

SECTION 1 - SITE PREPARATION

1.1 General Requirements: The work includes the clearing and grubbing within the construction limits shown, and the disposal of waste material resulting therefrom.

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

Grading entire area to eliminate humps and rice paddy dikes sufficient for mowing entire antenna field using power mowers.

1.3 Grubbing: Tree stumps shall be removed entirely. Tree roots and matted roots of brush shall be grubbed out to a depth of not less than 60 cm. below the finished subgrade for roads and buildings and to a depth of not less than 30 cm. for other locations.

1.4 Waste and Debris shall not be disposed of by piling it up along the limits of the area required to be cleared.

1.4.1 Non-Combustible waste and debris shall be gathered and disposed of as directed.

1.4.2 Combustible waste and debris shall be gathered for burning, except that when permitted (in writing) by the Contracting Officer, logs, and larger stumps may be removed and disposed of without burning at locations out of sight of public view.

1.4.2.1 Locations for burning shall be either in the cleared area near the center or in adjacent open areas where existing trees or other vegetation will not be harmed.

1.4.2.2 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.

1.4.2.3 Ashes shall be disposed of as for non-combustible material.

1.4.2.4 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 Contracting Officer for approval.

1.4.2.5 Rehandling: When conditions are not suitable for burning operations and waste material interferes with subsequent construction, such material shall be moved to locations clear of construction operations and later rehandled and burned or disposed of at approved locations and times.

- End of Section -

SECTION 2 - EARTHWORK

2.1 General Requirements: The work includes the providing of excavation, filling and backfilling, preparing embankment areas, formation of embankments, preparation of subgrades, construction of shoulders for roadways, complete, in strict accordance with the specifications and applicable drawings, and subject to the terms and conditions of the contract.

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

2.2 Applicable Specifications and Standards:

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

D 698-58T	Methods of test for moisture-density relations of soils, using 5.5-lb. rammer and 12-in. drop (tentative).
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2.3 Equipment: Any suitable and properly maintained type of equipment may be used. Equipment failing to achieve requirements specified shall be replaced.

2.4 Excavation:

2.4.1 Excavation for Structures shall conform to the dimensions and elevations shown, and the excavation shall extend a sufficient distance from the structure to allow for placing and removal of forms, and for inspection, except where concrete for structures is authorized to be deposited directly against excavated surfaces. When concrete 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.

2.4.2 Borrow Excavation shall consist of approved material excavated from borrow areas outside the normal grading limits for the completion of the embankments or for other purposes. Borrow excavation shall be made only at designated locations, and within the horizontal and vertical limits as staked or directed.

The Contractor shall notify the Contracting Officer sufficiently in advance of the beginning of excavation in order that necessary tests can be made. Unsuitable material encountered in borrow operations shall be excluded from the work. All borrow pits shall be opened up to expose the vertical face of various strata of acceptable material to obtain a uniform product. Borrow pits shall be excavated to regular lines and shall be drained if practicable and left in a neat and presentable condition with all slopes dressed uniformly.

2.5 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.

2.6 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.

2.7 Filling and Backfilling:

2.7.1 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.

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

2.7.3 Fill for Structures and Roadways shall be placed in horizontal layers of not more than 15 cm. for the full width of pre cross section, each layer to be thoroughly compacted and rolled before placing the next layer. Fill for structures shall be tested and proven to have attained a soil bearing capacity of not less than 2,000 ASF (10 tons/m²), or to a degree of compaction of not less than 95% of maximum density.

2.7.4 Degree of Compaction: Unless otherwise specified, the upper 15 cm. layer of fill within roadways and structures shall be compacted to a density of not less than 95% and 98% of maximum density respectively. All other fills shall be

compacted to a density of not less than 90% of maximum density. The maximum density as herein referenced shall be determined in accordance with the requirements of ASTM Designation D 698-58T, Method "D".

2.8 Preparation of Embankment Area:

2.8.1 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.

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

2.9 Formation of Embankment:

2.9.1 Material shall consist of suitable excavated material or borrow of 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.

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

2.9.3 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.

2.9.4 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.

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

2.10 Preparation of Subgrades:

2.10.1 Unsuitable Material within the top 15 cm. of the subgrade area shall be removed.

2.10.3 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.

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

2.10.5 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.

2.11 Shoulder Construction for Roadways: Shoulders shall be constructed with suitable approved material. 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.

2.12 Acceptance of Subgrade or Embankment: Each lift of embankment material placed by the Contractor shall be subject to approval. 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 Contracting Officer.

2.13 Tests: All tests required by the Contractor to control the quality of the work, and as specified hereinafter, shall be made by the Contractor under the supervision of the Contracting Officer by and at the expense of the Contractor.

2.13.1 Moisture-Density Relationship of Soils: The Contractor shall conduct a minimum of one moisture-density relationship of each type of soil encountered in the work. A sample of each soil shall also be maintained in glass containers for subsequent reference purposes. Each container shall be labeled with the sample number, maximum dry density and the optimum moisture content. Test shall be in accordance with ASTM Designation D698-58T, Method D.

SECTION 3 - TOPSOILING AND SPRIGGING

3.1 General Requirements: The work includes the providing of topsoil and sprigging for all areas disturbed by construction.

3.2 Materials:

3.2.1 Topsoil shall be a natural friable clay or other 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 operations may be utilized, or may be obtained from approved off-site locations that are naturally drained.

3.2.2 Sprigs shall be the healthy living stems 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.

3.2.3 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.

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

3.4 Topsoiling: Where shown, 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 sprigging operation is begun.

3.5 Sprigging:

3.5.1 Harvesting of Sprigs: Method of harvesting shall be as approved. 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.

3.5.2 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. Cover the roots with soil immediately after placing in the furrow in such manner that the surface is left even at the designated grade.

3.5.3 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.

3.5.4 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 5 DOUBLE BITUMINOUS SURFACE TREATMENT

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

5.2 Applicable Specifications and Standards:

5.2.1 Federal Specifications:

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

5.3.1 Mineral Aggregate shall consist of crushed stone or crushed gravel, free from adherent film of clay, and shall be of such nature that a through 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.

5.3.1.1 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.

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

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

<u>Sieve Designation</u>	<u>Percentage (By Weight)</u> <u>Passing Square Mesh Laboratory Sieves</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

5.3.2 Bituminous Material for Surface Treatment:

5.3.2.1 Rapid Curing Cut-Back Asphalt shall conform to Federal Specification SS-A-671b, grade RC-2, 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-2, 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, Saybolt Furel.

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

5.3.3 Bituminous Material for Prime Coat shall be medium curing cut - back asphalt conforming to Federal Specification SS-A-671b, grade MC-0 or MC-1, as applicable, Application temperature shall be as directed within the range of 70 to 140 degrees F. for MC-0 and 110 to 185 degrees F. for MC-1.

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

5.4.1 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.

5.4.2 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.

5.4.3 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.

5.4.4 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 the bituminous mixture from sticking to them.

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

5.4.6 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.

5.4.7 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.

5.5 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 double bituminous surface treatment.

5.6 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.

5.7 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.

5.8 Surface Treatment:

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

5.8.2 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 become coated or mixed with dirt or any other foreign material shall be removed, replaced with clean aggregate, and rerolled, as directed. All surplus aggregates shall be swept off the surface and removed prior to the second application of bituminous material.

5.8.3 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.

5.8.4 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.

5.8.5 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 B - CONCRETE WORK

8.1 General Requirements: The work covered by this section includes the providing of concrete work for stiffeners, complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

8.2 Materials:

8.2.1 Cement shall be portland cement, dry and free from lumps and caking and, when packaged, shall be in canvas 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. 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.

8.2.2 Fine Aggregate:

8.2.2.1 Composition: 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.

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

8.2.2.3 Grading: Grading of the fine aggregate shall be as follows:

<u>Sieve Designation</u>	<u>Percentage by Weight</u>
<u>U.S. Std. square mesh</u>	<u>Passing</u>
3/8" (9.50 mm)	100
No. 4 (4.75 mm)	95 - 100
No. 8 (2.38 mm)	80 - 100
No. 16 (1.19 mm)	50 - 85
No. 30 (0.59 mm)	25 - 60
No. 50 (0.30 mm)	10 - 30
No. 100 (0.15 mm)	2 - 10
No. 200 (0.07 mm)	0 - 4

8.2.2.4 Deleterious Materials In the fine aggregate shall not exceed the following limits:

<u>Material</u>	<u>Percentage by Weight</u>
Clay lumps	1.0
Material finer than No. 200 sieve	3.0
Saturated surface-dry material, coarser than No. 50 sieve, floating on liquid having a specific gravity of 2.0	0.5

8.2.3 Coarse Aggregate:

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

8.2.3.2 Quality: Aggregate, as delivered to the mixer, shall consist of clean, hard, angular, unweathered and uncoated particles. Where necessary, dust and other coatings shall be removed from the coarse aggregates by adequate washing.

