

GENERAL CONDITION

AND

SPECIFICATION

OF THE

**CONSTRUCTION OF WEAVING
PROCESSING AND DYEING CENTER
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Submitted by:

APPROVED:

STANDARD SPECIFICATIONS FOR PUBLIC WORKS STRUCTURES
(Buildings, Ports and Harbors, Flood Control and
Drainage Structures and Water Supply Systems)

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Division I - General

These Specifications cover public works construction such as buildings, flood control and drainage structures, port works and water supply systems including auxiliary/related structures and mechanical-electrical systems.

Unless otherwise provided herein, all applicable provisions of Volume II - standard Specifications for Highways, Bridges and Airports shall be adopted for the construction of the aforementioned structures.

PART A - EARTHWORK

ITEM 800 - CLEARING AND GRUBBING

Refer to Item 100, Part C of Volume II (Blue Book)

ITEM 801 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Refer to Item 101, Part C of Volume II (Blue Book)

ITEM 802 - EXCAVATION

Refer to Item 102, Part C of Volume II (Blue Book)

ITEM 803 - STRUCTURE EXCAVATION

Refer to Item 103, Part C of Volume II (Blue Book)
PART B - PLAIN AND REINFORCED CONCRETE WORK

ITEM 900 – REINFORCED CONCRETE

900.1 Description

This Item shall consist of furnishing, placing and finishing concrete in buildings and related structures, flood control and drainage, ports and water supply structures in accordance with this specification and conforming to the lines, grades, and dimension shown on the plans.

900.2 Materials Requirements

900.2.1 Portland Cement

This shall conform to the requirement of ITEM 700, Volume II (BlueBook), Hydraulic cement.

900.2.2 Concrete Aggregates

Concrete aggregate shall conform to the requirements of subsection 311.2.2 and 311.2.3 under Item 311 of Volume II, (Blue Book) and ASTM C 33 for lightweight aggregates, except that aggregates failing to meet these specifications but which have

been shown by special that or actual service to produce concrete of adequate strength and durability may be used under method (2) of determining the proportion of concrete, where authorized by the Engineer.

Except as permitted elsewhere in this section, the maximum size of the aggregate shall be not larger than one-fifth (1/5) of the narrowest dimensions between sides of forms of the member for which the concrete is to be used nor larger than three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars or pre-tensioning strands.

900.2.2.1 Aggregate Tests

Samples of the fine and coarse aggregates to be used shall be selected by the Engineer for tests at least 30 days before the actual concreting operations are to begin. It shall be the responsibility of the contractor to designate the source or sources of aggregate to give the Engineer sufficient time to obtain the necessary samples and submit them for testing.

No aggregate shall be used until official advice has been received that it has satisfactorily passed all test, at which time written authority shall be given for its use.

900.2.3 Water

Water used in mixing concrete shall conform to the requirement of subsection 311.2.4 under Item 311, Part E of Volume II, (BlueBook).

900.2.4 Metal Reinforcement

Reinforcing steel bars shall conform to the requirements of the following Specifications:

| | |
|--|-----------------------------|
| Deformed & Plain Billet Steel Bars for concrete Reinforcement | (ASTM A 615) AASHTO M 31 |
| Deformed Rail - Steel and Plain Bars for Concrete Reinforcement | ASTM A 616 |
| Deformed A x b - Steel and Plain Bars for Concrete Reinforcement | ASTM A 617 |

If reinforcing bars are to be welded, these ASTM specifications shall be supplemented by requirements assuring satisfactory weld ability.

| | |
|---|----------------------------|
| Bar and rod mats for concrete reinforcement | ASTM A 187 |
| Cold-Drawn Steel Wire for concrete reinforcement | (ASTM A 82) AASHTO M 32 |
| Welded steel wire fabric for concrete reinforcement | (ASTM A 185) AASHTO M55 |

except that the weld shear strength requirement of those specification shall be extended to include a wire size differential up to and including six gages.

| | |
|--|--------------------------|
| Wire and Strands for pre-stressed concrete | ASTM A 416 ASTM A 421 |
|--|--------------------------|

Used in making strands for post-tensioning shall be cold- drawn and either stress-relieved in the case of uncoated strands or hot-dip galvanized in the case of galvanized strands.

High strength alloy steel bar for post- tensioning shall be proof stressed to 90% of the granted tensile strength. After proofstressing, the bars shall conform to the following minimum properties:

| | |
|---|-------------|
| Tensile strength f_s' | 1000 MPa |
| Yield strength (0.2 offset) | 0.90 f_s' |
| Elongation at rupture in 20 diameter | 4 percent |
| Reduction of area at rupture | 25 percent |
| Structural steel | ASTM A 36 |
| Steel Pipe for concrete-filled pipe columns | ASTM A 53 |
| Cast-Iron Pipe for composite columns | ASTM A 377 |

900.2.5 Admixtures

Air-entraining admixtures, if used, shall conform to ASTM C 260. Water-reducing admixtures, retarding admixtures, water-reducing and retarding admixtures and water reducing and accelerating admixtures, if used, shall conform to the requirements of ASTM C 494.

900.2.6 Storage of Materials

Cement and aggregates shall be stored in such a manner as to prevent their deterioration or the intrusion of foreign matter. Cement shall be stored, immediately upon arrival on the site of the work, in substantial, waterproof bodegas, with a floor raised from the ground sufficiently high to be free from dampness. Aggregates shall be stored in such a manner as to avoid the inclusion of foreign materials.

900.3 Construction Requirements

Notations: The notations used in these regulations are defined as follows:

f'_c = compressive strength of concrete

f_{sp} = ratio of splitting tensile strength to square root of compressive strength.

900.3.1 Concrete Quality

All plans submitted for approval or used for any project shall clearly show the specified strength, f_c' , of concrete of the specified age for which each part of the structure was designed.

Concrete that will be exposed to sulfate containing or other chemically aggressive solutions shall be proportioned in accordance with "Recommended Practice for Selecting Proportions for Concrete (ACI 613)" and Recommended Practice for Selecting Proportions for Structural Lightweight Concrete (ACI 613A)."

900.3.2 Methods of Determining the Proportions of Concrete

The determination of the proportions of cement, aggregate, and water to attain the required strengths shall be made by one of the following methods, but lower water-cement ratios may be required for conformance with the quality of concrete.

Method 1. Without preliminary test

Where preliminary test data on the materials to be used in the concrete have not been obtained the water-cement ratio for a given strengths of concrete shall not exceed the values shown in Table 900.1. When strengths in excess of 281 kilograms per square centimeter (4000 pounds per square inch) are required or when light weight aggregates or admixtures (other than those exclusively for the purpose of entraining air) are used, the required water-cement ratio shall be determined in accordance with Method 2.

Method 2. For combination of materials previously evaluated or to be established by trial mixtures.

Water-cement ratios for strengths greater than that shown in Table 900.1 may be used provided that the relationship between strength and water-cement ratio for the materials to be used has been previously established by reliable test data and the resulting concrete satisfies the requirements of concrete quality.

Where previous data are not available, concrete trial mixtures having proportions and consistency suitable for the work shall be made using at least three different water-cement ratios (or cement content in the case of lightweight aggregates) which will produce a range of strengths encompassing those required for the work. For each water- cement ratio (or cement content) at least three specimens for each age to be tested shall be made cured and tested for strength in accordance with ASTM C 39 and C 192.

The strength test shall be made at 7, 14 and 28 days at which the concrete is to receive load, as indicated on the plans. A curve shall be established showing the relationship between water-cement ratio (or cement content) and compressive strength. The maximum permissible water-cement ratio for the concrete to be used in the structure shall be shown by the curve to produce an average strength to satisfy the requirements of the strength test of concrete provided that the water-cement ratio shall be no greater than that required by concrete quality when concrete that is to be subjected to the freezing temperatures which weight shall have a water-cement ratio not exceeding 6 gal per bag and shall contain entrained air.

Where different materials are to be used for different portions of the work, each combination shall be evaluated separately.

TABLE 900.1 MAXIMUM PERMISSIBLE WATER-CEMENT RATIOS FOR CONCRETE

(METHOD NO. 1)

| Specified compressive strength at 28 days, psi fc' | Maximum Permissible Water-Cement Ratios | | | |
|--|---|--------------------------|-------------------------------------|--------------------------|
| | Non-air-entrained concrete | | Air-entrained concrete | |
| | U.S. gal. per 42.6 kg.bag of cement | Absolute ratio by weight | U.S. gal. per 42.6 kg.bag of cement | Absolute ratio by weight |
| 2500 | 7 ¼ | 0.642 | 6 ¼ | 0.554 |
| 3000 | 6 ½ | 0.576 | 5 ¼ | 0.465 |
| 3500 | 5 ¾ | 0.510 | 4 ½ | 0.399 |
| 4000 | 5 | 0.443 | 4 | 0.354 |

900.3.3 Concrete Proportions and Consistency

The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the form and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface. The methods of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked at any time during the work.

900.3.4 Sampling and Testing of Structural Concrete

As work progress, at least one (1) set of sample consisting of three (3) concrete cylinder test specimens. 150 x 300 mm shall be taken from each class of concrete pieced each day and each set to represent not more than 75 cu m. of concrete.

900.3.5 Consistency.

Concrete shall have a consistency such that it will be workable in the required position. It shall be such a consistency that it will flow around reinforcing steel but individual particles of the coarse aggregate when isolated shall show a coating or mortar containing its proportionate amount of sand. The consistency of concrete shall be gauged by the ability of the equipment to properly' placed it and not by the difficulty of mixing water shall be determined by the Engineer and shall not be varied without his consent. Concrete as dryas it is practical to place with the equipment specified shall be used.

900.3.6 Strength Test of Concrete

When strength is a basis for acceptance, each class of concrete shall be represented by at least five tests (10 specimens). Two specimens shall be made for each test at a given age, and not less than one test shall be made for each 150 cu yard of structural concrete, but there

shall be at least one test for each days concreting. The Building Official may require a reasonable number of additional tests during the progress of the work. Samples from which compression test specimens are molded shall be secured in accordance with "'STM C 172.' Specimens made to check the adequacy of the proportions for strength of concrete or as a basis for acceptance of concrete shall be made and laboratory-cured in accordance with A8TM C 31 Additional test specimens cured entirely under field conditions may be required by the Building Official to check the adequacy of curing and protection of the concrete. Strength tests shall be made in accordance with 8TM C 39.

The age for strength tests shall be 28 days or, where specified, the earlier age at which the concrete is to receive its full load or maximum stress. Additional test may be made at earlier ages to obtain advance information on the adequacy of strength development where age-strength relationships have been established for the materials and proportions used.

To conform to the requirements of this Item:

1. For structures designed in accordance with the working stress design method of this chapter. the average of any five consecutive strength tests of the laboratory-cured specimens representing each class of concrete shall be equal on or greater than the specified strength, f_c' , and not more than 20 percent of the strength test shall have values less than that specified.
2. For structures designed in accordance with the ultimate strength design method of this chapter, and for pre-stressed structures the average of any three consecutive strength test of the laboratory cured specimens representing each class of concrete shall be equal to or greater than the specified strength. f_c' and not more than 10 percent of the strength tests shall have values less than the specified strength.

When it appears that the laboratory-cured specimens will fail to conform to the requirements for strength the Engineer shall have the right to order changes in the concrete sufficient to increase the strength to meet these requirements. The strengths of the specimens cured on the job are intended to indicate the adequacy of protection and curing of the concrete and may be used to determine when the forms may be stripped, shoring removed, or the structure placed in service. When, in the opinion of the Building Official, the strengths of the job-cured specimens, the contractor may be required to improve the procedures for protecting and curing the concrete. or when test of field-cured cylinders indicate deficiencies in protection and curing, the Engineer may require test in accordance with ASTM Specification C 42 or order load tests as outlined In the load tests of structures for that portion of the structure where the questionable concrete has been placed

900.3.7 Splitting Tensile Test of Concrete

To determine the splitting ratio. Esp. for a particular aggregate, test of concrete shall be as follows:

1. Twenty four (24) 15 cm. dia. by 30 cm long (6 in. dia. by 12 in.long) cylinders shall be made in accordance with ASTM C 192, twelve at a compressive strength level of approximately 210 kilograms per square centimeter (3000 psi) and twelve at approximately 280 kilograms per square centimeter (4000 psi) or 350 kilograms per square centimeter (5000 psi). After 7 days moist curing followed by 21 days drying at

23C (73F) and 50 percent relative humidity, eight of the test cylinders at each of the two strength levels shall be tested for splitting strength and four for compressive strength.

2. The splitting tensile strength shall be determined in accordance with ASTM C 496, and compressive strength in accordance with ASTM C 39.

The ratio, E_{sp} , of splitting tensile strength to the square root of compressive strength shall be obtained by using the average of all 16 splitting tensile test and all 8 compressive tests.

Minimum Strength, Concrete other than fill, shall have a minimum compressive strength at 28 days of 140 kilograms per square centimeter (2000 psi).

900.3.8 Batching

Batching shall conform to the requirements of Item 405, Structural Concrete.

900.3.9 Mixing and Delivery

Mixing and delivery shall conform to the requirements of Item 405. Structural Concrete.

900.4 Concrete Surface Finishing: General

This shall be in accordance with Item 407, Concrete Structures.

900.5 Curing Concrete (See subsection 407)

900.6 Acceptance of Concrete

The strength of concrete shall be deemed acceptable if the average of 3 consecutive strength test results is equal to or exceed the specified strength and no individual test result falls below the specified strength by more than 15 %.

Concrete deemed to be not acceptable using the above criteria may be rejected unless contractor can provide evidence, by means of core tests, that the quality of concrete represented by the failed test result is acceptable in place. Three (3) cores shall be obtained from the affected area and cured and tested in accordance with AASHTO T24. Concrete in the area represented by the cores will be deemed acceptable if the average of cores is equal to or at least 85 % and no sample core is less than 75 % of the specified strength otherwise it shall be rejected.

DIVISION II - BUILDINGS

PART C - FINISHING

ITEM 1000 - TERMITE CONTROL WORK

1000.1 Description

This Item shall consist of furnishing and applying termite control chemicals, including the use of equipment and tools in performing such operations in accordance with this Specification.

1000.2 Material Requirements

Termite control chemicals or toxicants shall be able to immediately exterminate termites or create barriers to discourage entry of subterranean termites into the building areas. The toxicants may be classified into the following types and according to use:

Type I. Liquid Termicide Concentrate

This type of toxicant shall be specified for drenching soil beneath foundations of proposed buildings. The concentrate shall be diluted with water in the proportion of 1 liter of concentrate material to 65 liters of water or as specified by the Manufacturer.

Type II. Liquid Termicide Ready Mixed Solution

This type of toxicant which comes in ready mixed solution shall be used as wood preservative by drenching wood surfaces to the point of run-off.

Type III. Powder Termicide

This type of toxicant shall be applied to visible or suspected subterranean termite mounds and tunnels where termites are exterminated through trophallaxes method (exchange or nourishment between termites while greeting each other upon meeting).

1000.3 Construction Requirements

Before any termite control work is started, thorough examination of the site shall be undertaken so that the appropriate method of soil poisoning can be applied. The Contractor shall coordinate with other related trades through the Engineer to avoid delay that may arise during the different phases of the Engineer to avoid delay that may arise during the different phases of application of the termite control chemicals.

1000.3.1 Soil Poisoning

There are two methods usually adopted in soil poisoning which are as follows:

1. Cordoning. This method is usually adopted when there is no visible evidence of termite infestation. Trenches in concentric circles, squares or rectangles are dug 150mm to 220mm wide and at least one meter apart and applied with Type I working solution at the rate of 8 liters per linear meter.
2. Drenching. When soil show termite infestation, this method shall be applied. The building area shall be thoroughly drenched with Type I working solution at the rate of 24 liters per square meter. When Powder Termicide is to be applied to eradicate subterranean termites, careful application and precaution shall be given considering that this toxicant is fatal to animal and human lives.

