BATAAN GENERAL HOSPITAL
Balanga City, Bataan

TECHNICAL SPECIFICATION

PROJECT : **CONSTRUCTION OF CONCRETE PERIMETER FENCE AND PARKING LOT WITH GUARDHOUSE AND STORM DRAINAGE SYSTEM**

SCOPE OF WORKS:

I. Site Preparation/ Earthworks
II. Concrete Works
III. Masonry Works
IV. Reinforcement
V. Forms and Scaffoldings
VI. Roof Framing Works
VII. Roofing and Tinsmithry Works
VIII. Carpentry Works
IX. Doors and Windows
X. Tileworks
XI. Metal Works
XII. Sanitary and Plumbing Works
XIII. Electrical Works
XIV. Painting Works
XV. Signages and Markings
XVI. Mobilization/ Demobilization

GENERAL CONDITIONS

All parts of the construction shall be finished with first class workmanship, to the fullest talent and meaning of the plans and these Specifications, and to the entire satisfaction of the Architect/ Engineer and the Owner.

The construction shall conform to all requirements of the National Building Code, as well as the local rules and regulations of the municipality.

1. SITE PREPARATION/ EARTHWORKS

1.1 Temporary Facilities and Utilities

1.1.1 Field Office

During the performance of the contract, the Contractor shall construct and maintain a field office and facilities at the site of the work at which he or his authorized agent shall be holding office and all times, while the work is in progress. The location, dimensions and layout of such field office shall be subject to approval, Construction shanties, sheds and temporary facilities provided as requires for the Contractor's convenience shall be maintain in good condition and neat appearance including finishes as required.

1.1.2 Temporary Light and Power

The Contractor shall provide and maintain temporary electrical service including installation of temporary power and lighting within the construction site. The electrical service shall be adequate in capacity to supply power to construction tools and equipment without over-loading the temporary equipment and wiring for power and lighting shall be in accordance with the applicable provisions of the local governing cods, At the completion of the construction work all temporary wiring, lighting, equipment and devices shall be removed.

1.1.3 Temporary Toilet

The Construction shall provide and maintain is sanitary condition enclosed toilet for the use of all construction personnel located within the contract limits, complete with fixtures, water and sewer connections and all appurtenances. Installation shall be in accordance with all applicable codes and regulations of the local authorities having jurisdiction thereof. Upon completion of the work, temporary toilet and their appurtenances shall be removed.

1.1.4 Temporary Water Service

The Contractor shall provide and maintain temporary water supply services, complete with necessary connections and appurtenances. Installed water supply lines shall be used as a source of water for construction purposes subject to the approval of the Project Manager. The Contractor shall pay the cost of operation, maintenance and restoration of the water system. All temporary water service including equipment and piping shall be removed upon completion of work and all worn out and damaged parts of the permanent system shall be replaced and restored in first class condition equal to new.

1.1.5 Security

The Contractor shall provide sufficient security in the construction site to prevent illegal entry or work damaged during nights; holidays and other period when work is not executed; and during working hours. The Contractor shall take ample precautions against fire by keeping away flammable

materials, and ensure that such materials are properly handled and stored. Fires shall not be built within the area of construction, except when permitted by the Project Manager.

1.2 Earthworks

1.2.1. Structural Excavation

All excavation shall be performed by the Contractor to the excavation lines, grades and slopes and profiles shown in the drawings, or as directed by the Project Manager. All excavation shall be performed in the dry condition, unless otherwise approved by the Project Manager.

(a) Excavation for Structure and Trenches

Excavations carried out below the depth indicated on the drawing without the approval of the Project Manager shall be refilled to the proper grade with thoroughly compacted suitable fill materials to the satisfaction of the Project Manager except for footing excavation where concrete shall be replaced to the bottom of the excavations; additional work of this nature shall be at the Contractor's expense. Where an existing structure lies adjacent to excavation line, adequate shoring and bracing shall be provided to prevent damage to persons and properties. Shoring, bracing and sheeting shall be removed in a manner to prevent caving-in. The grading in the vicinity of excavated areas shall be dome to prevent surface water from running into excavation and embankments. Water pumped from excavations shall be diverted to suitable disposal points. Trenches for pipelines shall be excavated along straight lines and provided with minimum of 150-mm space between the outside of the pipe and the side of the trench or bracing. Additional excavation shall be made for each joint to allow for joining.

Trench excavation, other than rock, shall be excavated at least 50 mm above final invert grade; the remainder of the excavation shall be shaped manually, and graded to provide uniform bearing when the pipe if laid. Unless otherwise indicated, backfill cover over water sewer, drainage and electrical conduit pipes shall not be less than 300-mm depth.

(b) Excavation Under Pavement and Concrete Slabs

The entire area of the original ground under pavements and concrete slabs shall be excavated to remove all objectionable matter, sod, muck, rubbish and other unsuitable material to a minimum depth of 300 mm.

1.2.2. Filling and Backfilling

Fill and backfill materials shall consist of suitable materials from excavation or from approved borrow areas, and shall be free from roots, wood scraps, vegetations, and other extraneous materials and from large clods of earth or stones greater than 100 mm. No fill material shall be placed until the surface to be filled has been approved.