8.2.3.3 Size and Grading: The maximum nominal size of the coarse aggregate shall be 38 mm. The coarse aggregate shall be well graded within the limits specified, and shall conform to the following grading requirements as delivered to the mixer:

<u>Sieve Size</u> <u>U.S. Standard square mesh</u>	<u>Percent by Weight Passing</u>
1 1/2" (38 mm)	90 - 100
1" (25 mm)	20 - 55
3/4" (19 mm)	0 - 15
3/8" (9.5 mm)	0 - 5
No. 200 (0.07 mm)	0 - 2

8.2.3.4 Deleterious Materials In the coarse aggregate shall not exceed the following limits:

<u>Material</u>	<u>Percentage by Weight</u>
Clay lumps	0.25
Material finer than No. 200 sieve	1.0
Saturated surface-dry material floating on liquid having a specific gravity of 2.0	1.0

8.2.4 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.

8.2.5 Curing Materials may be waterproof paper, cotton mats, burlap, or other approved means.

8.2.6 Forms shall be of a good grade of lumber or plywood and shall be subject to approval.

8.2.7 Reinforcing Steel shall be plain, structural grade billet steel, free from rust and mill scale. Steel shall have a minimum tensile strength of 53,000 lbs. per sq. in. or 3,860 kg/sq. cm. and a minimum yield point of 33,000 lbs. per sq. in. or 2,320 kg/sq. cm. Deformed bars of equal strength may be substituted for plain bars without reduction in bar area.

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

8.3.1 Design: 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. 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 prying against the concrete.

8.3.2 Form Ties shall be of suitable design and adequate strength for the purpose. Wire ties will not be permitted.

8.3.3 Coating: Forms for exposed surfaces shall be coated with color-less mineral oil before reinforcement is placed. Surplus oil on form surfaces and any oil on reinforcing steel shall be removed.

8.3.4 Removal: Forms shall be removed only after approval and in a manner to insure complete safety of the structure.

8.4 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 not be permitted.

8.5 Strength Requirements: Concrete required for the project shall be proportioned and mixed for a minimum ultimate compressive strength at 28 days of 3,000 lbs per sq.in. or 210 kg per sq.cm. using standard 6 inch diameter cylindrical specimens.

8.6 Proportioning of Concrete Mixes: Concrete shall be mixed by volume in the proportion of one part cement to 2.5 parts fine aggregate and 4 parts coarse aggregate.

8.6.1 Cement: A bag of portland cement will be considered as 50 kg in weight. The concrete as mixed shall contain not less than six 50 kg bags of cement per cubic meter.

8.6.2 Cement-Water Ratio: The concrete shall contain not more than 29 liters of water per 50 kg bag of cement in the mixed concrete, unless otherwise directed in order to obtain the specified slump.

8.6.3 Concrete Strength and Proportioning is based on the assumption that saturated-surface dry aggregates are used, and/or that the amount of water specified includes the free water in the aggregate.

8.7 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:

Slump for vibrated concrete

<u>Minimum</u>	<u>Maximum</u>
5.0 cm	10.0 cm

8.8 Batching and Mixing:

8.8.1 Concrete Mixing Equipment shall be power operated and in good mechanical condition. Hand mixing will not be permitted without written approval. Provisions shall be made for introducing cement, aggregate and water into the mixer in the proper quantities.

8.8.2 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, shall not be permitted. The entire batch shall be discharged before recharging.

8.8.3 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 $1/2$ cu.m. or fraction thereof.

8.9 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.

8.10 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 inner surfaces of mixer and conveying equipment. Reinforcement shall be secured in position, inspected and approved before pouring of concrete.

8.11 Placing Concrete: Concrete shall be handled from mixer 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. 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 formation and planes of weakness within the section.

8.11.1 Concrete shall not be placed except in the presence of the Contracting Officer nor prior to his approval of forms and placement of reinforcing bars. In no case shall approval relieve the contractor of responsibility for the work.

8.12 Compaction:

8.12.1 Concrete 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.

8.12.2 Vibrators shall in no case be used to transport concrete inside forms. Use of form vibrators will not be permitted. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete.

8.13 Finishes of Concrete: Slight honey-comb and minor defects in all concrete surfaces shall be patched with cement mortar of one part cement and two parts sand. Trowel 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 straight edges 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 wood floated 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.

8.14 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.

8.14.1 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.

- End of Section -

SECTION 9 - MASONRY

9.1 General Requirements: The work includes the providing of all brick masonry work, complete, in strict accordance with the applicable drawings and specifications and subject to the terms and conditions of the contract.

9.2 Brick: Common brick shall be of the type and sizes conforming to local brick standards.

9.3 Mortar shall be in the proportion of 1 part portland cement, 1 part hydrated lime and 4 1/2 parts sand mixed with sufficient water to make a mortar of such consistency that it can be handled easily with a trowel. Mixing shall be performed in mechanical mixers, unless hand-mixing and equipment used are approved by the Architect. The dry materials shall be thoroughly mixed before water is added. The mortar shall be used within 45 minutes after mixing or shall be discarded. Retempering of mortar will not be permitted.

9.4 Laying of Units: No brick having a film of water on its surface shall be laid. Bricks shall be wetted before laying. Each brick shall be laid in a full bed of mortar. Brick shall be laid plumb, true to line, with level courses, and with each course breaking joints with the course next below. Any brick(s) that are disturbed after the mortar has stiffened shall be removed and retain with fresh mortar. Mortar in the joints of the brickwork shall be struck off flush.

- End of Section -

SECTION 11 - PLASTERING

11.1 General Requirements: The work includes the providing of all plaster work complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

11.2 Materials:

11.2.1 Cement: Portland cement, type for general concrete construction.

11.2.2 Sand: Salt free, clean and screened, gradation as follows:

<u>Sieve size</u>	<u>Percent by weight retained</u>	
	<u>Maximum</u>	<u>Minimum</u>
No. 4 (4.76 mm)	0	0
No. 8 (2.38 mm)	5	0
No. 16 (1.19 mm)	30	5
No. 30 (0.59 mm)	65	30
No. 50 (0.297 mm)	95	65
No. 100 (0.149 mm)	100	90

11.3 Protection: Woodwork, glass, floors and other finishes shall be carefully protected from damage and from plaster droppings. All damages shall be repaired and necessary patching shall be done by the Contractor.

11.4 Workmanship: Plastering shall be carefully installed. Finish surfaces shall be plumb, straight, true and free from waves or defects of any kind.

11.5 Proportions: Cement plaster for all coats shall be mixed in the proportions of 1-part portland cement, 3-parts sand, and 1/10-part hydrated lime.

11.6 Application of Plaster: Properly regulated ventilation shall be provided in areas being plastered. Masonry surfaces on which suction must be reduced shall be dampened with a fog spray. Unless otherwise indicated, plastering shall be 3-coat work on all plaster bases, and the scratch and brown coats shall be carried down to the floor. Finish coats shall have a reasonably uniform thickness of approximately 10 millimeters, and the minimum thickness at any point shall be 8 millimeters. The thickness of the plaster, from the face of the

plaster base to the finished plaster surface, shall be not less than 15 millimeters over masonry. Plaster corners above bull-nose facing-tile wainscots shall be neatly molded to the radius of the facing tile and formed flush therewith.

11.6.1 Scratch Coat shall be full and thick and shall be applied with sufficient force to form good keys. The scratch coat shall be cross-scratched upon attaining its initial set and shall be kept damp with a fog spray.

11.6.2 Brown Coat shall be applied after the scratch coat has set, but not less than 24 hours after the application of the scratch coat, when applied directly to masonry, the brown coat shall be applied with sufficient pressure to fill the joints, to prevent air pockets and secure a good bond. The brown coat shall be lightly scratched and broomed, shall be kept moist with a fog spray for 2 days, and then be allowed to dry out.

11.6.3 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 with a fog spray. Cement plaster shall be given a sand float finish of an approved uniform texture. The finish coat shall be kept moist with a fog spray for at least 2 days, and thereafter shall be protected against rapid drying until properly and thoroughly cured.

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

- End of Section -

SECTION 12 - CAULKING

12.1 General Requirements: The work involves the providing of all caulking work, complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

12.2 Materials:

12.2.1 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 light gray.

12.2.2 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 3.73 liter of thinner. The materials shall be field mixed.

12.2.3 Rope Yarn shall be the revealed strands of rope fiber, free from oil or other staining elements.

12.3 Samples of all materials proposed for use shall be submitted to the Contracting Officer for approval.

12.4 Preparation of Surfaces:

12.4.1 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.

12.4.2 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.

12.4.3 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.

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

12.5 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.

12.6 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.

12.7 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 13 - TERRAZZO

13.1 General Requirements: The work includes the providing of all terrazzo work, complete, in strict accordance with the specification and applicable drawings, and subject to the terms and conditions of the contract.

13.2 Materials:

13.2.1 Portland Cement shall conform to the applicable requirements of the section entitled CONCRETE WORK.

13.2.2 Water shall conform to the applicable requirements of the section entitled CONCRETE WORK.

13.2.3 Sand shall be clean, siliceous masonry sand passing a 19 millimeters screen.

13.2.4 Coloring Material shall be the best quality of mineral pigment of high purity, shall be finely ground, sunproof, and limeproof, and shall have a specific gravity similar to that of portland cement. Coloring material shall not exceed 5 percent, by weight, of the cement used.

