the following:

Thickness of a single layer of veneer shall be not less than 0.008 (0.2 mm.). The lamina shall be superimposed in layers with fibers crossing at right angles in successive layers. The number of layers shall be 3, 5 or 7.

Surface Veneer shall be of hardwood, and shall be suitable for paint finish.

Classification: Plywood having a high water resistance shall be used for exterior work, and plywood having moderate or no water resistance shall be used for interior work. Plywood for exterior doors shall be exterior grade.

Screening, Wire, Insect, shall be woven wire mesh of aluminum alloy; meshes per linear inch shall be 16/16 regular, or other as approved.

Screws shall be of galvanized or cadmium coated steel or aluminum or brass, slotted, flat-head, counter-sunk type, and shall be of adequate size to secure the work.

Timber Connectors; Split-Ring Type shall be standard product of a manufacturer regularly engaged in the production of this type of connector, shall be of hot-rolled carbon steel, one piece forming a closed circular shape with the ring split to form a tongue and groove and shall be unfinished. Design shall permit simultaneous bearing of the inner surface of the ring against the core left in grooving and the other face of the ring against the outer wall of the groove. Split ring sizes and respective groove size shall be as follows:

<u>Split Ring Size</u>	<u>Groove Size</u>
2-1/2" \emptyset x 0.75"D x 0.163"A	2.56" I.D. x 0.18"W x 0.375"D

Washers Each bolt and nut shall be provided with a steel washer. Unless otherwise shown, washers shall be square, unfinished type. Inner hole shall closely fit the bolt. Washer sizes shall be as follows:

Bolt Size

3/8" Ø
1/2" Ø
5/8" Ø
3/4" Ø

Washer Size

1-1/2" by 1-1/2" by 3/16"
2" by 2" by 1/4"
2-1/2" by 2-1/2" by 3/8"
3" by 3" by 3/8"

Samples of all material, other than lumber, shall be submitted for approval prior to delivery to the site.

Framing, (Except Trusses and Roof):

General: Lumber shall be common grade, or better, Lumber, and other rough work, shall be closely fitted, and accurately set to required lines and levels. Special framing or construction, not indicated or specified, shall be provided as necessary for the proper completion of the work. Members shall be set with the crown edge up.

Fastening: Members shall be rigidly secured in place. Spiking, nailing and bolting shall be done in an approved manner. Spikes, nails and bolts shall be of the proper types and sizes for the use intended. Members shall be drilled accurately so that bolts are tight fitting; washers shall be provided under heads and nuts; bolts shall be drawn up tight. Care shall be taken so as not to split members.

Splicing: Framing members shall not be spliced between bearing points, and shall be free from pronounced defects. Joints and splices shall be bolted or spiked together, and shall occur over bearings only.

Sills shall be set level and square, and firmly anchored. Unless otherwise shown, anchor bolts shall be unfinished steel not less than 1/2 inch (1.25 cm.) diameter and not less than 12 inches (30 cm.) long. Unless otherwise shown, anchor bolts shall be provided at all corners and splices, and spaced at not more than 5 feet (1.5 m.) on centers intermediately between. Provide not less than 2 bolts for each sill member. Sills shall be lapped at corners and splices, and shall be bolted through the laps, or the ends shall be butted and through-bolted not more than 6 inches (15 cm.) from the ends. Bolts shall be provided with washers under heads and nuts. Sills shall be leveled and wedged with steel shims. Sills shall be grouted with a mixture of 1 to 3 cement sand mortar to provide continuous and solid bearing.

Studs shall be selected for straightness, and set plumb, true, and in alignment. Each stud shall be toe-nailed to sill or sole plate, with two 8-d common nails on each wide face.

Plates shall be same width as the studs, and shall form continuous horizontal ties. Single plates shall be spliced, and shall be thru nailed to each stud and corner post thereunder with two 20-d common nails.

Blocking shall be installed level, and shall be closely fitted. Each unit shall be double nailed through each stud.

Lube Oil Storage Room: Exterior walls shall consist of 5 cm. x 10 cm. wood studs securely anchored in place, then covered with No. 12 gage, crimped wire with 1 1/2 inches diamond mesh, conforming to Federal Specification RR-W-360.

Framing; Roof:

Truss Framing

Specie, Grade and Quality of Lumber: Lumber shall be of common grade. The timbers shall be seasoned to a moisture content corresponding as nearly as practicable to that which they will attain in service. Wood at the points shall be clear and relatively free from checks, shakes and splits. Cross grain at the joint shall not exceed a slope of 1 in 10.

Fabrication: Trusses shall be fabricated, as shown, and assembled on the ground in true rigid form ready for erection.

Splices other than those shown, will not be permitted without specific approval by the Government.

Camber: Finish truss shall have a camber of not less than 4 centimeters.

Bolting: Bolt holes shall be drilled with a twist drill. The drill shall produce shavings and not chips and the hole shall be smooth. Bolt holes shall be such that bolts will fit neatly and can be inserted by tapping lightly with a wood mallet. No threaded part of the bolt shall bear on the wood members. All bolt heads and nuts shall be provided with washers. All bolts shall be tightened firmly without crushing wood fibers. Bolts shall be retightened as required during the time the members are at moisture equilibrium.

Installation of Split Ring Connectors: Grooves for rings shall be accurately aligned and cut with an approved standard grooving tool. Grooves shall be cut clean and of the proper diameter so that the inner surface of the ring will bear against the core left in the grooving and the outer face of the ring will lean against the outer wall of the groove when the bolt is drawn tight.

Erection: Trusses shall be erected using suitable tools and equipment. Lifting shall be accomplished in such manner as will preclude damage.

Purlins: shall be of the sizes and spacing indicated, and shall be set accurately and in alignment. Units shall be placed with the crown edge up. Units shall have full bearing on supports. Laps shall occur over bearings only and shall be as detailed. Units bearing on plates shall be spiked securely thereto.

Plywood shall be nailed with easing nails 8 inches (20 cm.) on centers 1/2 inch (1.25 cm.) in from edges and along all bearing. Nails shall penetrate the bearings not less than 3/4 inch (2 cm.). Nail heads shall be flush with surface without damaging the surface of the panels.

Louvers and Screens: Lumber shall be hardwood, select grade.

Wood Louvers: Lumber shall be of hardwood, select grade. Louver frame shall be routed out to receive slats of proper width to provide the edge finish shown. Joints shall be nailed and glued. Sides of frames shall rest on the still; top member shall cap the sides.

Louver Screens shall be fixed and shall have insect mesh, as shown. Screen wire shall be taut. Insect screen shall be 16 x 16 meshes per sq. 1 inch (2.5 cm.) aluminum, bronze or stainless steel-wire fabric.

Wood Doors and Frames: Lumber shall be of hardwood, select grade.

Door Frames: shall be of type and design shown. Frames shall be set plumb and square. Frames shall be set with finishing nails. In masonry openings, frames shall be set with double wedge blocking in back of nailing points; also at back of butts and lock strike. Frames in masonry, where no bucks are indicated or required, shall be double-rabbeted from solid stock and shall have three jamb anchors on each side.

Doors, Hinged shall be of type and design shown. Flush type exterior doors shall be painted with a prime coat and finish of lead-oil base paint conforming to the requirements of Federal Specification TT-P 102a. Door surfaces shall be free of dust and in proper condition to receive paint.

Flush Type (Hollow Core): Doors shall have hollow cores of such type as will adequately support the outer plywood and afford strength and stability sufficient for the use intended. Stiles shall be not less than 1-1/8 inches (2 cm.) and rails shall be not less than 2-3/4 inches (7 cm.). A lock block shall be provided at the center of each stile, 18 inches (45 cm.) long and wide enough to extend 6 inch (15 cm.) from the edge of door to the inside of the lock block. Cross rails shall be provided at the top and bottom of the lock, and shall be securely connected to the stiles. Veneers for cross banding and faces shall be plywood of two or more plies, with a combined minimum thickness of 5/16 inch (7 mm.) before sanding. Face veneer shall be of hardwood, as approved. Edge strips shall be of the same hardwood as the face veneer. Edge strips shall be tongued and grooved into the stiles and rails, glued and nailed with ample size finishing nails not more than 15 cm. on centers. All veneers shall be bonded with water-resistant type adhesive applied to all contact surfaces, and the whole door shall be placed in a gluing press that applies uniform pressure over the entire surface of the door.

Screen Doors shall be as shown. Solid stiles and rails shall be rabbeted on one side, and the insect screen wire shall be stretched tightly and secured in place. The edges of the wire shall be covered with moulding mitered at the corners.

Fitting: Unless otherwise shown, doors shall have 1/16 inch (2 mm.) space at sides and tops and 3/16 inch (6 mm.) over thresholds. Doors in openings without thresholds shall have 3/8 inch (8 mm.) clearance at bottoms. Meeting stiles of double doors shall be shaped to provide the minimum practicable clearance not less than 1/16 inch (2 mm.).

Hanging and Trimming: Doors shall be properly hung in accordance with clearances specified herein. Doors shall swing horizontally, and shall stand in any position.

Wire Mesh Door shall be as shown. No 12 gage, crimped wire with 1 1/2 inches diamond mesh, conforming to Federal Specification RR-W-360 shall be installed. The mesh shall be stretched tightly and secured in place prior to the edges being covered with trim.

Wooden Shelving shall be of solid hardwood construction in the sizes shown.

Fabrication: As far as possible nailing shall be done in concealed places and all exposed nails shall be set or counter-sunk and putty stopped. Exposed work shall be set-up, screwed, doweled or mortised and tenoned together, and glued. No work shall be installed until masonry and plaster work have cured and will not release moisture harmful to woodwork. Woodwork shall be neatly fitted into proper position, leveled and secured as indicated. Surfaces damaged in any way shall be repaired. All woodwork shall be finished smooth on exposed surfaces, and a slight bevel on exposed edges. All work shall be of neat appearance. All holes shall be puttied with putty colored to match the wood, and when dry shall be slightly sanded.

Hardware as specified under SECTION: HARDWARE, BUILDERS', shall be carefully fitted and securely attached. Care shall be exercised not to mar existing work. Upon completion of the work, and in the presence of the Contracting Officer's representative, hardware shall be demonstrated to work properly, keys shall be fitted into their respective locks. Upon acceptance of the work, keys shall be tagged and delivered to the Contracting Officer's representative.

- End of Section -

10. CAULKING

General: The work includes providing of caulking, complete.

Materials:

Caulking Compound shall be composed of pigments (with or without fibers) uniformly mixed in a liquid vehicle to a plastic consistency for gun application, and shall be specially manufactured as being suitable for the use intended. The compound shall adhere tenaciously to the surface to which applied, shall not shrink excessively and shall be non-staining. Color shall be gray.

Sealer shall be a mixture of aluminum paste, spar phenolic resin varnish and thinner that is compatible with the varnish, mixed in the proportion of 0.9 kg. of paste to not more than 3.78 liters of thinner. The materials shall be field mixed.

Rope yarn where required shall be the raveled strands of rope fiber, free from oil or other staining elements.

Samples of all materials proposed for use shall be submitted to the Government for approval.

Preparation of Surfaces:

Cutting of Grooves: Where grooves in concrete and masonry are indicated and not formed, the grooves shall be cut and cleaned out to a minimum depth of 19 mm. and ground to a minimum width of 6.35 mm. without damage to adjoining work.

Backstop: Joints and spaces to be caulked that are deeper than 15 mm. shall be firmly packed with rope yarn to within 15 mm. of the surface.

Cleaning: Joints and spaces to be caulked shall be raked and cleaned out to a depth of 15 mm., and all particles of mortar, dust, and other foreign matter shall be brushed out just prior to caulking.

Priming: Grooves in concrete, masonry, and softwood that will absorb the essential oils from the caulking compound shall be primed with sealer using a brush that will reach all parts of the grooves to be filled with compound. The primer shall be allowed to dry thoroughly, prior to caulking the grooves.

Caulking compound shall be forced into the joints with a pressure caulking gun using nozzles of the proper size to fit the width of the joints. Joints shall be completely filled. Surface shall be uniformly smooth and free from wrinkles, and shall be sufficiently convex

to result in a flush joint when dry. Excess material shall be removed.

Re-Caulking: Upon completion of the caulking, any joints not completely filled shall be roughened and filled as specified, and the exposed surface tooled smooth.

Cleaning: Adjacent materials which have been soiled due to the caulking operation shall be cleaned immediately and the work left in a neat, clean condition.