(a) Filling and Backfilling for Structures and Trenches

Filling around structures shall be placed as the construction work progress, insofar practicable. Backfilling of trenches shall progress as rapidly as construction and testing will permit. In backfilling pipe trenches, approved backfill shall be compacted in 200 mm layers to a depth of 150 mm over the pipe and the remainder of the trench depth shall be backfilled and compared in 300 mm layers; for trenches under road pavements and concrete floor slabs, the backfill shall be placed and compacted in 200 mm layers to the top of the trench.

(b) Embankment Construction

Before placing fill material, the surface upon which it will be placed shall scarified to insure good bonding between the existing surface and the fill material. Where embankment are to be constructed on sloping ground with slopes steeper than 1 vertical to 4 horizontal, the new fill shall be cut into or benched as the embankment is brought up in layers in such a manner that the embankment material will bond with the existing surface.

1.3 Demolition/ Relocation Works

1.3.1 Site Demolition

All superficial obstructions shall be demolished and removed from the site to disposal areas approved by the Consultant.

1.3.2 Clearing and grubbing

(a) Clearing

All areas within which the structure or related construction has to be accomplished shall be completely cleared of matted roots, trees brush, snags, vegetation, rubbish, spoils and other objectionable matters. All combustible materials form clearing operation shall be completely burned or removed form

the site of work or otherwise disposal off as directed by the Project Manager. All materials to be burned shall be piled neatly and when in suitable condition shall be burned completely. Piling for burning shall be done in such a manner and location as cause least fire risk. All burning shall be thorough that the cleared materials can be reduced to ashes. The Contractor shall at all times take special precautions to prevent fire form spreading and shall have available at all times, suitable equipment and supplies, for use in preventing and fighting fires.

(b) Grubbing

Grubbing shall consist of the removal of tree stumps, brush and rubbish from the work areas to be occupies by permanent structures, from other areas within the indicated clearing limits as directed by the Consultant. Trees and shrubs to be retained shall be protected properly form damage. Stumps shall be removed entirely. Roots and matted roots shall be grubbed and cut to at least 450 mm below the existing surface.

1.3.3. Relocation Works

All relocation works shall be in accordance with the specifications and details shown on the approved plans.

2. CONCRETE WORKS

The work includes construction of concrete structures complete in accordance with the standard specifications and conformity with the lines, grades, thickness and typical cross-section shown on the plan.

2.1 Material Requirement

2.1.1 General

Concrete shall be composed of Portland cement; fine and coarse aggregates, water and admixture as specified all thoroughly mixed and brought to proper consistency, uniformity and temperature for final placement.

2.1.2 Cement

Concrete shall be Portland cement of a brand approved by the Project Manager and conforming to ASTM Specification C150, Type I of Type II.

2.1.3 Water

Water shall be clean and free from injurious amounts of oils, acids, alkalics, salts, organic materials, or other substances that may be deleterious to concrete or steel.

2.1.4 Admixtures

Admixtures shall be subject to prior approval by the Project Manager. The admixtures shall be capable of maintaining essentially the same composition and performance throughout the work.

2.1.5 Fine Aggregates

Fine aggregates shall consist of natural sand, manufactured sand, or a combination thereof. If the fine aggregate shall be a combination of separately processed sizes, or if batching shall result in a combination of natural and manufactured sand, the different components shall be batched separately. Fine aggregates shall consist of hard, tough, durable, uncoated particles. The specified percentages of fines in the sand may be obtained either by the processing of natural sand or by the production of suitably graded manufactured sand. The shape of particles shall be generally rounded or cubical and reasonably free from flat or elongated pieces. The use of beach sand shall be prohibited. The fine aggregate shall conform to the following specific requirements:

Sieve Designation		Cumulative Percentage by
Std	U.S Std., Square Mesh	Weight Passing
9.5 mm	3/8	100
4.75 mm	No.4	95-100
2.36 mm	No.8	80-100
1.18 mm	No.16	45-80
300 micron	No. 50	10-30
150 micron	No.100	2-10

In addition to the grading limits shown above, the fine aggregates, as delivered to the mixer, shall have a fineness modulus not less than 2.3 more than 3.0 and during normal operations, the grading of the fine aggregate shall be controlled so that the fineness modulus of at least nine (9) out of ten (10) test samples of fine aggregate as delivered to the mixer shall not vary by more than 0.20 from the average fineness modulus can be determined by dividing 100 the sum of the cumulative percentages retained on U.S. Standard Sieves Nos. 4, 8, 16, 50 and 100.

2.1.6 Coarse Aggregates

Coarse aggregate shall consist of washed gravel, crushed stone or rock, or a combination thereof conforming to ASTM C33. The coarse aggregate, as delivered to the batching plant, shall have uniform and stable moisture content. The approval of deposits shall not be construed as constituting the approval of all materials taken from the deposits, and the Contractor shall be held responsible for the specified quality of all such materials used in the work. Coarse aggregate shall consist of hard, tough, durable, clean and uncoated particles. All foreign materials and dust shall be removed by adequate shall be generally rounded or cubical, and the coarse aggregate shall be reasonably free from flat and elongated particles. A thin, flat and elongated particle can be as defined as a particle having a maximum dimension greater than five times the minimum dimension. The coarse aggregate shall be graded from fine too coarse. It shall be separated into size groups.