13.2.5 Marble Chips shall be hard and durable. Size No. 1 chips shall pass a 1/4-inch-mesh screen and be retained on a 1/8-inch-mesh screen. Size No. 2 chips shall pass a 3/8-inch mesh screen and be retained on a 1/4-inch-mesh screen.

13.2.6 Mortar shall be composed of one part cement and three parts of sand thoroughly mixed dry before adding sufficient water for proper workability.

13.2.7 Cleaning Compound used for cleaning terrazzo shall be an approved neutral chemical cleaner free from acids and strong alkalis or other material that would affect the color or otherwise damage the terrazzo.

13.2.8 Preservative Material for terrazzo floors shall be an approved material of a type required to produce a waterproof finish that will not be impaired by immersion in water at room temperature for a period of 2 1/2 hours, approximately 18 hours after the floor is finished by buffing, as specified. The preservative material shall not discolor the terrazzo nor leave a tacky or sticky finish film on the surface after buffing.

13.2.9 Terrazzo shall be composed of 1 part cement and 2 parts marble chips of the sizes and colors selected by the Contracting Officer from the samples submitted to him for approval.

13.2.10 Division Strips shall be 3 millimeters thick of brass and shall not be less than 19.6 millimeters wide. Strips shall be of the same material and thickness and shall conform to the profile of the base.

13.3 Preparation for Terrazzo: Concrete slabs shall be of a suitable rough texture to bond to the terrazzo finish. Any surface that is too smooth shall be roughened with a toothed chisel and, prior to laying the terrazzo, shall be cleaned of all dirt, oil, grease and extraneous material.

13.3.1 Division strips for terrazzo floors shall be set immediately after spreading the underbed, the strips being partially embedded therein, securely anchored to the sub-floor and grouted solid. Division strips shall be set straight to lines and to the proper level to ensure that the tops of the strips will show uniformly after grinding and smoothing operations are completed. End joints and intersections shall be fitted tight. Strips shall be braced to prevent bulging during the placing of the terrazzo.

13.4 Sample Pattern: The contractor shall construct for approval two one meter square sample models, for the Contracting Officer's approval, of each color pattern of the terrazzo work proposed for the project. One sample will be retained by the Contracting Officer and the other returned to the contractor.

13.5 Laying Terrazzo: The forms shall be swept clean and moistened, installed in the green underbed. The terrazzo mix shall be spread, tamped, and rolled into a compact mass of sufficient depth that after surface grinding the thickness shall be as shown. After rolling, additional aggregate mix shall be sprinkled over the surface to fill up all depressions, to take up excess moisture, and to permit the terrazzo to be troweled to a level, dense, and even surface, slightly above the finish line of the floor. This level shall allow for the surface grinding necessary to expose the specified area of aggregate, and to produce smooth, level surface free of waves and depressions.

13.6 Curing: The completed terrazzo shall be kept moist and free of traffic during a 6-day curing period. The curing shall be accomplished by (1) covering with approximately 25 millimeters thickness of sand, or (2) covering with building paper or mats, or (3) sprinkling with water at not over 10-hour intervals.

13.7 Surfacing: Following the curing period, the terrazzo shall be machine-ground to a true even surface using No. 24 grit followed by No. 60 grit or finer abrasive stone. After the first grinding, the surface shall be thoroughly grouted with the same cement and color composition as specified for the matrix of the terrazzo mix. The grout shall be of the consistency of thick cream, and shall be brushed over the surface to eliminate all imprisoned air and to thoroughly fill the surface for final grinding.

13.8 Finishing: Not less than 72 hours after application, the grouting coat shall be removed by grinding. In the latter stages of grinding the gritstones or other abrasive used in the grinding machine shall be of a grain that will give the surface a honed finish. Small areas, inaccessible portions, and corners that cannot be reached by the grinding machine shall be ground and rubbed by hand. The honed surface of finished terrazzo shall show not less than 70 percent of the area as exposed aggregate evenly distributed, and shall conform in appearance to the approved samples.

13.9 Protection: After the finish grinding has been completed and the surface treatment applied, the terrazzo work shall be covered and protected with approved material until completion of the work of all other trades.

13.10 Cleaning and Coating: Prior to the placing of the protective covering, or if approved, after the work of all other trades has been completed and the protective covering removed, terrazzo work shall be washed with an approved cleaning compound mixed with warm water, and shall be cleaned with a fine abrasive where necessary to remove any stains or cement smears. The terrazzo shall be allowed to dry thoroughly and shall be given a sealing application of approved preservative material. The sealing preparation shall be applied in accordance with the manufacturer's directions, leaving all terrazzo work in clean condition as approved.

- End of Section -

SECTION 15 - TILE WORK

15.1 General Description: The work includes providing all tile work, complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

15.2 Materials:

15.2.1 Glazed Ceramic Tiles shall be approximately 3/8 inch thick and shall have matte glazed finish on exposed-to-view surfaces. Stops, returns, trim units, caps and special shapes shall be provided as required for sills, jambs, recesses, offsets and other conditions so as to provide a complete and neatly finished installation. Color shall be as approved by the Contracting Officer.

15.2.2 Lime: Lime shall be hydrated lime suitable for tile work. The total unhydrated calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product shall not exceed 8 percent by weight, calculated.

15.2.3 Sand for setting beds, base coats and grout shall be clean, washed, sharp, durable particles, free from silt, loam, clay, soluble salts, and organic impurities. Sands for setting bed of floors shall be well graded, passing a No. 8 sieve, with not more than 8 percent passing a 100-mesh screen. Sand for grout shall be screened to pass a 30-mesh sieve, with not more than 5 percent passing a 100 mesh screen.

15.2.4 Cement shall conform to the applicable requirements of the section entitled Concrete Work, except cement for wainscoat shall be white cement.

15.2.5 Water shall be clean and free from injurious amounts of oils, acids, soluble salts, and organic impurities.

15.3 Samples: Samples of materials shall be submitted to the Contracting Officer for approval before proceeding with the tile work.

15.4 Installation of Wainscoat:

15.4.1 Scratch Coat: Scratch coat for application as a foundation coat shall be not less than 1/4-Inch (6 mm.) thick composed of one part cement, 4 parts

sand, and 1/4 part hydrated lime by volume. While still plastic, the scratch coat shall be deeply scored or scratched and cross-scratched. The scratch coat shall be protected and kept reasonably moist during the seasoning period. All mortar for scratch and float coats shall be used within one hour after mixing. The retempering of partially hardened mortar will not be permitted. The scratch coat shall be applied not less than 48 hours nor more than 54 hours before starting the setting of tile.

15.4.2 Float Coat: The float coat shall be composed of 1 part cement, 1/2 part of hydrated lime and 4 parts sand. The float coat shall be brought flush with screeds or temporary guide strips so placed as to give a true and even surface at the proper distance from the finished face of the tile.

15.4.3 Setting Wainscoat: Wainscoat shall be thoroughly soaked in clean water before setting. Wainscoat shall be set by trowelling a skim coat of neat Portland cement mortar on the float coat or applying a skim coat to the back of each tile unit and immediately floating the tile into place. Joints shall be straight, level, perpendicular, and of even width not exceeding 1/16-inch (2 mm.). Wainscoats shall be built of full courses, which may extend to a greater height, but in no case more than 1-1/2-inches (4 cm) lower than the specified or figured height. Vertical joints shall be maintained plumb for the entire height of the tile work.

15.4.4 Grouting: All joints in wainscoat shall be grouted full with plastic mix of neat white cement immediately after a suitable area of tile has been set. The joints shall be tooled slightly concave and the excess mortar shall be cut off and wiped from the face of tile. Any interstices or depressions in the mortar joints after the grout has been cleaned from the surface shall be roughened at once and filled to the line of the cushion-edge before the mortar begins to harden. All joints between wainscoat and plumbing or other built-in fixtures shall be made with a light-colored calking compound.

15.5 Cleaning: Upon completion, tile shall be thoroughly cleaned in a manner as not to affect the surface. Damaged or defective tiles shall be replaced, at no cost to the Owner.

- End of Section -

SECTION 16 GLASS AND GLAZING

16.1 General Requirements: The work includes the providing of all glass and glazing, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

16.2 Materials:

16.2.1 Glass: All glass shall be 1/4 inch clear polished plate glass, unless otherwise shown.

16.2.2 Putty shall have a plastic consistency and shall be specially manufactured for the intended use. The compound shall adhere tenaciously to the surface to which applied, and shall not shrink excessively and shall be non-staining.

16.3 Installation: Glass shall be cut, where required, with the visible lines or waves running with the horizontal dimensions. All glass shall be well bedded and carefully back puttied and for wood sashes etc. It shall be sprung in and fixed with beads. Beads, equally spaced on all four sides, shall be carefully driven into the wood to keep the glass from shifting. Glass in metal windows shall be secured with spring clips and patent mastic. Glass shall be neatly cut to fit the rebates with 1.5 mm. clearance all around the rebates shall be primed before glazing.

16.4 Cleaning: On completion all glass shall be cleaned both sides and any broken, cracked or defective panes shall be replaced at the Contractor's expense to the satisfaction of the Contracting Officer.