1000.3.2 Application

At the time soil poisoning is to be applied, the soil to be treated shall be in friable condition with low moisture content so as to allow uniform distribution of the toxicant agents. Toxicant shall be applied at least twelve (12) hours prior to placement of concrete which shall be in contact with treated materials.

Treatment of the soil on the exterior sides of the foundation walls, grade beams and similar structures shall be done prior to final grading and planting or landscaping work to avoid disturbance of the toxicant barriers by such operations.

Areas to be covered by concrete slab shall be treated before placement of granular fill used as capillary water barrier at a rate of 12 liters per square meter with Type I working solution after it has been compacted and set to required elevation. Additional treatment shall be applied as follows:

1. In critical areas such as utility openings for pipes, conduits and ducts, apply additional treatment at the same rate of 6 liters per linear meter in a strip 150mm to 200mm wide.
2. Along the exterior perimeter of the slab and under expansion joint, at the rate of 2.5 liters per linear meter in a strip 150 mm to 200 mm wide in a shallow trench.

1000.3.3 Wood Protection

Where the application of wood preservative is necessary, the Contractor shall use Type II working solution as recommended by the manufacturer.

All wood materials not pressure treated as specified in Item 1003 -Carpentry and Joinery shall be treated with Type II ready mixed solution as herein called for or as directed by the Engineer.

1000.3.4 Guarantee

The contractor shall guarantee the work for one (1) year after final acceptance.

ITEM 1001 - STORM DRAINAGE AND SEWERAGE SYSTEM

1001.1 Description

This Item shall consist of furnishing all materials, equipment and labor for the complete installation of the storm drainage system to include all pipings, gutters, canals, catch basins, junction boxes, handholes, manholes and other appurtenant structures, and sewerage system to include all sanitary sewer piping and septic vault where no public sewer exist, from the building to the point of discharge.

1001.2 Material Requirements

1001.2.1 Materials for storm drainage system shall meet the requirements specified in the following standard specifications:

| | |
|--|----------------------------|
| Portland Cement | ASTM C-150 |
| Fine and Coarse Aggregate | ASTM C-33 |
| Reinforcing Steel | ASTM A-615 |
| Non-reinforced Concrete Pipes | ASTM C-14 |
| Reinforced Concrete Pipes | ASTM C-76 (AASHTO M-86) |
| Cast Iron Pipes (for conductors and downspout) | ASTM A-74 |
| Galvanized Iron Pipes Scheduled 40 (for conductors and downspouts) | ASTM A-120 |
| Polyvinyl Chloride (PVC) (for conductors and downspouts) | ASTM 2729 |

Where the covers for catch basins, junction boxes, manholes and canals for gratings are required same shall be made of wrought iron and of the dimensions as shown on the Plans.

1001.2.2 Materials for sewerage system shall meet the requirements specified in the following standard specifications:

| | |
|--|--------------|
| Cast Iron Pipes and Fittings | ASTM A-74 |
| Pig Lead (for securing and sealing joints) | ASTM B 29-77 |
| PVC Pipes and Fittings (where called in Plans) | ASTM D 1784 |
| Solvent Cement (for securing PVC joints) | ASTM D 2564 |

Where PVC pipes and fittings are used, joints shall be secured with rubber "O" ring or solvent cement, as the case maybe.

Oakum for joints in bell and spigot pipes shall be made from hemp fiber, braided or twisted and oil impregnated free from lumps, dirt and extraneous matter.

1001.3 Construction Requirements

1001.3.1 Installation of Pipes

Under no circumstances shall pipes shall be laid under water and when the trench condition or weather is unsuitable for such work.

- a. Bedding. Materials such as sand, sandy soil or any approved material shall be used to provide a firm foundation of uniform density. The bedding shall have a minimum thickness equivalent to one-fourth (1/4) of the pipe's diameter.
- b. Laying of Pipes. Proper facilities shall be provided for lowering and placing pipes into trenches in order to preclude damage. Laying of pipes shall start up grade with the spigot end of bell-and-spigot pipe, or the tongue end of tongue-and-groove pipe, positioned towards the direction of the flow. The pipes shall be laid in accordance with the grades and alignments shown in the Plans.

The spigots or tongues shall be adjusted in bells or grooves to provide uniform space around joints to receive mortar. Blocking/wedging between spigot and bell or between tongue and groove to attain proper spacing shall be allowed provided such blocking/wedging shall not interfere with the caulking and shall not affect the water tightness of the joint.

- c. Bell and Spigot Joint for Drain Pipe. The first pipe shall be properly bedded at the required grade. Just below the spigot of the first unit, a sufficient space shall be provided for engaging the bell end of the second pipe. The spigot shall be carefully cleaned with a wet brush and the upper exterior portion applied with mortar to such a thickness as to bring the inner surfaces of the abutting pipes flush and even. The bell end of the second pipe shall be cleaned with a wet brush and uniformly matched with the spigot of the first pipe so that the sections are closely fitted. After the second pipe is laid, the remainder of the joint shall be fitted with mortar, and a bead shall be formed around the outside of the joints with sufficient amount of additional mortar. The inside of the joints shall be wiped and finished smooth. The mortar bead on the outside shall immediately be protected with a cover of wet burlap or wet earth for at least three (3) days for curing.
- d. Tongue and Groove Joint for Concrete Pipe. The first pipe shall be properly bedded. A shallow excavation shall be made underneath the joint and filled with mortar to provide a bed for the second pipe. The tongue end of the first pipe shall be carefully cleaned with wet brush and soft mortar applied around the upper half of the tongue. After cleaning and positioning the second pipe close to the first, mortar shall be applied around the lower half of the groove. With just sufficient thrust, the second pipe shall be brought in close contact with the first until mortar is squeezed out of the joint. Sufficient mortar shall be used to fill the joint and to form a bead on the outside.

- e. Mortar for Joint. Mortar shall be a mixture of Portland cement, sand and water mixed in the proportion by volume of one part cement to two parts of clean sand with just sufficient amount of water for plasticity.
- f. Leaded Joints of Cast Iron Pipes. Joints of cast iron pipes shall be packed with braided or twisted oil-impregnated hemp or oakum, properly caulked around the joint. The packing shall be at least 20mm below the rim of the hub or bell and this space shall be filled with molten pig lead in one continuous pouring. The "ring" of pig lead formed around the joint shall be properly caulked by appropriate caulking tools to render the joints watertight.

1001.3.2 Concrete structures. Concrete structures such as catch basins, canal gutters, junction boxes and manholes for the drainage system, and septic vault for sewerage system, shall be constructed in accordance with the Plans and Specifications on Concrete Work.

1001.3.3 Sewer Connections and Clean-Outs

- a. The outlet of the septic vault shall be connected to the street drain or to other discharge point where no sanitary sewer exists. Connection with the sanitary sewer shall not be made without the permission of the proper authorities, but shall be made in such a manner that any and all the service water, as well as house and other liquid wastes, will flow to the sanitary sewer. Provided, that isolated faucets used exclusively for garden purposes may, in the discretion of the proper authorities, be allowed not to flow into the sanitary sewer.
- b. Clean-outs or rodding holes consisting of cast iron extensions with long sweep elbow fittings shall be provided at the ends of runs and at every change of directions. Clean-outs shall be capped with cast brass ferrules with threads and screwed-on removable brass plugs. Clean-outs extended outside the building and raised to the level of finished grade shall be terminated with the same cast brass ferrule with brass plug set into a concrete slab shall be 150mm thick and 300mm square finish flush with grade.

1001.3.4 Incidental Earthwork

Incidental earthwork for the storm drainage and sewerage systems, such as excavation and backfilling shall be undertaken in accordance with applicable part of Excavation Filling and Grading.

1001.3.5 Inspection and Quality Control

Materials shall be inspected and accepted as to quality before same are installed. Piping installed in trenches shall first be inspected, tested and approved by the Engineer before these are covered or backfilled. All defects/ leaks disclosed by the water test shall be remedied to the satisfaction of the Engineer and any extra cost shall be at the expense of the Contractor.

ITEM 1002 - PLUMBING

1002.1 Description

This Item shall consist of furnishing all materials, tools, equipment and fixtures required as shown on the Plans for the satisfactory performance of the entire plumbing system including installation in accordance with the latest edition of the National Plumbing Code, and this Specification.

1002.2 Material Requirements

All piping materials, fixtures and appliances fitting accessories whether specifically mentioned or not but necessary to complete this Item shall be furnished and installed.

1002.2.1 Cast Iron Soil Pipes and Fittings

- a. Pipes and fitting materials shall comply with the specification requirements defined in PNS/SAO 4-1: 1974. The material description and standards of manufacture are herein described:
 1. Cast Iron - the casting shall be made of gray iron which shall be sound, free from cracks, sand holes and blow holes. They shall be uniformly low hardness that permits drilling and cutting by ordinary methods. Pipes and fittings shall be true to pattern and of compact closed grained structure.
 2. Quality of Iron - the iron shall be made by the cupola, air furnace, electric furnace or other processes which shall be checked by regular chemical and physical control test. The resultant shall be gray iron of good quality.
 3. Manufacture - the pipes shall be made with hub and spigot ends or hub ends only. All hubs for pipes and fittings shall be provided with held lead grooves and all spigot ends shall be made with beads or plain. if machine cast centrifugally. Plugs shall be wrought or cast, machined to the dimensions required and shall be free from defects.
 4. Freedom from defects - pipes and fittings shall be true, smooth and cylindrical, their inner and outer surfaces being as nearly concentric as practicable. They shall be in all aspects, sound and good casting free from laps, pin holes or other imperfections and shall be neatly dressed and carefully fettled. The ends shall be finished reasonably square to their axes.
- b. Clean-outs shall be made of heavy cast brass ferrule with counter sunk screw cover same diameter as the pipe except that they shall not be larger than 100mm diameter.
- c. Caulking lead shall be of molten type peg lead conforming to specification requirements defined in ASTM B-29.
- d. Oakum shall be twisted or braided hemp or abaca fibers slightly impregnated with oil.

1002.2.2 Water Supply Pipes and Fittings

- a. Pipes shall be galvanized iron pipe schedule 40 conforming to specification requirements defined in ASTM A-120 with threaded connection. Under roads where necessary shall be suitably protected as shown on the Plans.

Fittings shall be malleable iron Type II, galvanized iron conforming to specification requirements defined in ASTM A338.

b. Valves

Valves for water supply shall be bronze body with threaded ends rated 21.0kgf/cm. square. All valves shall be gate valves unless otherwise specified. Gate valves shall have solid wedge body and discs conforming to specification requirements defined in ASTM B-62. Globe valves shall have plug type discs with ferrule threaded ends and bronze body.

c. Unions

Unions on ferrous pipe 50mm in diameter and smaller shall be malleable iron.

d. Water Meter

Water meter where required to be furnished by the Contractor shall be of the type tested and approved by MWSS.

1002.2.3 Approved Alternate Pipes and Fittings

Pipes and fittings for sanitary and potable water lines as approved alternate shall be Un-plasticized Polyvinyl Chloride Pipes and Fittings (UPVC).

Pipes and fittings shall be made of virgin materials conforming to specification requirements defined in ASTM 0-2241 and PNS 65: 1986. Fittings shall be molded type and designed for solvent cement joint connection for water lines and rubber a-ring seal joint for sanitary lines.

1002.2.4 Septic Tank

The septic tank shall be provided as shown on the Plans including all pipe vents and fittings. The various construction materials such as concrete masonry work shall conform to the corresponding items of this Specifications. Inlet and outlet pipes shall conform to the latest edition of the National Plumbing Code.

1002.2.5 Plumbing Fixtures and Fittings

All fittings and trimmings for fixtures shall be chromium-plated and polished brass unless otherwise approved. Exposed traps and supply pipes for fixtures shall be connected to the roughing in, piping system at the wall unless otherwise indicated on the Plans. Built-in fixtures shall be watertight with provision of water supply and drainage outlet, fittings and trap seal. Unless otherwise specified, all plumbing fixtures shall be made of vitreous china complete with fittings.

- a. Water closet shall be vitreous china, free standing toilet combination, round front bottom outlet symphonic wash down bowl with extended rear self and closed coupled tank with cover complete with fittings and mounting accessories. Model

make and color shall be submitted for approval prior to delivery at jobsite by the Engineer.

- b. Lavatory shall be vitreous china, wall-hung with rear overflow and cast-in soap dishes, pocket hanger with integral china brackets, complete with twin faucets, supply pipes, P-trap and mounting accessories. Where indicated on the Plans to be counter top model make and color shall be approved by the Engineer.
- c. Urinal shall be china vitreous, wall-hung wash-out urinal with extended shields and integral flush spreader, concealed wall-hanger pockets, 19mm top spud complete with fitting and mounting accessories. Model make and color shall be approved by the Engineer.

1002.2.6 Bathroom and Toilet Accessories

- a. Shower head and fitting shall be movable, cone type with escutcheon arm complete with stainless steel shower valve and control lever, all exposed surface to be chromium finish.
- b. Grab bars shall be made of tubular stainless steel pipe provided with safety grip and mounting flange.
- c. Floor drains shall be made of stainless steel beehive type, measuring 100mm x 100mm, and provided with detachable stainless strainer, expanded metal lath type.
- d. Toilet paper holder shall be vitreous china wall mounted. Color shall reconcile with the adjacent fixture and facing tiles.
- e. Soap holder shall be vitreous china wall mounted. Color shall reconcile with the adjacent tile works.
- f. Faucet(s) shall be made of stainless steel for interior use.
- g. Hose-bib(s) shall be made of bronze cast finish.

1002.2.7 Special Plumbing Fixtures

- a. Kitchen sink shall be made of stainless steel self rimming, single compartment complete with supply fittings, strainer traps, dual control lever and other accessories.
- b. Laboratory sink shall be made of cast iron metal with white porcelain finish with single compartment, flat rim ledge, 762mm x 533mm complete with supply fittings, strainer, trap and other accessories.
- c. Scrub-up sink shall be made of cast iron metal with white porcelain finish measuring 610mm x 610mm complete with supply fittings, strainer, trap and wall mounting accessories.
- d. X-ray developing tank shall be made of cast iron white porcelain finish with three (3) compartment x-ray processing tank, drain plug, open standing drain, 19mm IPS inlet spud complete with stand and mounting accessories.
- e. Squat bowl(s) shall be vitreous china, wash down squat bowl with integral foot treads, pail flush type. Color, make and type to be approved by the Engineer.
- f. Grease traps shall be made of cast bronze with detachable cover and mounting accessories.

1002.2.8 Roof Drains, Downspout, Overflow Pipes and Steel Grating

The Contractor shall provide, fit and/or install necessary drains with strainers, where shown on the Plans. Each drain with strainer shall fit the size of the

corresponding downspout (or roof leader) over which it is to be installed and in conformity with the following schedule:

- a. Scrapper drains (for balconies, parapet) shall be made of bronze base with flashing. Flange threaded outlet and convex with integral flashing clamp bolted to flange.
- b. "Josam" type drains shall be made of bronze base semi-dome with large free area, flashing clamp and integral gravel stopper. To be used at roof decks, canopies, gutters, and elsewhere indicated on the Plans.
- c. Downspouts when encased in concrete, unless otherwise shown on the Plans shall be polyvinyl chloride (PVC). Whether indicated or specified to be cast iron or galvanized iron the same shall meet the specification requirement as herein described.
- d. Overflow pipes shall be made of galvanized iron pipe measuring at least 13mm diameter and spaced 200mm on center.
- e. Steel grating shall be made of wrought iron metals of design on shop drawings approved and surfaces to be coated with shop finish.