The grading of the aggregate within the separated size groups as delivered to the mixer shall be as follows:

Sieve Sizes	Percent by Weight		Passing Individual 1-1/2
Std (MM)	U.S Std., Sq. Mesh	¾ Size	Size
50	2″		100
37.5	1-1/2″		90-100
25	1″	100	20-55
19	¾″	90-100	0-15
9.5	3/8″	20-55	0-5
4.75	No. 4	0-10	

Use 19-mm (3/4”) coarse aggregate for slab on grade, columns, beams, suspended slabs and tie beams.

Use 38 mm (1 ½”) coarse for footings

2.1.7 Reinforcing Steel

Reinforcing steel shall be locally manufactured, deformed billet steel bars conforming to Philippine Standard, Grade 275, Intermediate grade (40, 000 psi).

2.1.8 Forms

Concrete form shall be wood, plywood, steel or other suitable materials. Form surfaces requiring standard or special finish shall be plywood or a non-absorptive hand pressed fiberboard or other suitable materials. Plywood shall not be less than 12 mm thick and shall be free from irregularities, dents and sags. Forms shall be coated with non-staining form coating compound such as form oil of the approved make.

2.2 Construction Requirements

2.2.1 Concrete Proportion

The proportion of all materials in concrete shall be subject to the approval of the Project Manager. The Contractor shall employ at his own expense an approved testing laboratory, which shall design the mix proportions in accordance with ACI 211.01. Strength requirements shall be 20.7 Mpa (3000 psi) for footing, columns, beams, slabs and stairs lavatory counter, wash basin; 17.2 Mpa (2500 psi) for ramp, slab on grade, water meter box, grease trap; and 13.8 Mpa (2000 psi) for lean concrete or as required by the Project Manager. The adequacy of this test shall be verified by a test on a minimum of 6 cylinders; 3 tested at 7 days, 3 at 38 days, in accordance with ASTM C39.

If, at any time during construction, the concrete resulting from the approved mix design proves to be unsatisfactory for any reason such as too much water, lack of sufficient plasticity to prevent segregation, honeycomb, etc., or insufficient strength, the Contractor shall notify the testing, laboratory and the Project Manager. The laboratory shall modify the design, subject to the approval of the Project Manager until satisfactory concrete is obtained.

2.2.2 Concrete Samples and Testing

Sampling and testing of concrete shall be done by and at the expense of the Contractor. Throughout the period that the concrete is being poured into cylinder shall be taken from fresh concrete from the forms.

The rests shall be made for each 10 cu. m. of concrete or fraction thereof for each portion of structure as may required by the Project Manager as follows:

1. Compression Tests:

   At least two (2) sets of samples consisting of three (3) concrete cylinder specimens per set shall be made. Fresh concrete shall be placed inside standard 150 x 300 mm cylindrical mould in three (3) separate equal layers and rodded separately with 25 strokes with a 16 mm diameter. Surface shall be leveled with trowel and samples are to be labeled to identify the class, strength of concrete, date taken and part of structure samples are taken. The samples shall be cured in accordance with ASTM C31.

   One set of cylinders shall be tested at the age of seven (7) days, and one set at the age of twenty-eight (28) days, in accordance with ASTM C39. Additional cylinder samples may be molded in reserve for further tests, if the results of the twenty-eight (28)-day-test do not meet the requirements.

2. Additional Tests

   If, in the opinion of the Project Manager, based on the cylinder reports, concrete with strengths below specification requirements has been placed, the Project Manager, at the expense of the Contractor shall make additional tests. Additional tests may be compression test on cored cylinder, ASRM C42, and/or load tests as outlined in ACT 318 Sec. 202.

2.2.3 Mixing Concrete

Mixing shall be thoroughly mixed in a mixer of an approved size and type to insure a uniform distribution of the materials throughout the mass:

1. Site Mixed Concrete

All structural concrete shall be machine-mixed for at least 1 ½ minutes after all materials including water are in the mixing drum. The time elapse between the introduction of the mixing of water to the cement and aggregate and placing of the concrete in final position shall not exceed 45 minutes. Placing of the material in the mixer shall be done in such a way that the first batch of concrete materials in the mixer shall contain sufficient excess cement, sand and water to coat the inside of the drum without reducing the cement content of the mix to be discharged. The retempering of concrete, placing additional cement, aggregate or water during mixing period shall not be permitted.

No hand mixing shall be allowed, except in case of emergency of breakdown during pouring operations, subject to the approval of the Project Manager.

2. Ready-Mixed Concrete

Ready-mixed concrete, when shall be batched, mixed and delivered from a plant approved by the Project Manager, and shall be in strict compliance with the requirements set forth in ASTM C94.

The rate of delivery of the mixed concrete shall be such that the interval between placing of successive batches shall not exceed thirty (30) minutes. The elapsed time between the introduction of mixing water to the cement and aggregate, and completion of discharge shall not exceed one (1) hour, or not more than 1 ½ hours if retarder is used. It should be kept constantly agitated during the transit period. Delivery tickets shall contain data on the weight of sand, gravel and amount of cement and water added. The Contractor shall keep legible copies available for examination of the Project Manager.

Retempering of concrete shall not be permitted. The Contractor shall mix only quantities required for immediate use and mixture, which has developed setting, shall not be used. Concrete, which has partially hardened, shall not be retempered.

2.2.4. Concrete Placing

Concrete shall be placed only after all formworks, materials to be embedded, and preparation of surface involved in the placing have been inspected and approved by the Project Manager. The Contractor shall provide equipment and shall employ methods that will minimize separation of aggregates from the concrete mix.