- End of Section -

SECTION 11 - ROOFING; ASBESTOS CEMENT

General: The work includes all corrugated asbestos cement roofing, complete.

Applicable Specification: The work shall conform to current issues of the following publication:

Federal Specification:

TT-C-598(2)

Compound Caulking; Plastic (for
Masonry and Other Structures)

Materials:

Asbestos Cement Sheets: All sheets shall be cement gray, new standard sizes as manufactured locally, without holes, cracks or any other defects. Sheets shall be composed of asbestos fiber and Portland cement. Sheets shall be dense, tough and manufactured with the weather side relatively smooth.

Corrugated Type: Corrugations shall be formed with inside and outside radii the same so that all sheets shall rest snugly at laps.

Accessories: Ridge pieces, flashings, closers, fillers and similar items required to assure weatherproof and watertight installation shall be used with the sheets. Accessories shall be of the same basic material as the sheets, shaped or formed as standard with and recommended by the manufacturer of the sheets.

Fasteners for Wood Purlins shall be heavy duty galvanized metal clips furnished by the manufacturer of the asbestos cement sheets. Clips or screw bolts shall be of the type which permits installation without drilling holes in the sheets. Fasteners for miscellaneous accessories shall be galvanized steel hooked bolts with synthetic rubber gasket, galvanized nuts and washers, supplied by the manufacturer of the asbestos cement sheets.

Caulking Compound shall conform to Federal Specification TT-C-598(2). The compound shall be slate gray in color, non-staining and suitable for gun application.

Installation:

General: All sheets, with all fasteners and accessories, shall be erected and installed in accordance with the manufacturer's instructions. Sheets shall be laid with corrugations in the direction of the roof slope, starting at end of building opposite the prevailing wind direction. End laps shall be not less than 8 inches (20 cm.), side laps shall be not less than one corrugation.

Fasteners for Wood Purlins shall be attached to the purlin with two eight penny nails. Accessories shall be used as required by the manufacturer to insure a weatherproof installation. All laps and joints shall be used as required by the manufacturer to insure a weatherproof installation. All laps and joints shall be caulked.

Drilling: In order to avoid cracking of corrugated panels, the use of a punch is strictly prohibited. Twist drills shall be used for all drilling. Location and size of holes shall be as recommended by the manufacturer.

Cutting: When asbestos cement sheets are cut in the field, a power driven carborundum wheel or saw properly guarded or a hand-saw for cross cutting shall be used, with templates of approved type, as recommended by the manufacturer.

Ridges for asbestos cement roofing shall be formed with a ridge roll resting on panel-end-closures as shown with a cement mortar filling composed of one part Portland cement and 3 parts sand and shall be caulked with a plastic sealer.

Caulking: Ridge roll joints and spaces between overlaps of asbestos cement roof panels shall be caulked with application of compound by a caulking gun with a continuous head from a 1/2 inch (12.5 mm.) nozzle. Prior to application, joints and spaces to be caulked shall be thoroughly dry and shall be raked clean. Caulking shall be done to a depth of 3/4 inch (19 mm.).

Protection: The roofing units shall be protected during the erection by the use of planks for walkways. Workmen shall use proper caution in the disposition of their own weight and shall not store material on any part of the roofing after erection.

- End of Section -

12. INSTALLATION OF WINDOWS:

General: Installation shall be done in accordance with the window manufacturer's instructions. At the Contractor's option, unless otherwise indicated or specified, windows may be built-in or set in prepared openings. Windows shall be set plumb, level, in alignment, and properly braced to prevent distortion. Ventilators and operating parts shall be protected against accumulation of cement, lime, and other building materials by keeping ventilators tightly closed.

Window anchors shall be properly spaced not exceeding 60 cm. apart and set in masonry openings during progress of wall construction.

Adjustment: After window installation and completion of glazing and painting, windows and operating hardware shall be adjusted to provide free operation and water-tight conditions when sashes are closed and locked. Hardware and operating parts shall be lubricated or waxed as required.

Protection and Cleaning:

Protection: Care shall be used in handling windows during transportation and at the job site. Windows shall be stored at the site on edge and under cover. After installation, windows shall be protected from damage during subsequent construction activities.

Cleaning: Metal surfaces of windows shall be cleaned on both the inside and outside of all mortar, paint, and other foreign matter to present a neat appearance and prevent fouling of weathering surfaces, weatherstripping, or the operation of hardware. Abraded surfaces of steel windows shall be satisfactorily cleaned and touched up. Stained, discolored or abraded windows that cannot be satisfactorily repaired shall be replaced with new windows at no additional cost to the Government.

- End of Section -

13 GLASS AND GLAZING

General: The work consists of glass and glazing, complete.

Applicable Specifications:

Federal Specification:

DD-G-451a(1)

Glass, flat and corrugated, for glazing mirrors, and other uses.

TT-G-00410b
(GSA-FSS)

Glazing compound, sash (metal) for bedding and face glazing.

Materials:

Clear Sheet Glass B quality not less than 7/32 inch (7 mm.) thick and a tolerance in dimensions of cut size of 1/32 inch.

Installation:

General: Sizes of glass shown are approximate. Actual sizes required shall be determined by measuring the opening to be glazed. Each piece of glass shall bear the manufacturer's label showing type, thickness and quality. Labels shall not be removed until installation is approved.

Glass, Clear Sheet shall be set in sash and secured with wood or metal steps as applicable. Sheet glass shall be cut and installed with the visible lines or waves running with the horizontal dimensions.

Glazing Compound shall conform to Federal Specification TT-G-00410b, and shall be of gray color. After the glass has been set in the sash and securely fastened, caulking compound shall be applied in quantity, and a workmanlike manner necessary to provide a watertight and neat installation.

Replacement and Cleaning: Upon completion of the work, all glass surfaces shall be thoroughly cleaned, with all labels, paint spots and other defacements removed. Cracked, broken, and imperfect glass shall be replaced at no additional cost to the Government.

- End of Section -

14 SHEET METAL WORK

General Requirements: This work consists of providing of all sheet metal work, complete.

Applicable Specifications: The work shall conform to current issues of the following publications:

Federal Specification:

O-F-506b	Flux, Soldering, Paste and Liquid
QQ-S-571d	Solder, Tin Alloy; Lead-Tin Alloy; and
	Lead Alloy
QQ-S-775e	Steel Sheets, Carbon, Zinc-Coated

Materials:

Galvanized Iron and Steel shall be copper-bearing, conforming to Federal Specification QQ-S-775c, Type I, Class D. Except as otherwise specified or indicated, sheets shall be not lighter than 26 gage.

Nails, and Screws shall be new steel of adequate size and strength necessary for their intended use. They shall be of a composition that will not support galvanic action in the installation.

Solder shall conform to Federal Specification QQ-S-571d, composition S50.

Soldering Flux not otherwise specified shall be resin, and, where conditions of application prohibit use of resin, flux conforming to Federal Specification O-F506b shall be used.

Installation:

General: Surfaces to which sheet metal is to be applied shall be even, smooth, sound, thoroughly clean and dry and free from all defects that might affect the application. All items of sheet and miscellaneous metal, which are to be built into the buildings, shall be furnished to the trades concerned in time to avoid delays to construction progress. All accessories or other items essential to complete sheet metal and miscellaneous metal installation; though not specifically shown or specified, shall also be provided. Standard commercial products which meet the general requirements of the drawings and specifications will be acceptable. Welding shall be continuous along entire line of contact except where tack welding is authorized. Tack welding will not be permitted on exposed surfaces. Exposed welds shall be ground smooth. Bolting shall be done with proper size bolts. Nuts shall be

drawn tight. Steel shall be clean and free from mill scale, flake rust or pittings. Nails, brads, clips, and so forth for ferrous metal shall be galvanized iron or steel. All items shall be installed plumb, straight, square, level, at their proper elevation and location, and in proper alignment with adjacent work.

Soldering: All edges of uncoated sheet metal to be soldered shall be pre-tinned before soldering is begun. Soldering shall be done slowly with well-heated irons so as to heat the seam thoroughly and sweat the solder completely through the full width of the seam. Ample solder shall be used and the seam shall show not less than one full inch of evenly flowed solder. Soldering shall follow immediately after application of flux. Upon completion of soldering, acid shall be neutralized and surfaces shall be cleaned thoroughly.

Seams:

Flat Lock Seams shall finish not less than 19 mm. wide.

Soldered Lap Seams shall finish not less than 25.4 mm. wide.

Unsoldered Plain Seams shall lap not less than 101.6 mm. unless otherwise specified.

Flat Seams shall be made in the direction of the flow.

Welding shall be done in accordance with the best commercial practice for the type of metal to be joined. Care shall be taken to prevent crawling or distortion through welding heat and to maintain alignment.

Generator Radiator Exhaust Duct shall be constructed of 18 gage galvanized steel sheet and of the design shown. A 1.5 mm. thick asbestos flexible duct connection shall be provided and installed as indicated.

Miscellaneous Sheet Metal Work: Sheet-metal items not covered elsewhere in this section shall be as indicated, and as required to provide a watertight installation, or an installation suitable for the use intended. Formed sheet metal for metal covered work shall accurately reproduce the detail and the design shown, and bends, and intersection shall be sharp, even and true. Joints shall be locked, lapped, and soldered, as applicable. Reinforcement shall be provided as required.

- End of Section -

15 MISCELLANEOUS METAL WORK

General: The work consists of the providing all miscellaneous metal work shown or required, complete.

Applicable Specifications and Standards: The work shall conform to current issues of the following publications:

Federal Specifications:

QQ-S-741b	Steel plates, Shapes and Bars, Carbon, Structural
WW-P-404C(1)	Pipe, Steel (Seamless and Welded, Black and Zinc-Coated) (Galvanized)

ASTM: (American Society for Testing and Materials 1916 Race St., Philadelphia 3, Pa.)

A 239	Method of test for uniformity of coating by the preece test (copper sulfate dip) on zinc-coated (galvanized) iron or steel articles.
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Materials:

Steel: Steel shapes shall conform to Federal Specification QQ-S-741, Type I and II.

Bolts, Nuts, Washers, Screws, etc.: Bolts, nuts, washers, screws, etc., shall be standard commercial quality and shall be galvanized.

Bolt or Screw Anchors: Bolt or screw anchors for fastening work to poured concrete shall be of the Rawl or expansion shield type best suited for the purpose and the ferrous metal parts shall be galvanized or cadmium-plated.

Sleeves: Sleeves for pipe, conduits, etc., into or through masonry or concrete for other than plumbing work shall be approved galvanized electric metal tube or sheet metal sleeves.

Galvanizing shall be performed after fabrication into the largest practical sections. Galvanizing shall be the hot-dip process conforming to the requirements of ASTM Specification A-239.

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Steel Pipes shall conform to Federal Specification WW-P-404C galvanized and black.

Galvanizing Repair Compound: Galvanizing repair compound shall be an approved standard commercial product, in stick form, composed of prime zinc, tin and lead with fluxing ingredients.

Checkered Plate for trench covers shall be of 0.006 thickness and 1.20 long, and shall have diamond lug projections.

Pipe Gate Frames for transformer enclosure, shall be constructed of 1 1/2 \emptyset galvanized steel pipe conforming to Federal Specification WW-P-404C, rigidly welded together in a workmanlike manner, No. 9 gage chain link fabric with approximately 1 1/2 inch diamond shape opening shall be welded to the frames. Three (3) coats of aluminum paint shall be applied by the spray method, after the gate is completely fabricated. Suitable hinges shall be provided on the gate for attachment to the concrete of the enclosure as shown.

Fabrication: The work shall be well formed to the shapes and sizes shown and assembled as detailed. Shearing and punching shall produce clean true surfaces, with all burrs removed. Connections shall be welded, bolted, or riveted as indicated, but galvanized material shall not be welded, except as shown. Rivets and screws in exposed work shall be drawn up tight. Joints which are to be exposed to the weather shall be made watertight. The workmanship shall be not less than equal to that practiced in first-class modern shops.

Installation: The miscellaneous metal work shall be positioned and securely anchored in place. Items which are to be positioned in the forms prior to placing of concrete shall be so fastened in place as to insure stability during concrete placing operations. The work shall be true to line and so installed as to insure satisfactory operation of any moving parts.