- End of Section -

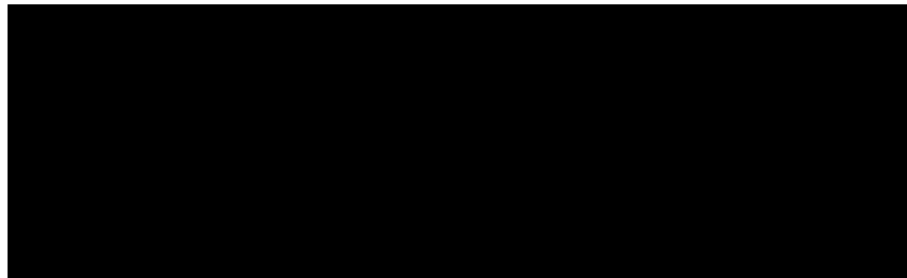
SECTION 17 - CARPENTRY

17.1 General Requirements: The work includes the providing of all carpentry work, complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

17.2 Materials (Lumber):

17.2.1 Lumber shall be heartwood of the following specie (s), (or others as approved); the wood shall be heavy, close-grained and resistant.

25X1A



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

17.2.3 Dimensions: Unless otherwise shown, lumber shall not be shorter than 10 feet (3.3 meters) in length. All lumber shall be surfaced and planned. All finish lumber, after planning, shall not vary from the indicated thickness by more than 10 percent.

17.3 Materials (Other Than Lumber):

17.3.1 Acoustic Tiles shall not be less than 16 mm. thick, with regular or random perforation and beveled face edges. The size and color of units shall be manufacturer's standard.

17.3.2 Nails, Screws and Other Fastening Devices shall be of the proper type and of adequate size to secure the work.

17.3.3 Plywood, unless otherwise shown, shall be 1/4-inch thick, and shall be suitable for paint or varnish finish. Thickness of a single layer of veneer shall be not less than 0.2 mm. Ply-wood for toilet doors shall be of the water resistant type.

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

17.3.5 Pentachlorophenol: All wood surfaces in contact with masonry or concrete shall receive two coats of pentachlorophenol preservative treatment by brush application. The final coat will not be applied until the initial coat has dried.

17.4 Samples of all materials other than rough lumber shall be subject to approval prior to delivery to the site.

17.5 Rough Carpentry: 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 rigidly secured in place with proper size fastenings.

17.6 Interior Carpentry:

17.6.1 Suspended Ceiling System: Ceiling runners and furring shall be hardwood lumber, sizes and spaced as shown, and shall be set level to the required ceiling height.

17.6.2 Ceilings: The edges of ceiling units shall be closely fitted, and the joints shall be in a line both ways perpendicular to the walls. Damaged sheets shall not be used in the work. Units shall be flat and free from any wavy condition prior to fastening.

17.6.2.1 Asbestos Cement Boards shall be pre-drilled for fasteners, holes spaced at 10 inches on centers $\frac{3}{8}$ -inch from edges and along all bearings. Fasteners may be nails or screws. Nails shall have flat heads and of size and length as will penetrate the bearings not less than $\frac{3}{4}$ inch. Screws shall have flat countersunk heads, and shall be No. 9 AWG $\frac{3}{4}$ inch long.

17.6.2.2 Acoustic Tiles shall be glued to $\frac{1}{4}$ -inch thick plywood backing by acoustic tile adhesive. Dirty or discolored surfaces of acoustic units shall be cleaned and left free from defects. Units that are damaged or improperly applied shall be removed and replaced as directed.

17.6.3 Wood Doors and Frames shall be of the type and design shown. Frames shall be set plumb and square and shall be properly anchored to the structure.

17.6.3.1 Hinged Doors shall be of type and design shown.

17.6.3.1.1 Flush Type (Hollow Core): Doors shall have hollow cores of such type as will adequately support the outer plywood and afford strength and stability for the use intended. Doors shall be provided with a lock of sufficient size for the proper installation of intended finish hardware. Veneers for cross banding and face shall be at least 2 or more piles with a combined minimum thickness of 5/16 inch before sanding. Face veneer shall be of approved hardwood. Edge strips shall be tongued and grooved into stiles and rails and properly glued and nailed. All veneers shall be bonded with a water-resistant type adhesive applied to all contact surfaces, and the whole door shall be placed in a gluing press and uniformly pressed.

17.6.3.1.2 Panel Type: Stiles and rails shall be fitted together with open mortise-and-tenon joints, routed to receive panels. Solid wood panels shall not be glued at the edges, but shall be capable of self adjustment within the stiles and rails to prevent splitting. Type of panels shall be as shown.

17.6.3.1.3 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.

17.6.3.1.4 Louver Inserts in the doors shall be as shown. Louver frame shall have mitered joints, and shall be routed out to receive slats of proper width to provide the edge finish shown. Joints shall be glued.

17.6.3.1.5 Toilet Stall Doors shall be of plywood built up to the 1 1/4-inch thickness.

17.6.3.2 Hanging and Trimming: Doors shall be properly hung with sufficient clearance for proper operation. Doors shall swing horizontally, and shall stand in any position.

17.6.4 Shelves & Work Bench shall conform to details and shall be in unit lengths as required for the location where shown.

17.7 Hardware, as specified under the section entitled Hardware shall be carefully and securely attached. Care shall be taken not to mar existing work. Upon completion of the work keys shall be fitted into their respective locks and shall be demonstrated to work properly.

- End of Section -

SECTION 18 HOLLOW METAL DOORS AND FRAMES

18.1 General Requirements: The work includes the providing of hollow metal doors and door frames shown or required, complete, in strict accordance with the specification and applicable drawings, and subject to the terms and conditions of the contract.

18.2 Materials:

18.2.1 Steel Shapes, Structural shall be of the type shown and shall be standard commercial quality.

18.2.2 Galvanized Iron and Steel, Sheet, Hot-Dip shall be copper-bearing standard commercial quality. Thickness shall be as indicated.

18.2.3 Mastic: Metal to metal joints between member of door, and door frames shall be set in mastic of the type recommended by the door manufacturer and as approved to provide completely watertight joints. Excess mastic shall be removed before it hardens. Calking between metal and masonry or concrete shall be as specified in section entitled calking.

18.2.4 Metal for door shall be cold-rolled, stretcher-leveled sheet steel and shall have clean smooth surfaces.

18.3 Workmanship: The finish work shall be strong and rigid, neat in appearance, free from defects, warp, or buckle. Molded members shall be clean-cut, straight and true, with joints coped or mitered, well formed, and in true alignment. Exposed welded joints shall be dressed smooth. Exposed screws or bolts, shall have heads countersunk.

18.4 Hollow Metal Doors: Doors shall be flush type. 1 3/4 inches thick and sheet steel of not less than 18 gage and shall be galvanized. Door shall be reinforced for hardware to insure alignment and rigidity. Where practicable joints shall be mitered. All joints shall be thoroughly welded their entire length. Insulating boards (strip cork, air cell asbestos, or wood fiber) shall be fastened properly to reduce metallic ring. Approved astragal metal strip shall be provided for metal double doors. Doors shall be shop galvanized and bonderized.

18.5 Hardware shall be as specified in section entitled Hardware and shall be furnished and installed at the factory.

18.6 Door Frames shall be formed from sheet steel to sizes and designs shown and shall be galvanized. Allowance shall be not more than 3/32 inch clearance for door at Jamb and head. Door metal frames 3 feet wide or less shall be not less than 16 gage steel; metal frame wider than 3 feet shall be 14 gage. Corners shall be accurately fitted and welded. All exposed welded joints shall be smooth and invisible when finished. Where practicable, joints shall be mitered, and all miters shall be well-formed and true. All finished work shall be free from warps and buckles. Frames shall be anchored securely to the wall and/or partition construction with 3 galvanized steel bolts with galvanized steel expansion shields at each jamb. Floor clips for fastening to the floor and temporary spreaders shall be provided. Door frames and trims shall be shop galvanized and banded.

18.6.1 Provisions for Hardware: Frames shall be prepared at the factory for installation of hardware. Frames shall be mortised, reinforced, drilled, and tapped to templates to receive mortised template hinges, lock strikes, and overhead door closers where required, and shall have reinforcing plates for surface-applied hardware. Cover boxes in back of hardware cutouts shall be provided. Adequate reinforcement plates shall be also provided for surface applied hardware for which drilling and tapping is to be done in the field. Location of hardware shall be as specified in section entitled Hardware.

18.7 Installation:

18.7.1 Door Frames shall be installed plumb, straight, and true, rigidly secured in place and properly braced. Where construction will permit, the spreaders used for bracing during shipment shall be left in place and concealed. Spreader that cannot be concealed shall be left in place until the frames are set and anchored. Frames shall be anchored to concrete or masonry with proper size anchoring straps as indicated.

18.7.2 Hinged Door shall be fitted, hung and trimmed with the hardware. Door clearances shall be as hereinbefore specified. After erection, hardware shall be properly adjusted and lubricated to operate freely.