1002.2.9 Fire Protection System

- a. Fire hose cabinets shall be locally available consisting of 38mm diameter valve hose rack with nipple 30mm rubber lined hose cable withstanding 4268 kg/cm square, nozzle 38mm diameter brass, chromium plated.
- b. Fire standpipe system shall consist of risers and hose valves. Pipe shall be extra strong black iron. Valves to be high grade cast bronze mounted withstanding 79.40 kg. working pressure as indicated on the Plans.
- c. Fire extinguishers shall be potable, suitable for Class A, B, C fires, mounted inside cabinet. Cabinet shall be full flush mounting door with aluminum trim for glass plate, frame and box shall be made of gauge 14 galvanized iron sheet with white interior and red exterior baked enamel finish over primer. Cabinet to be wall mounted and size to be able to accommodate the defined components.
- d. Yard hydrant where shown on the Plans shall match the Integrated Fire Department requirements. Outlet shall be single 63mm diameter gate valves with chain connected caps.

1002.2.10 Built-in appliances such as urinal trough, lavatory and sloped sink shall be made as indicated on the Plans, exposed surfaces to be tile wainscoting complete with fitting accessories required as practiced in this specialty trade.

1002.3 Construction Requirements

The Contractor before any installation work is started shall carefully examine the Plans and shall investigate actual structural and finishing work condition affecting all his work. Where actual condition necessitates a rearrangement of the approved pipe layout, the Contractor shall prepare Plan(s) of the proposed pipe layout for approval by the Engineer.

1002.3.1 Installation of Soil, Waste, Drain and Vent Pipes

- a. All cast iron soil and drainage pipes shall be pitch 6mm per 300mm but in no case flatter than 3mm per 300mm.
- b. Horizontal lines shall be supported by well secured length heavy strap hangers. Vertical lines shall be secured strongly by hooks to the building frame and a suitable brackets or chairs shall be provided at the floor from which they start.
- c. All main vertical soil and waste stacks shall be extended full size to and above the roof line to act as vents, except otherwise indicated on the Plans.
- d. Vent pipes in roof spaces shall be run as close as possible to underside of roof with horizontal piping pitched down to stacks without forming traps. Vertical vent pipes may be connected into one main vent riser above the highest vented fixtures.
- e. Where an end or circuit vent pipe from any fixtures is connected to a vent line serving other fixtures, the connections shall be at least 1.20 m above the floor on which the fixtures are located.
- f. Horizontal waste line receiving the discharge from two or more fixtures shall be provided with end vents unless separate venting of fixtures is noted on the Plans.
- g. All changes in pipe sizes on soil and waste lines shall be made with reducing fittings or recessed reducers. All changes in direction shall be made by appropriate use of 45 degree wyes, half wyes, long sweep quarter bends or elbows may be used in soil and waste lines where the change in direction of flow is from the horizontal to the vertical and on the discharge from waste closets. Where it becomes necessary to use short radius fittings in other locations the approval of the Engineer shall be obtained prior to installation of the same.
- h. All joints of cast iron pipes in bell and spigot shall be firmly packed with oakum or hemp and caulked with pig lead at least 25 mm deep.
- i. Cleanouts at the bottom of each soil stack, waste stack, interior downspout and where else indicated shall be the same size as the pipe up to and including 102 mm . 152 mm, for larger pipes.

Cleanouts on floors shall be cast iron ferrule caulked into cast hub and fitted with cast brass screw plug flush with floor. Cleanouts for threaded pipes shall be installed at the foot of soil, waste and drain stacks and on each building drain outside the building.
- j. Vent pipe shall be flashed and made watertight at the roof with ferrule lead sheet. Flashing shall be turned down into pipes.
- k. Each fixtures and place of equipment requiring connection to the drainage system except fixtures with continuous waste shall be equipped with a trap. Each trap shall be placed as near to the fixture as possible.

Traps installed on threaded pipe shall be recessed drainage pattern.
- l. Overhead horizontal runs of pipes shall be hung with adjustable wrought iron pipe hanger spaced not over 3.04 m apart except hub and spigot soil pipe which shall have hanger spaced not over 1.50 m apart and located near a hub.

1002.3.2 Water Pipes, Fittings and Connections.

All water pipings inside the building and underground, 100 mm diameter and smaller shall be galvanized iron threaded pipe with malleable iron fittings.

- a. The water piping shall be extended to all fixtures, outlets, and equipment from the gate valves installed in the branch near the riser.

- b. The cold water system shall be installed with a fall towards a main shutoff valve and drain. Ends of pipes and outlets shall be capped or plugged and left ready for future connections.
- c. Mains and Branches
 - 1. All pipes shall be cut accurately to measurements and shall be worked into place without springing or forcing. Care shall be taken so as not to weaken the structural portions of the building.
 - 2. All piping above the ground shall be run parallel with the lines of the building unless otherwise indicated on the Plans.
 - 3. All service pipes, valves and fittings shall be kept at sufficient distance from other work to permit finished covering not less than 12.5mm from such work or from finished covering on the different service.
 - 4. No water piping shall be buried in floors, unless specifically indicated on the Plans and approved by the Engineer.
 - 5. Changes in pipes shall be made with reducing fittings.
- d. Drain Cocks
 - 1. Pipe drain indicated on the drawings shall consist of 12 mm globe valve with renewable disc and installed at 10 points on the cold water piping so that all piping shall slope 00 mm in 30.5 m.
- e. Threaded Pipe Joints
 - 1. All pipes shall be reamed before threading. All screw joints shall be made with graphite and oil or with an approved graphite compound applied to make threads only. Threads shall be full cut and not more than three threads on the pipe shall remain exposed.

Expansion and Contraction of Pipes

Accessible contraction-expansion joints shall be made whenever necessary. Horizontal runs of pipe over 15m in length shall be anchored to the wall to the supporting structure about midway on the run to force expansion and contraction equally toward the ends or as shown on the Plans.

f. Fire Standpipe System

Fire standpipe system shall consist of risers and hose valve. Pipes shall be extra strong black iron. Valves to be underwriter's approval high grade cast bronze mounted.

g. Valves and Hose Bibs

- 1. Valves shall be provided on all supplied fixture as herein specified.
- 2. The cold water connections to the domestic hot water heaters shall be provided with gate valves and the return circulation connections shall have gate and a check valve.

3. All connection to domestic hot water heaters shall be equipped with unions between valve and tanks.
4. Valve shall not be installed with its stem below the horizontal. All valves shall be gate valves unless otherwise indicated on the Plans.
5. Valves up to and including 50 mm diameter shall be threaded ends, rough bodies and finished trimmings, except those on chromium plated brass pipe.
6. Valves 63 mm in diameter and larger shall have iron bodies, brass mounted and shall have either screws or flange ends.
7. Hose bibs shall be made of brass with 12.5 mm inlet threads, hexagon shoulders and 19mm male.

1002.3.3 Fixtures, Equipment and Fastenings

- a. All fixtures and equipment shall be supported and fastened in a safe and satisfactory workmanship as practiced.
- b. All fixtures, where required to be wall mounted on concrete or concrete hollow block wall, fasten with brass expansion bolts. Expansion bolts shall be 6 mm diameter with 20 mm threads to 25 mm into solid concrete, fitted with loose tubing or sleeves of proper length to acquire extreme rigidity.
- c. Inserts shall be securely anchored and properly flushed into the walls. Inserts shall be concealed and rigid.
- d. Bolts and nuts shall be horizontal and exposed. It shall be provided with washers and chromium plate finish.

1002.3.4 Pipe Hangers, Inserts and Supports

- a. Pipe hangers shall be wrought iron or malleable iron pipe spaced not more than 3m apart for horizontal runs or pipe, except hub and spigot soil pipe which shall have hanger spaced not over 1.50 m apart located near the hub.
- b. Chains, straps perforated turn-buckles or other approved means of adjustment except the turn-buckles may be omitted for hangers on soil or waste lines or individual toilet rooms to maintain stacks when spaced does not permit.
- c. Trapeze hangers may be used in lieu of separate hangers on pipe running parallel to and close to each other.
- d. Inserts shall be cast steel and shall be of type to receive a machine bolt or nut after installation. Insert may be permitted adjustment of the bolts in one horizontal direction and shall be installed before pouring of concrete.
- e. Wrought iron clamps or collars to support vertical runs of pipe shall be spaced not more than 6 m apart for as indicated on the Plans.

1002.3.5 Plates and Flashing

- a. Plates to cover exposed pipes passing through floor finished walls or ceiling shall be fitted with chromium plated cast brass plates or chromium plated cast Iron or steel plates on ferrous pipes.
- b. Plates shall be large enough to cover and close the hole around the area where pipes pass. It shall be properly installed to insure permanence.
- c. Roof areas penetrated by vent pipes shall be rendered watertight by lead sheet flashing and counter flashing. It shall extend at least 150 mm above the pipe and 300 mm along the roof.

1002.3.6 Protection and Cleaning

- a. During installation of fixtures and accessories and until final acceptance, protect items with strippable plastic or other approved means to maintain fixtures in perfect conditions.
- b. All exposed metal surfaces shall be polished clean and rigid of grease, dirt or other foreign materials upon completion.
- c. Upon completion, thoroughly clean all fixtures and accessories to leave the work in polished condition.

1002.3.7 Inspection, Warranty Test and Disinfection

All pipes, fittings, traps, fixtures, appurtenances and equipment of the plumbing and drainage system shall be inspected and approved by the Engineer to insure compliance with all requirements of all Codes and Regulations referred to in this Specification.

1002.3.7.1 Drainage System Test

- a. The entire drainage venting system shall have all necessary openings which can be plugged to permit the entire system to be filled with water to the level of the highest stack vent above the roof.
- b. The system shall hold this water for a full 30 minutes during which time there shall be no drop greater than 102 mm.
- c. Where only a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system except that a vertical stack 3.00 m highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure or water pump may be used to supply the required pressure.
- d. If and when the Engineer decides that an additional test is needed, such as an air to smoke test on the drainage system, the Contractor shall perform such test without any additional cost.

1002.3.7.2 Water Test on System

- a. Upon completion of the roughing-in and before connecting fixtures the entire cold water piping system shall be tested at a hydrostatic pressure $1\frac{1}{2}$ times the expected working pressure in the system during operation and remained tight and leak-proofed.
- b. Where piping system is to be concealed the piping system shall be separately in manner similar to that described for the entire system and in the presence of the Engineer or his duly designated representative.

1002.3.7.3 Defective Work

- a. All defective materials replaced and tested will be repeated until satisfactory performance is attained.
- b. Any material replaced for the satisfactory performance of the system made shall be at the expense of the Contractor.
- c. Caulking of screwed joints or holes will not be permitted.

1002.3.7.4 Disinfection

- a. The entire water distribution system shall be thoroughly flushed and treated with chlorine before it is operated for public use.
- b. Disinfection materials shall be liquid chlorine or hypochlorite and shall be introduced in a manner approved as practiced or approved by the Engineer into the water distribution system.
- c. After a contact period of not less than sixteen hours, the heavily chlorinated water shall be flushed from the system with potable water.
- d. Valves for the water distribution system shall be opened and closed several times during the 16 hours chlorination treatment is done.

1002.3.8 As-Built Drawings

Upon completion of the work, the Contractor shall submit two sets of prints with all as-built changes shown on the drawings in a neat workmanship manner. Such prints shall show changes or actual installation and conditions of the plumbing system in comparison with the original drawings.

ITEM 1003 - CARPENTRY AND JOINERY WORKS

1003.1 Description

The work under this Item shall consist of furnishing all required materials, fabricated woodwork, tools, equipment and labor and performing all operations necessary for the satisfactory completion of all carpentry and joinery works in strict accord with applicable drawings, details and these Specifications.

1003.2 Material Requirements

1003.2.1 Lumber

Lumber of the different species herein specified for the various parts of the structure shall be well seasoned, sawn straight, sundried or kiln dried and free from defects such as loose unsound knots, pitch pockets, sapwood, cracks and other imperfections impairing its strength, durability and appearance.

1003.2.1.1 Grades of Lumber and Usage

- a. Stress grade is seasoned, close-grained and high quality lumber of the specified species free from defects and suitable for sustaining heavy loads.

Stress grade lumber shall be used for wooden structural members subject to heavy loads, and for sub-floor framing embedded or in contact with concrete or masonry.

- b. Select grade lumber of the specified species is generally of high quality, of good appearance, without imperfections, and suitable for use without waste due to defects and suitable also for natural finish.

Select grade lumber shall be used for flooring, sidings, fascia and base boards, trims, moldings, millwork, railings, stairs, cabinet work, shelving, doors, windows and frames of openings.

- c. Common grade lumber has minimum tight medium knot not larger than 25 mm in diameter, with minimal imperfections, without sapwood, without decay, insect holes, and suitable for use with some waste due to minor defects and suitable also for paint finish.

Common grade lumber shall be used for light framework for wall partitions, ceiling joist and nailers.

1003.2.1.2 Lumber Species and Usage

Unless otherwise specified on the Plans, the following lumber species shall be used as indicated:

- a. Yacal (stress grade) for structural member such as post, girders, girts, sleepers door and window frames set or in contact with concrete or masonry.
- b. Guijo (select grade) for door and window frames set in wooden framework, for stairs, for roof framing supporting ceramic or cement tiles, for floor joists and other wooden structural parts.
- c. Apitong (common grade) for roof framing supporting light roofing materials such as galvanized iron, aluminum or asbestos sheets, for wall framing, ceiling joists, hangers and nailers.
- d. Tanguile (select grade) for doors and windows, fascia and base boards, trims, mouldings, millwork, railings, stairs, cabinet work, shelvings, flooring and siding.
- e. Narra (select grade) for stair railings, flooring boards, wall panels, base boards, trims, mouldings, cabinet work, millwork, doors and windows when indicated as such in the Plans.
- f. Dao (select grade) for parts of the structure as enumerated under Section 1003.2.1.2 (e), when indicated as such on the Plans.

1003.2.1.3 Moisture Content

Rough lumber for framing and siding boards shall be air-dried or sun-dried such that its moisture content shall not exceed 22 percent. Dressed lumber for exterior and interior finishing, for doors and windows, millwork, cabinet work and flooring boards shall be kiln-dried and shall not have a moisture content in excess of 14 percent at the time of installation in the structure.

1003.2.1.4 Substitution in Lumber Specie

Any lumber equally good for the purpose intended may be substituted for the specified kind subject to the prior approval of the Engineer, provided the substitution shall be of an equal or better specie acceptable to the Engineer. In case of substitution with a better specie, no additional cost therefore shall be allowed to the contractor.

1003.2.2 Plyboard

Plyboard shall be good grade and made of laminated wood strips of uniform width and thickness bounded together with water resistant resin glue. The laminated core shall be finished both faces with select grade tanguile or red lauan veneers not

less than 2 mm thick similarly bonded to the core. The plyboard of not less than 19 mm thick shall be free from defects such as split in veneer, buckling or warping.

1003.2.3 Plywood

Plywood shall conform to the requirements of the Philippine Trade Standards 631-02. Thickness of a single layer laminae shall not be less than 2 mm. The laminae shall be superimposed in layers with grains crossing at right angles in successive layers to produce stiffness. The face veneers shall be rotary cut from select grade timber. The laminae and face veneers shall be bonded with water resistant resin glue, hot pressed and pressure treated. Ordinary tanguile or red lauan plywood with good quality face veneers, 6 mm thick shall be used for double walling and ceiling not exposed to moisture; waterproof or marine plywood shall be used for ceiling exposed to moisture such as at toilets and eaves, and ceiling to be finished with acrytex.