Repair of Damaged Galvanizing: Whenever it is necessary to cut or otherwise impair the continuity of galvanized (zinc-coated) surfaces in the field, or when they have been damaged in transit or in storage, the surfaces shall be repaired by applying galvanizing repair compound in accordance with the manufacturer's instructions.

Welding: Welding shall be done in accordance with the best commercial practice for the type of metal to be joined.

Trench Covers shall be furnished and installed as shown. Edge frames shall be galvanized steel angles embedded in concrete with anchor strap as indicated. Angle frames shall have welded-on bar plate stops of the same thickness as the cover plates. Cover plate shall be of the size and thickness and be of checkered plate as hereinbefore specified. Cover plate shall be cut accurately to required size with all edges grounded smooth to straight lines and fitted to frames, and to each other with a tolerance of not more than 1.5 mm. Cover plates shall have slots for lifting, and shall be fitted in frames without fasteners.

Hand Hole Covers shall be furnished and installed as shown. Edge frame and cover frames shall be of steel angles as detailed.

Day Tank shall be 976 liters (258 gal.) capacity, 0.96 m \varnothing x 1.56 m long, fabricated from 4.76 mm thick steel plate complete, with 0.254 m diameter handhole. Connections shall be provided for 1 inch fuel supply pipe line to engines, 1 inch over flow pipe line, 1 1/4 inch vent pipe line and 1/2 inch float switches pipe line.

Day Tank Saddle and Pipe Support, shall be fabricated from 6.35 mm (1/4) thick steel plate and 76.2 mm (3 inch) \varnothing steel pipe, welded construction. Pipe supports shall not be more than 1.50 meters on center. The pipe support stand shall be welded to a 150 x 150 x 6 mm thick steel floor plate. Four 13 mm \varnothing anchor bolts shall be provided for each floor plate, for fastening the pipe support to the concrete floor.

Exhaust Silencer Pipe Saddles and Supports shall be fabricated of 38 mm x 5.16 mm. thick steel straps. The saddles shall be securely fastened to the roof in a workmanlike manner.

"A" Frame, shall be constructed of galvanized steel pipe of the dimensions indicated on drawings. The frame legs shall be provided with swivel type round wheels 0.152 (6 inches) in diameter and of non-metallic material. All connections shall be (0.0063 min. welded). All pipes shall be cut to fit with adjoining pipes and edges chamfered 0.0063 before welding.

Anchor Bolts of the sizes indicated on drawings shall be provided and installed on each reinforced concrete engine foundation.

- End of Section -

76 **HARDWARE: BUILDERS¹**

General: The complete work consists of furnishing and installation of all finish hardware. All items of finish hardware of like kind and purpose shall be of the same manufacture, as specified herein.

Applicable Specifications: The work shall conform to current issues of the following publications:

Federal Specifications

FF-H-106a & Am-1 & Int. Am-8	Hardware, Builders ¹ ; Locks and Door Trim
FF-H-00111b (GSA-FSS)	Hardware, Builders ¹ , Shelf and Miscellaneous
FF-H-116c & Am-4	Hinges, Hardware, Builders ¹
FF-H-136	Hardware and Fittings; (For) Lavatory partitions and Inclosures
FF-L-486	Locks, Cabinet
QQ-A-374 & Int. Am-1	Aluminum Alloy Ingot (For Remelting)
QQ-A-601e & Am-2	Aluminum Alloy Sand Castings
QQ-S-766c & Am-2	Steel Plates, Sheets, and Strip Corrosion Resisting

General: Unless otherwise specified, hardware shall conform to the applicable requirements of the Federal Specifications listed herein. Where manufacturer's products are specified the products of other manufacturers, equal to the product specified and approved may be used. All modifications to hardware, required by reason of construction characteristics, shall be such as to provide the specified operative or functional features. Hardware for application on metal shall be made to standard templates, and shall be attached with proper size machine screws of the same material as the hardware or compatible with the hardware. If the hardware for any particular location is not described herein, it shall be provided and shall be as nearly like that for similar locations as is practicable. If no similar location is specified, such hardware shall be of bronze or aluminum; plain, heavy pattern, suitable type and proper size for the service required. All hardware shall be delivered to the project site in unopened manufacturer's original containers or packages, with seals unbroken and labels intact. Containers or packages furnished shall be the approved products of only United States of America Manufacturers, unless this requirement is waived by the Contracting Officer.

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Materials: Items of hardware may be supplied in aluminum alloy or corrosion-resisting steel in lieu of brass or bronze. Except that where aluminum hardware is furnished, the trim of mortise locks and latches shall be supplied in bronze (US26D) or corrosion-resisting (US32D), conforming to Federal Specification FF-H-106. Aluminum alloy shall be cast, or may be forged, extruded, or wrought, provided the forged, extruded or wrought items or parts thereof are of approximately the same weight or thickness as are the corresponding cast items or parts of cast items.

Samples Schedule and Samples: As soon as practicable after award of contract and before a hardware schedule is prepared or any hardware delivered to the project site, the Contractor shall submit for approval a sample list in quintuplicate, listing each of the different items of finish hardware required, no consideration will be given to partial lists of hardware submitted from time to time. The samples list shall be submitted in the following form:

<u>Specification Reference, Type, or Catalog No.</u>	<u>Name of Item</u>	<u>Mfrs. Name and Catalog No. of Item Supplied</u>
161 B T2102 NRP	Lock Butt Hinge	ABC Lock Company-L10 XYZ Hinge Company-L20

Opposite each listed item number the following shall be inserted; the specification reference, type, or catalog number; the name of the item; and the manufacturer's name and catalog number of the item supplied. In addition to the samples list, a sample of each different item of builders' hardware, properly tagged and marked for identification, shall be submitted for approval. Following approval of the samples list and the samples, a permanent schedule of hardware showing the quantities, types, and locations of the various items of hardware required for the project shall be delivered in triplicate for record. The permanent schedule shall include only the catalog number of the items appearing on the approval samples list.

Hardware Types:

Butt Hinges shall conform to Federal Specification FF-H-116, of the types indicated below.

For Outswing Exterior Doors: Type T2107.

For Interior Doors without Closer: Type T2127.

For Doors 42 Inches Wide or Wider: Extra-Heavy Type T2117.

Where Extra-Heavy Butts are Required: Butts shall be full mortise, half-mortise, full-surface, or half-surface type, as applicable.

Butt Hinge Widths: Where the projection of the door trim is such as to prevent clearance with the butt hinges specified, hinges with leaves of sufficient width to clear the trim shall be provided.

Contractor's Option: Contractor has the option of supplying butt hinges with oil-impregnated bearing in lieu of the ball-bearing-type hinges specified.

Butt Hinges Per Door:

<u>Height of Door (meters)</u>	<u>Butts Required</u>
1.5 or less	2
Over 1.5 and not over 2.28	3
Over 2.28	4

Butt Hinge Sizes

<u>Door Thickness (Millimeters)</u>	<u>Door Width (Meters)</u>	<u>Butt Size (Inches)</u>
38	0.914 and less	4-1/2 x 4-1/2
38	Over 0.914	5 x 4-1/2
50	Any	5 x 5

Barrel Bolts shall conform to the Federal Specification FF-H-111 of the types as hereinafter specified.

Lock Sets and Latch Sets: Federal Specification FF-H-106, series 160 of the types as hereinafter specified.

Manufacture: Lock sets and latch sets supplied for the project shall be those of a single manufacturer.

Knobs and Roses shall be the cold forged or heavy wrought type. Metal may be solid, laminated, or reinforced. The minimum thickness of knob shells and of roses shall be 2.0 mm. Knob shanks shall have a minimum thickness of 1.52 mm. Laminated or reinforced-type knobs and roses shall have a minimum outer shell thickness of 0.86 mm. Roses shall be of the concealed-screw type.

Backset shall be 63 mm., unless otherwise specified.

Screen Door Catch: Federal Specification FF-H-111, of the type as hereinafter specified.

Miscellaneous Requirements:

Finishes: Hardware shall have the following U. S. Standard finishes:

- USP - Exposed surfaces of ferrous metal, unless otherwise specified.
- US4 - Exposed surfaces of brass metal, unless otherwise specified.
- US10 - Exposed surfaces of bronze metal, unless otherwise specified.
- US26D - Exposed surfaces of brass or bronze when aluminum or corrosion-resisting steel is furnished.
- US28 - Exposed surfaces of aluminum.
- US32D - Exposed surfaces of corrosion-resisting steel.

Keys and Keying:

Keys shall be supplied as follows:

- Locks and latches 2 Keys each
- Master-Keyed sets 6 Keys each

Keying: Keys shall be stamped with the change number. After all locks have been installed, the respective keys shall be shown to operate all locks in the presence of the Government representative. The keys shall be properly tagged and delivered to the Government. Each lock shall be keyed differently from any other lock in the building, unless otherwise specified or directed by the Government.

Two or more entrances to the same room shall be keyed alike.

Locks shall be master-keyed unless otherwise directed by the Government.

Before any hardware is delivered, a keying system shall be prepared and submitted for approval by the Government.

Application of Hardware: Hardware shall be applied with fastenings of proper size, quantity, and finish.

Butt Hinges Unless otherwise indicated or directed by the Government shall be installed as follows:

Top Hinges shall be installed with the top of hinge 5 inches below the rabbet of the head jamb.

Bottom Hinges shall be installed with the bottom of the hinge 10 inches above the finish floor.

Intermediate Hinges shall be equidistant between the top and bottom hinges.

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Chain and Foot Bolts: of suitable size shall be installed on the interior edge of one leaf of double doors. One chain bolt shall be located on the top edge of the door and one foot bolt shall be located at bottom edge of the door.

Lock and Latch Strikes:

The Location of Strikes for Knob Locks and Knob Latches shall be determined by installing the center of the door knob 0.96 meter above the finish floor.

Hardware-Sets: Hardware type numbers listed hereinbefore without reference to their designated Federal Specifications refer to the Federal Specification listed paragraph: Applicable Specifications:

Hardware Set Numbers: The following hardware-sets are required for the doors listed.

<u>Set No.</u>	<u>Door Hardware</u> <u>Description</u>	<u>Quantity</u> (each door)
HW-1 (Door-1)	<u>Butt Hinges:</u> Type T2127; Size 3 1/2 inches Open	3
	<u>Lock Set:</u> Type 160 D-4	1 (one side only)
	<u>Chain Bolt:</u> Type 1021A. Cast Bronze. Length 6 inches	2 (on one leaf only)
	<u>Foot Bolt:</u> Type 1021B. Cast Bronze. Length 6 inches	2
HW-2 (Door-2)	<u>Butt Hinges:</u> Type T2127, Size 3 1/2 inches Open	3
	<u>Lock Set:</u> Type 160 D-4	1
HW-3 (Door-3)	<u>Butt Hinges:</u> Type T2127, Size 3 1/2 inches Open	3
	<u>Lock Set:</u> Type 160 D-4	1
HW-4 (Wire Mesh Door)	<u>Butt Hinges:</u> Type T2127, Size 3 1/2 inches Open	3
	<u>Lock Set:</u> Type 160 D-4	1
HW-5 (Screen Doors)	<u>Spring Hinges:</u> Type 2301, Size 3 x 3 inches	3
	<u>Door Pulls:</u> Type F1275	1

- End of Section -

18 DIESEL ELECTRICAL GENERATING UNIT

General: The work consists of installation of Government-furnished generator sets, the providing of an exhaust system, fueling system, with a day tank, transfer pumps and piping, complete.

Applicable Specifications and Standards: The work shall conform to current issues of the following publications:

Federal Specifications:

- WW-P-406b Pipe, Steel, (Seamless and Welded)
(for Ordinary Use)
- WW-P-521d (1) Pipe-Fittings, Malleable Iron, Wrought Iron and Steel-Screwed,
150 Pound.
- WW-U-531a Unions, Pipe, Steel or Malleable Iron, Threaded Pipe Connection,
250 psi, WSP, 500 psi WOG - Cold Non-Shock.
- WW-V-54b Valves, Gate 125 and 150 Pound Screwed and Flanged, Bronze,
(For Land Use).
- WW-P-401c Pipe and Pipe Fittings; Cast-Iron Soil.

Military Specifications:

- MIL-G-10228A Generator Sets, Engine-Driven, Methods of Test.
- MIL-V-13612A Valves; Relief, Pressure and Temperature.

API: (American Petroleum Institute, 1271 Avenue of the American, New York 20,
N.Y.)

- 12C-58 Specifications for Welded Oil Storage Tanks.