18.8 Protection and Cleaning:

18.8.1 Protection: Care shall be used in handling door, door frames and other items hereinbefore specified during transportation and at the job site. Such items shall be stored at the site on edge and under cover. After installation, they shall be protected from damage during subsequent construction activities.

18.8.2 Cleaning: Metal surfaces shall be cleaned on both the inside and outside of all mortar, plaster, paint, and other foreign matter to present a neat appearance and prevent fouling of weathering. Surfaces of painted items shall be satisfactorily cleaned and touched up. Stained, discolored, or abraded items that cannot be satisfactorily repaired shall be replaced with new items. Abrasive, caustic, or acid cleaning agents shall not be used.

18.9 Shop Drawings shall be submitted for approval.

- End of Section -

SECTION 26 - SANITARY SYSTEM

26.1 General Requirements: The work includes the providing of a sanitary system, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

26.2 Applicable Specifications and Standards:

26.2.1 Federal Specifications:

WW-P-401c Pipe and Pipe-Fittings, Cast-Iron, Soil

26.3 Materials:

26.3.1 Concrete: Concrete for septic tanks, manholes and concrete headwall and similar items shall conform to Section: Concrete Work.

26.3.2 Cast Iron Pipe and Fittings, piping out of the septic tank and into the leaching pits shall conform to Federal Specification WW-P-401c, Class XH.

26.3.2.1 Joint Packing shall be of braided or twisted hemp or oakum of best commercial grade.

26.3.2.2 Lead for joints shall contain not less than 99.0 percent metallic lead.

26.3.3 Vitrified Clay Pipe where shown shall be standard strength clay sewer pipe manufactured from surface clay, fire clay, shale, or a combination of these materials. The materials or any combination thereof, when molded into pipe and subject to suitable temperatures, shall yield a product that will be strong, durable, serviceable, and free of objectionable defects. The glaze shall consist of a continuous layer of salt glaze substantially free from large blisters. Not more than 10 percent of the inner surface of any pipe barrel shall be bare of glaze except the socket, where it may be entirely absent. There shall be no well defined network of glazing lines or hair cracks. The ends of the pipes shall be square with the longitudinal axis.

26.3.4 Vitrified Clay Wye Branches, Cleanouts and Fittings shall be of quality not less than that specified for vitrified clay pipe.

26.3.5 Joint Packing shall be jute, hemp, or asbestos fibre, square braided or tightly twisted. The packing shall contain no material that would coat the pipe so as to adversely affect the adhesion of the joint sealer.

26.3.6 Joint Sealer shall be bituminous, mineral filler, hot-pour type. Compounds for the sealer shall consist essentially of asphalt or coal-tar pitch with an inert mineral filler. The material shall be free from water, uniform in appearance, and shall not foam when heated to 177 degrees C.

26.4 Installation:

26.4.1 General: The location of the sewer line shall be as shown on the plans. Sewer pipe shall be fully encased in concrete, where such requirement is noted on the plans.

26.4.2 Pipe-Laying: The bottom of the trench shall be shaped to give uniform circumferential support to the lower fourth of the pipe. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line. Trenches shall be kept free from water until pipe jointing material has set, and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth, or other substances will enter the pipe or fittings. Pipe laying shall proceed up grade with the spigot end pointing in the direction of the flow.

26.4.3 Hot-Poured Bituminous Compound Joints: The gasket shall be rammed solidly and tightly home into the annular space within the socket of the pipe with a suitable caulking tool. A suitable runner shall be placed around the pipe to close the socket opening. The bituminous compound shall be heated to approximately 175 degrees C. (350 degrees F.). The compound shall be poured into the joint in such a manner that the annular space will be completely filled.

26.4.4 Lead Caulked Joints shall be made by the using of a packing material and hot caulking lead. The packing materials shall be handled with care in order to prevent contamination and shall be dry when put into place in the joint. The material shall be free of oil, tar or grease. Before jointing, all lumps, blisters, and excess coating material shall be removed. The outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry. The joint packing shall then be carefully placed and tightly caulked to a uniform thickness. No loose or frayed ends of fiber shall protrude into the space to be filled with lead. Each joint shall be carefully inspected and checked for proper depth before the lead is poured. The depth of lead in the joints shall be not less than 2 cm back of the face of the bell. Lead shall be heated in a melting pot kept near the joint to be poured, brought to proper temperature, so that when stirred, the surface will

show a rapid change in color, and when poured into the joint space, will insure a perfect joint. Before lead is poured, scum shall be removed. Each joint shall be made with one pour completely filling the joint space. The caulking shall be done by competent mechanics, in such manner as to secure tight joints.

26.4.5 Septic Tanks, Manholes Distribution Box and Cesspool shall be constructed of materials, sizes and shapes as shown on the plans.

- End of Section -

SECTION 28 - ELECTRICAL WORK: INTERIOR

28.1 General Requirements: The work includes the providing of service connection and interior electrical lighting and power systems, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

28.1.1 Nameplates: Nameplates shall be furnished for all major component parts of equipment, identifying the equipment with respect to service, capacity and required operating instructions. The identification plates shall be of appropriate material with bold type letters of appropriate size for easy reading. All nameplates shall be fastened to the equipment with sheet metal screws.

28.2 Applicable Specifications and Standards:

28.2.1 Federal Specifications:

J-C-129c(2)	Cable and Wire: Thermoplastic-Insulated General Purpose (0 - to 600-Volt Service)
W-B-30(2)	Ballast, Fluorescent Lamp
W-F-414a	Fixture, Lighting (Fluorescent, Alternating Current, General Purpose).
W-L-116a(3)	Lamps, Fluorescent
HH-I-510a	Insulation Tape, Electrical, Friction
HH-I-553	Insulation Tape, Electrical, (Rubber, Natural & Synthetic)
WW-C-581d(3)	Conduit, Metal, Rigid, and Coupling, Elbow, and Nipple Electrical Conduit, Zinc-Coated

28.2.2 National Electric Manufacturer's Association (copies of publication are obtainable from Edison Electric Institute, 750 Third Avenue, New York 17, N.Y.)

AB1-1959	Molded case circuit breaker
ICI-1959	Industrial Control

28.2.3 NFPA: (National Fire Protection Association, 85 Johns Street, New York 38, New York)

Pamphlet
Number

70

National Electrical Code: 1965

28.3 Code Requirements: The complete installation shall comply with applicable provisions of the National Electric Code 1965 Edition except as otherwise shown or specified herein.

28.4 Departures: The drawings indicate the extent and general arrangements of the wiring and raceway systems. If any departure from the contract drawing is deemed necessary by the Contractor, details of such departure, and the reasons therefore, shall be submitted to the Contracting Officer for approval. No such departures shall be made without prior written approval.

28.5 Standard Products: Materials furnished under this specification shall be standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.

28.6 Materials and Equipment Schedules: As soon as practicable and within 30 days after the date of award of contract and before any material or equipment is purchased, the Contractor shall submit 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 as may be required. No consideration will be given to partial lists submitted from time to time. Approval of materials will be based on manufacturers' published ratings. Any material, fixtures, and equipment listed which are not in accordance with the specification requirements may be rejected.

28.7 Grounding: Raceway systems and neutral conductor of the wiring system shall be grounded, and the ground connections shall be made at the Service Switchboard. All metallic fixtures, fittings and equipment shall be grounded. A bare conductor of proper size shall be provided wherever grounding continuity is lost due to the use of flexible conduit. Install the conductor in the conduit and terminate properly at both ends. All metallic non-current carrying portions of the electrical system shall be grounded. Cords and UF cables shall have a separate grounding conductor.

28.8 Wiring and Raceways: Conductor for circuits of 480 volts between conductors, or less, shall have insulation rated not less than 600 volts. Conductors for higher voltages and busways, shall be rated as indicated."

28.8.1 Telephone wiring and cables shall be Government furnished and installed. Contractor shall install and provide conduits, pull wire, outlets and cabinets.

28.8.2 Telephone Raceways. As indicated shall be installed in accordance with preceding requirements for conduit but with the additional requirements that no run shall exceed 75 feet for 3/4-inch sizes and 150 feet in length for 1-inch or larger sizes, and shall not contain more than three 90-degree bend or equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated on the drawings. Inside radii of bends in conduits of 1-inch size or larger shall be not less than ten times the trade diameter. A zinc-coated steel wire not less than 12 gage shall be installed in empty telephone conduits with not less than 8-inches of slack left at each outlet.

28.8.3 Wiring in Conduit or EMT shall be single conductor with Type TW insulation up through No. 8 Wires, No. 6 and larger shall be THW, THW or THWN. Conductors in raceways, and cables shall be of copper, rubber or thermoplastic insulated. Conductors in wet locations shall be installed in rigid steel conduit. Thermoplastic-insulated conductors shall conform to Federal Specification J-C-129c(2).