Water shall be removed from excavation before concrete is deposited. Flow of water shall be diverted through proper side drains to a pump, or removed by other approved methods to avoid washing over freshly deposited concrete. Hardened concrete, debris and foreign materials shall be removed from the interior of forms and from inner surfaces of mixing and conveying equipment.

Reinforcements shall be secured in position, inspected and approved before pouring concrete. Runaways shall not be provided for wheeled concrete-handling equipment's, such equipments shall not be wheeled over reinforcement nor shall runaways be supported by reinforcements.

Concrete shall be handled from the mixer to the place of final deposits as rapidly as practicable by methods, which shall prevent segregation or loss of the ingredients. It shall be deposited in the forms in approximately layers and as nearly as practicable in its final position to avoid re-handling.

Conveying or handling of concrete by the use of inclined chutes or pipes of more than three (3) meters shall not be permitted. Dumping of concrete into buggies, buckets or wheelbarrows with a free fall of more than one (1) meter shall not be permitted. When placing operations would involve dropping of concrete more than 1 ½ meters, it shall be deposited through a sheet metal or other approved conveyor. AS for practicability, the conveyor shall be kept full of concrete during placing and their lower ends shall be kept buried in the newly placed concrete. After the initial set of concrete, the forms shall not be jarred and no strain shall be placed on the ends of the reinforcing bar, which are being projected.

Concrete in columns shall be placed in one continuous operation. Concrete in girders, beams and slabs in superstructures shall be poured in a monolithic and continuous manner. No construction joint shall be allowed on any part of the structure without the approval of the Project Manager.

Consolidate all concrete in accordance with provisions of ACI 309R. Consolidate each layer of concrete greater than 4 inches in depth with high frequency, interval, mechanical equipment supplemented by hand spading and tamping. Consolidate concrete slab 4 inches or less in depth by wood tampers, spading and settling with a heave leveling straight edge. Operate vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Insert and withdraw vibrators approximately 18 inches apart. Penetrate the previously place lift with the vibrator when more than one lift is required. Place concrete in 180-inch maximum vertical lifts. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation of aggregates. Provide adequate number of units and power source at all times. Maintain spare units on hand to ensure adequacy. If in the opinion of the Project Manager the equipment being used is not adequate to accomplish proper consolidation, the Project Manager may order delay in further placement of concrete until such equipment is available for use at the location of placement of concrete.

2.2.5 Protection and Curing

1. General

Concrete surfaces exposed to conditions causing premature drying shall be protected as soon as possible with canvas, straw, burlap and or other satisfactory material and kept moist; or if the surfaces are not covered they shall be kept moist by flushing or sprinkling, as directed by the Project Manager. All concrete shall be moist cured for a period of not less than seven (7) consecutive days after placing by an approved method or combination of methods applicable to local conditions. Curing period is 28 days.

2. Moist Cutting

The surface of the concrete shall be kept continuously wet water for a period of seven (7) days, by spraying or covering with burlap or other approved material thoroughly saturated with water and keeping the covering wet by spraying or intermittent hosing. Water for curing shall be generally lean and free from any element, which might cause objectionable staining or discoloration of the concrete.

2.2.6. Repairs to the Concrete

All imperfections on concrete surfaces are corrected to produce concrete surfaces that conform to the requirements of this section. Unless otherwise approved by the Project Manager, patching with the cement mortar shall repair imperfections on formed surfaces. Cement mortar for patching shall be the same composition as used in the concrete, except for exposed surfaces; part of the cement shall be while cement to provide a finish color matching the surrounding concrete. Honeycomb or otherwise detective areas shall be cut out from solid concrete to a depth of not less than 25 mm. the edges of the cut shall be perpendicular to the surface of the concrete. The area to be patched, at least 15 mm adjacent thereto shall be saturated with water before placing the mortar. The mortar shall be mixed approximately one (1) hour before placing and shall be remixed occasionally during this period with trowel without adding water. A grout of cement and water, mixed to a consistency of paint, shall then be brushed onto the surface to which the mortar is to be bonded. The mortar shall be compacted into place and screened slightly higher than the surrounding surface. Patches on exposed surfaces shall utilize plywood forms, after the removal of forms, shall not be plastered, unless other wise directed by the Project Manager. All joint marks on the formwork shall be reworked to a smooth surface to match adjacent areas and to present a new appearance.

3. MASONRY WORKS

The work includes furnishing and placing of concrete masonry units in conformity with the lines, grades and cross-sections shown on the drawings and in accordance with the specifications.

3.1. Material Requirements

3.1.1 Concrete Hollow Blocks

Concrete hollow blocks shall be a standard product of recognized manufacturer to PNS 16, as indicated on the drawings. Exterior and interior masonry units shall be non-load bearing units. However, load-bearing units may be provided in lieu of non-load bearing units. For non-load bearing units, the required compressive strength shall be 25 kg/cm^2 or 2.48 Mpa.

3.1.2 Cement, Reinforcing Steel and Water

Cement, reinforcing steel and water shall be as specified in Section 2.0.