AWS: (American Welding Society, 345 East 47th Street, New York 17, N.Y.)

- DI. 0-46 Standard Code for Arc and Gas Welding in Building Construction.

ASA: (American Standards Association, 70 East 45th Street New York 17, N.Y.)

- B31.1-1955 Standard Code for Pressure Piping.

ASME: (American Society of Mechanical Engineers, 29 West 39th Street New York
City 13, N.Y.)

- Unfired Pressure Vessel Code, 1959; Including 1959 Addenda.

Equipment Installation: The Contractor shall perform all operations of uncrating, removal of temporary protective coatings, transferring, assembly, setting in place in the location shown, levelling, anchoring, connecting, testing and adjusting for satisfactory operation of the Diesel Electric Generator Sets, and all other components or accessory equipment. The locations shown are subject to minor revisions by the Contracting Officer to avoid interference with other equipment, utility lines or architectural features of the building. The location of electrical conduits, fuel lines, exhaust lines or other associated features will be confirmed in the field prior to installation to provide the most convenient accessibility to the connecting point of the machine. The Contractor shall apply and install all connection boxes necessary to insure satisfactory installation and connections.

Exhaust Silencer and Piping shall be installed as shown on the plans. All required piping, supports and flashing shall be provided as indicated.

Exhaust Pipes shall be seamless and welded, black, schedule 40 steel pipe, beveled ends for welding. Fittings shall be steel, standard weight conforming to ASA B16.9 and ASTM 234, beveled ends welding fittings. Flanges shall be forged carbon steel, 150 lbs. rating drilled to ASME Standards.

Exhaust Pipe Saddles and Supports shall be fabricated from 38 mm. x 5.16 mm. thick steel bars to forms as shown.

Exhaust Piping Insulation consisting of premolded asbestos cement insulation, wire mesh and canvas jacketing shall be provided for pipes inside the building.

Vibration Dampers shall be provided between Diesel engine-generator base and equipment foundation. Vibration dampers shall be made from an oil, grease and acid resistant hard rubber permanently bonded between two steel plates. Vibration dampers shall each have a capacity of permanently supporting a load between 1,500 to 3,000 lbs.

Day Tank: Elevated day tank with capacity as shown of welded steel shall be provided. The day tank shall be equipped with sight glass and float operated switches.

Float Operated Switches for Day Tank shall be provided as shown. Each float operated switch shall be complete with steel float bowl provided with 1/2 inch tappings on top and bottom for external installation, copper float, slyphon bellows and Underwriters' Laboratories approved seal which will prevent oil leakage into terminal housing even if slyphon bellows should rupture, terminal housing, mercury switch and electrical connections. Float operated switches shall be provided in two sets. One set shall start the fuel oil transfer pump when the fuel oil level drops to 0.30 meter from bottom of tank and stop the pump when the fuel oil level rises to 0.15 meter from top of tank. One set shall sound an alarm when the fuel oil level drops to 0.20 meter from bottom of tank and when the fuel oil level rises to 0.10 meter from top of tank.

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Motor-Driven Transfer Pump: One rotary type, 5 gpm capacity and 11 psi discharge pressure, directly driven through a flexible coupling by a 1/3 HP, 1,200 rpm single phase, 60 cycle, 120 volts, electric motor shall be furnished and installed as shown.

Hand Pump: One rotary type hand pump, 10 gpm capacity at 25 feet discharge head and 100 rpm, shall be installed as shown.

Line Strainers shall be furnished and shall be WYE type, bottom opening, iron body, 40 mesh brass screen, reinforced with expanded metal backing to prevent screen from buckling.

Water Softener: Furnish and install a pressure type ION exchange water conditioner, designed in accordance with the following specifications:

Steady Demand Flow Rate, 14 gpm. Pressure drop through unit at steady demand rate, 3 to 12 psi. Peak demand service rate 20 gpm. Salt usage at low salting, 30 lbs. per regeneration. Salt usage at basic rating, 75 lbs. per generation. Daily maximum grain exchange, 300,000 grains. Basic rating of softener, 150,000 grains. Threaded openings on main control valve shall be 2 inch I.P.S.

Softener tank shall be constructed of ASTM A-283-58t Specification steel for 100 psi working pressure and tested at 150 psi. Tank to be hot-dipped galvanized inside and out after welding. Tank shall be supported on legs welded to the bottom bead only. A handle shall be provided near the bottom for future inspection or maintenance. Bottom distribution system shall be completely non-metallic and no gravel or other subfill shall be required. Distribution shall consist of at least 12 collector tubes to assure an even pattern of water during regeneration and in service. Slotted openings of collector tubes shall be designed with slots wider on the inside than on the outside, to prevent clogging. Top distribution system shall be adequate to distribute water evenly over the cross-section of mineral bed and the use of screens or strainers will not be accepted. The main operating valve shall be rustproof cast bronze. It shall be completely automatic and provided with sight windows for all moving parts and shall be insulated from the softener tank by dielectric bushings. Hydraulic pressure from cycle controller pilot shall be the operating force without the use of solenoids or diaphragms. Valve shall have full-ported passageways equal to 2" schedule 40 pipe and all seating surfaces shall be self-cleaning. The main control valve shall be designed with a constant flow, backwash regulator. Regulator shall be self-cleaning and assure a thorough loosening and cleaning of the mineral bed during back-washing. Brine injector shall be tamper-proof, self-cleaning and preset at factory to assure maximum efficiency. Softening mineral shall be a permanent, sulfonated styrene base type in bead form. Brine system shall consist of a fiberglass or hot-dipped galvanized steel tank, fitted with necessary corrosion-resistant parts for metering out the correct amount of brine for each regeneration. Design shall be for dry salt storage in a manner to permit replenishing of salt at any time without affecting the accuracy of the brine dosage.

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Flexible Tubing shall be bronze flexible connectors with male and female pipe threaded bronze couplings, tube braided, pressure ratings shall not be less than the service intended.

Piping: Unless otherwise shown on the drawings or specified, all piping shall be installed in accordance with the applicable requirements of Standard Code for Pressure Piping ASA B31.961.

Water and Fuel Piping: Water supply lines including pipe supports shall be standard weight or schedule 40, galvanized steel pipes, threaded and coupled ends with 150 pounds, galvanized, malleable iron, screwed fittings. Fuel supply lines, fuel return lines and tank lines shall be standard weight or schedule 40, black steel pipes, threaded and coupled ends. Fittings for fuel lines shall be 150 pounds, black, malleable iron, screwed fittings. Tank connections shall be forged steel fittings with ratings shown.

Gate Valves for Water and Fuel Lines shall be bronze, 125 pounds, rising stem, inside screw and screwed ends, and shall conform to Federal Specification WW-V-0054a.

Check Valves for Fuel Lines shall be bronze, 125 pounds, swing check for horizontal installation and screwed ends, and shall conform to Federal Specification WW-V-51a (2).

Unions shall be 250 pounds, iron to brass seat, black, for fuel lines malleable iron and screwed connection, and shall conform to Federal Specification WW-U-531a. Unions for water shall be galvanized.

Hose Bibbs shall be provided as shown and shall be, rough brass, hand wheel operated cast rough brass with hose connection.

Hangers and Supports: All piping shall be securely supported. Overhead horizontal runs of piping shall be supported by adjustable clevis type hangers and solid rods securely attached to the building structure. All hangers shall have turnbuckles or other approved means of adjustment.

Sleeves of proper size shall be furnished and installed where pipes pass through floors and walls. Unless shown otherwise, sleeves shall be wrought iron or steel pipe with inside diameter not less than 1/2 inch larger than the diameter of the pipe.

Pipe and Fittings under the building up to including the surface cleanout pipe and fittings shall be cast iron soil pipe fitting, conforming to Federal Specification WW-P-00401b (GSA-FSS).

Floor Drains shall be cast iron body with integral P-Trap, brass cleanout flush with floor, double drainage flange, loose set grate, perforated shallow sediment bucket and backwater valve.

Duct Work shall be fabricated of zinc-coated iron or steel sheets of thickness not less than that indicated. Duct shall be straight and smooth on the inside, with joints neatly finished, and shall be anchored securely so as to be completely free from vibration. Flexible connections shall be a wire reinforced gales or asbestos fabric of suitable weave and weight. All necessary angles, bolts, clips, or other fastenings for securing the flexible connection and ductwork to the generator unit and building structure shall be furnished.

Welding, Gas and Electric: Welding and welding materials shall conform to the American Welding Society Code for Arc and Gas Welding in Building Construction, and ASA B31.1, 1951, Section 6.

Electric Installation shall conform to the applicable portion of SECTION: ELECTRICAL WORK; INTERIOR. The phase rotation of all new work shall correspond with the existing system and any damage resulting from incorrect phase rotation is the responsibility of the Contractor.

Outages shall be kept to a minimum in both number and duration. The existing power plant and system must remain in operation throughout the construction period of the new power plant and system until the new construction is operational. All outages must be scheduled and the Contractor shall request outages in writing five (5) days prior to the intended outage.

Tests:

General: After the diesel generator sets installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for the Contracting Officer. Engines shall be run continuously through the consecutive tests, to demonstrate engine performance within normal operating limits of engine temperatures and operating pressure in accordance with published Instruction Manual data of the manufacturer, a copy of which will be furnished the Contractor by the Contracting Officer. The Contractor shall furnish all labor and water rheostat or other artificial electrical load, except that electrical load which is already installed may be connected if considered suitable for test use by the Contracting Officer. Fuel, oil and water will be furnished by the Government. Starting time shall be approved by the Contracting Officer. Instrument readings shall be recorded at 30 minutes periods for the following items:

- (a) Generator KW
- (b) Generator voltage
- (c) Engine speed (RPM)
- (d) Engine lube oil temperature
- (e) Engine jacket water temperature
- (f) Ambient temperature

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Run-In Period: The engine shall be run-in at a loading specified by the Contracting Officer for not less than 2 hours prior to the beginning of load test runs. During this time all instruments, controls, temperatures and pressures shall be adjusted to normal and shall be so certified by the Contractor.

75% Rated Load Run: The engine shall be run for 8 hours at 75% of generator rated load.

100% Rated Load Run: The engine shall be run for 8 hours at 100% of generator rated load.

110% Rated Load Run: The engine shall be run for 2 hours at 110% of generator rated load.

Upon completion of all load runs the following safety control and alarms shall be tested.

- (a) Increase engine speed manually and note RPM at which overspeed trip functions.
- (b) During the shutting down sequence on each engine note the pressure at which lube oil low pressure alarm functions.

The Following Tests shall be performed; these tests are to be performed in accordance with Military Specification MIL-G-10228A (CE):

- (a) Regulation
- (b) Critical frequency
- (c) Voltage regulator range
- (d) Exciter commutation

Piping Finish; Identification: Service pipes exposed or concealed in accessible pipe spaces shall be provided with color bands and legends adjacent to all valves. All pipe and fittings other than conduit shall be painted with approved enamels utilizing the following colors for the systems involved.

Color Bands: The following colors bands with legends in color black (or contrasting color) lettering shall be used:

<u>Piping</u>	<u>Band Color</u>	<u>Band Legend</u>
Size of Stencil Letters:		
<u>Diameter of Pipe (inches)</u>		<u>Size of Stencil Letters (inches)</u>
1/2 - 3/4		3/8
1 - 1 1/2		1/2

Stenciled Flow Arrows approximately 2 inch long shall be provided on 8 ft. centers.

- End of Section -

SECTION 19 - ELECTRICAL WORK - INTERIOR

General: The work includes furnishing all labor, equipment, supplies, and materials and in performing all operations, including cutting, channeling, and chasing, necessary for the installation of complete interior wiring systems, raceways, electrical equipment, power systems and electric-service connections, complete.