1003.2.4 Lawanit

Lawanit, when required per plans, shall be 6 mm thick, tempered or oil impregnated for moisture/water resistance. Texture of lawanit shall be subject to the approval of the Engineer.

1003.2.5 Materials Other Than Lumber

1003.2.5.1 Plastic Sheet

When required for counter top, plastic sheet such as Formica shall not be less than 1.50 mm thick and shall have hard, durable and glossy surface resistant to stain, abrasion and heat. Color and design shall be as selected from the manufacturer's standard and approved by the Engineer.

1003.2.5.2 Glue

Glue shall be from water resistant resins which, upon hardening, shall not dissolve nor lose its bond or holding power even when soaked with water for extended period. Glue in powder form be in sealed container and shall be without evidence of lumping or deterioration in quality.

1003.2.5.3 Fasteners

Nails, screw, bolts and straps shall be provided and used where suitable for fixing carpentry and joinery works. All fasteners shall be brand new and of adequate size to ensure rigidity of connections.

- a. Nails of adequate size shall be Steel wire, diamond-pointed, ribbed shank and bright finish.
- b. Screws of adequate size shall be cadmium or brass plated steel with slotted head.
- c. Lag screws of adequate size, for anchoring heavy timber framing in concrete or masonry, shall be galvanized steel.
- d. Bolts and nuts shall be of steel having a yield point of not less than 245 MPa. Bolts shall have square heads and provided with standard flat steel washers and

hexagonal nuts. Threads shall conform to American coarse thread series. The threaded portion shall be long enough such that the nut can be tightened against the bolted members without any need for blocking. The bolt's threaded end shall be finished smooth fore and aft of engaging and turning of the nut.

- e. Wrought iron straps or angles, when required in conjunction with bolts or lag screws to provide proper anchorage, shall be of the shape and size shown on the Plans.

1003.3 Construction Requirements

1003.3.1 Quality of Materials

All materials to be incorporated in the carpentry and joinery work shall be of the quality specified under Section 2. Before incorporation in work, all materials shall have been inspected/accepted by the Engineer or his authorized representative.

1003.3.2 Storage and Protection of Materials

Lumber and other materials shall be protected from dampness during and after delivery at the site. Materials shall be delivered well in advance of actual need and in adequate quantity to preclude delay in the work. Lumber shall be piled in orderly stack at least 150 mm above ground and at sheltered place where it will be of least obstruction to the work.

1003.3.3 Shop Drawings

Shop drawings complete with essential dimensions and details of construction, as may be required by the Engineer in connection with carpentry and joinery work, shall be submitted for approval before proceeding with the work.

1003.3.4 Rough Carpentry

Rough carpentry covers timber structural framing for roof, flooring, siding, partition and ceiling.

- a. Framing shall be stress grade or common grade lumber of the species specified under Section.
- b. Rough carpentry shall be done true to lines, levels and dimensions. It shall be squared, aligned, plumbed and well fitted at joints.
- c. Trusses and other roof framing shall be assembled, fitted and set to exact location and slope indicated on the Plans.
- d. Fasteners, connectors and anchors of appropriate type and number shall be provided and fitted where necessary.
- e. Structural members shall not be cut, bored or notched for the passage of conduits or pipes without prior approval of the Engineer.

Members damaged by such cutting or boring shall be reinforced by means of specifically formed and approved steel plates or shapes, otherwise, damaged structural members shall be removed and replaced to the satisfaction of the Engineer.

- f. Timber framing in contact with concrete or masonry shall be treated with termite-proofing solution and after drying coated with bituminous paint.

1003.3.5 Finished Carpentry

Finished carpentry covers works on flooring, siding and ceiling boards, stairs, cabinets, fabricated woodwork, millwork and trims.

- a. Framing lumber shall be select grade, free from defects and where exposed in finished work, shall be selected for color and grain.
- b. Joints of framing shall be tenoned, mortised or doweled where suitable, closely fitted and secured with water resistant resins glue. Exterior joints shall be mitered and interior angles coped.
- c. Panels shall be fitted allow for contraction or expansion and insure that the panels remain in place without warping, splitting and opening of joints.
- d. Plyboard shall be as specified under Section 1003.2.3 unless otherwise indicated on the Plans.
- e. Plywood shall be specified under Section 1003.2.4.
- f. Exposed edges of plywood or plywood for cabinets shall be provided with select grade hardwood strips, rabbeted as necessary, glued in place and secured with finishing nails. To prevent splitting, hardwood for trims shall be drilled before fastening with nails or screws.
- g. Fabricated woodwork shall be done preferably at the shop. It shall be done true to details and profiles indicated on the Plans.

Where set against concrete or masonry, woodwork shall be installed when curing is completed.

- h. Exposed wood surfaces shall be free from disfiguring defects such as raised grains, stains, uneven planing, sanding, tool marks and scratches.

Exposed surfaces shall be machine or hand sanded to an even smooth surface, ready for finish.

ITEM 1004 - HARDWARE

1004.1 Description

This Item shall consist of furnishing and installing all building hardware required to: (1) ensure rigidity of joints/connections of the different parts of the structure; and (2) equip in a satisfactory operating condition parts of the structure such as doors, windows, cabinets, lockers, drawers and other similar operating parts as indicated on the plans and in accordance with this specifications.

1004.2 Material Requirements

1004.2.1 Rough Hardware

All rough hardware such as nails, screws, lag screws, bolts and other related fasteners required for carpentry work shall be first class quality and locally available.

1004.2.2 Finishing Hardware

All finishing hardware consisting of locksets, latches, bolts and other devices, door closers, knobs, handles, hinges and other similar hardware shall be first class quality available locally and conforming with the following specifications.

1004.2.2.1 Door Locksets

Door locks appropriate for particular functions shall be of durable construction, preferably the product of single reputable manufacturer for consistent quality and master keying.

1004.2.2.1.1 Cylindrical lockset for swing wood door shall be of sturdy construction and knob design. The cylindrical case shall be made of steel, zinc coated & dichromate dip. The knobs, latch, strike & pin tumbler assembly shall be cast brass or bronze. The spring and spindle shall be steel, zinc coated. The pins and the key, shall be nickel-silver. The latch, with a minimum throw of 16mm, shall be retracted by knob from either side except when the outside knob is locked by key in the outside knob or by the turn/ push button on the inside knob.

1004.2.2.1.2 Mortise lock for swing door shall have cast bronze latch bolt with steel compression spring, cast bronze dead bolt with hardened steel inserts, wrought bronze or brass knobs heavy gauge and cold formed steel operation levers. The pin tumbler cylindrical assembly shall be cast bronze or brass and fitted with 5 spring pressed nickel silver pins. Mortise lock used in conjunction with fire exit bolts shall have armored fronts.

1004.2.2.1.3 Unit of monolock for swing door shall be factory assembled in one piece, with knobs and escutcheons attached, ready for installation.

All parts of unit lock shall be non-ferrous metal. Frame shall be one piece cast bronze or extruded brass, front shall be flat for door 35 mm thick and beveled for door 45 mm thick, and latch bolt shall be pivoted swing type with minimum 26 mm throw. Cylinder shall be extruded brass with 5 spring-pressed pins and keys shall be nickel silver.

1004.2.2.1.4 Dead lock for sliding door shall be mortise or surface mounted type to suit particular application.

1004.2.2.1.4.1 Mortise type dead lock shall have cast bronze case, front, latch bolts, strike and cylinder. Operation of dead bolt shall be by drop handles from either side. When locked by key from outside, or by thumb knob from inside, drop handle will not operate the dead bolt.

1004.2.2.1.4.2 Surface type deadlock shall have cast bronze case, strike and cylinder. Interlocking vertical bolt shall be hardened steel operated by key from outside and thumb turn from inside. Strike shall be angled type.

1004.2.2.1.5 Deadlock for swinging door shall be tubular design with mechanism made of heavy gauge cold-rolled steel, zinc coated and dichromated. Dead bolt, strike and pin tumbler cylinder shall be bronze. Dead bolt, with at least 25 mm throw, shall be operated by key from outside and by thumb from inside.

1004.2.2.1.6 Lock for door of emergency/fire exit (panic hardware) shall be cast bronze or brass and heavy duty locking device coupled with a horizontal crossbar. Latch shall be operated by key from outside and by crossbar from inside. Locking device shall be surface or mortise type suitable for a particular application.

Inactive leaf of double doors oremergency/fire exit shall be fitted with vertical rod actuated by crossbars,such vertical rod providing two point locking, bottom and overhead.

1004.2.2.1.7 Lock for drawers and cabinets shall be bronze or brasswith latch operated by key through a pin-tumbler cylinder 22 mm indiameter. Back plate of the lock shall be provided with four screw holesfor mounting.

1004.2.2.1.8 Hasplock, when required as indicated on the Plans shall behinge hasp with integral padlock. The hinge hasp shall be zinc coatedwrought steel, 47.5 mm in width and 100 mm in length when closed. Theintegral padlock shall be pin tumbler type with solid or laminated zinccoatedwrought steel case with hardened steel shackle securely attachedto the draw bolt.

1004.2.2.2 Door Closers

- a. All door closer shall be cast bronze provided with a key valve orcap valve for making necessary adjustment.
- b. The following table shall serve as guide in determining door closersizes:

| Door Maximum Width | Size of Closer |
|--------------------|----------------|
| 0.76 m | Size 2 |
| 0.90 m | Size 3 |
| 1.07 m | Size 4 |
| 1.20 m | Size 5 |
| 1.37 m | Size 6 |

Use larger size where unusual conditions exist.

1004.2.2.3 Hinge

Hinge unless otherwise indicated on the Plans shall be brass coatedwrought iron steel for interior doors and wrought bronze for exteriordoors with non-rising loose steel pins with button tips and mountingscrews of the same materials.

1004.2.2.4 Sliding Door Hardware

Sliding door hardware shall be four-wheel ball bearing trolley onoverhead track. Track is of rolled steel formed steel or extruded aluminum.Bearing is of plain steel balls or steel rollers. Wheels are to be steel, brass,rubber or plastic as the case maybe.

1004.2.2.5 Miscellaneous Hardwares

1004.2.2.5.1 Flush Bolt

Flush/extension flush type bolt shall be made of stainless steel withproper length suitable to the door specified.

1004.2.2.5.2 Barrel bolts shall be of wrought steel brass coated with anattachment of at least 4-screws.

1004.2.2.5.3 Door Pull and Push Plate

Door pull and push plate shall be made of stainless steel with concealed attachments.

1004.2.2.5.4 Hook, Bumper and Silencer

Hook, bumper and silencer shall be made of extruded brass or bronze, dull chrome finish with at least 2 screw attachments.

1004.2.2.5.5 Furniture and Cabinets Hardware

Furniture and cabinet hardware line piano hinge, invisible hinge, floor pivot hinge, cabinet door catch, shall be made from extruded brass or bronze with dull chrome finish, of sizes and type suited for use.

1004.2.2.5.6 Push Plate

Push plate for metal door shall be made of stainless steel with concealed attachments.

1004.3 Construction Requirements

1004.3.1 Submittals:

The Contractor shall submit all necessary information to the Engineer prior to placing of order.

1004.3.1.1 Manufacturers data such as catalog for every hardware item to be furnished, showing all finishes, sizes, catalog numbers and pictures, with all abbreviations fully explained shall be submitted as general information and reference.

1004.3.1.2 Hardware templates for fabricated doors and windows shall be furnished to each fabricator to confirm that adequate provision will be done for proper installation of the hardware.

1004.3.1.3 Operation and maintenance data shall be provided and submitted to the Owner/DPWH showing all the hardware component part lists and maintenance instructions for each type supplied including the necessary wrenches of tools required.

1004.3.2 Packaging and Marking

1004.3.2.1 Each article shall be individually packaged in the manufacturer's commercial carton/container properly marked or labeled so as to be readily identified and delivered to the project site in the original manufacturer's container/package.

1004.3.2.2 All hardware shall be provided with fasteners necessary for the installation packed in the same container with the Hardware.

1004.3.3 Storage and Protection

Hardware shall be properly stored in a dry and secured place. It shall be protected from damage at all times prior to and after installation.

1004.3.4 Installation of Hardware

- a. All hardware shall be installed in a neat workmanship manner following the manufacturer's instruction manual to fit details as indicated on the Plans.
- b. Except as indicated or specified otherwise, fasteners furnished with the hardware shall be used to fasten hardware in place.
- c. After installation works are completed the hardware shall be protected from paints, stains, blemishes and other damage until the work is properly turned over and accepted.
- d. All hardware shall be properly checked and adjusted in the presence of the engineer and all hinges, locks, catches, bolts, pulls, closers and other miscellaneous items shall operate properly.
- e. After hardware are properly checked and adjusted keys shall be properly identified with key tags and turned over to the Engineer.

1004.3.5 Keying

Locks shall be keyed in sets and subsets. Where locks are required by the owner to be keyed alike in one system furnish a total of 4 keys for each set.

ITEM 1010 – WOODEN DOORS AND WINDOWS

1010.1 Description

This Item shall consist of furnishing all materials, hardware, plant, tools, labor and services necessary for complete fabrication and installation of wooden doors and windows of the type and size as shown on the Plans and in accordance with the following specifications and applicable specifications under Item 1003 on Carpentry and Joinery Works.

1010.2 Material Requirements

1010.2.1 Lumber

Lumber of doors, windows and jambs, and panels when required, shall be kiln-dried with moisture content of not more than 14% and shall be of the species indicated on the Plans and/or specified under Item 1003 on Carpentry and Joinery Works.

1010.2.2. Plywood

Plywood for veneer of solid core and hollow core flush doors shall be 3-ply, rotary cut, 6mm thick ordinary plywood, Class B grade. Marine or waterproof plywood, rotary cut, 3-ply, 6mm thick shall be used for flush doors at toilets and bathrooms or at places where these are exposed to moisture.

1010.2.3 Adhesive

Adhesive shall be water resistant resins and shall be non-staining.

1010.2.5 Capiz Shells

Capiz shells, when required for window sashes, shall be of selected quality, free from dirt or blemishes and shall be large enough to obtain flat square piece.

1010.2.6 Hardware

Hardware shall be as specified under Item 1004 on Building Hardware.

1010.3 Construction Requirements

1010.3.1 Fabrication

Wooden doors and windows, including frames, shall be fabricated in accordance with the designs and sizes shown on the Plans. The fabricated products shall be finished square, smoothly sanded and free from damage or warpage.

a. Flush Type Hollow Core Doors

Flush type hollow core doors shall be adequately framed with stiles and top and bottom rails having a minimum thickness of 44mm and width of 75mm. Two intermediate rails at least 44mm wide shall be provided for stiffness.

The stiles and the top and bottom rails shall be rabbeted at least 10mm wide to receive the 6mm thick plywood veneer. A lock block shall be provided at each stile, long enough to connect to the two intermediate rails and at least 75mm wide for mounting the lockset.

The plywood veneer shall be glued and nailed to the framing with 25mm long finishing nails space at not more than 150mm on centers.

b. Flush Type Solid Core Doors

Flush type solid core doors shall be fabricated in the same manner as the hollow core type except that spaces between stiles and rails shall be filled and fitted with wood blocks of the same specie and of uniform thickness thinner by about the thickness of the plywood veneers. The filler blocks shall be secured to either stiles or rails by nails. Stiles and nails of flush type doors shall be joined by

means of blind mortise and tenon joint, tightly fitted, glued and locked with bamboo pin 5mm round.

c. Panel doors

Stiles and rails of panel doors shall have a minimum thickness of 44mm and width of 140mm.