3.2. Construction Requirements

3.2.1 Workmanship

Masonry walls shall be placed level and plumb all around. One section of the walls shall not be placed in advance of the others, unless specifically approved. Unfinished work shall be stepped back for joining with the new work; tooting shall not be permitted. Heights of masonry work shall be checked with an instrument at sills and heads of openings, to maintain the level of the walls. Door and window frames, louvered openings, anchors, pipes and conduits shall be installed carefully and neatly as the masonry work progresses. Spaces around door frames shall be filled solidly with mortar. Drilling, cutting, fitting and patching to accommodate the work of others, shall be performed by skilled workers. Bolts, anchors, inserts, plugs, ties and miscellaneous metal work specified elsewhere shall be placed in position as the work progress. Chases of approved dimensions for pipes and other purposes shall be provided, where indicated or necessary. Top of exposed walls and partitions, not being worked on, shall be covered with a waterproof membrane, well secured in place. Wall and partitions shall be structurally bonded or anchored to each and to concrete wall beams, and columns.

3.2.2 Mortar Mixing

Mortar materials shall be measured in approved container to insure that the specified proportions of materials are controlled and accurately maintained during the progress of the work. Unless specified otherwise, mortar shall be mixed in such a manner that the materials will be disturbed uniformly throughout the mass. A sufficient amount of water shall be added gradually and the mass further mixed, not less than 3 minutes, until a mortar of the plasticity required for the purpose intended shall be obtained. The mortar shall be mixed in a manner such that the quality of water can be controlled accurately and uniformly. Mortar boxes, pans of mixing drums shall be kept clean and free of debris or dried mortar. The mortar shall be used before the initial setting of the cement has taken place; retempering of mortar in which cement has started set shall not be permitted.

3.2.3 Proportion of Mortar Grout

Fine mortar grout shall be mixed in the volumetric proportion of one part Portland cement. ¼ part hydrated lime and 3 parts sand. Coarse grout shall be mixed in proportion of one part Portland cement, ¼ hydrated lime, 3 parts sand and 3 parts pea gravel passing a 3/8-inch sieve.

3.2.4 Use of Fine and Coarse Grout

Fine grout shall be used in grout spaces less than 50 mm in my horizontal dimension or when clearance between reinforcement and masonry id more than 17mm.

3.2.5 Mortar Joints

Mortar joint shall be uniform in thickness, and the average thickness of any three consecutive joints shall be 9.50 mm. “Gage rods” shall be made and approved prior to starting the work and shall be used throughout the work. Changes in coursing or bonding after the work has started shall not be permitted. The jointer shall be slightly larger than the width of the joints, so that complete contact is made along the edge of the units, compressing and sealing the surface of the joint. Joints in masonry, which will not be exposed, shall be stuck flush. Joints shall be brushed to remove all loose and excess mortar. All horizontal joint shall be on level and vertical joins shall be plumbed and aligned from the top to the bottom of the wall with a tolerance of plus or minus 12 mm.

3.2.6 Concrete Masonry Unit

The first course of concrete masonry unit shall be laid in full bed of mortar, for the full width of the unit; the succeeding courses shall be laid with broken joints. Concrete masonry units with the cells verticals shall have bed-joints formed by applying the mortar to the entire top of the surface of the inner and outer face shall, and the head joints formed by applying mortar of a width of about 25 mm to the ends of the adjoining units lay previously. The mortar for joints shall be smooth, not furrowed, and shall be of such thickness that it will be forced out of joints as the units are being placed in position. Where anchors, bolts, ties and reinforcing bars occur within the cell of the units, such cells shall be solidly filled with mortar or grout as the work progress.

3.2.7 Reinforcement

Horizontal tie reinforcement shall be provided where indicated. Reinforcement shall be continuous and provided in the longest available lengths. Reinforcement above and below openings shall extend and be embedded into the columns, unless otherwise shown on the drawings. Spices shall overlap not less than 150 mm. Reinforcement shall be embedded in the mortar joints in the manner that all parts shall be protected by mortar. The two top courses of filler block walls shall have their cores filled with grout when placed in position.

Unless otherwise shown on the drawings, the size and spacing of bars shall be as follows:

For Vertical Bars:

150 mm (6”) CHB	-	12 mm dia. At 600 mm (24”) on centers
125 mm (5”) CHB	-	10 mm dia. At 600 mm
For horizontal bars:	-	10 mm dia at 600 mm (24”) on center (every third Course) for 150 mm (6”) and 100 m (5”) CHBs.

3.2.8 Bounding and Anchoring

Masonry walls and partitions shall be accurately anchored or bonded at points where they intersect, and where they abut or adjoin the concrete frame of the building. All anchors shall be completely embedded in mortar.

3.2.9 Grout Placement

Grout shall be performed on the interior side of wall, except as approved otherwise, sills, ledges, offsets and other surfaces to be left exposed shall be protected form grout falling on such surfaces and be and shall be removed immediately. Grout shall be stirred before placing to avoid segregation of the aggregate and shall be sufficiently fluid to flow into joints and around the reinforcement without leaving any voids. Grout shall be placed by pumping or pouring from buckets equipped with spouts, in lifts not exceeding 1.2 meters high. Grout shall be puddle thoroughly to eliminate voids without displacing the masonry units form its original position. Masonry units displaced by grouting operation shall be removed and re-laid to its proper alignment using fresh mortar grout.

3.2.10 Tests and Test Reports

The testing requirements stated herein or incorporated in referenced contract documents may be waived provided certified copies of report of tests from approved laboratories preformed on previously manufactured materials are submitted and approved. Test reports shall be accompanied by notarized copies from the manufacturer certifying that the previously tested material is of the same type, quality manufacturer, and make those

4. REINFORCEMENT

Steel reinforcement shall be provided together with all the necessary wire tie chairs, spacers, support and other necessary devices.