Applicable Specifications and Standards: The work shall conform to current issues of the following publications:

Federal Specifications:

J-C-129c	Cable and wire; thermoplastic-insulated, general purpose (0 to 600 volt service).
W-B-30(2)	Ballast, fluorescent lamp.
W-C-586a	Conduit outlets and entrance caps, electrical, cast metal for for shore use.
W-C596	Connector, Plug, Electrical; connector, receptacle electrical; plate, wall, electrical.
W-C-601	Connectors, Wire, pressure, solderless (for electric cable and wire).
W-F-406a	Fittings, cable and conduit.
W-F-408	Fittings for conduit, metal, rigid (rigid steel and electrical metallic tubing).
W-F-412c	Fixture, lighting, incandescent lamp, industrial.
W-F-414a	Fixture, lighting (fluorescent, alternating-current, general purpose).
W-J-800a(2)	Junction Box; extension, junction box, junction box cover (steel cadmium or zinc coated).
W-L-101e	Lamps, electric incandescent, large, tungsten-filament, including current supplements.
W-L-116(3)	Lamps, fluorescent.
W-L-131(3)	Lamp-Auxilliarities, fluorescent.
W-L-142	Lampholder, adapter and shadeholder, medium screw-shell 125, 250 amp, 600 volts.
W-L-331	Light fixtures; direct, industrial (for hot cathode fluorescent lamps).

W-O-821a(3) Outlet boxes; steel, cadmium or zinc-coated, with covers and accessories.

W-S-865a Switches, enclosed (safety) surface mounted.

W-S-893a(1) Switches, toggle, multiple-unit; with wall plates.

W-S-896b Switches, toggle, single unit, with wall plates.

CC-M-636a(1) Motors, fractional horsepower (alternating current).

CC-M-641(3) Motors, alternating-current, integral-horsepower.

HH-I-510a Insulation tape, electrical, friction.

HH-T-111c(1) Tape, rubber (natural and synthetic), insulating.

WW-C-566a Conduit, steel, flexible.

WW-C-581e Conduit, electrical, steel, rigid, zinc-coated.

WW-T-00806c Tubing, electrical, metallic.
(GSA-FSS)

Military Specifications:

MIL-T-152a Treatment, Moisture - and Fungus Resistant of Communications, Electronics, and Associated Electrical Equipment.

MIL-T-7798 Insulation tape, electrical pressure sensitive, adhesive plastic.

MIL-V-173A Varnish moisture and fungus resistance for the treatment of communications, electronic, electrical equipment.

MIL-V-1137A Varnish, electrical insulation (for electromotive equipment).

MIL-W-3861 Wire, electrical (bare copper).

MIL-I-11683B Interference suppression, radio, requirements for engine generators and miscellaneous engines.

ULT: (Underwriters' Laboratories, Inc., 161 Sixth Avenue, New York 13, New York).

50 Cabinets and boxes, May 1956

869 Service equipment, 1951, including revisions through August 1958.
Thermoplastic insulated wires.

U. S. Department of Commerce:

National Bureau of Standards Handbook:

National Electrical Safety Code

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Installation and maintenance of electric supply and communication lines; safety rules and discussion.

ASA: (American Standards Association, 70 East 45th Street, New York 17, New York)

C7.8 Concentric lay-standed copper conductors, hard, medium-hard, or soft.

C37.13 Low voltage circuit breakers (including application guide)

IPCE: (Insulated Power Cable Engineers Association 283 Valley Road, Montclair, N.J.)

S-19-81 Rubber insulated wire and cable for the transmission and distribution of electrical energy, third edition March 1959.

NBFU: (National Board of Fire Underwriters, 38 John Street, New York 38, New York)

Pamphlet
Number

70 National electrical code.

General: The complete installation shall comply with applicable provisions of Pamphlet No. 70 of the NBFU, except as otherwise shown or specified herein. Electrical materials shall be new and approved by the Underwriters' Laboratories, Inc., wherever standards have been established by that agency. In lieu of the Underwriters' Laboratories, Inc., approval consideration will be given to certified test reports of an adequately equipped, recognized, independent testing laboratory competent to perform such testing, indicating conformance to all requirements of the applicable Underwriters' Laboratories, Inc., standard. Defective equipment or equipment damaged in the course of installation of test shall be replaced or repaired. The contract drawings indicate the extent and general arrangement of the conduit and wiring systems. If any departures from the contract drawings are deemed necessary by the contractor, detail of such departures and the reasons therefore shall be submitted as soon as practicable, and within 30 days after award of the contract. No such departures shall be made without the prior written approval.

Standard Products: Unless otherwise indicated the materials to be furnished under this specification shall be the standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design that complies with the specification requirements.

Material and Equipment Schedules: As soon as practicable and within 30 days after the date of notice to proceed and before commencement of installation of any materials or equipment, the Contractor shall submit to the Contracting Officer for approval, a complete list, in triplicate, of materials, fixtures, and equipment to be incorporated in the work. The list shall include catalog numbers, cuts, diagrams, drawings, and such other descriptive

data. No consideration will be given to partial lists submitted from time to time. Approval of materials will be based on manufacturers' published ratings. Any materials, fixtures, and equipment listed that are not in accordance with the specification requirements will be rejected.

Fungus and Moisture Resistance: All equipment shall be treated to resist fungus and moisture as specified below:

Electrical Components Such as Switches, Fuses, Contacts, oil-immersed transformer windings and heater elements shall not be treated. Other materials and components which are inherently fungus resistant or are protected by hermetic sealing need not be treated.

Circuit Elements not covered above and which have a temperature rise of not more than 75° F. when operating at full load, shall be coated with a fungus-resistant, varnish conforming to Military Specification MIL-V-173, Type I or Type II at the contractor's option. The method of treatment shall be in accordance with Military Specification MIL-T-152. Circuit elements include, but are not limited to, cable, wire, switchboards, terminal and junction blocks, junction boxes, capacitors, and coils.

Circuit Elements such as motor coils, generator and dry type transformer windings, and similar electrical components, which have a temperature rise exceeding 75°F. when operating at full load, shall not be coated with a fungitoxic compound. Instead, such components shall be given two coats of varnish conforming to Type M, Grade BB or CB, and one sealer coat conforming to Type M, Grade CB of Military Specification MIL-V-1137. The coats shall be applied by the vacuum-pressure, immersion, centrifugal, pulsating-pressure or built-up method so as to fill all interstices in the coils and preclude the entrapment of air or moisture. The sealer coat may also be applied by brushing or spraying.

Grounding: Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of electrical equipment, raceway system and neutral conductor of the wiring systems shall be grounded. Ground electrodes shall be driven ground rods of cone-pointed, copper-encased steel or solid copper having the upper 6 inches tinned. Copper-encased steel ground-rod shall be rolled to a commercially round shape from a welded copper-encased steel bullet and shall have a conductivity not less than 27 percent of that of pure copper. The rods shall have clean, smooth, continuous copper surfaces and the proportion of copper shall be uniform throughout the length of the rod. Ground wires shall be secured to the upper ends of ground rods by approved copper alloy clamps brazed to the ground rods. Ground rods shall be 8 "0" long and shall have diameters sufficient to permit driving to the necessary depth without being damaged, but in no case shall they be less than 5/8" in diameter. Each ground rod shall be die-stamped near the top with the name or trademark of the manufacturer and the length of the rod in feet. The maximum resistance of the grounding system shall not exceed twenty-five (25) ohms. If this resistance cannot be obtained by the number of rods indicated, a sufficient number of additional rods shall be installed not closer than two (2) meters on centers, or if sectional type rods are used, additional sections may be

coupled and driven with the first rod so that the resultant resistance will not exceed twenty-five (25) ohms.

Grounding Conductors sizes shall be as indicated and be of stranded, bare, medium hard drawn copper.

Wiring Methods: Generally, and unless otherwise specified or indicated, wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit, rigid aluminum conduit, or electrical metallic tubing. Cable and conduit fittings shall conform to Federal Specification W-F-406a and 408 respectively.

Conduit and Tubing Systems: Conduit shall be rigid zinc-coated steel. Steel conduit shall conform to Federal Specification WW-C-581e and conduit shall be installed in accordance with Article 346 of the National Electrical Code. Tubing shall be zinc-coated electrical metallic tubing conforming to Federal Specification WW-T-00806c and shall be installed in accordance with Article 348 of the National Electrical Code. Minimum size of conduit and tubing shall be 1/2 inch. Conduits installed in concrete floor, and in direct contact with earth shall be suitably covered with plastic tape, plastic coating, or asphalt tar enamel. Underground conduits for outgoing services stubbed outside the building shall be encased in concrete as shown. Raceways shall be exposed. Raceways shall be supported at intervals of not more than 8 feet and shall have runs installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Field-made bends and offsets shall be avoided where possible, but where necessary shall be made with an approved hickey or conduit-bending machine. Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Crushed or deformed raceways shall not be installed. Care shall be taken to prevent the lodgement of plaster, dirt, or trash in raceways, boxes, fittings, and equipment during the course of construction. Clogged raceways shall be entirely free of obstructions. Conduits shall be fastened to all sheet metal boxes and cabinets with two locknuts where required by the National Electrical Code, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise a single locknut and bushing are acceptable. Bushings shall be installed on the ends of all conduits and shall be of the insulating type where required by the National Electrical Code. Threadless fittings for electrical metallic tubing shall be of the type approved for the conditions encountered; those installed in concrete shall be concrete-tight and those installed in wet locations or exposed to wet weather shall be rain-tight. Raceways crossing expansion joints in concrete slabs shall be provided with suitable expansion fitting or other suitable means shall be provided to compensate for the building expansion and construction. Wooden plugs inserted in concrete or masonry and nails inserted in wood are not acceptable as a base for boxes or raceway fastenings, nor shall boxes, raceways or pipe straps be welded to steel structures. Raceways shall be secured by pipe straps or shall be supported by wall brackets, strap hangers, or ceiling trapeze, fastened by wood screws on wood, toggle bolts on hollow masonry units, expansion bolts on concrete or brick, and machine screws or welded threaded studs on steel

work. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of expansion bolts or machine or wood screws. Conduit leaving or entering concrete, or connecting to outlet boxes, outlet bodies, panels or similar terminal points encased in concrete, shall be coated with a bituminous paint compound for a distance of fifteen (15) cm. each way from point of entry. Galvanizing on conduit damaged by wrenches or other mechanical means, shall be given a coat of zinc chromate after installing.

Wires and Cables:

Conductors in Raceways and Cables shall be copper, thermoplastic insulated unless otherwise specified. Thermoplastic-insulated conductors shall conform to Federal Specification J-C-129a. Wire connectors of insulating material or solderless pressure connectors properly taped shall be utilized for all splices where possible. Soldered joints insulated with tape shall not be used. Vinyl plastic tape shall conform to Military Specification MIL-T-7798. Rubber and friction tapes conforming to Federal Specification HH-T-111c (1) and HH-T-101a (1) respectively are acceptable in lieu of vinyl tape.

Conductor Sizes shall not be less than shown. Branch circuit conductors shall not be smaller than No. 12 AWG insulated for 600 volt.

Conductor Insulation: Conductors No. 3 AWG and larger shall be type THW. Conductors smaller than No. 3 AWG shall be type TW.

Conductor Marking: All conductors shall be marked with plastic coated wiremarkers at all junction and pull boxes clearly indicating their electrical characteristics, circuit number and equipment designation.

Outlets: Each outlet in the wiring or raceway systems shall be provided with an outlet box to suit the conditions encountered. Boxes installed where they are exposed to the weather or in normally wet locations shall be of the case metal type having threaded hubs conforming to Federal Specification W-C-586a. Boxes in other areas shall be of the zinc-coated sheet metal type conforming to Federal Specification W-J-800a (2). Exposed outlets on walls shall be of the sheet metal type. Each box shall have sufficient volume to accommodate the number of conductors entering box in accordance with the requirements of the National Electrical Code. Boxes shall be not less than 1-1/2 inches deep unless shallower boxes are required by structural conditions. Ceiling and bracket outlet boxes shall not be less than 4 inch octagonal except that smaller boxes may be used where required by the particular fixture to be installed. Switch and receptacle boxes shall be approximately 4 inches by 2 inches. Boxes shall be installed in a rigid and satisfactory manner and shall be supported by bar hangers in frame construction or shall be fastened directly with wood screws on wood, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws or welded threaded studs on steel work. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of

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wood screws, expansion shields, or machine screws. When necessary, with approval of the Contracting Officer outlets shall be relocated to avoid interference with mechanical equipment or structural features.

Pull Boxes shall be constructed of code gage galvanized sheet metal, or not less than the minimum size recommended by the National Electrical Code. Boxes shall be furnished with screw-fasteners. Where several circuits or feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit numbers and panel designation.

Device Plates of the one-piece type shall be provided for all outlets to suit the devices installed. Plates shall be of zinc-coated sheet metal having rounded or beveled edges. Screws shall be of metal with countersunk heads, with finish to match the finish of the plate. Plates shall be installed vertically and with an alignment tolerance of 1/16 inch. The use of sectional-type device plates will not be permitted.