Rails minimum thickness of 44mm and width of 140mm. Rails shall be framed to stiles by mortise and tenon joints. Rabbets or grooves of stiles by mortise and tenon joints. Rabbets or grooves of stiles and rails to receive panels shall be 6.5mm wide and 20mm deep. Integral mouldings formed on both faces of stiles and rails framing the panels shall be true to shape and well defined. Intersections of mouldings shall be mitered and closely fitted.

Panels of the same specie and having a minimum thickness of 20mm shall be beveled around its edges up to minimum width of 50mm, both faces. The beveled edges shall closely fit into the grooves of stiles and rails, but free to move to prevent splitting when shrinkage occurs.

d. Window Sashes with Glass Panes or Wood Panels

Window sashes shall be fabricated in conformity with the design, size and type of installation shown on the Plans. Unless otherwise shown on the Plans, stiles and rails shall be Tanguile with minimum thickness of 30mm and width of 70mm. Jointing of stiles and rails shall be mortise and tenon secured with flue and bamboo pin. Stiles and rails shall rabbeted at the exterior face for mounting glass panes or wood panels. Integral mouldings formed as frames for panes or panels shall be true to shapes, sharply defined and mitered at joints. Separate mouldings of the same design shall be provided for fixing glass panel and wood panel from the outside.

e. Window Sashes with Capiz Shells

Stiles and rails shall be of the same sizes specified under Item 1010.3.1 (d) and assembled with mortise and tenon joint. Unless otherwise indicated on the Plans, lattices for framing capiz shall be tanguile, 8mm thck and 15mm wide, spaced at not more than 60mm on centers bothways. Grooves 2mm wide and 5mm shall be made at sides of lattices to receive the preformed capiz shells.

The lattices shall be assembled with half lap joints at their intersections and the assembled lattices containing the capiz shells shall be framed into the stiles and rails.

Selected capiz shells shall be washed to remove dirt and blemished and drier under the sun for bleaching effect. Capiz shells shall be cut square to required sized with sharp bench cutter to produce non-serrated and non-peeling edges.

f. Sliding Type Window Sashes

Stiles of sliding type window sashes shall be framed to the top and bottom rails with mortise and tenon joints. Tenons shall be formed on the stiles. Joints shall be tightly fitted, glued and locked with bamboo pins. Top and bottom rails

shall be 10mm wider than the stiles. Top rails shall be rabbeted to form tongue flush with the outer face, with the outer face, with width 8mm and height of 10mm. The stiles and rails shall be rabbeted as specified under Item 1010.3.1 (d) to receive glass panes or wood panels.

g. Awning Type Window Sashes

Tenons of rails shall be fitted into the mortises formed on the stiles and the joints glued and locked. The stiles and rails shall be rabbeted as specified under Item 1010.3.1 (d) for mounting of glass panes. Series sashes to be installed vertically shall have their meeting rails rabbeted for half lapping when in closed position.

h. Casement Type Window Sashes

Rails of casement type window sashes shall be fitted to stiles with mortise and tenon joint. Tenons shall be formed in the rails. Meeting rails shall be rabbeted to provide for half lapping when in closed position. The stiles and rails shall be rabbeted as specified under Item 1010.3.1 (d) for mounting of glass panes or wood panels.

i. Door and Window Frames

Framing of the specie(s) specified under Item 1003 shall be fabricated in conformity with the profile and sizes shown on the Plans. Frames shall be assembled with tightly fitted tongue and groove joint mitered at both sides, and nailed. The assembled frames shall be finished square and flat on the same plane. Assembled frames shall be braced temporarily to prevent their distortion during delivery to the site and installation.

1010.3.1. Installation

- a. Frames shall be set plumb and square in concrete/masonry work or framework of walls or partitions. Frames set in concrete or masonry shall be painted with hot asphalt at its contact surface and provided with two rows of common wire nails 100mm long for anchorage. The nails shall be staggered and spaced at 300mm on center along each row. Frame set in concrete shall be installed in place prior to concrete work.

Frames set in masonry work may be installed after laying of hollow concrete blocks, bricks or adobe. Space between frames and masonry shall be fully filled with cement mortar proportioned 1:3.

b. Hinged Doors

Hinged doors, whether panel or flush type with standard height of 2100 mm and width or not more than 900mm shall be hung with four loose-pin butt hinges, 100mm x 100mm. Swing out exterior doors shall be hung with four fast-pin butt hinges. Two hinges shall be fitted 100mm from top and bottom edge of door. The other two hinges shall be fitted at third points between top and bottom hinges. Care should be taken to ensure that the hinges are fitted such that their pins are aligned for ease of pin insertion and smoothness of operation. For added

smoothness pins should be lightly greased. Hammering of hinges to attain proper alignment shall not be allowed.

For wider and heavier doors such as narra panel doors, and additional hinge shall be fitted 100mm below the top hinge to counteract the door tilting action.

Mounting screws shall be screwed in place in their entire length, not forced into place by hammering. Hammering of screw into place shall not be permitted.

c. Sliding Doors

Overhead tracks, standard, locally manufactured as per Plans shall be installed level and mounting bracket secured in place with lag screws supplied with the set. Brackets shall be placed 1000mm on centers. Hangers, two each per door leaf, shall be pre-fitted and bolted to the door rail. For panel doors the hangers shall be centered on the door stiles. For flush doors, the hangers shall be centered 100mm from the edges of the door. If there is no adequate space for installing the door with is attached rollers. Through either end of the track the pre-fitted hangers shall be disassembled for connection to the rollers.

After installation on the track, set the door plumb and in alignment by means of the adjustment mechanism integrated with the roller assembly.

e. Lock Installation

Locks of doors shall be fitted at the same height, centered 1000mm above the finished floor level. Locks shall be installed in conformity with the templates and instruction supplied with locksets. Holes for mounting locks shall be properly formed to provide snug fit and rigid attachment of the locks to the doors. Strike plates shall be fitted on the door frame in true alignment with the lock latch.

e. Sliding Type Window Sashes

Sashes shall be trimmed to fit height of opening. A clearance of 2mm shall be provided between the tongue's base at the top rail and the bottom of the window head. The same clearance shall be provided between the sash tongue and the groove at the window head. Paraffin wax shall be applied to contacts of sliding surfaces. The bottom rails shall be fitted with standard brass guided spaced 75mm from both ends of the rail, mounted flush with the inner face and secured with three brass screws each guide.

f. Casement Type Window Sashes

Sashes shall be trimmed to fit size of opening, with provision for half lapping of meeting stiles. Right side sash shall lap onto the left side sash. Sashes shall be fitted with two brass plated narrow hinges, 50mm x 75mm, spaced 150mm from top and bottom of stiles. In lieu of hinges, sashes maybe hung with cadmium-plated steel casement adjusters 200mm long, subject to prior approval of the Engineer. The top and bottom rails of casement type window sashes shall be milled to provide for the installation of adjusters.

g. Awning Type Window Sashes

Installation of awning type sashes shall be by means of casement adjusters specified under Item 1010.3.2.(f).

ITEM 1013 - CORRUGATED METAL ROOFING

1013.1 Description

This item shall consist of furnishing all plant, equipment, tools, materials and labor required to properly perform and complete the corrugated metal roofing, together with related accessories such as ridge/hip rolls, valleys, gutters and flashing, when called for on Plans all in conformity with his Specifications.

1013.2 Material Requirements

Corrugated galvanized iron (G.I.) sheets, including plain G.I. sheets for roofing accessories, shall be cold-rolled meeting ASTM A 153 and spelter coating of zinc of not less than 0.281 kg/m^2 (1.25 ounces/square foot), conforming to ASTM A 525 OR pns 67:1985. Unless otherwise specified or shown on Plans roofing sheets shall be gauge 26 (0.48 mm thick) and provided in long span sizes to minimize end laps.

Sheets shall weight not less than 3.74 kg/m^2 and shall be marked or stamped showing the gauge, size, amount of zinc coating, brand and name of manufacturer. Test specimens shall stand being bent through 180° flat on itself without fracture of the base metal and without flaking of the zinc coating.

1013.2.2. Strap Fasteners

Strap fasteners shall be gauge 26 G.I. 25mm wide and sufficiently long to bend around up to the opposite face of purlin, with corners chipped off at the riveting ends.

1013.2.3 Rivets, Washers and Burrs

Rivets and washers shall be galvanized mild iron. Rivets shall not be less than 5mm in diameter and 10mm length. Washers shall not be less than 1.5mm thick and 20mm in outside diameter. Washer's inside diameter shall provide snug fit to the rivet.

1013.2.4 Soldering Lead

Soldering lead shall have a composition of 50 percent tin and 50 percent lead, conforming to ASTM B 32.

Rivets and burrs for lap joints of gutters, downspouts and flashing shall be copper not let than 3.175 mm in diameter (No. 8).

1013.2.5 Fabricated Metal Roofing Accessories

Ridge/hip rolls, valleys, flashing and counter flashings, gutters and downspouts, whenever required, shall be fabricated from plain G.I. sheets. Ridge/hip rolls, flashings and counter flashings shall be gauge 2. Valleys, gutters and downspouts

shall be gauge 24 unless otherwise specified on Plans. Wire basket strainers shall be galvanized, gauge 24.

Roof ventilators, whenever required shall be fabricated from gauge 26 plain G.I. sheets and constructed to the dimensions and details shown on Plans.

1013.3 Construction Requirements

1013.3.1 Preparatory Work

Preparatory to the installation of the corrugated G.I. roofing, purlins should have been placed and spaced properly to fit the length of roofing sheets to be used such that the centerline of the purlins at end laps are 150mm from the bottom line of end laps and intermediate purlins are placed equidistantly. Top of purlins should be at the same plane.

1013.3.2 Installation of corrugated G.I. Sheets

Installation of corrugated G.I. sheets with end laps shall start at the lower part of the roof and proceed towards the direction of monsoon wind with side laps of two-and-a-half (2-1/2) corrugations. End laps shall be 250mm minimum. Each sheet shall be fastened temporarily by 1.83 mm diameter by 25mm long galvanized flat head nails at valleys of corrugations covered by side or end laps.

Succeeding upper rows of corrugated G.I. sheets shall be installed in the same manner until the entire roof area is covered.

Valleys, ridge/hip rolls and flashings when required, shall be installed before fastening the roofing sheets with galvanized straps and rivets. One strap shall be riveted at each alternate corrugation at the gutter line, the ridge line and at end laps and the straps bent around and nailed to the purlins. Riveting at intermediate purlins between end laps shall be done at every fourth corrugation. Rivets shall be provided with a galvanized mild iron washer below and one lead and one galvanized iron washer above the sheet. Rivet shall be sufficiently long to permit forming a hemispherical head. Riveting shall be done such that the lead washer shall be compressed to provide a watertight fit around the rivet.

1013.3.3 Installation of Roofing Accessories

a) Ridge and Hip Rolls

Ridge and hip rolls shall lap at least 250mm over roofing sheets and, together, shall be riveted at every second corrugation.

b) Valleys

Valleys shall lap at least 450mm each way under the roofing sheets and shall be secured to the framework with galvanized nails, such nails placed below the roofing sheets. Rivets along side of the valley shall be at every second corrugation.

c) Flashing

Flashing, of gauge 2 plain G.I. sheets, unless otherwise specified, shall be installed along intersections of roofs with concrete or masonry walls in accordance with details shown on Plans. Flashing running parallel to sheet corrugation shall lap at least two corrugations with edge turned down. Flashing across sheet corrugation or at an angle thereto, shall lap at least 250mm and the edge of flashing turned down at each corrugation. The vertical portion of flashing adjoining wall shall be at least 200mm wide and provided with counter flashing.

d) Counter Flashing

Counter flashing sheets of gauge 24 plain G.I. shall be built into preformed wedge-shape groove of concrete or masonry wall. The edge to be built into wall groove shall a 25mm strip bent 45 degrees and shall be sealed in the groove with cement mortar or caulking compound.

e) Reglets

Reglets, when required per plans in connection with counter flashing, shall be fabricated products approved by the Engineer, complete with fittings. Reglets shall be located not less than 200mm or more than 40mm above roofing. Reglet plugs shall be spaced not more than 300mm on center. Open-type reglets shall be filled with fiber board or other suitable separator to prevent crushing of the slot during installation. The counter flashing shall be inserted into the full depth of reglet and the reglet lightly punched every 300mm to crimp the reglet and the counterflashing together.

f) Gutters

Gutters, from gauge 24 plain G.I. sheets, shall be fabricated to the shape and dimensions indicated on the Plans. The rear side of the gutter shall have a 12.5mm strip bent 30 degrees and shall be not less than 12.5mm higher than the opposite side. Gutter joints shall be flat seam folded in the direction of flow and soldered evenly. Otherwise, gutter joints shall be lapped at least 25mm, fastened together with 3.175mm diameter (No. 8) copper rivets and burrs, and sealed by soldering along both exposed edges of lap.

Gutter shall be attached to fascia board or roof nailer with galvanized nails or screws spaced at not more than 900mm on centers and at a point slightly higher than leading edge of gutter. As additional support, gutter shall have plain G.I. strap hangers 25mm wide fastened to roof nailers by screw shank-type nails and riveted to the gutter's leading edge. Strap hangers shall be spaced at not more than 900mm on centers. When shown on Plans that gutter is not fixed to fascia board or purlin, gutter shall be supported by wrought iron (W.I.) hangers not less than 4.75mm thick and 19mm wide spaced at not more than 900mm on centers. W.I. hanger shall be fabricated to fit configuration of the gutter and attached to fascia board or purlin with two (2) No. 8 flat head wood screws.

Gutter shall be installed with a pitch of 1 in 100 slope to downspout.

Downspout

1) Downspout

Unless specified otherwise, downspouts shall be plain G.I., thickness fabricated to the dimensions shown on the Plans and installed at indicated locations. Downspout shall be secured to the wall with G.I. straps 25mm wide, spaced at more than 1000mm and anchored with concrete nails. Inlets of downspouts shall be fitted with gauge 14 wire basket strainers.

2) Unplasticized Polyvinyl Chloride Downspouts

When shown on Plans that downspouts are other than G.I. sheets, downspouts shall be unplasticized polyvinyl chloride (UPVC) pipes and fittings with dimensions indicated and conforming with ASTM D 3033 and D 3034. Joints shall be made with either solvent cement or rubber "O-rings" depending on the design of fitting for the joints. Rubber "O-rings" shall be neoprene type, heat and oil resistant, complying with ASTM F-477. Downspout shall be secured to adjoining wall with plain G.I. Straps 25mm wide and spaced at not more than 1000mm.

g) Roof Ventilators

Roof ventilators, whenever shown on Plans shall be firmly secured to the roofing or roof structure by means of rivets. Roof ventilators installed on the roof at places other than the ridge shall be provided with adequate flashing around intersection with roofing to ensure watertight joints.

1013.3.4 Joints of G.I. Roofing Accessories

a) Soldered Joints

Joints made by lapping coupled with riveting shall be rendered watertight by soldering. All edges of uncoated sheet metal to be soldered shall be pre-tinned before soldering. Soldering shall be done slowly with well heated iron in order to thoroughly heat the seam and sweat the solder completely through the full length of the seam. Upon completion of soldering, acid shall be neutralized by washing thoroughly with water.

a) Non-soldered Joints

Non-soldered joints of G.I. gutters, downspout and flashing shall be done by flat lock seams. Two adjoining edges of lock seam shall be bent 90°. One bent strip shall be at least 15mm wide and the connecting piece shall have a bent strip twice in width which shall be bent down over the upturned narrower strip and pressed together. Once properly interlocked, the joint shall be flattened such that the edge of the wider strip be concealed.