4.1. Cutting and Bending

Reinforcing steel shall be accurately cut and bent in accordance with the approval detailed reinforcement drawings. Reinforcing steel shall not be straightened or re-bend in a manner that will injure the material. Bars with kink or with bends not shown on the approved detailed reinforcing drawings or with cracks or splits of the bends shall not be used. All the bars shall be bent cold. If Contractor elects to have reinforcing steel cut and bent off the site, he shall provide, maintain and operate a small cutting and bending shop on the site and maintain and representative stock of steel. This provision is to take care of minor revisions and additions in an expeditious manner.

The Project Manager may require the contractor to prepare and submit bar cutting schedule prior to fabrication of reinforcing steel bars.

4.2. Placing Reinforcement

Reinforcing steel shall be accurately placed in accordance with approved detailed reinforcement drawings and shall be adequately secured against displacement by using specified tie wires or approved clips at all intersections. After it has been installed, reinforcing steel shall be inspected by the Project Manager for compliance with requirements as to size, shape, length, splicing, position and number. Reinforcing steel shall be supported by concrete or metal supports, spacers or metal hangers, except for surfaces exposed to the ground or to the weather, where supports shall be concrete. Wooden support spreaders shall not be used. At surfaces where attractive appearance is requires, the supports shall be of the type, which shall not cause subsequent staining

5. FORMS AND SCAFFOLDINGS

Forms shall be used whenever necessary to confine the concrete and shape it to the required lines and dimensions, or to protect the concrete from contamination. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall be maintained rigidly in correct position. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Forms for exposed surface shall be lines with form grade plywood. Bolts and roods used for interval ties shall be so arranged that when the forms are removed, they shall not be less than two (2) centimeters from the formed surface.

Removal of forms or shoring is subject to approval by the engineer, and under no circumstances shall bottom form and shoring be removed until after the members have acquired sufficient strength to support their weight and the load thereon. Forms shall remain in place for a minimum time as follows:

Columns, sides of beams, shear and bearing walls ------- 3 days
Beams ------- 14 days

Reshore immediately after stripping beams and girders that support subsequent formwork.

5.1. Cleaning and Oiling Forms

Before placing concrete, the contact surface if the forms shall be cleaned of incrustations of mortar, grout or other foreign material. Forms shall be coated with standard form oil that can effectively prevent sticking and will not stain the concrete surfaces.

5.2. Removal of Forms

Forms shall be removed in a manner, which shall prevent damage to concrete structures. Forms shall not be removed without prior approval of the Project Manager. Any repairs of the surface imperfections shall be performed at once and curing shall be started as soon as the surface is sufficiently hard to permit it without further damage. The minimum time period for removal of forms shall govern where it exceeds the minimum specified curing period. Where the formwork for one element supports the formwork for one element supports the formwork for another element, the greater time period shall apply to both elements. Forms shall not be removed before the expiration of the minimum time specified below:

Element	Time Period
Walls columns, sides of beams and girders, and slabs on grade	1
Pan joist forms (side only): 76 cm (30 inches) Wide or less over 76 cm (30 inches) wide	3

Where design live:	less than the dead load	greater than dead load
Joist, beam or girder, soffits:		
(Clear span between structural support):		
Under 3.00 m (10 ft.)	7	4
3.00 m (10 ft) to 6.00 m (20 ft.)	14	7

Over 6.00 m (20 ft)	21	14
One-way floor slabs: (Clear span between structural supports)		
Under 3.00 m (10 ft)	4	4
3.00 m (10 ft) to 6.00m (20 ft)	7	4
Over 6.00m (20 ft)	10	7

Sufficient shoring members to support dead loads including construction loads on beams and slabs shall be provided for a period of eight (8) days in addition to the seven (7) days specified thereto. The time for removal of forms for structures not included thereto shall be as directed by the Project Manager. Concrete work shall be protected from damage during construction.

6. ROOF FRAMING WORKS

The work includes the furnishing, fabrication, erection or installation of structural steel roof framing in accordance with this specification and as shown in the drawings.

6.1 Material Requirement

6.1.1 Structural Steel Shapes Plates and Bars

Unless otherwise shown or specified on the drawing, structural steel shapes plates and bars shall conform to ASTM specification A36/A6M.

6.1.2 Hot-Formed Steel Sheet and Strip

Unless otherwise shown or specified on the drawings, hot-formed steel and strip shall conform steel and strip shall conform to ASTM A570.

6.1.3 Bolts, Nuts and Washer

It shall conform to specification STM A370, with a minimum yield point of 33, 000 psi, unless otherwise shown in the drawings. Heavy hexagonal structural bolts, heavy hexagonal nuts and hardened washers, shall be quenched and tarpapered medium-carbon steel bolts, nuts and washers complying with ASTM A325.

6.1.4 Screw and Expansion Bolts

Screw and Expansion colts be of standard commercial grade, and of the sizes and types indicated as approved by the

6.1.5 Electrodes

Electrodes for are welding shall be E60, or E70, AWS D1.1

6.1.6 Galvanizing

Unless otherwise specified, galvanizing shall be of standard quality, hot-dipped process of 1.25 ounces per square foot of coating. Galvanized surface that are damaged prior to final acceptance shall be repaired using and approved repair compound to the satisfaction of the Project Manager.