Receptacles shall conform to Federal Specification W-C-596.

Duplex Receptacles shall be rated 15 amperes, 125 volt and 10 amperes, 250 volt, 2-pole 3-wire grounding type with polarized parallel slots, Style D series. Bodies shall be of brown thermosetting compound supported by mounting yoke having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacles shall be side or back-wired with two screws per terminal, or shall have pressure-type screwless terminals having suitable conductor-release arrangement. Receptacles shall be capable of receiving two-wire parallel-bladed caps or three-pole caps. The third grounding pole shall be connected to metal mounting yoke.

Wall Switches: Wall switches shall be of the totally enclosed tumbler type and shall conform to the requirements of Federal Specification W-S-896. Enclosures shall be of thermosetting plastic compound. Not more than one switch shall be installed in a single gang position of a switch box. Single-pole, three-way and four-way switches shall be of the tumbler type, rated 10 amperes minimum at 250 volts. All switches shall be suitable for the control of tungsten-filament lamp loads and shall carry the "T" marking of the Underwriters Laboratories, Inc.

Weatherhead shall be galvanized cast iron or aluminum, as approved.

Secondary Service Racks shall be of galvanized steel, as shown, with insulators conforming to the requirements of ASA Standard C 29.3-1961.

Motors furnished and installed under this and other sections of this specification shall be of sufficient size for the duty to be performed and shall not exceed their full rated load when driven equipment is operating at specified capacity under the most severe conditions likely to be encountered. The horse-power ratings indicated are for guidance only and do not limit the equipment size. Unless otherwise specified, all motors shall have open

frames, Class B tropical insulation except asbestos insulation shall not be used, and continuous-duty classification based on a 40 ambient temperature for reference. Motors for exterior use shall have splash proof enclosure.

Fractional-Horsepower Motors: Fractional-horsepower motor shall conform to the requirements of Fed. Spec. CC-M-636a(1).

Integral-Horsepower Alternating-Current Motors: Integral-horsepower alternating-current motors shall conform to the requirements of Fed. Spec. CC-M-641 (3). Polyphase motors shall be Class B, squirrel-cage type, having normal-starting torque and low-starting-current characteristics unless other characteristics are specified elsewhere.

Motor Controllers and Control devices furnished and installed under other sections of this specification shall be suitable for performing the function specified. Controllers shall conform to the National Electrical Manufacturers Association Standard ICI and the Underwriters' Laboratories, Inc., Standard for Industrial Control Equipment. Each motor 1/8 horsepower or larger shall be provided either integral with the motor or controller, or mounted in a separate enclosure. The protective device shall be of the manually reset type. Single-or-double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating of not in excess of 80% of the switch rating.

Station Service Battery shall be lead-acid Plante Type, Sealed type, assembled in heat-resistant, shock-absorbing, clear plastic containers with covers cemented in place to form a permanent leak-proof seal. Covers shall be fitted with spray-proof vent plugs. Negative plates shall have life equal to or greater than that of the positive plates. Cells shall have sufficient electrolyte to provide for full capacity at all ratings, and shall have a nominal specific gravity of 1.200 to 1.220 at 77°F. when the cells are fully charged. The battery shall be twelve cell (24 volt nominal voltage) and SAE 8 hour 400 ampere-hour rating. The battery shall be furnished complete with mounting rack.

Battery Charger shall consist of a dry plate type full wave rectifier with an automatic charge control. The rectifier shall have a high/low type charging control with a high charge rate of twenty-five (25) amperes and a low charge rate adjustable from 1.0 to 10.0 amperes. The operation of the charger shall be such that once every hour the voltage is "tested". If the voltage of the battery has been lowered the charger starts high charge. The high charge rate shall continue until the battery up to full charge. At that time a relay operates and returns the battery charger to low charge rate. The battery charger shall be rated single phase, 120 volts 60 cps input and rated approximately 28 volts output.

Lamp and Lighting Fixtures of types and sizes as indicated on the drawings shall be furnished and installed complete. Illustrations shown on the drawings shall be indicative of the general type desired and shall not restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent light-distribution and brightness

characteristics having equal finish and quality will be acceptable if approved by the Contracting Officer.

Accessories, such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

Lamps of the proper type, wattage, and voltage rating shall be furnished and installed in each fixture.

Incandescent Industrial-Type Fixtures shall conform to Federal Specification W-F-412c.

Incandescent Lamps: shall conform to Federal Specification W-L-101e. They shall be 120 volt operation unless otherwise specified.

Equipment Connections: All wiring for the connections of appliances and equipment indicated on the electrical drawings shall be furnished and installed.

Equipment installed under other sections of the specification shall have wiring extended to the equipment and proper connections made thereto.

Flexible Connections of short length shall be provided for all motors and equipment subject to vibration or movement. Flexible steel conduit shall conform to Federal Specification WW-C-566a. Liquid tight flexible conduit shall be used in wet locations.

Repair of Existing Work: The work shall be carefully laid out in advance and where cutting, channelling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces, necessary for the proper installation, support, or anchorage of the conduit, raceway, or other electrical work shall be carefully done, and any damage to buildings, piping and equipment shall be repaired by skilled mechanics of the trades involved, at no additional cost to the Government.

Tests: After the electrical system installation is completed, and such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. The test shall be performed in the presence of the Contracting Officer or his authorized representative. The Contractor shall furnish all instruments and personnel required for the test, and the Government will furnish the necessary electric power. Such other tests as required shall be carried out and the Contractor shall furnish the equipment and personnel required to perform such tests.

- End of Section -

20 ELECTRICAL WORK; EXTERIOR

General: The work consists of providing exterior electrical work complete.

Applicable Specifications and Standards: The work shall conform to current issues of the following publications:

Federal Specifications:

QQ-W-339 (2) Wire, copper, medium-hard-drawn
W-C-591c Conduit and Fittings; Fibre, Bituminized
WW-C-381d Conduit, metal rigid; and coupling, elbow, and nipple, electrical conduit: Zinc-coated.

Military Specifications:

MIL-T-152B Treatment, moisture-and-fungus-resistant of communications, electronic, and associated electrical equipment.
MIL-V-173B Varnish, moisture-and-fungus-resistant.

U. S. Department of Commerce:

National Bureau of Standards Handbook:

H30 National Electrical Safety Code.
H81 Installation and maintenance of electric supply and communication lines.

ASTM: (American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, Pa.)

B 229 Concentric-lay-stranded copper and copper covered steel composite conductor.

ASA: (American Standard Association, 70 East 45th Street, New York 17, N.Y.)

C7.8 Concentric-lay-stranded copper conductors, hard, medium-hard, or soft.

NBFU: (National Board of Fire Underwriters, 85 Johns Street, New York 38, N.Y.)

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NEMA: (National Electrical Manufacturers Association, Edison Electrical Institute, 750 Third Avenue, New York 17, N.Y.)

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SG2-1960 High-voltage fuses (Distribution cutouts, fuse links, power fuses, and current limiting reactors).

140 to 145, incl. Wet-process porcelain insulators.

Lal-1948 Lighting Arresters.

Electrical Installation: The installation shall conform to the latest applicable rules of the National Electrical Code and the workmanship shall be of the highest grade. Electrical materials shall be new and approved by the Underwriters' Laboratories, Inc., wherever standards have been established by the agency. In lieu of the Underwriters' Laboratories, Inc. approval, consideration will be given to certified reports of adequately equipped recognized independent testing laboratories competent to perform such testing, indicating conformance to all requirements of the applicable Underwriters' Laboratories, Inc., standards. Defective equipment or equipment damaged in the course of installation or test shall be replaced or repaired in a manner meeting with the approval of the Contracting Officer. The contract drawings indicate the extent and general arrangement of the conduit and wiring systems. If any departures from the "contract" drawings are deemed necessary by the Contractor details of such departures and the reasons therefore shall be submitted as soon as practicable, and within 30 days after award of the contract to the Contracting Officer for approval. No such departures shall be made without the prior written approval.

Standard Products: Unless otherwise indicated the materials to be furnished under this specification shall be the standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturers' latest standard design that complies with the specification requirements.

Material and Equipment Schedules: As soon as practicable and within 30 days after the date of notice to proceed and before commencement of installation of any materials or equipment, the Contractor shall submit a complete list, in triplicate, of materials, fixtures, and equipment to be incorporated in the work. The list shall include catalog numbers, cuts, diagrams, and such other descriptive data. Approval of materials will be based on manufacturers' published ratings. Any materials, fixtures, and equipment listed that are not in accordance with the specification requirements will be rejected.

Interruption of Service: All work shall be conducted in such manner that interruptions of electrical service are kept to a minimum in duration and number. Request for interruption of electrical service, schedule of operations in connection therewith shall be submitted in writing not less than 5 days prior to the intended outage and the Contractor shall proceed with the outage only if written approval is given by the Contracting Officer.

Fungus Control for Electrical Components: The equipment shall be treated to resist fungus and moisture as specified below:

Materials and components which are inherently fungus resistant or are protected by hermetic sealing need not be treated.

Circuit Elements, not covered above and which have a temperature rise of not more than 75 degrees F. when operating at full load, shall be coated with a fungus-resistant varnish conforming to Military Specification MIL-V-173b (1), Type I or Type II at the Contractor's option. The method of treatment shall be in accordance with Military Specification MIL-T-152b. Circuit elements include cable and wire.

Groundings: Except where specifically indicated otherwise, all exposed noncurrent carrying parts of electrical equipment, raceways and neutral conductor of the wiring systems shall be grounded. Ground rods shall be driven so that the tops are approximately 6 inches below the finished grade. Ground electrodes shall be driven ground rods of cone-pointed, copper-encased steel or solid copper having the upper 6 inches tinned. Copper-encased steel ground-rod shall be rolled to a commercially round shape from a welded copper-encased steel billet and shall have a conductivity not less than 27 percent of that of pure copper. The rods shall have clean, smooth, continuous copper surfaces and the proportion of copper shall be uniform throughout the length of the rod. Ground wires shall be secured to the upper ends of ground rods by approved copper alloy clamps brazed to the ground rods. Ground rods shall be 10'-0" long and shall have diameters sufficient to permit driving to the necessary depth without being damaged, but in no case shall they be less than 5/8 in. in diameter. Each ground rod shall be die-stamped near the top with the name or mark of the manufacturer and length of the rod in feet. The maximum resistance of the grounding systems shall not exceed ten ohms. If this resistance can not be obtained by the number of rods indicated, a sufficient number of additional rods shall be installed not closer than two (2) meters on centers, or if sectional type rods are used, additional sections may be coupled and driven with the first rod so that the resultant resistance will not exceed ten ohms.

Grounding at Poles: The grounding terminal of each lightning arrester, the tank of each transformer, and the neutral shall be solidly interconnected and connected to ground at each pole. Ground rods shall be at least three feet from the pole.

Grounding Conductor sizes shall be as indicated and be of stranded, bare, medium hard drawn copper. Grounding conductors at poles shall be protected by wood molding or plastic pipe extending not less than eight feet above grade.

Special Conditions: All equipment and overhead line construction shall be for a light loading district, and shall withstand winds of 50 miles per hour.

Concrete Poles:

Strength: Concrete shall have an ultimate compressive strength at 28 days of 2,500 psi. and compressive stress in extreme of 1125 psi. Allowable stress in tensile reinforcement of 20,000 psi. with a minimum yield of 40,000 psi.

Imbedments:

Through-Bolt Sleeves shall be located as required by the drawings and be exactly 1/4 diameter larger than the accommodated belt diameter.

Concrete Material shall meet the requirements of section entitled "CONCRETE FOR STRUCTURES".

Surface Finish: Exterior surfaces shall be a smooth, even taper from the ground-line to this top.

Limiting Requirements:

Chiseled and drilled holes will not be permitted. Honey comb, voids or weight saving vents will not be allowed.

Trowelling, cement washes or other types of filling washes will not be allowed.

Sweep, twists, or bulging will not be allowed.

Surfacing of Reinforcement will not be allowed.

Spalling, Chipping, excessive surface cracking or fractures will not be permitted. Imbedments improperly located will not be allowed.

Secondary Racks shall be 1, 2, 3, or 4 wire as shown and shall be complete with high-glaze spool type wet process porcelain insulators. Racks shall be of sheet steel not higher than No. 9 gauge. The vertical spacing between conductors, clearances between conductors and pole surfaces, method of providing climbing space, and strength requirements shall conform to the requirement of the National Bureau Standards Handbook H81. All steel shall be galvanized.