1013.3.5 Roof Installation of Metal Purlins

Installation on metal purlins shall follow the same procedure as that on wood purlins, except the fastening shall be done with thread-cutting, zinc-coated steel

screws, No. 12 by 50mm. having hexagonal heads and provided with neoprene washers. Screw holes shall be drilled using 5mm (13/64") diameter bit.

1013.3.6 Water Leak Test

The completed roofing shall be tested for watertightness at side and end laps at joints of roofing sheets with ridge/hips rolls, valleys and flashings by means of waterspray system. The water-spray system shall have nozzle which will deliver water pressure of 2 kg/cm² directly to the joint being tested in such manner and for a duration directed by the Engineer. All defective works as determined by this test shall be remedied by the contractor at his expense and the test shall be repeated until the work is found satisfactory.

ITEM 1014 – PRE-PAINTED METAL SHEETS

1014.1 Description

This item shall consist of furnishing all pre-painted metal sheet materials, tools and equipment, plant including labor required in undertaking the proper installation complete as shown on the Plans and in accordance with this Specification.

1014.2 Material Requirements

All pre-painted metal sheet and roofing accessories shall be oven baked painted true to profiles indicated on the plans.

1014.2.1 Pre-Painted Roofing Sheets

Pre-painted roofing sheets shall be fabricated from cold rolled galvanized iron sheets specially tempered steel for extra strength and durability. It shall conform to the material requirements defined in PNS 67:1985. Profile section in identifying the architectural moulded rib to be used are as follows: Regular corrugated, Quad-rib, Tri-wave, Rid-wide, twin –rib, etc. Desired color shall be subject to the approval of the Architect/Engineer.

1014.2.2 Gutters, Valleys, Flashings Hip and Ridge roll shall be fabricated from gauge 24 (.600mm thick) cold-rolled plain galvanized iron sheets specially tempered steel. Profile section shall be as indicated on the Plans.

1014.2.3 Fastening hardware shall be of galvanized iron straps and rivets. G.I. straps are of .500mm thick x 16mm wide x 267 mm long (gauge 25 x 5/8" x 10-1/2" and standard rivets.

1014.2.4 Base metal thickness shall correspond to the following gauge designation available locally as follows:

| | |
|-------------------------|------------------|
| a) Base Metal Thickness | Designated Gauge |
| .400mm thick | Gauge 28 |
| .500mm thick | Gauge 26 |
| .600mm thick | Gauge 24 |
| .800mm thick | Gauge 22 |

- | b) Protective Coatings | Thickness |
|------------------------|---------------------------------------|
| 1. Zinc | 34.4 microns (244 gm/m ²) |
| 2. Paint coatings | |
| Top coat | 15.20 microns |
| Bottom coat | 6.8 microns |
- c) Overall thickness with protective coats
- | | |
|--------|-------------|
| .400mm | .428-451 mm |
| .500mm | .532-551 mm |
| .600mm | .638-651 mm |
- d) Length of roofing sheets – available in cut to length long span length up to 18.29 meters
- e) Special length and thickness are available by arrangements.

1014.3 Construction Requirements

Before any installation work is commenced, the Contractor shall ascertain that the top face of the purlins are in proper alignment. Correct the alignment as necessary in order to have the top faces of the purlins on an even plane.

1014.3.1 Handling/Lifting/Positioning of Sheets

Sheets shall be handled carefully to prevent damage to the paint coating. Lift all sheets or sheet packs on to the roof frame with the overlapping down-turned edge facing towards the side of the roof where installation will commence, otherwise sheets will have to be turned end-to-end during installation.

1014.3.2 Installation Procedure

1014.3.2.1 Start roofing installation by placing the first sheet in position with the down turned edge in line with other building elements and fastened to supports as recommended.

1014.3.2.2 Place the downturned edge of the next sheet over the edge of the first sheet, to provide side lap and hold the side lap firmly in place. Continue the same procedure for subsequent sheets until the whole roofing area is covered and/or (Adopt installation procedure provided in the instruction manual for each type of Architectural molded rib profile section).

1014.3.2.3 For walling applications follow the procedure for roofing. Allow a minimum end lap of 100mm (4") for vertical walling.

1014.3.3 Gutters, Valleys, Flashing ridge and Hip rolls

Gutters, valleys, flashing ridge and hip rolls shall be fastened where indicated on the Plans by self-tapping screws or galvanized iron straps and rivets.

1014.3.4 End Laps

In case handling of transport consideration requires using two or more end lapped sheets to provide full length coverage for the roof run, install each line of sheets from bottom to top or from eave line to apex of roof framing. Provide 150 mm minimum end lap.

1014.3.5 Anchorage/Fastening

1014.3.5.1 Pre-painted steel roofing sheets shall be fastened to the wood purlins with standard length G.I. straps and rivets.

1014.3.5.2 For steel frame up to 4.5mm thick use self-drilling screw No. 12 by 35mm long hexagonal head with neoprene washer.

1014.3.5.3 For steel support up to 5mm thick or more use thread cutting screw No. 12 by 40mm long hexagonal head with neoprene washer.

1014.3.5.4 Side lap fastener use self drilling screw No. 10 by 16mm long hexagonal head with neoprene washer.

1014.3.5.5 Valley fastened to lumber and for walling use self-drilling wood screw No. 12 by 25mm long hexagonal head with neoprene washer.

1014.3.5.6 Valleys fastened to steel supports use self drilling screws, hexagonal head with neoprene washer. Drill size is 5mm diameter.

1014.3.6 Cutting of Sheets

1014.3.6.1 In cutting pre-painted steel roofing sheets and accessories to place the exposed color side down. Cutting shall be carried out on the ground and not over the top of other painted roofing product.

1014.3.6.2 Power cutting or drilling to be done or carried out on pre-painted products already installed or laid in position, the area around hole or cuts shall be masked to shield the paint from hot fillings.

1014.3.7 Storage in Protection

Pre-painted steel roofing, walling products and accessories should be delivered to the jobsite in strapped bundles. Sheets and/or bundles shall be neatly stacked in the ground and if left in the open it shall be protective by covering the stack materials with loose tarpaulin.

ITEM 1017 – ROOF DRAINS WITH STRAINERS

1017.1 Description

This Item shall consist of furnishing all items, articles, plant, equipment, labor and materials and performing all methods necessary of required for the complete installation of all roof drains with strainers in accordance with all applicable drawings as shown on the approved Plans.

1017.1 Materials Requirements

The roof drains with strainers specified herein shall be from the “JOSAM” catalog of the JOSAM Manufacturing Company, Michigan City, Indiana, notwithstanding what are shown on the Plans. The series and type number herein designate the quality and style, design and operation material and finish of drains desired. Any drain with strainer of approved equivalent locally made may be substituted subject to the approval of the Engineer. Equivalent materials, if locally available will be acceptable.

Should the series and type numbers specified herein be not suitable to a particular location due to concrete space limitation, adequation of the series specified of the same size, body materials and finish may be substituted subject to the approval of the Engineer.

1017.3 Construction Requirements

The Contractor shall provide, fit and install all necessary drains with strainers where so shown or indicated on the Plans, and/or where the Engineer directs. Each drain with strainer shall fit well without leaks into the corresponding downspout or conductor over which it is to be installed and in accordance with the following schedule:

Roof Eaves and Gutter

Where so indicated on the Plans, “JOSAM” SERIES 4820-bf, type 4823-BP, cast iron lacquer finish, roof drain with round flange, cast iron rough brass high dome secured to clamping ring by screws, 4-inch deep body (for locally made, 6-inch deep body) with bottom outlet; for “side outlet” “JOSAM” series 4870-BP, type 4873-BP, series 4863-BP.

Any other roof drain shown on the Plans not specified herein or neither shown on the Plans, but necessary to leave the work complete, shall be provided and fitted by the contractor suitable to the service required and fitted to the concrete limitations at the point of installation, based on or similar to those specified herein.

ITEM 1018 – CERAMIC TILES

This item shall consist of furnishing all ceramic tiles and cementitious materials, tools and equipment including labor required in undertaking the proper installation of walls and floor tiles as shown on the Plans and in accordance with this Specification.

1018.2 Materials Requirements

1018.2.1 Ceramic tiles and trims shall be made of clay, or a mixture of clay and other materials which is called the body of the tile. Tile bodies are classified by ASTM C 242 as to their degree of water absorption. Ceramic tiles and trims are manufactured either by dust-pressed process in which the clays are ground to dust mixed with a minimum of water shaped in street dies and then fired or by plastic process in which the clays are made plastic by mixing with water, shaped by extrusion or in molds and then fired.

1018.2.1.1 Glazed Tiles and Trims

Glazed tiles and trims shall have an impervious face of ceramic materials fused onto the body of the tiles and trims. The glazed surface may be clear white or colored depending on the color scheme approved by the Engineer. Standard glazes may be bright (glossy) semi-matte (less glossy) matte (dull) or crystalline (mottled and textured; good resistance to abrasion). Glazed tiles are used principally for walls; crystalline glazed tiles may be used for floors provided however that these are used as lightduty floors.

1018.2.1.2 Unglazed Tiles

Unglazed tiles shall be hard dense tile of homogeneous composition, Its color and characteristics are determined by the materials used in the body, the method of manufacture and the thermal treatment. It is used primarily for floors and walks.

1018.2.1.3 Trims

Trims are manufactured to match wall tile color, texture and to coordinate with it in dimension. These are shaped in various ceramic trim units such as caps, bases, coved, bullnoses, corners, angles, etc. that are necessary for edging or making a transition between intersecting planes.

1018.2.1.4 Accessories

Accessories like some soap holders and shall be made wall mounted type with colors to reconcile with the color of the adjacent wall tiles.

1018.2.1.5 Cement

Cement shall be Portland conforming to the specification requirements defined in Item 700, Hydraulic Cement.

1018.2.1.6 Sand

Sand shall be well graded fine aggregate clean river sand, free from soluble salts and organic impurities.

1018.2.1.7 Lime

Lime shall be hydrated lime with free unhydrated oxide and magnesium oxide content not to exceed 8 percent by weight.

1018.3 Construction Requirements

Tile work shall not be started until roughing-ins for plumbing, electrical and other trades have been completed and tested. The work of all other trades shall be protected from damage.

1018.3.1 Surface Preparation

- a) Mortar mix for scratch coat and setting bed shall consist of one part Portland cement $\frac{1}{4}$ part lime and 3 parts sand by volume. Surface to receive tile must be level, true to elevation, dry, free from dirt, oil and other ointments. Allow at least seven days curing of scratch coat and setting bed.

Installation work shall not be allowed to proceed until unsatisfactory conditions are corrected.

- b) Bond coat shall be Portland cement paste.

1018.3.1.1 Thoroughly dampen surfaces of masonry or concrete walls before scratch coat is applied.

1018.3.1.2 On masonry or concrete surface first apply a thin coat with pressure, then bring it out sufficiently to compensate for the major irregularities of the surface to a thickness not less than 10mm at any point.

1018.3.1.3 Evenly rate scratch coat to provide good mechanical key before the mortar mix has fully hardened.

1018.3.2 Installation Procedure

Ceramic tiles shall be soaked in clean water prior to installation for a minimum of one hour.

1018.3.2.1 Ceramic Glazed Wall Tiles

- a) Determine and mark layout of ceramic tiles, joint location, position of trims and fixtures so as to minimize cut less than on-half tile in size.
- b) Thoroughly dampen surface of wall but do not saturate surface.
- c) Apply a bond coat mix with consistency of cream paste 1.5mm thick to the wall surface or to the back of the tile to be laid.
- d) Lay the tiles true to profile then exert pressure and tamp tile surface before the bond coat mix has initially set.
- e) Continue with the next full tile to be laid and pressed firmly upon the setting bed until flush and in place of the other tiles.
- f) Intersections and returns shall be formed accurately using the appropriate trims.

- g) All lines shall be kept straight and true to profiles, plumbed and internal corners rounded using the appropriate trims.

1018.3.2.2 Vitriified Unglazed Floor Tiles

- a) Before tire is applied the floor surface shall be tested for levelness or uniformity of slope by flooding it with water. Area where water ponds are filled or leveled, shall be retested before the setting bed is applied.
- b) Establish line of borders and center of the walls at the field work in both direction to permit the pattern to be laid with a minimum of cut tiles.
- c) Clean concrete subfloor then moisten but do not soak. Then sprinkle dry cement over the surface and spread the mortar on the setting bed.
- d) Apply and spread mortar mix for setting bed and tamp to assure good bond over the entire area to be laid with tile.
- e) Pitch floor to drain as shown on Plans or as directed by the Engineer.
- f) Allow the setting bet to set sufficiently to be worked over then spread a bond coat over the surface and lay tile in accordance with items 1019.3.2.1 a,b,c,d,e,f,g.

1018.3.3. Grouting and Pointing

1018.3.3.1 Tiles shall have laid in place for at least 24 hours before grouting of the joints is started. Grouting mortar shall be white Portland cement or blended with pigments to acquire the color appropriate for the ceramic tile.

1018.3.3.2 Grouting mortar shall be applied over the tile by float or squeegee stroked diagonally across the joints. Remove excess mortar with a wet sponge stroked diagonally or in a circular motion after 12-15 minutes. Follow with a barely damp or dry sponge to remove remaining haze while smoothing all grouted joints.

1018.3.4 Cleaning

- a. Clean ceramic tile surfaces thoroughly as possible upon completion of grouting.
- b. Remove all grout haze, observing tile manufacturers recommendations as to use of acid or chemical cleaners.
- c. Rinse tile thoroughly with clean water before and after using chemical cleaners.
- d. Just before final acceptance of the work remove paper and rinse protective coat of neutral cleaner from tile surface. Do not let protective paper get torn or removed.

ITEM 1019 - WOOD TILES

1019.1 Description

This item shall consist of furnishing and installing of wood tiles onthe area indicated on the Plans and in conformity with this Specification.

1019.2 Material Requirements

Wood tile flooring shall be Narra, Tanguile or other wood specie, kiln-dried of not more than fourteen percent (14 %) moisture content of the best quality manufactured locally.

1019.2.1 Wood tiles shall have a minimum dimension of 150 mm x 150mm x 19 mm. Two-ply pieces shall be prefabricated by the manufacturer into rectangular, square or other block shapes as designed and secured together by wood splints, set into ends or sides.

1019.2.2 Adhesive shall be waterproof glue. The consistency of the adhesive shall suit local conditions at the time of laying and the quality of the adhesive shall be such as to bind the wood tiles permanently to the subfloors.

1019.3 Construction Requirements No work shall be started until plastering on the interior surfaces of walls has been completed and dry windows and glazings are installed, and exterior doors are completely operational.

1019.3.1 Installation

Before wood tiles are laid, sub-floors shall be perfectly dry, thoroughly cured, level and true to elevation as required on the Plans.

Wood parquet tiles shall be installed by the manufacturer, this type of job being a specialty trade to assure of the type of adhesive, the proper equipment and tools and the guarantee of quality and workmanship and other considerations. The following installation instructions shall be followed strictly:

- a. Provide adequate cross ventilation as a drying aid during the installation of wood tile.
- b. Clean thoroughly the area over which wood tile will be installed or laid and make certain that the surface over which the material will be held is dry.
- c. Plan and mark carefully installation layout.
- d. Spread enough adhesive to permit the laying of two (2) to three (3) wood tile blocks at a time beginning at the starting lines marked.
- e. Lay the wood tile on surface coated with adhesive and apply hard pressure to seat the materials firmly.
- f. After laying, dampen the gummed paper then peel it off.
- g. Adjust and reseal, when necessary, any individual fillets without decreasing the spacing between individual fillets.
- h. Allow a drying period of 24 hours; then smooth surface using an electric sanding machine with the proper number of sand paper grit.
- i. Seal all defects exposed upon the process of sanding if manageable, otherwise the defective wood tile shall be removed and replaced with new wood tile without extra cost.
- j. Whenever necessary scrape carefully with a hand scraper tool and thoroughly sandpaper smooth works near to walls, corners and other parts which cannot be reached by the electric sanding machine.