28.8.4 Conduit and Tubing Systems (Raceways): Conduit shall be rigid zinc-coated steel. Conduit shall not be plastic. Conduit shall be installed in accordance with Article 346 of the National Electrical Code. Minimum size of conduit and tubing shall be 1/2-inch. Raceways shall be concealed within finished walls, ceilings, and floors where possible unless indicated otherwise. Raceways shall be rigidly 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 off-sets shall be avoided where possible, but where necessary shall be made with an approved hickey or conduit bending machine. Changes in directions of runs shall be made with asymmetrical bends or cast-metal fittings conforming to Federal Specification J-C-586a. In dry locations, fittings may be of aluminum or of zinc- or cadmium-coated steel. Crushed or deformed raceways shall not be installed. Trapped raceways shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, water or trash in raceways boxes, fittings, and equipment during the course of construction. Only approved pulling-in compounds shall be used in raceways. Raceways shall be entirely free of obstructions or shall be

replaced. Conduits shall be fastened to all sheet metal boxes and cabinets with two locknuts. Bushings shall be installed on the ends of all conduits and shall be of the insulating type. All conduit which is imbedded in concrete or masonry, or is exposed less than 1.6 meters above the floor or below grade, shall be rigid galvanized. Conduit below grade shall have threads coated with white lead, and all scratches or tool marks shall be painted with zinc paint.

28.8.4.1 Steel Conduit shall conform to Federal Specification WW-C-581d(3).

28.8.4.2 Electrical Metallic Tubing shall be zinc-coated and shall conform to Federal Specifications WW-T-506 and shall be installed in accordance with Article 348 of the National Electrical Code. EMT of one-inch size and smaller only shall be used.

28.8.5 Branch-Circuit Conductors shall be not smaller than No. 12 AWG. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet or junction boxes.

28.8.6 Junction Boxes shall be utilized where required.

28.8.7 Splices Wire connectors of insulating material or solder-less pressure connectors, properly taped, shall be utilized for all splices in wiring. Rubber and friction tape shall conform to the requirements of U.S. Federal Specifications HH-I-553 and HH-I-510a respectively. Vinyl plastic tape will be acceptable in lieu of rubber and friction tape.

"Untaped pre-insulated compression connectors, applied with proper tools, may be used for splices. Not more than four conductors shall be connected in one splice. Each splice for fixture connections shall be made to a single conductor, using spiral wire connectors (wire nuts) with insulating covering."

28.9 Outlets shall conform to the following requirements with respect to locations. (minimum box size shall be four-inches square or octagonal):

- (a) Sheet Steel Boxes, zinc-coated or cadmium-coated, conforming to Federal Specification W-J-800c type suitable for the use intended, shall be used for concealed work, and shall be of a minimum size of four inches.

- (b) Cast Metal Boxes, galvanized malleable iron or aluminum, conforming to Federal Specification W-C-586a, Class 1, shall be used in combination with exposed metallic conduit.
- (c) Pressed Steel Boxes, one piece, cadmium plated, shall be used in combination with EMT.
- (d) Fixture Boxes, of approved type not less than 4 inches wide, and 1 1/2" deep, shall be used on ceilings.
- (e) Gang Boxes, one piece, cadmium plated steel, shall be used where necessary.
- (f) Combination Boxes, switch and receptacle, shall be not less than 4 inch (10.2 cm) square, and shall be used where necessary.
- (g) Clock outlets shall be the recessed - receptacle type with mechanical support on the cover-plate for surface-mounted clock.
- (h) Telephone outlets and cabinets. Telephone terminal cabinets shall be of steel and shall conform to the National Electrical Code, and shall be sized as shown. The boxes of cabinets shall be made from steel sheets zinc-coated by the hot-dip process. The fronts of cabinets shall be finished to resist corrosion with not less than one priming coat and one pearl-gray finishing coat. Wall outlets shall be standard rectangular switch boxes approximately 4 by 4 inches by not less than 1-1/2 inches deep with one-hole cover plates of fire resistant non-absorptive hot-molded composition.

20.9.1 Installation: Boxes shall be installed in a rigid and satisfactory manner using wood screws on wood and expansion shields on masonry.

20.10 Weatherproof Convenience Outlets shall be installed where indicated, and shall consist of a single convenience outlet in a flush box with a gasketed, weatherproof, cadmium-plated, metal cover plate having a spring-hinged, lift-up gasketed lid.

20.11 Device Plate shall be provided for each outlet to suit the device installed. All plates on unfinished walls or on fittings shall be of zinc-coated sheet metal

having rounded or beveled edges. All plates on finished walls shall be of brown phenolic compound plates having polished stippled or polished ribbed finish with plain polished borders. Screws shall be of metal with countersunk heads, with finish to match the finish of the plate. Plates shall be installed with all four edge in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed vertically and with an alignment tolerance of 1/64 in, (0.5 mm) in 6-inch (15.2 cm). Device plates shall be of the one-piece type, of suitable shape for the devices to be covered. The use of sectional device plates will not be permitted.

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

28.13 Wall Receptacles shall conform to Federal Specification W-C-596a type and style as herein specified. Heavy-duty receptacles shall be of the single type having capacity to carry the rated load continuously without damage and shall be furnished with a suitable cord-grip cap.

28.13.1 Duplex Convenience Receptacles for general service shall be specification grade grounding type rated 15 amps 125 volts 2 pole 3 wires, in accordance with Federal Specification W-C-596. Receptacles shall have bodies of brown colored molded material, back or side wired with two screw terminals per pole and two grounding terminals. Receptacles shall be of a type making contact on both sides of an inserted blade, and shall have mounting yokes with plaster ears.

28.14 Wall Switches for general service on a-c circuits shall be of the totally-enclosed, tumbler, quiet a-c, heavy-duty type rated 15 amps 120-277 volts, and shall conform to the requirements of Federal Specification W-S-896c(c) or W-S-893c. Switches shall be back or side wired type with screw terminals. Handles shall be of brown colored molded material. Switches shall be single or two-pole, 3-way, or 4-way as required.

28.15 Lamp and Lighting Fixtures of types and sizes as indicated on the drawings shall be furnished and installed complete.

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

28.15.1.1 Incandescent lamps shall conform to Federal Specification W-L-101f(2) and the latest supplement. They shall be for 120-volt operation unless otherwise specified.

28.15.1.2 Fluorescent lamps shall be the rapid or trigger start type conforming to Federal Specification W-L-116a(2) and shall have standard cool white color characteristics. Standard 40 watt 48 inch lamps shall have an initial light output of not less than 3000 lumens.

28.15.1.3 Mercury-Vapor Lamps shall be suitable, and of proper bulb shape, for the fixtures with which they are to be used. Unless otherwise indicated, mercury-vapor lamps shall be phosphor-coated, color improved type, and shall have a rated life of not less than 16,000 hours.

28.15.2 Fixtures shall conform to the Underwriters' Laboratories, Inc. standard for Electric Lighting Fixtures. Fluorescent lamp ballasts shall be the high power factor, rapid or trigger start type, suitable for the lamps used and shall conform to Federal Specification W-B-30(2). Ballasts shall have nonresetting thermal protectors.

"Mercury-vapor lamp ballasts shall be of the regulated-output high-power-factor type".

28.15.2.1 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.

28.16 Floodlights shall be of the enclosed type, mercury vapor and of wattage as indicated suitable for operation on 120 volts, 60 cycles as indicated. Beam spread shall be as indicated. Support shall be adjustable with provision for locking in the required position. Floodlights shall be grounded. Ferrous metal parts shall be zinc-coated and aluminum parts shall be anodized except for weather proof enclosed reflectors.

28.17 Panelboards shall be of the dead-front safety conforming to the Underwriters' Laboratories Inc., standard for Panelboards, and provided with the size and number of circuits as indicated on drawings. Mains shall be arranged for a grounded, solidneutral system. Boxes shall be of steel having a zinc-coated and enameled finish. Panelboards shall be the automatic circuit breaker type, and shall conform to W-P-115a. Circuit breakers shall conform to W-C-375a.

28.18 Transformers shall conform to specification W-T-631a, to the National Electrical Manufacturers Association, Standards for Transformers, publications nos. TRI and STI, and to the American Standards Association, American Standards for Transformers. Regulators, and Reactors, publications nos. C57 and C89.1.

28.19 Motors and motor control equipment:

28.19.1 Motors shall conform to specification CC-M-00636b and CC-M-641b for fractional and integral horsepower motors respectively. Motors not covered by the foregoing specifications shall conform to the American Standards Association Standards publication: Rotating Machinery, publication No. C50. Alternating-current motors shall be wound for a frequency of 50 cycles per second.

28.19.2 Motor Controllers: Starters for a-c induction motors shall conform to specification MIL-S-12514, and to the requirements of the National Electrical Manufacturers Association Publication ICI entitled "Standards for Industrial Control". Starters shall be manual or magnetic, across-line or reduced voltage, or combination type as indicated. Starters shall provide thermal overload protection for the motor by means of heaters and overload devices, or by thermostatic elements embedded in the motor windings. Overcurrent protection shall be provided for all three phases of 3-phase motors. Heater elements for starter overload devices shall be selected and furnished based on the name-plate current rating of the motor. In addition, for starters with non-adjustable over-current devices, one set of space heaters having a rating approximately 20% greater than the heaters installed in the starter shall be furnished with each starter. Magnetic starter coils and control relays shall be rated for 60-cycle service. Starter enclosures shall be of the type indicated and shall be suitable for the location where installed.