Crossarms and Fittings: Crossarms shall be straight grained, airdried or preservative treated. The wood species for treated crossarm shall be Yang; Yung; Pluang or Hiang. For untreated crossarm wood shall be Teng, Rang, Dang, or Kiam. The Crossarm shall be drilled for pins, through bolts, brace bolts, and double-arming bolts as applicable to the installation. Provide arm braces of adequate strength and length, bolted to the crossarm. Crossarms shall have cross-sectional dimensions not less than 8 cm. by 10 cm., except as otherwise shown. Crossarms shall be 130 cm. length unless otherwise shown.

Pins: Steel pins shall be one-piece steel, with lead threads and shall be designed to carry the full strength of the pin body to the top. They shall be of the long shank type and shall be equipped with lock washers and square nuts at the bottom of the crossarms. The diameter of shank shall be not less than 3/4 inch. Lead threads shall be securely banded to the steel and carefully formed to fit the insulator heads. Lead tops shall be

designed to prevent localized pressure on the insulator top when it is turned down too tightly.

Insulators: On the primary distribution system provide insulators of brown-glaze, wet-process porcelain or glass. Provide insulators of the pin type, suspension type, strain type, or clevis type as applicable to the installation. The 60-cycle, wet-flashover voltage of insulator assemblies shall be greater than 35,000 volts.

Lightning Arresters shall conform to the applicable recommendations and requirements of the National Electrical Manufacturers Association Standard L1-1958. Arresters shall be mounted with suitable mounting brackets and installed as shown.

Primary Fuse Cutouts: Provide cutouts conforming to National Electrical Manufacturers Association Standard, SG2-1960. Cutouts shall have a voltage rating as shown. The interrupting capacity of cutouts shall be not less than 8,000 rms asymmetrical amperes. Furnish six spare fuse links for each rating and type of cutout furnished.

Pole Line Hardware shall be hot-dipped galvanized. Suitable washers shall be installed under bolt heads and nuts. Washers used on through bolts and double-arming bolts shall be approximately 6 1/4 square and 5 mm. thick. The diameter of holes in washers shall be correct standard size for the bolt on which they are used. Double-arming bolts equipped with 4 nuts and 4 washers shall be installed for each double-arm installation.

Line Conductors: Primary conductors on crossarms shall be medium hard drawn bare copper wire conforming to the applicable requirements of Federal Specification QQ-W-339 (2), for solid conductor and ASTM Specification B229 for stranded conductors. Secondary conductors shall be thermoplastic insulated medium hard drawn copper wire conforming to the applicable requirements of American Standard Association C7.8. Conductors larger than No. 2 shall be stranded. Splices under tension shall be made mechanically and electrically secured by means of copper sleeves or tension line splices. Splicing sleeves shall be made of annealed copper tubing. Sleeves splices shall be made with not less than 3-1/2 turns. The equipment and methods used for stringing conductors shall be such that conductors shall not become kinked, twisted, or abraded, in any manner. The conductors shall not be prestretched, and shall be sagged in accordance with the sag tables indicated. Sagging operations shall not be carried on when wind or other adverse weather conditions prevents sagging. Stringing blocks must be used for sagging operations. No conductors shall be drawn across the insulators or crossarms. After being sagged, the conductors shall be allowed to hang in the stringing blocks for not less than one hour before being ties in, to permit the conductor tension to equalize. Where insulated wires are spliced, tapped, or have exterior covering injured, they shall be covered with neoprene tape. Service drop wires shall be pulled by hand only.

Tests: After the installation of the system is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. The test shall be performed in the presence of the Contracting Officer or his authorized representative. The Contractor shall provide all necessary instruments and personnel required in the test.

- End of Section -

2/ WATER DISTRIBUTION SYSTEM

General: The work consists of removal of an existing building service water line in way of construction, installation of a new service water line, valves, boxes and connections, complete.

Applicable Specifications: The work shall conform to current issues of the following publications:

Federal Specifications:

WW-P-404c	Pipe, Steel, Seamless and Welded, Black and Zinc-Coated (Galvanized)
WW-V-54b	Valve, Gate, Bronze, 125 & 150 Pound, screwed & flanged, (for Land Use)

Materials:

Steel Pipe, Fittings & Connections:

General: Pipes and fittings shall be standard screw type galvanized steel pipe, of the designated nominal pipe size. Pipe shall conform to Federal Specification WW-P-404c. The pipe shall have right hand tapered threads and be capable of watertight assembly without the use of jute, lamp-wicking or any other foreign material. Pipe may be furnished in random lengths and shall be furnished with one coupling for each length of pipe.

Valve, Smaller Than 3 inches shall be screwed type, bronze body and shall conform to Federal Specification WW-V-54b, Class B.

Valve Boxes: Valve boxes shall be concrete pipe. The cover shall have the word "WATER" cast in the concrete. Boxes shall be installed over each outside gate valve unless otherwise shown. The boxes shall be of such length as will be adapted without full extension, to the depth of cover required over the pipe at the valve location.

Installation of Pipe:

Pipe Handling: Pipe and Accessories shall be handled in such manner as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to damage the galvanizing.

Threading and Joining Pipe: Pipe threading shall be done with an American Standard die so that a tapered thread results that will be suitable to join the pipe and fittings

furnished. The pipe threads shall be out full. Threads shall be coated with graphite compound. No jute lamp-wicking or other similar material will be permitted in the joint. The joint shall be assembled so that no more than three threads remain exposed at each joint.

Installation of Valves: Gate

Gate Valves: Gate valves shall be installed in locations indicated or as directed. Gate valves underground shall be installed plumb and shall be equipped with valve boxes reaching to the ground surface to facilitate operation of the valve from the ground surface by means of a valve tool. The top of the valve box shall extend 5 cm. above the ground surface. The valve box shall be concrete.

Testing:

Testing of Galvanized Steel Pipe Connections: Galvanized steel pipe at service connections may be backfilled immediately after assembly and visual inspection by the Contracting Officer to insure that all couplings and fittings are properly tightened. After completion of the distribution system, the building connections shall be tested to insure watertight conditions. The Contractor shall locate and repair defective joints until no leakage is in evidence.

Test of Equipment: After the installation of the system is completed, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. The test shall be performed in the presence of the Contracting Officer.

- End of Section -

22. PAINTING, GENERAL

General: This section covers painting that is itemized hereinafter under SURFACE TO BE PAINTED and that is not specified in other sections.

Applicable Specifications and Standards: Work shall conform to current issues of the following publications:

Federal Specifications:

SS-C-192	Cement, Portland
TT-E-489c & Am-3	Enamel, Alkyd, Gloss, (for Exterior and Interior Surfaces)
TT-E-496 & Am-2	Enamel; Heat-Resisting (400° F.). Black
TT-E-506c	Enamel, Tints and White, Gloss, Interior
TT-E-508	Enamel, Interior, Semigloss, Tints and White
TT-E-543	Enamel-Undercoat, Interior, Tints and White
TT-P-0019a (Army-CE)	Paint, Aerylic Emulsion, Exterior
TT-P-29b & Int. Am-1	Paint, Latex, Base, Interior, Flat White and Tints
TT-P-30b	Paint, Alkyd, Odorless, Interior, Flat, White and Tints
TT-P-31c	Paint, Oil; Iron-Oxide, Ready-Mixed, Red and Brown.
TT-P-56b	Primer Coating (Primer-Sealer), Pigmented Oil, Plaster and Wallboard.
TT-P-61d	Paint, Exterior, Chrome-Green, Ready-Mixed.
TT-P-81d	Paint; Oil, Ready-Mixed, Exterior, Medium Shades on a Lead-Zinc Base.
TT-P-102a	Paint, Oil; (Titanium-Lead-Zinc and Oil, Exterior, Ready-Mixed White and Light Tints).
TT-P-320a	Pigment, Aluminum; Powder and Paste, for Paint.
TT-P-641b	Primer, Paint; Zinc Dust-Zinc Oxide (for Galvanized Surfaces).
TT-P-645	Primer, Paint, Zinc-Chromate, Alkyd Type.
TT-V-119	Varnish, Spar, Phenolic-Resin.

Federal Standard:

No. 595 Colors.
& Int. Change
Notice No. 1
(Army-CE)

Military Specifications:

MIL-S-12935B Sealer, Surface for Knots
MIL-P-15328B Primer, Pretreatment (Formula No. 117 for Metals).

General: The term "paint", as used herein, includes emulsions, enamels, paints, varnish, sealers, cement-latex filler, and other coatings, whether used as prime, intermediate, or finish coats.

Materials: Paints shall be in unbroken containers that plainly show at the time of use the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use. Pigmented paints shall be furnished in containers not larger than 5 gallons. Materials shall conform to the specifications shown in the painting schedule herein and to the requirements hereinafter specified.

Aluminum Paint shall consist of aluminum paste conforming to Federal Specification TT-P-320, Type II, class B; thinner compatible with varnish; and varnish conforming to Federal Specification TT-V-119, mixed in the proportion of 2 pounds of paste to not more than 1 pint of thinner to 1 gallon of varnish. The paste, thinner, and vehicle shall be field-mixed.

Cement-Latex Filler shall be of acrylic base.

(1) Materials:

(a) Portland cement: Federal Specification SS-C-192, Type I and shall be of the same brand as the cement used for the concrete work.

(b) Aggregate shall be washed sand containing not more than 0.5 percent colloidal clay. One hundred percent shall pass through a No. 20 sieve, 30 percent shall pass through a No. 70 sieve, and 100 percent shall be retained on a No. 100 sieve.

(c) Mixing Liquid acrylic polymer, 46 percent N.V., shall be the same latex resin emulsion as used in formulating exterior acrylic polymer, 46 percent N.V., shall be the same latex resin emulsion as used in formulating exterior acrylic emulsion paint specified below.

(d) Acrylic emulsion paint, exterior: Federal Specification TT-P-19.

(2) Composition:

Portland cement	16.5 pounds	
Aggregate	33.5 pounds	
Mixing liquid	0.75 gallon	
Potable water	maximum	1.5 gallons
Acrylic emulsion paint, exterior	1.0 gallon	

(3) Mixing instructions: Cement and aggregate shall be dry-mixed so that uniform distribution and intermixing are obtained. Water and mixing liquid shall be premixed and added gradually to the cement and aggregate with constant stirring until smooth. Acrylic emulsion paint shall be added to the foregoing and stirred until uniformity is obtained. The blend shall have a thick creamy consistency. Blending latex resin emulsion or latex paint with any other component shall be done with caution. Too rapid agitation will cause air entrapment and foaming. When either of those conditions is present, the paint shall not be applied until it is free of entrapped air form.

Exterior latex paint shall be exterior acrylic emulsion paint conforming to Federal Specification TT-P-0019a.

Exterior oil paint shall conform to the following Federal Specifications: White, TT-P-102, class A; light tints, TT-P-102, class B; green, TT-P-71; other medium colors, TT-P-81; red or brown, TT-P-31; black, TT-P-61.

Vinyl-type wash coat: Military Specification MIL-P-15328.

Fungicides: Both the specified first-coat material and finish paint shall contain a fungicide. The fungicidal agent shall be of a type that will not adversely affect the color, texture, or durability of the paint or size. One percent of one of the phenol mercuric compounds or 4 percent tetrachlorophenol will be acceptable. Four percent sodium tetrachlorophenale is acceptable for water-emulsion paint and size. Percentages are based on non-volatile vehicle content of the paint.

Samples and Testing: Suitably sized samples of only one brand for each type of paint proposed for use shall be submitted for approval sufficiently in advance of need to allow 30 days for testing. All test samples shall be supplied by and at the expense of the Contractor, and all tests will be made by the Government without cost to the Contractor.