1019.3.2 Precaution

Wood tile shall be laid so as to provide a free open space for expansion around sides of room, such space shall be equal to 5 mm for each meter in width and or

length of room. Clearance between trim and floor shall be at least 1.6 mm. Expansion joints at doorways shall be covered by saddle.

Temperature of room shall be maintained at approximately 85° degrees Fahrenheit during laying.

Adhesive shall be applied in strict compliance with manufacturer's manual. Mastic shall be spread to a minimum thickness of 24 mm with a notch spreader.

1019.3.3 Guaranty

The Contractor shall furnish a written notice that work under this Item will be free from defects for a period of one (1) year from the date of final acceptance of the work.

Defects such as creaking, loosening, lifting, cracking, bulging, splitting, undue warping and undue shrinkage shall be adjusted. This guaranty will not apply to defects covered by failure of the work of others, if such defects were impossible to detect at the time of the examination of other works, or defects caused by other than the wear and tear of normal service.

ITEM 1021 - CEMENT FLOOR FINISH

1021.1 Description

This Item shall consist of furnishing all materials, labor, tools and equipment in undertaking cement floor finishing where shown on the Plans and in accordance with this Specification.

1021.2 Material Requirements

Manufactured materials shall be delivered in the manufacturer's original unbroken packages or containers which are labeled plainly with the manufacturer's name and trademark.

1021.2.1 Cement

Portland cement shall conform with the requirement of Item 700, Hydraulic Cement.

1021.2.2 Fine Aggregates

Fine aggregates shall be clean, washed, sharp river sand and free from dirt, clay, organic matter or other deleterious substances. Sand derived from crushed gravel or stone may be used with the Engineer's approval but in no case shall such sand be derived from stone unsuitable for use as coarse aggregate.

1021.2.3 Coloring Material

The coloring material shall be red or green oxide powder of the quality capable of achieving the best staining power and homogeneity.

1021.2.4 Metallic Floor Hardener (Premix)

Metallic floor hardener shall be a mixture of oil-free specially graded clean Iron particles, mineral oxide pigment and portland cement binder, premixed according to the manufacturer's instruction manual.

1021.2.5 Non-Metallic Floor Hardener

- a) Powder type hardener shall be a silica quartz aggregates, workability admixtures, mineral oxide pigments and portland cement mixed according to the manufacturer's instruction manual.
- b) Epoxy type topping hardener shall be a combination of epoxy resins filled With hard and natural emery or silica quartz aggregates, premixed according to the manufacturer's instruction manual.

1021.3 Construction Requirements

1021.3.1 Mixture

Concrete topping materials shall be measured accurately in accordance with the following:

- a) Mortar topping shall be one (1) part portland cement and three (3) parts fine aggregate by loose volume.
- b) Finish topping shall be pure portland cement properly graded conforming to the requirements of Item 700, Hydraulic Cement mixed with water to approved consistency and plasticity. Where required to be colored cement floor finish, red or green oxide powders shall be premixed with portland cement complying with finish topping requirements and the desired color intensity. Cement floor finish floor hardener shall be premixed as required and applied in accordance with the manufacturer's instruction manual.

1021.3.2 Preparation of Concrete Surface

Surface to receive mortar concrete topping shall be cleaned of all projections, dust, loose particles and other foreign matters.

Finish elevation shall be established over the areas indicated on the Plans.

1021.3.3 Application

Before any mortar concrete topping is applied, the prepared concrete base surface shall first be wetted and grouted with portland cement.

- a) Mortar topping of the thickness specified on the Plans, shall be spread over the prepared concrete base and shall be float finished using wood hand trowel. Batches of mortar topping shall be emplaced within one hour of mixing thereof.
- b) As soon as the water sheen has disappeared the surface shall be lightly scratched with a stiff bristle broom.
- c) The finish topping mixture whether plain, colored, or with floor hardener shall be spread over the lightly scratched surface before final set taken place and hand troweled to produce a smooth surface.
- d) The finished surface shall be free of trowel marks, have uniform texture and true to a plane within an allowable tolerance of 3 mm in 3.0 meters.

1021.3.4 Protection of Finished Surface

Cement floor finished surface shall be covered with burlap or appropriate covering to avoid injurious action by sun, rain, flowing water and mechanical injury.

1021.3.5 Workmanship

Cement floor shall be finished level and true to finish elevation as shown on the Plans. Finish topping shall have no visible junction marks where one (1) day work adjoins the other. v-cut groove lines shall be provided where shown on the Plans or as directed by the Engineer.

ITEM 1027 - CEMENT PLASTER FINISH

1027.1 Description

This Item shall consist of furnishing all cement plaster materials, labor, tools and equipment required in undertaking cement plaster finish as shown on the Plans and in accordance with this Specification.

1027.2 Material Requirements

Manufactured materials shall be delivered in the manufacturer's original unbroken packages or containers which are labeled plainly with the manufacturer's name and trademark.

1027.2.1 Cement

Portland cement shall conform with the requirements as defined in Item 700, Hydraulic Cement.

1027.2.2 Hydrated Lime

Hydrated lime shall conform with the requirements as defined in Item 701, Hydrated Lime.

1027.2.3 Fine Aggregates

Fine aggregates shall be clean, washed Sharp River sand and free from dirt, clay, organic matter or other deleterious substances. Sand derived from crushed gravel or stone may be used with the Engineer's approval but in no case shall such sand be derived from stone unsuitable for use as coarse aggregates.

1027.3 Construction Requirements

1027.3.1 Mixture

- a) Mortar mixture for brown coat shall be freshly prepared and uniformly mixed in the proportion by volume of one part Portland Cement, three (3) parts sand and one fourth (1/4) part hydrated lime.
- b) Finish coat shall be pure Portland Cement properly graded conforming to the requirements of Item 700, Hydraulic Cement and mixed with water to approved consistency and plasticity.

1027.3.2 Surface Preparation

- a) After removals of formworks reinforced concrete surfaces shall be roughened to improve adhesion of cement plaster.
- b) Surfaces to receive cement plaster shall be cleaned of all projections, dust, loose particles, grease and bond breakers. Before any application of brown coat is commenced all surfaces that are to be plastered shall be wetted thoroughly with clean water to produce a uniformly moist condition.

1027.3.3 Application

- a) Brown coat mortar mix shall be applied with sufficient pressure starting from the lower portion of the surface to fill the grooves and to prevent air pockets in the reinforced concrete/masonry work and avoid mortar mix drooping. The brown coat shall be lightly broomed or scratched before surface has properly set and allowed to cure.
- b) Finish coat shall not be applied until after the brown coat has seasoned for seven days and corrective measures have been done by the Contractor on surfaces that are defective. Just before the application of the finish coat, the brown coat surface shall be evenly moistened with potable water. Finish coat shall be floated first to a true and even surface, then troweled in a manner that will force the mixture to penetrate into the brown coat. Surfaces applied with finish coat shall then be smoothed with paper in a circular motion to remove trowel marks, checks and blemishes. All cement plaster finish shall be 10mm thick minimum on vertical concrete and/or masonry walls.

Wherever indicated on the Plans to be "Simulated Red Brick Finish" the Contractor shall render brick design on plaster surface before brown coat has properly set and then allowed to dry. Cement plaster shall not be applied directly to:

- 1) Concrete or masonry surface that had been coated with bituminous compound and,
- 2) Surfaces that had been painted or previously plastered.

1027.3.4 Workmanship

Cement plaster finish shall be true to details and plumb. Finish surface shall have no visible junction marks where one (1) Day's work adjoins the other. Where directed by the Engineer or as shown on the Plans vertical and horizontal groove joints shall be 25 mm wide and 10mm deep.

ITEM 1032 – PAINTING, VARNISHING AND OTHER RELATED WORKS

1032.1 Description

This item shall consist of furnishing all paint materials, varnish and other related products, labor, tools, equipment and plant required in undertaking the proper application of painting, varnishing and related works indicated on the Plans and in accordance with this Specification.

1032.2 Materials Requirements

1032.2.1 Paints Materials

All types of paint material varnish and other related products shall be subjects to random test to material composition by the Bureau of Research and Standard, DPWH or the National Institute of Sciences and Technology. (Use the following approved and tested brand name: Boysen, Davies, Dutch Boy, Fuller O Brien, or any approved equal)

1032.2.2 Tinting Colors

Tinting colors shall be first grade quality, pigment ground in alkyd resin that dispenses and mixes easily with paint to produce the color desired. Use the same brand of paint and tinting color to effect good paint body.

1032.2.3 Concrete Neutralizer

Concrete neutralizer shall be first grade quality concentrated dulled with clean water and applied as surfaces conditioner of new interior and exterior walls thus improving paint adhesion and durability.

1032.2.4 Silicon Water Repellant

Silicon water repellant shall be transparent water shield especially formulated to repel rain moisture on exterior masonry surfaces.

1032.2.5 Patching Compound

Patching compound shall be fine powder type material like calsomine that can be mixed into putty consistency, with oil base primers and paints to fill minor surface dents and imperfections.

1032.2.6 Varnish

Varnish shall be a homogeneous of resin, drying oil, drier and solvent. It shall be extremely durable clear coating, highly resistant to wear and tear without cracking, peeling, whitening, spotting, etc. with minimum loss of gloss for a minimum period of time.

1032.2.7 Lacquer

Lacquer shall be any type of organic coating that dries rapidly and solely by evaporation of the solvent. Typical are acetates, alcohols and ketones. Although

lacquers were generally based on intrecellulose, manufacturers currently use, vinyl resins, plasticizers and reacted drying oils to improve adhesion and elasticity.

1032.2.8 Shellac

Shellac shall be a solution of refined lac resin in denatured alcohol it dries by evaporation of the alcohol. The resin is generally furnished in orange and bleached grades.

1032.2.9 Sanding Sealer

Sanding sealer shall be quick drying lacquer, formulated to provide quick dry, good holdout of succeeding coats, and containing sanding agents such as zinc stearate to allow dry sanding of sealer.

1032.2.10 Glazing Putty

Glazing putty shall be alkyd-type product for filling minor surface unevenness.

1032.2.11 Natural Wood Paste Filler

Wood paste filler shall be quality filler for filling and sealing open grain of interior wood. It shall produce a level finish for following coats of paint varnish/lacquer and other products.

1032.2.12 Schedule

Exterior:

- | | |
|--|--|
| a. Plain cement plastered finish to be painted | <i>3 coats acrylic base masonry</i> |
| b. Concrete exposed aggregate and/or tool finish | <i>1 coat water repellent</i> |
| c. Ferrous metal | <i>1 coat primer and 2 coats enamel Paint</i> |
| d. Galvanized metal | <i>1 coat zinc chromate primer and 2 coats Portland cement paint</i> |
| e. Wood painted finish | <i>3 coats oil based paint</i> |
| f. Wood varnished finish | <i>varnish water repellent</i> |

Interior:

- | | |
|--|---|
| a. Plain cement plastered finish to be painted | <i>2 coats acrylic base masonry paint</i> |
| b. Concrete exposed aggregate and/or tool finish | <i>clean surface</i> |
| c. Ferrous metal | <i>1 coat primer and 2 coats Enamel paint</i> |

| | |
|-----------------------------------|--|
| d. Woodwork sea- mist | <i>3 coats of 3parts thinner 1 part lacquer</i> |
| e. Woodwork varnish | <i>1st coat, of one part sanding sealers to one part solvent 2nd coat of 2/3 sanding sealer to 1/3 solvent</i> |
| g. Woodwork painted finish | <i>3 coats of oil base paint</i> |
| h. Ceiling boards textured finish | <i>1 coat oil based paint allow to dry then patch surfaces unevenness and apply textured paint coat.</i> |

1032.3 Construction Requirement

The Contractor prior to commencement of the painting varnishing and related work shall examine the surfaces to be applied in order not to jeopardize the quality and appearances of the painting varnishing and related works.

1032.3.1 Surfaces Preparation

All surfaces shall be in proper condition to receive the finish Woodwork shall be hand-sanded smooth and dusted clean. All knot-holes pitch pockets or sappy portions shall be sealed with natural wood filler. Nail holes, cracks or defects shall be carefully puttied after the first coat, matching the color of paint.

Interior woodworks shall be sandpapered between coats. Cracks, holes of imperfections in plaster shall be filled with patching compound and smooth off to match adjoining surfaces.

Concrete and masonry surfaces shall be coated with concrete neutralized or and allowed to dry before any painting primer coat is applied. When surface is dried apply first coating. Hairline cracks and unevenness shall be patched and sealed with approved putty or patching compound. After all defects are corrected apply the finish coats specified on the Plans (Color scheme approved).

Metal shall be clean, dry and free from millscale and rust. Remove all grease and oil from surfaces. Wash, unprimed galvanized metal with etching solution and allow it to dry. Where required to prime coat surface with Red lead Primer same as approved by the Engineer.

In addition the Contractor shall undertake the following:

1. Voids, cracks, nick etc. Will be repaired with proper patching material and finish flushed with surrounding surfaces.
2. Marred or damaged shop coats on metal shall be spot primed with appropriate metal prime.
3. Painting and varnishing works shall not be commenced when it is too hot or cold.
4. All hardware will be fitted and remove or protected prior to painting and varnishing works.

1032.3.2 Application

Paints when applied by brush shall become non-fluid, thick enough to lay down as adequate film of wet paint. Brush marks shall flow out after application of paint.

Paints made for application by roller must be similar to brushing paint. It must be nonstick when thinned to spraying viscosity so that it will break up easily into droplets.

Paint is atomized by high pressure pumping rather than broken up by the large volume of air mixed with it. This procedure changes the required properties of the paint.

1032.3.3 Mixing and thinning

At the time of application paint shall show no sign of deterioration. Paint shall be thoroughly stirred, strained and kept at a uniform consistency during application. Paints of different manufacturer shall not be mixed together. When thinning is necessary, this may be done immediately prior to application in accordance with the manufacturer's directions, but not in excess of 1 pint of suitable thinner per gallon of the paint.

1032.3.4 Storage

All materials to be under this item shall be stored in a single place to be designated by the Engineer and such place shall be kept neat and clean at all time. Necessary precaution to avoid fire must be observed by removing oily rags, waste, etc. at the end of daily work.

1032.3.5 Cleaning

All cloths and cotton waste which constitute fire hazards shall be placed in metal containers or destroyed at the end of daily works. Upon completion of the work, all staging, scaffolding and paint containers shall be removed. Paint drips, oil, or stains on adjacent surfaces shall be removed and the entire job left clean and acceptable to the Engineer.

1032.3.6 Workmanship in General

a) All paints shall be evenly applied. Coats shall be of proper consistency and well brushed out so as to show a minimum of brush marks.

b) All coats shall be thoroughly dry before the succeeding coat is applied.

c) Where surfaces are not fully covered or cannot be satisfactorily finished in the number of coats specified such preparatory coats and subsequent coats as may be required shall be applied to attain the desired evenness of surface without extra cost to the owner.

d) Where surface is not in proper condition to receive the coat the Engineer shall be notified immediately. Work on the questioned portion(s) shall not start until clearance be proceed is ordered by the Engineer.

e) Hardware, Lighting fixture and other similar shall be removed or protected during the painting varnishing and related work operation and re-installed after completion of the work.