6.1.7 Miscellaneous Metals

Miscellaneous metals including fastenings, anchorage's and incidentals not specifically mentioned herein or in other section of this specifications but are required to complete the work, for which there are no detailed drawings, shall be provided and installed in accordance with standard practice of the trades as approved by the Project Manager.

6.1.8 Delivery, Storage and Handling

Fabricated materials delivered to job site shall be stored in clean and protected dry areas in manufacturer's protective package. Structural steel materials to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. Skids placed near enough together to prevent injury from deflection shall support long members, such as purlins and chords. The Contractor shall check the quantity and quality f materials turned over to him against the delivery list and repot promptly in writing my shortage or damage discovered.

6.2 Construction Requirements

6.2.1 General

Fabrication and erection of structural steel shall be in accordance with AISC specification for the design. Fabrication and erection of structural steel for buildings, except as specified herein. The Contractor shall submit to the Project Manager for approval shop drawings showing the proposed method of fabrication and installation of all metal work. No work shall be started until the shop drawings have been approved. And all work shall conform to the approved shop drawings.

6.2.2 Fabrication of Steel Structure

The work shall be well formed at the shape and size shown and assembles as detailed. Structural members shall be fabricated and assemblers in the shop to the greatest extent as possible. Shearing and punching shall be produced in clean, true lines and surfaces with burrs removed. Nuts shall be drawn up tight. Joints, which ate to be

exposed to the weather, shall be waster lights. Hole shall be cut, drilled or punched at right angles to the surface of the metal and shall not burning enlarge made ort. Holes in base or bearing plates shall be drilled.

1) Welding

Structural steel shall be welded in accordance with the standard code of Are and Gas Welding in Building Construction of the American Welding Society. Qualified welders shall perform all welding work only.

2) Shop Painting

Unless otherwise specified of indicated in the drawings, all structural steel work (except galvanized surfaced and surfaces that will be painted with epoxy) shall be given a shop coat of red lead or zinc chromate primer.

6.2.3 Erection

The steel structure shall be erected true to line and grades. Bracing's and supports shall be introduces whenever necessary to take care of all the loads to which the structure may be subjected. Such bracings shall be left in place as ling as may be required for safety. As erection progress, the work shall be securely bolted to take are of all the dead loads, wind and erection stresses. No reaming of undersize bolt holes shall be permitted, and erection bolts shall not be used for lining up members.

(1) Rift Pins

Drift pins may be used only to bring together several parts; they shall not be used in such a manner as to distort or damage the metal.

(2) Gas Cutting

The use of gas cutting torch in the fields for correcting fabrication errors shall not be permitted on any major member in the structural framing. Its use may be permitted only when the member is not under stress, and subject to the approval of the Project Manager.

(3) Base Plates and Bearing Plates

Base plates and large bearing plates shall be supported in steel wedges or shims until the supported members have been plumbed, following which the entire bearing are shall be grouted with no-shrink cement grout.

(4) Grouting Mortar for Setting Base Plates

Concrete grout shall be a non-shrinking type grouting mortar. The mortar subject to the approval by the Project Manager can either be a mixture of Portland cement, well

graded fine aggregate, aluminum powder; and water or an approved commercial grouting mortar containing non-metallic chemical oxidizing agent. If adopted, the approved product shall be delivered to the site of the work in original sealed container bearing the trade name of the manufacturer. Surfaces to receive the mortar shall be clean and shall be clean and shall be moistened thoroughly before placing the mortar. Exposed surfaces of mortar shall be water cured we burlap for at least seven (7) days.

(5) Setting Up

Steel shall be erected plumb, level and properly guyed. In setting or erecting structural steel, the individual piece shall be considered plumb or level where the error does not exceed 1 to 500.

(6) Inspection

The Contractor shall give the Project Manager at least fifteen (15) day notice prior to the start of work at the mill shop, so that the required inspection may be made. The term "mill" means any rolling mill, shop or foundry where material for the work is to be manufactured or fabricated. No materials shall be rolled or fabricated until the said inspection has been provided.

The Contractor shall furnish the Project Manager with copies of the certificate mill reports of the structural steel structure preferably before but not later than the delivery of steel structure to the job site.

The Contractor shall furnish all facilities for inspection and the Project Manager shall be given free access to the mill or shop and premises at all times. The Contractor shall furnish without charge all labor; machinery, materials and tools necessary to prepare test specimens.

Inspection at the mill or shop is intended as a means of facilitating work and avoiding errors. It is expressly understood that it will not relieve the Contractor form any responsibility for imperfect materials or workmanship and the necessity for replacing the same. The acceptance of any materials or furnished member at the mill or shop by the Project Manager shall be preclude their subsequent rejections if found defective before final acceptance of the work. Inspection of welding works will be in accordance with the provision of Section 5 of the "Standard Code for Arc and Gas Welding in Building Construction" of the American Welding Society.

7. ROOFING AND TINSMITHRY WORKS

The work includes installation of pre-painted Rib-type Long Span roofing and Roof Insulation with complete with hardware and accessories.

7.1 GENERAL

The work includes furnishing all materials and requirements performing all operations to provide a long span corrugated twin ribbed roofing and miscellaneous roofing work as required to provide an acceptable installation. Surfaces to which metal formed roofing sheets are to be applied shall be thoroughly cleaned and prepared, free from any defects that may affect the application. Metal formed roofing shall be locked and lapped and installed as applicable. Details shall be in accordance with manufacturer's recommended installation practice.