Cleaning and Preparation of Surfaces:

a. General: Hardware, hardware accessories, factory finished or machined surfaces, plates, lighting fixtures, and similar items in place and not to be painted shall be removed prior to surface preparation and painting operations or otherwise protected. Any item shall be removed if necessary for the complete painting of the items and adjacent surfaces. Following completion of painting of each space, removed items shall be reinstalled. Such removal and reinstalling shall be done by workmen skilled in the trades involved. Exposed ferrous metal on surfaces to be painted with water-thinned paints shall be spot-primed with zinc dust-zinc oxide or red metal primer. Surfaces to be painted shall be clean before applying paint or surface treatments. Oil and grease shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning, except when sandblasting is employed. Cleaning solvents shall be of low toxicity and shall have a flash point in excess of 100°F. Cleaning and painting shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

b. Concrete, concrete-masonry-unit and Portland cement plaster surfaces to be painted shall be prepared by removing all efflorescence, chalk, dust, dirt, grease, oil, tar, and old weathered paint, and by roughening to remove glaze. Surface deposits of free iron shall be removed prior to painting. Immediately before coating with cement-latex filler, concrete surfaces to be painted shall be uniformly and thoroughly dampened, with no free surface water visible, by several applications of potable water with a fog spray, allowing times between the sprayings for the water to be absorbed.

c. Wood surfaces:

(1) Wood surfaces, shall be primed and finish-coated as specified in the painting schedule herein. Wood surfaces to be painted shall be cleaned of all dirt, oil, or other foreign substances with mineral spirits, scrapers, sandpaper, and/or wirebrush. Finished surfaces exposed to view shall be made smooth by sandpapering. All wood members that will be in contact with masonry, shall be given a coat of the specified first-coat material on all sides and edges before installation. Edges of doors that have been trimmed during hanging and fitting shall be given a coat of the specified first-coat material. Small, dry, seasoned knots shall be surface scraped and thoroughly cleaned, and shall be given a thin coat of knot sealer conforming to Military Specification MIL-S-12935 before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or if still soft, shall be removed with mineral spirits or turpentine and the resinous area thinly coated with knot sealer. After priming, all holes and imperfections in finish surfaces shall be filled with putty or plastic wood-filler colored to match the finish coat, allowed to dry, and sandpapered smooth. Unless otherwise authorized, painting shall proceed only when the moisture content of the wood does not exceed 15 percent as measured by a moisture meter.

d. Ferrous surfaces that have not been shop-coated shall be cleaned and painted with protective paint, followed by finish coats as hereinafter specified. Shop-coated metal shall be protected from corrosion before and after installation by treating corroded areas immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be wire-brushed and touched-up with the same material as the shop coat. Cut edges of galvanized sheets and exposed threads and cut ends of galvanized piping, electrical conduit, and metal pipe sleeves, not to be finish painted, shall be solvent-cleaned and primed with zinc dust-zinc oxide metal primer.

e. Galvanized and zinc-copper-alloy surfaces to be painted shall be solvent-cleaned and treated with vinyl-type wash coat as hereinafter specified. Galvanized and zinc-copper-alloy surfaces not to be painted shall be solvent-cleaned.

f. Aluminum and aluminum-alloy surfaces to be painted shall be solvent-cleaned to remove oil and grease and then treated with vinyl-type wash coat as hereinafter specified. Aluminum and aluminum-alloy surfaces not to be painted shall be solvent-cleaned. Painting to protect aluminum from contact with dissimilar materials is specified under the section of the specifications covering this specific item.

g. Copper surfaces to be painted shall be solvent-cleaned and treated with vinyl-type wash coat as hereinafter specified. Copper surfaces not to be painted shall be solvent-cleaned.

h. Portland cement plaster surfaces shall be dry, clean, and free from grit, loose plaster, and surface irregularities before paint is applied. Plaster to receive oil or varnish-base materials shall have an instrument-measured moisture content not to exceed 8 percent.

Where plaster surface contains severe suction spots, one coat of primer does not give a uniform finish (as to color and gloss), a second coat of primer should be applied or at least the suction spots touched up with a second coat of primer before applying the finish coats without additional cost to the Government.

i. Mastic-type surfaces to be painted shall be prepared by removing all foreign material.

j. Fabric covering or laminated-paper jackets (concealed or exposed) over insulation on pipes, ducts, and other equipment shall be given a heavy coat of nonpenetrating size to which subsequent paint coats will permanently adhere. The size shall be applied in such manner as to completely seal the surface. A sufficient amount of fungicidal agent shall be added to the size and each finish coat of paint thereafter to render the fabric mildewproof.

Paint Application:

a. General: The finished surfaces shall be free from runs, drops, ridges, waves laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat of paint would not increase the hiding. All coats shall be so applied as to product film of uniform thickness. Special attention shall be given to insure that edges, corners, crevices, welds, and rivets receive a film thickness equivalent to adjacent painted surfaces. Respirators shall be worn by persons engaged or assisting in spray painting. Adjacent areas and installation shall be protected by the use of drop cloths or other approved precautionary measures. Metal or wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up prior to the application of water-thinned paints.

b. Storage, mixing, and thinning: At time of application, paint shall show no signs of deterioration. Paint shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Paints of different manufacturers shall not be mixed together. Where necessary to suit conditions of surfaces, temperature, weather, and method of application, the packaged paint may be thinned immediately prior to application in accordance with the manufacturers' directions, but not in excess of 1 pint of suitable thinner per gallon. The use of thinner for any reason shall not relieve the Contractor from obtaining complete hiding.

(1) Aluminum paint shall mixed just prior to use. The paste pigment shall be reduced to a slurry by the addition of not more than 1 pint of thinner for 2 pounds of paste. The slurry shall then be added to the varnish.

(2) Vinyl-type wash coat shall be mixed by adding 1 volume of acid component to 4 volumes of resin component. The acid component shall be added slowly with constant stirring to the resin component. After mixing, the wash coat shall be used within 8 hours. If additional thinning is required to maintain a wet spray, reduction shall be made with normal butyl alcohol or 99 percent isopropyl alcohol.

c. Time between surface preparation and painting: Surfaces that have been cleaned, pretreated, and/or otherwise prepared for painting shall be given a coat of the specified first-coat material as soon as practicable after preparation has been completed, but in any event prior to any deterioration of the prepared surface.

d. Method of paint application: Except for the cement-latex filler coat, which shall be applied by brush, applications on interior masonry surfaces may be by brush, roller, or spray. Vinyl-type wash coat used on metal surfaces may be applied by brush, spray, or swab. On other surfaces, exterior first coats shall be applied by brush; subsequent coats and interior coats may be applied by brush, roller, or spray. Rollers for applying enamel shall have a short nap. Areas inaccessible to spray painting shall be coated by brushing or other suitable means. Brushes used for the application of water-emulsion paints shall be soaked in water for a period of 2 hours prior to brushing operation.

(1) Cement-latex filler shall be vigorously scrubbed into the surface with a stiff-bristle brush having Tampico or Palmyra bristles not longer than 2-1/2 inches. All surfaces voids, pores, and cracks shall be completely filled. The dry film shall be uniform and free from pinholes or other voids. The material shall not be applied over caulking compound. Curing of cement-latex filler coating is not required.

(2) Exterior latex paint: At least 24 hours shall elapse before applying exterior latex paint over cement-latex filler coat. When the ambient temperature is in excess of 85°F., cement-latex filler surfaces shall be lightly dampened with a fog spray of potable water immediately prior to application of the subsequent latex paint coat.

(3) Vinyl-type wash coat shall be applied at a coverage rate of 250 to 300 square feet per gallon to give a dry-film thickness of 0.3 to a maximum of 0.5 mil. Care shall be exercised in spray application to avoid the deposition of dry particles on the surface. A wet spray shall be maintained at all times. Surfaces treated with the wash coat shall be permitted to dry for not less than 1 hour and shall be coated as soon thereafter as possible.

Surfaces to be Painted:

a. General: Except as specified under paragraph, SURFACES NOT TO BE PAINTED, the surfaces indicated to be painted and listed in the painting schedule below shall receive the surface preparation, paints, and number of coats prescribed. Piping shall not be painted until piping has been tested and approved. Explanatory information for use with the painting schedule is as follows:

(1) Surfaces of fabricated and assembled items that are finish-painted by the manufacturer, or specified to be finish-painted under other sections of the specification, are exempted from the following schedule requirements for surface preparation and painting. Shop-primed items shall receive surface preparation and finish painting as required by this section.

(2) Color and tints; shall match the respective color specimens selected by the Contracting Officer. Colors and tints shall conform to Federal Standard Number 595. All preceding coats shall match approximately the color of the finish coat. Color chips shall be submitted for approval.

(3) Method of Surface Preparation and pretreatment shown in the schedule is for identification purposes only. Cleaning and pretreatment of surfaces prior to painting shall be accomplished in accordance with the detailed requirements described hereinbefore.

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b. Painting Schedule:

<u>Surface</u>	<u>Surface Preparation and Pretreatment</u>	<u>1st coat</u>	<u>2nd coat</u>	<u>3rd coat</u>
Exterior poured concrete surfaces (except slab surfaces).	Remove all foreign matter, efflorescence, loose particles and roughen glazed surfaces.	Cement-latex filler	None	None
Exterior Portland cement plaster surfaces.	Remove all foreign matter, efflorescence, loose particles and roughen glazed surfaces.	Exterior-latex	Exterior-latex	None
Exterior ferrous surfaces subject to atmospheric exposure.	As previously specified.	Exterior oil paint	Exterior oil paint	None
Exterior galvanized and zinc-copper-alloy surfaces.	Wash with solvents, apply vinyl-type wash coat.	TT-P-641 Type II	Exterior oil paint	None
Exterior and interior aluminum and aluminum-alloy surfaces.	Clean with solvents, apply vinyl-type wash coat.	TT-P-645	TT-E-489 Class A	TT-E-489, Class A
Exterior copper surfaces.	Clean with solvents, apply vinyl-type wash coat.	Exterior oil paint	Exterior oil paint	None
Exposed exterior caulking compound.	None	Aluminum paint	Same as adjacent areas.	
Interior and concrete masonry units, concrete (except concrete floors)	As previously specified for each type of surface.	TT-P-29	TT-P-29	None

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<u>Surface</u>	<u>Surface preparation and pretreatment</u>	<u>1st coat</u>	<u>2nd coat</u>	<u>3rd coat</u>
Interior ferrous surfaces, unless otherwise specified.	As previously specified.	TT-E-543	TT-E-508	None
Interior Portland cement plaster surfaces unless otherwise specified.	As previously specified.	TT-P-56	TT-P-30	TT-P-30
Ferrous surfaces of mechanical equipment and machinery other than machined surfaces.	As previously specified.	TT-E-489 Class A	TT-E-489 Class A	None
Wood and metal trim, and doors.	As previously specified for each type of surface.	TT-E-543	TT-E-543	TT-E-508
Interior wood and metal surfaces and galvanized metal surfaces.	As previously specified for each type of surface.	TT-E-543	TT-E-543	TT-E-506
Interior hardboard surfaces.	As previously specified for wood surfaces.	TT-E-543	TT-E-508	None
Interior galvanized metal surfaces.	Wash with solvent, and apply vinyl type wash coat.	TT-P-641 Type II	Paint to match adjacent surfaces.	
Electrical conduit runs, metallic tubing, ducts, pipe hangers, leuvers, and grilles, other than surfaces specified elsewhere to be asphaltic-coated surfaces, in areas having painted adjacent surfaces.	As previously specified for each type of surface.	TT-E-543	TT-E-543	TT-E-508

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<u>Surface</u>	<u>Surface preparation and pretreatment</u>	<u>1st coat</u>	<u>2nd coat</u>	<u>3rd coat</u>
Exposed threads of galvalnized piping and electrical conduit and cut edges of galvanized sheets not to be finish painted interior and exterior.	Solvent clean.	TT-P-641 Type II	None	None
Asphaltic-coated surfaces.	Remove all foreign matter.	TT-P-29	Second and third coats to match adjacent surfaces.	
Exterior or interior metal surfaces subject to high temperature (up to 400°F.)	Solvent cleaning and wire brushing no pretreatment.	TT-E-496, Type II	TT-E-496 Type II	None
Fabric covering over insulation (concealed or exposed)	As previously specified.	Paint to match adjacent surface		
Laminated-paper jacket and organic (cellulose) over insulation (concealed or exposed)	Remove foreign matter.	TT-P-29	TT-P-29	None

Surfaces Not To be Painted: The following listed items will not require painting:

- a. Interior of concrete pipe trenches.
- b. Concrete floor, and exterior concrete slabs.
- c. Unexposed interior ferrous surfaces.
- d. Anodized aluminum surfaces.
- e. Corrugated asbestos cement roofing and accessories.

Cleaning: All cloth and cotton waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day. Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint spots, oil, or stains upon adjacent surfaces shall be removed and the entire job left clean and acceptable to the Government.

- End of Section -

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