1032.3.7 Procedure for Sea-Mist Finish

- a) Depress wood grain by steel brush and sand surface lightly.
- b) Apply sanding sealer.
- c) Apply two coats of industrial lacquer paint.
- d) Spray last coat of industrial lacquer paint mixed with sanding sealer.
- e) Apply wood paste filler thinned with turpentine or paint thinner into the wood surface.
- f) Wipe Off wood paste filler immediately.
- g) Spray flat or gloss lacquer whichever is specified.

1032.3.8 Procedure for Varnish Finish

- a) Sand surface thoroughly.
- b) Putty all crack and other wood imperfections with wood paste filler.
- c) Apply oil strain.
- d) Apply lacquer sanding sealer.
- e) Sand surface along the grain.
- f) Spray three (3) coats of clear dead flat lacquer.
- g) Polish surface coated using cloth pad.
- h) Spray gloss lacquer or flat lacquer whichever is desired or specified.

1032.3.9 Procedure for Ducco Finish

- a) Sand surface thoroughly.
- b) Apply primer surface white or spray by brush or spray.
- c) Apply lacquer spot putty in thin coat. Allow each coat to become thoroughly dry before applying next coat.
- d) Apply primer surface and then allow to dry in two (2) hours before applying the next coat.
- e) Apply a coat of flat tone semi-gloss enamel as per color scheme submitted and approved by the Engineer.

PART D ELECTRICAL

ITEM 1100 – CONDUITS, BOXES AND FITTINGS

1100.1 Description

This item shall consist of the furnishing and installation of the complete conduit work consisting of electrical conduits, conduit boxes such as junction boxes, pull boxes, utility boxes, octagonal and square boxes, conduit fittings such as couplings, locknut and bushings and other electrical materials needed to complete the conduit rough-in work of this project.

1100.2 Material Requirements

All materials shall be new and shall be of the approved type meeting all the requirements of the Philippine Electrical Code and bearing the Philippine Standard Agency (PSA) mark.

Conduits:

Conduit shall be standard rigid steel, zinc coated or galvanized. Intermediate metal conduit may be used if shown or specified on the approved Plans. PVC conduits if required shall be Schedule 40. Enamel coated steel conduit and conduits with rough inner surfaces are not acceptable.

Conduit Boxes:

All conduit boxes shall be Code gauge steel and galvanized. Outlet boxes shall be galvanized pressed steel of standard make. In General, outlet boxes shall be at least 100 mm square or octagonal, 53 mm deep and 16 mm minimum gauge.

Conduit Fittings:

All conduits fitting such as locknut and galvanized bushings shall be galvanized of standard make.

1100.3 Construction Requirements

All works throughout shall be executed in the best practice in a workmanlike manner by qualified and experienced electricians under the immediate supervision of a duly licensed Electrical Engineer.

Conduits:

Conduits should be cut square with a hacksaw and reamed. Bends shall be made with the required radius. In making bends only conduit bending apparatus will be used. The use of a pipe tee or vise for bending conduits shall not be permitted. Conduits which have been crushed, deformed or flattened shall not be installed. No running thread shall be allowed. Conduit runs crossing construction joints of the building shall be provided with standard expansion fittings of the approved type.

No conduit shall be used in any system smaller than 12mm diameter electric trade size nor shall have more than four (4) 90 degree bends in any one run and where necessary, pull boxes shall be provided.

All ends of conduits which are left empty in cabinets and conduit boxes shall be plugged with lead or approved pipe caps so as to prevent the entrance of white ants and dirt within the conduit system. Pull wires shall be inserted in the empty ducts before they are closed with lead or pipe caps and shall be therein for future use.

On exposed work, all pipes and outlet boxes shall be secured by means of galvanized metal clamps which shall be held in place by means of machine screws. When running over concrete surfaces, the screws shall be held in place by means of expansion sleeves for big pipes and rolled lead sheet for small pipes. All pipes shall be run at right angles to and parallel with the surrounding walls. No diagonal run shall be allowed and all bends and offsets shall be avoided as much as possible. Conduits shall be supported at 1,500 mm intervals maximum.

Conduits Boxes and Fitting:

Provide conduit boxes for pulling and splicing wires and outlet boxes for installation of wiring devices.

As a rule, provide junction boxes or pull boxes in all runs greater than 30 meters in length, for horizontal runs. For other lengths, provide boxes as required for splices or pulling. Pull boxes shall be installed in inconspicuous but accessible locations.

Support boxes independently of conduits entering by means of bolts, red hangers or other suitable means.

Conduit boxes shall be installed plumb and securely fastened. They shall be set flush with the surface of the structure in which they are installed where conduits are run concealed.

All convenience and wall switch outlet boxes for concealed conduit work shall be deep, rectangular flush type boxes. Four-inch octagonal flush type boxes shall be used for all ceiling light outlets and shall be of the deep type where three or more conduit to a single box.

Floor mounted outlet boxes required shall be waterproof type with flush brass floor plate and brass bell nozzle.

All boxes shall be painted with antirust red lead paint after installation.

All conduits shall be fitted with approved standard galvanized bushing and locknuts where they enter cabinets and conduit boxes.

Junction and pull boxes of code gauge steel shall be provided as indicated or as required to facilitate the pulling of wires and cables.

1100.6 General Specifications

The work to be done under this division of specifications consist of the fabrication, furnishing, delivery and installation, complete in all details of the electrical work, at the subject premises and all work materials incidental to the proper completion of the installation, except those portions of the work which are expressly stated to be done by other fields. All works shall be done in accordance with the rules and regulations and with the specifications.

1100.7 Specification on:

1. Lighting fixtures and lamps

All lighting fixtures and lamps are as specified and listed on lighting fixture schedule.

For Fluorescent lamp, it shall be 28 watts or LED. All Fluorescent ballast shall be 230 volt, electronic ballast of good quality materials and approved by the Bureau of Product Standards (BPS)

2. Materials Requirements

All materials to be used shall conform to the BPS Specification.

3. Construction Requirements

All grounding system installation shall be executed in accordance with the approved plans.

Grounding system shall building perimeter ground wires, ground rods, clamps, connectors, ground well and ground wire taps as shown in the approved design.

1100.8 Auxiliary Systems

All Auxiliary systems such as telephone and intercom system, time clock system, fire alarm system and public address/nurse's call/paging system installations shall be done in accordance with the approved design.

All materials to be used shall conform to the Bureau of Product Standard (BPS) Specifications.

1100.9 Important requirement regarding supervision of the work and submission of certificate of completion.

All wiring installation herein shall be done under the direct supervision of a licensed Electrical Engineer at the expense of the Contractor. The contractor shall submit the certificate of completion duly approved by the owner's representative.

1100.10 Test and Guarantee

Upon completion of the electrical construction work, the contractor shall provide all test equipment and personnel and to submit written copies of all test results.

The contractor shall guarantee the electrical installation are done and in accordance with the approved plans and specifications. The contractor shall guarantee that the electrical system are free from all grounds and from all defective workmanship and materials and will remain so for a period of one year from date and acceptance of works. Any defect shall be remedied by the contractor at his own expense.

ITEM 1101 – WIRES AND WIRING DEVICES:

1100.1 Description

This item shall consist of the furnishing and installation of all wires and wiring devices consisting of electric wires and cables, wall switches, convenience receptacles, heavy duty receptacles and other devices shown on the approved Plans but not mentioned in these specifications.

1101.2 Materials Requirements

Wires and cables shall be of the approved type meeting all the requirements of the Philippine Electrical Code and bearing the PSA mark unless specified or indicated otherwise, all power and lighting conductors shall be insulated for 600 volts.

All wires shall be copper, soft drawn and annealed, smooth and of cylindrical form and shall be centrally located inside the insulation.

All wiring devices shall be standard product of reputable electrical manufacturers. Wall switches shall be rated at least 10A, 250 volts and shall be spring operated, flush, tumbler type. Duplex convenience receptacles shall be rated at least 15A, 250 volts, flush, parallel slots. Single heavy duty receptacles shall be rated at least 20A, 250 volts, 3-wire, flush, polarized type.

1101.3 Construction Requirements

Conductors of wires shall be drawn in conduits until after the cement plaster is dry and the conduits are thoroughly cleaned and free from dirt and moisture. In

drawing wires into conduits, sufficient slack shall be allowed to permit easy connections for fixtures, switches, receptacles and other wiring devices without the use of additional splices.

All conductors of convenience outlets and lighting branch circuit homeruns shall be with a minimum of 3.5 mm in size. Circuit homeruns to panelboards shall not be smaller than 3.5 mm but all homeruns to Panelboard more than 30 meters shall not be smaller than 5.5 mm. No conductor shall be less than 3.50 mm in size.

All wires of 14 mm and larger in size shall be connected to panels and apparatus by means of approved type lugs or connectors of the solderless type, sufficiently large enough to enclose all strands of the conductors and securely fastened. They shall not loosen vibration or normal strain.

All joints taps and splices on wire larger than 14 mm shall be made of suitable solderless connectors of the approved type and size. They shall be taped rubber and PVC tapes providing insulation not less than that of the conductors.

No splices or joints shall be permitted in either feeder or branch conductors except within outlet boxes or accessible junction boxes or pull boxes. All joints in branch circuit wiring shall be made mechanically and electrically secured by approved splicing devices and taped with rubber and PVC tapes in a manner which will make their insulation as that of the conductors.

All wall switches and receptacle shall be fitted with standard bakelite face plate covers. Device plates for flush mounting shall be installed with all four edges in continuous contact with finished wall surfaces without the use of coiled wire or similar devices. Plaster fillings will not be permitted. Plate installed in wet locations shall be gasket.

When more than one switch or device is indicated in a single location gang plate shall be used.

ITEM 1102 – POWER LOAD CENTER, SWITCHGEAR PANELBOARDS:

1102.1 Description

This item shall consist of the furnishing and installation of the power load center unit substation or low voltage switchgear and distribution panelboards at the location shown or the approved Plans complete with transformer. Circuit breaker, cabinets and all accessories, completely wired and ready for service.

1102.2 Materials Requirements

All materials shall be new and shall be of the approved type. It shall conform to the requirements of the Philippine Electrical Code and shall bear Philippine Standard Agency (PSA) mark.

Power Load Center Unit Substation:

The Contractor shall furnish and install an indoor-type Power Load Center Unit Substation at the location shown on the approved Plans if required. It shall be totally metal enclosed, dead front and shall consist of the following coordinated component parts.

High voltage Primary Section:

High voltage primary incoming line section consisting of the following parts and related accessories.

- (a) One (1) Air-filled Interrupter Switch, 2-position (open-close) installed in a suitable air filled metal enclosure and shall have sufficient interrupting capacity to carry the electrical load. It shall be provided with key interlock with the cubicle for the power fuses to prevent access to the fuses unless the switch is open.
- (b) Three (3)-power fused mounted in separate compartments within the switch housing and accessible by a hinged door.
- (c) One (1) set of high voltage potheads or 3-conductor cables or three single conductor cables.
- (d) Lightning arresters shall be installed at the high voltage cubicle if required.

Item (a) and (b) above could be substituted with a power circuit breaker with the correct rating and capacity.

Transformer Section:

The transformer section shall consist of a power transformer with ratings and capacities as shown on the plans. It shall be oil liquid-filled non- flammable type and designed in accordance with the latest applicable standards.

The transformer shall be provided with four(4)approximately 2 ½% rated KVA taps on the primary winding in most cases one (1) above and three (3) below rated primary voltage and shall be changed by means of externally gang-operated manual tap changer only when the transformer is de-energized. Tap changing under load is acceptable if transformer has been so designed.

The following accessories shall be provided with the transformer, namely: drain valve, sampling device, filling connection, oil liquid level gauge, ground pad, top filter press connection, lifting lugs, diagrammatic nameplate, relief valve, thermometer and other necessary related accessories.

The high-voltage and low-voltage bushings and transition flange shall be properly coordinated for field connection to the incoming line section and low voltage switchboard section, respectively.

Low-voltage Switchboard Section

The low-voltage switchboard shall be standard modular-unitized units, metal-built, dead front, and safety type construction and shall consist of the following:

(a) Switchboard Housing

The housing shall be heavy gauge steel sheet, dead front type,gray enamel finish complete with frame supports, steel bracings, steel sheet panelboards, removal rear plates, copper busbars, and other necessary accessories to insure sufficient mechanical strength and safety. It shall be provided with grounding bolts and clamps.

(b) Secondary Metering Housing

The secondary metering section shall consist of one (1) ammeter, transfer switch for 3-phase; one (1) voltmeter transfer switch for 3-phase; and current transformer of suitable rating and capacity.

The above-mentioned instruments shall be installed in one compartment above the main breaker and shall be complete with all necessary accessories completely wired, ready for use.

(c) Main Circuit Breaker

The main circuit breaker shall be draw-out type, manually or electrically operate as required with ratings and capacity as shown on the approved Plans.

The main breaker shall include insulated control switch if electrically operated, manual trip button, magnetic tripping devices, adjustable time over current protection and instantaneous short circuit trip and all necessary accessories to insure safe and efficient operation.

(d) Feeder Circuit Breakers

There shall be as many feeder breakers as are shown on the single line diagram or schematic riser diagram and schedule of loads and computations on the plans. The circuit breaker shall be draw out or molded case as required. The circuit breakers shall each have sufficient interrupting capacity and shall be manually operated complete with trip devices and all necessary accessories to insure safe and efficient operation. The number, ratings, capacities of the feeder branch circuit breakers shall be as shown on the approved Plans.

Circuit breakers shall each be of the indicating type, providing "ON" "OFF" and "TRIP" positions of the operating handles and shall each be provided with nameplate for branch circuit designation. The circuit breaker shall be so designed that an overload or short on one pole automatically causes all poles to open.

Low-Voltage Switchgear

(For projects requiring low-voltage switchgear only)

The Contractor shall furnish and install low-voltage switchgear at the location shown on the plans. It shall be metal-clad, dead front, free standing, safety type construction and shall have copper busbars of sufficient size, braced to resist allowable root mean square (RMS) symmetrical short circuit stresses, and all necessary accessories.

The low-voltage switchgear housing, secondary metering, main breaker and feeder branch circuit breakers and all necessary accessories completed for service.

Grounding System:

All non-current carrying metallic parts like conduits, cabinets and equipment frames shall be properly grounded in accordance with the Philippine Electrical Code, latest edition.

The size of the ground rods shall be $\frac{3}{4}$ in dia. as shown on the approved Plans. The ground resistance shall not be more than 5 ohms.

Panelboards and Cabinets

Panelboards shall conform to the schedule of panelboards as shown on the approved Plans with respect to the supply characteristics, rating of main lugs or main circuit breaker, number and ratings and capacities of branch circuit breakers.

Panelboards shall consist of a factory completed dead front assembly mounted in an enclosing flush type cabinet consisting of code gauge galvanized sheet steel box with trim and door. Each door shall be provided with catch lock and two (2) keys. Panel boards shall be provided with directories and shall be printed to indicate load served by each circuit. Panelboard cabinets and trims shall be suitable for the type of the mounting shown on the approved Plans. The inside and outside of panelboards cabinets and trims shall be factory painted with one rust proofing primer coat and two finish shop coats of pearl gray enamel paint.

Main and branch circuit breakers for panelboards shall have the rating, capacity and number of poles as shown on the approved Plans. Breakers shall be thermal magnetic type. Multiple breaker shall be of the common trip having a single operating handle. For 50-ampere breaker or less it may consist of single-pole breaker permanently assembled at the factory into a multi-pole unit.

1102.3 Construction Requirements

The contractor shall install the Power Load Center Unit Substation or Low-Voltage Switchgear and Panelboards at the location shown on the approved Plans.

Standard panels and cabinet shall be used and assembled on the job. All panels shall be of dead front construction furnished with trims for flush or surface mounting as required.