28.19.2.1 Starter Control Devices shall be provided as indicated. If not otherwise specified, magnetic starters intended for manual control shall be provided with cover-mounted start-stop push buttons wired to provide under-voltage protection. Starters controlled from interlock circuits or on-off control devices such as pressure switches and float switches shall be provided with a cover-mounted on-off-automatic switch. Starters, including manual starters, controlling motors or devices not visible from the controller locations or otherwise arranged such that it is not readily apparent from the controller location whether or not the motor is running or the device energized, shall have a cover-mounted red pilot light wired to be lighted when the controller is closed. At contractor's option, devices required by this paragraph may be mounted in a separate enclosure of the same type as the associated starter or controller, located with the starter in lieu of being cover-mounted as specified.

28.19.2.2 Combination Starters shall be the circuit-breaker type. The operating handle of the disconnect device in combination starters shall be provided with a means for padlocking in the "off" position, and shall be interlocked with the door or cover of the starter to prevent opening the door or cover unless the switch or circuit breaker is in the off position.

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

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

28.20.2 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-1738(1), type I or type II at the contractor's option. The method of treatment shall be in accordance with Military Specification MIL-T-1528. Circuit elements include cable and wire.

28.21 Marking: Enclosures of electrical equipment, starters, control stations and similar locations as directed, shall be provided with a suitable nameplate or stencilled legend identifying the equipment or function served. The color-coding and marking requirements of the National Electrical Code shall be adhered to. Control circuit wiring shall be color-coded in accordance with the recommendations of the IPCEA. Where more than three control-circuit conductors occupy one conduit or wireway, each shall be identified with suitable label of an oil resistant material indicating the wire number, or terminal number to which connected. Each wire shall have the same identification at both ends, and no two wires shall have the same identification. Where applicable, wire identification shall be indicated on the appropriate wiring or control diagrams. Wiring and raceways extending outside the building, or for future use, or whose function is not otherwise readily apparent, shall be tagged or marked at both ends with a suitable permanent-type identification means.

26.22 Manuals: All installation-instruction leaflets, parts lists, operating-instruction sheets, wiring diagrams and similar literature packed with equipment or otherwise obtained by contractor for all equipment and devices installed in the facility, shall be assembled by the contractor, bound neatly in a substantial folder or cover, and submitted to the Contracting Officer prior to performing the acceptance tests for the completed facility. Each brochure or leaflet shall be marked to indicate the building, contract number, and location where installed. In addition, for installations requiring field-installed control connections between a number of devices (except conventional on-off switches or single start-stop pushbutton stations) contractor shall prepare or cause to be prepared an interconnecting wiring diagram or diagrams indicating equipment terminals, terminal and wire numbers, and wire coding and routing as installed. Where control schemes involving a coordinated sequence of functions by an operator for start-up, shut-down or maintenance, are installed, contractor shall furnish a scheme of operations and coordinated operating instructions. These instructions should be prepared by the manufacturer of the major equipment or control item. When so directed, contractor shall provide one copy of these instructions, in English and the local language, framed under glass and mounted as directed. One copy of these instructions and all related wiring diagrams, shop drawings, and interconnecting diagrams, shall be bound with instruction leaflets etc. as specified in the foregoing.

26.23 Wire and Cable Color Code shall be used to identify the different phases as follows:

<u>Phase</u>	<u>120/208V</u>
A	Black
B	Red
C	Blue
N	White
G	Green

On wire sizes #8 and larger, a 1" wide colored tape band shall be applied to each conductor in lieu of colored insulation. The tape band shall be used to identify the conductors in panels, outlets, junction boxes and switchboards. Apply one band at the conduit entrance and one band at the cable terminal.

28.24 Tests: After the interior wiring system installation 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 or his authorized representative. The Contractor shall furnish all instruments and personnel required for the tests, and the Government will furnish the necessary electric power.

28.25 Substitutions: If any substitutions of materials or equipment specified and/or shown are deemed necessary by the contractor, comparative details of such substitution shall be submitted as soon as practicable, and within 30 days after award of the contract, to the Contracting Officer for approval. In addition, the contractor shall furnish proof, satisfactory to the Contracting Officer, that items identical to those proposed as substitutions are in current use and performing satisfactorily in similar installations. No such substitutions shall be made without the prior and specific written approval of the Contracting Officer.

- End of Section -

SECTION 29 FUEL TANKS AND PIPING

29.1 General: The contract drawings indicate the extent and general arrangement of the fuel tanks and piping systems. If any departures are deemed necessary details of such departures and the reasons therefor shall be submitted as soon as practicable for approval. No such departures shall be made without prior written approval. The dimensions of the equipment space are as indicated. Equipment and piping arrangement shall provide adequate and acceptable clearances for entry, servicing and maintenance.

29.1.1 Standard Products: The material and equipment to be furnished under this specification shall be the standard product of a reputable manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, component parts of the system need not be the products of the same manufacturer.

29.1.2 Materials and Equipment Schedule: Before purchase of any materials or equipment, a plan and elevations of the equipment spaces showing the proposed piping and equipment together with a complete schedule of the material proposed for installation shall be submitted for approval. The schedule shall include catalogues, performance data, cuts, diagrams, drawings and such other descriptive data as may be required. In the event any items of material contained in the schedule or the plan and elevations of the equipment spaces, fail to comply with the specification requirements, such items or layout arrangement may be rejected.

29.2 Materials and Equipment: The following materials and equipment shall conform to the respective specification and other requirements specified below:

29.2.1 Steel Pipe: Federal Specification WW-P-406b, type I, class A, coating as hereinafter specified.

29.2.2 Pipe Fittings: Federal Specifications WW-P-521d(1), class as required to match adjacent piping.

29.2.3 Unions: Federal Specifications WW-U-531a, class as required to match adjacent piping.

29.2.4 Steel Plates and Shapes: Federal Specification QQ-S-741a(1).

29.2.5 Steel Sheets: Federal Specification QQ-S-633e, composition, condition and finish best suited to the end use.

29.2.6 Lead Expansion Sleeves: Federal Specification FF-H-136(1), type 4425, of required sizes.

29.2.7 Wood Screws: Federal Specifications FF-S-111b, round head galvanized or brass and required size.

29.3 Piping and Fittings: Oil fill, oil supply & return, and sounding pipe shall be standard weight black steel pipe with 150 psi malleable iron fittings. Vent pipe shall be standard weight galvanized steel pipe with galvanized malleable iron fittings.

29.4 Fuel Oil Storage Tanks shall have capacities as indicated. The tanks shall be constructed and installed in accordance with Pamphlet No. 31 of the NBFU except as otherwise indicated, and shall be approved and labeled by the Underwriters' Laboratories, Inc. The tanks shall be provided with all pipe connections, including oil-fill, suction, return, vent, sounding and oil-burner connections. Tank gage rods calibrated to indicated gallons of oil content for each inch of depth shall be furnished. The rod shall be of a suitable hardwood or brass. The tank shall be supported on a concrete base and anchored by steel rods with adjustable devices. Tank shell shall be not less than 3/16-inch (6 mm.) thick.

29.5 Cleaning and Painting of Tanks: The exterior surfaces shall be prepared for painting by steel-grit or sand blasting. Prior removal of oil, grease and other foreign matter by solvents or mechanical means will not be required, provided that blast cleaning alone accomplishes the complete removal of mill scale, rust, oil grease, welding slag and other surface contaminants and leaves a surface of uniform appearance. Tanks shall be painted in accordance with Section: Field Painting.

29.6 Accessories: Tanks shall be fitted with two manholes not less than 500 millimeters in diameter. Manholes shall have a bolted cover and gasket. All tanks shall be provided with fill, suction and return pipes, vent pipe connection, screened gooseneck or tee vent, and gage stick. Fill pipes shall extend to within 5-inches (12.7 cm.) of the the bottom of the tanks and to not less than 6-inches (15 cm.) above the tanks. Fill and sounding caps shall be watertight, and fill cap shall be fitted with removable strainer. Suction pipe shall extend to within 3-inches (7.6 cm.) of the bottom of the tank. Pipe connections shall be as indicated on the drawings or as required by project specifications. Pipe connections shall be temporarily plugged before shipment.

29.7 Tests: Upon completion of the installation, the tanks shall be pressure tested at twice the working pressure of the system. Minimum pressure shall be 5 psi by hydrostatic test. All leaks shall be made tight.

29.8 Substitutions: If any substitutions of materials or equipment specified and/or shown are deemed necessary by the Contractor, comparative details of such substitution shall be submitted as soon as practicable, and within 30 days after award of the contract, to the Contracting Officer for approval. In addition, the Contractor shall furnish proof, satisfactory to the Contracting Officer, that items identical to those proposed as substitutions are in current use and performing satisfactorily in similar installations. No such substitutions shall be made without the prior and specific written approval of the Contracting Officer.

- End of Section -

SECTION 31 - WATER STORAGE TANK; ELEVATED

31.1 General Requirements: The work includes the providing of an elevated water tank, complete in strict accordance with the specifications and the applicable drawings and subject to the terms and conditions of the contract.

31.2 Tank shall be welded construction of $3/16$ inch steel plate body and $1/8$ inch steel plate cover with a capacity of 9,000 gallons, connected as shown. Fittings, valves and appurtenances shall be provided as indicated. Connecting piping shall be standard weight galvanized steel pipes.

31.2.1 Float Valves shall be brass body, brass mounted valves suitable for the application shown.

31.2.2 Steel Ladder shall be constructed of $1\ 1/4$ by 2-inch steel flat bar and $5/8$ -inch round steel bar rungs, drilled and welded to the flat bars, spaced at 30 centimeters on center. The flat bars shall be welded to the side of the steel tank.

31.3 Tower shall be constructed as shown, closely fitted, accurately set to the required lines and levels, and shall be bolted and nailed in a thorough manner with bolts and nails of ample size. Materials and workmanship shall be in accordance with Section entitled Carpentry. Concrete footings for the tower shall be in accordance with Section entitled Concrete for Structures.

31.4 Painting of the water storage tank shall be in accordance with the section entitled Field Painting.

31.5 Cleaning and Testing: After erection, the interior of the tank shall be cleaned and filled with water, and demonstrated to be watertight.

- End of Section -

SECTION 32 - FIELD PAINTING

32.1 General Requirements: The work includes the providing of field painting, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

32.2 Applicable Specifications and Standards:

32.2.1 Federal Specifications:

TT-P-21(2)	Paint; cement-water, powder, white and tints (for interior and exterior use).
TT-P-25a(1)	Primer, paint, exterior (under-coat for wood, ready-mixed, white and tints).
TT-P-29(1)	Paint, latex base, interior, flat white and tints.
TT-P-51d	Paint, oil, interior, flat, white and tints.
TT-P-86a	Paint; red-lead base, ready-mixed.
TT-P-102(2)	Paint (titanium-lead-zinc, and oil, exterior, ready-mixed, white and light tints).
TT-P-641b	Primer, paint; zinc dust - zinc oxide (for galvanized surfaces).

32.3 Materials:

32.3.1 Primer for Ferrous Metals shall be red-lead base paint conforming to Federal Specification TT-P-86c.

32.3.2 Varnish for Natural Wood Finish shall conform to Federal Specification TT-V-121c(1).

32.3.3 Primer for Exterior Wood Surfaces shall conform to Federal Specification TT-P-25a(1).

32.3.4 Latex Base Paint shall conform to Federal Specification TT-P-29(1).

32.3.5 Interior Oil Paint shall conform to Federal Specification TT-P-51d.

32.3.6 Primer for Galvanized Surfaces shall conform to Federal Specification TT-P-641b.

32.3.7 Exterior Oil Paint shall be the titanium-lead-zinc and oil paint conforming to Federal Specification TT-P-102(2).

32.4 Samples: The contractor shall submit paint and color samples to the Contracting Officer and obtain approval prior to use.

32.5 Preparation of Surfaces: All dirt, dust, rust, scale, loose particles, disintegrated paint, grease, and foreign matter shall be removed from all surfaces which are to receive paint or other finish.

32.6 Application: Paint shall be applied carefully with good clean brushes. Sufficient time shall be allowed between coats to permit thorough drying. Finish coats shall be smooth and free from runs, sags, or other defects. Each coat of paint shall be sufficiently heavy to cover completely the previous coat or surfaces.

32.6.1 Ferrous Surfaces, that have not been shop coated, shall be cleaned and given a prime coat of red-lead paint, followed by two coats of oil paint. Shop-coated metal shall be touched up with similar paint, if required, and given two coats of oil paint.

32.6.2 Galvanized Metal Surfaces, except fencing, shall be given a prime coat of zinc dust-zinc oxide primer and two coats of oil paint.

32.6.3 Interior Plaster shall be cleaned, allowed to dry, and given two coats of latex base paint.

32.6.4 Exterior Wood Surfaces shall be cleaned, given one coat of exterior wood primer and two coats of exterior oil paint.

32.6.5 Interior Wood Surfaces shall be given two coats of interior oil paint.

32.6.6 Exterior Plaster shall be cleaned, allowed to dry, and given two coats of water cement paint.

32.7 Markings: Cases of regulators, transformers, circuit breakers, relay cabinets and similar equipment shall be identified by stencil in white oil paint and worded as directed in English [REDACTED] letters not less than 2 inches high.

- End of Section -

SECTION 33 - DIESEL ELECTRIC GENERATING UNITS

33.1 General Requirements: The work includes the installation of diesel generator sets, complete in strict accordance with the contract drawings and this specification.

33.2 Applicable Specifications and Standards:

33.2.1 AWS: (American Welding Society, 347 East 47th Street, New York 17, N. Y.)

B3.0-41 Standard Qualification Procedure.

01.0-46 Standard Code for Arc and Gas Welding in Building Construction.

33.2.2 ASA: (American Standard Association 1951)

B31.1-1955 Code for pressure piping.

33.3 Equipment Installation: The contractor shall perform all operations of uncrotting, removal of temporary protective coatings, assembly, setting in place in the location shown, levelling, anchoring, connecting, testing and adjusting for satisfactory operation of the Diesel Electric Generator sets, panel boards 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 supply and install all connection boxes necessary to insure satisfactory installation and connections.

33.3.1 Piping: Unless otherwise shown or specified, all piping shall be installed in accordance with the applicable requirements of American Standard Code for Pressure Piping ASA B31.1-1955.

33.3.2 Gaskets: Gaskets shall be class I for fuel, lubricant, coolant and high temperature service. The gaskets for water and low temperature service shall be Class II. All gaskets shall be cut of one piece.

33.3.3 Welding, Gas and Electric: Welding and welding materials shall conform to the American Welding Society Code D1.0 - 46, and AWS Procedure B3.0-41.

33.3.4 Fuel and Lube Oil System: All fuel oil and lube oil piping on engines and within the building shall be pickled using a 25% muriatic solution or equivalent, neutralized and flushed clean prior to start up of a new engine or plant. Fuel oil and lubricating oil lines will be welded type steel. Copper tubing will not be used except when furnished with, and as an integral part of the engine. Pipe flanges and pipe fittings will be of the socket welding type. Socket welding unions will be used at threaded valves and socket welding flanges will be used at flanged valves. Flanged connections will be used to fullest extent, so that the piping valves and equipment may be isolated without disturbing the general piping system. The fuel oil supply and return lines will be flushed with No. 2 diesel oil. The lubricating oil supply and return lines will be flushed with light (#10 or equal) lubricating oil. The engine will be bypassed during flushing. Pumping capacity for flushing will be arranged to maintain a velocity of 10 to 20 feet per second. The flushing will continue for at least one hour after the flushing product becomes clean.

33.3.5 Cooling System: The entire cooling system to be flushed in accordance with manufactures specifications.

33.4 Tests:

33.4.1 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 approval. 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 Contracting Officer by contractor. 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 60 minute periods for the following items.

- (a) Generator KW
- (b) Generator voltage
- (c) Engine speed (RPM)
- (d) Engine lube oil entering and leaving temperatures
- (e) Engine jacket water inlet and outlet temperatures
- (f) Engine exhaust temperature of each cylinder
- (g) Ambient temperature.

33.4.2 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.

33.4.3 50% Rated Load Run: The engine shall be operated at 50% load for a period of 4 hours.

33.4.4 100% Rated Load Run: The engine shall be run at 100% load for a period of 4 hours.

33.4.5 110% Rated Load Run: The engine shall be run at 110% for a period of 2 hours.

33.4.6 Parallel Operation: Parallel operation test will be required where more than one generating unit is provided. Parallel operation test shall be conducted by running a full load test on all generators successfully for a period of four hours simultaneously within the speed and voltage specified in Military Specification 19826A(DOCKS). At the end of four hours parallel operation at 100% full load the load shall be reduced and equally shared by all engines as follows:

- (a) Run all engines 100% load for fifteen minutes.
- (b) Reduce engine No. 1 to 50% load and read just remaining engines until load is shared evenly, then run all engines at equal load for fifteen minutes.
- (c) Continue same test (a) and (b) above for each engine.

33.4.7 Upon completion of all load runs, the following safety controls and alarms shall be tested:

- (a) Increase engine speed manually and note RPM at which overspeed trip functions.
- (b) Adjust jacket water temperatures above normal and note temperature at which safety alarm functions.
- (c) During the shutting down sequence on each engine, note the pressure at which lube oil low pressure alarm functions.

33.5 Electrical Load: The contractor may use the electrical load of the Facility by arrangement if available and/or shall furnish electrical dummy load as required for testing purposes.

- End of Section -

$$KW = \frac{KVA \times PF}{1000} \times PF$$

$$188 \times \frac{400}{1000} \times 0.8 = \frac{128}{1000} \times 104.1 \times 0.95$$

376
564
6016
1.73
18048
42112
6016
1040768

8205
9369
98895

175
205
280
590197
304
788
5910
59888

177
304
708
5210
52808
8660
177 x 380 x 0.8 x 1.732 = 910496

180
185
165
530
177 x 380 x 0.8 x 1.732 = 910496

17.7
1.732
5210
13856
3464