7.2 MATERIALS

All Roofing Sheets (.5mm thk), Gutters, Ridge and Valley Roll, and Flashing must be Pre-Painted and should be #24 of thickness. Roofing insulation must be at least 100mm thick.

7.3 INSTALLATION

Lay and install the first sheet with turned down edge towards the outside of the area to be covered. Overlap the next sheets to the previous sheet in such a manner that the exposed edge I turned down and the covered edge is turned up. Side up fasteners should be done by rivets and washers spaced from 300mm to 450mm on centers.

Care should be exercised in the proper anchorage of all roof frames.

Ridge strips for ridge rolls and ridge flashings are attached to the roofing sheets by means of rivets. Other flashings are to be fabricated from plain sheets of the same materials as the roofing in accordance with the details and/or site requirements. These are also attached to roofing sheets by means of rivet.

7.4 TEMPORARY PROTECTION

Metal formed roofing sheets surfaces requiring protection from stains, discoloration, surface abrasion and other construction abuses shall be suitably protected in accordance with the manufacturer's recommendations.

7.5 FINAL CLEARING

Upon completion, the Contractor shall clean the metal formed roofing sheets surfaces and drain line of burrs, leaves, stones and other foreign matter that may impair the flow of water. Surface shall be kept clean by periodic inspection.

8. CARPENTRY WORKS

This section includes all rough and finish carpentry and joinery works, as shown in the drawings and in accordance with this specification.

8.1 Material Requirements

Use ¼" x 4' x 8' Fiber Cement Board as specified on the detailed plans. For other areas use ¼" Gypsum board on Metal Furring.

Eaves ceiling must be Metal Spandrel 4" x 20'.

Fasteners shall be of the type and size best suited for the purpose as shown in the drawing. Fasteners shall be zinc coated regular commercial size as indicated and shall conform to ASTM specification A307.

¼" thk Marine Plywood must be used for fabrication of cabinets, shelves and other wooden furnitures.

8.2 Construction Requirements

8.2.1 Workmanship

Lumber for framing and other carpentry or metal framing shall be fitted closely, set accurately to the required lines and levels, and shall be secured in a place in a rigid and substantial manner. Spiking, nailing and bolting shall be done in an approved manner. Spikes, nails and bolts shall be of the proper size, and care shall be taken so as not to split the members. All frames coming in contact with concrete or masonry shall be anchored by means of nails metal screws with tox spaced sufficiently apart all around the contact surfaces. Bolt holes shall be drilled accurately and shall have a diameter of 3 mm more than the bolt size. All exposed wood surfaces shall be smoothly dressed and if so required, shall be well sand papered to an even smooth surface ready for finishing.

8.2.2 Finish Framing

Grades and species of wood shall be as specifies. Interior finish shall be set plumb, level, square and in true alignment and joints shall be tight and formed to conceal shrinkage. All finish framing, shall be done as much as possible with carefully fitted mortise and tendon joints as much as possible, if not possible locate them in inconspicuous places where nailing is permitted on wood surfaces. Nailing and blocking shall be provided as necessary.

8.2.3 Rough Framing

Framing and other rough carpentry shall be fitted closely and set accurately to the required line and levels and shall be secured in place in a rigid and substantial manner. Framing members shall not be spliced between bearing points and shall be provided as necessary for the proper completion of the work. Nailing shall be done in an approved manner, so as not to split the framing members.

8.2.4 Protection of Work

The Contractor shall protect all finished woodwork and millwork from injury after it has been set in place until completion and final acceptance.

8.2.5 Hardware

Items of hardware to be installed shall be as directed or as shown in the drawings and fitted carefully attached securely. Care shall be exercised not to mar or injure the work.

9. DOORS AND WINDOWS

This section calls for the furnishing, fabrication and installation of doors and windows in accordance with the plans and specifications.

9.1 General

Doors schedule, color and design shall be in accordance with the plans. Door panels shall have 44-mm thickness, unless otherwise specified or shown on plans, except for counter doors, which shall be 31 mm thick.

9.2 Door Types

9.2.1 Hollow Core Doors

Except as otherwise specified, flush door shall be done in accordance with the detail as shown on the plans. The plywood edge protection shall be around and into the outside frame of the door in order to prevent “peeling off” of the plywood veneers at the edges.

9.2.2 PVC Doors

PVC doors for interior shall be of best quality. PVC doors shall be 44 mm. thick. and shall also be provided with bottom louvered portions as indicated in the plans.

9.2.3 Aluminum Glass Doors

Aluminum frame glass doors shall be provided with 6 mm. thick laminated colored or tinted glass; with standard aluminum tubular sections with powder coated finish; with upper transoms or fixed fan lights (also provided with 6 mm thick laminated colored or tinted glass) as indicated in the plans. Also provide aluminum push bar with powder coated finish and door pivots or thin-slab floor hinges. Also provide integral lock system. Details and sizes shall be in accordance with the plans and supplementary

9.2.4 Flush Doors (Wooden Hollow-core Flush Doors)

Wooden Hollow-Core Flush Doors shall be 44 mm. thick. And use 6 mm thick marine plywood. Provide paint finish.

9.2.5 Metal Flush Doors

Tubular framed Steel Door with 1.5mm G.I. Sheet body. With complete lock system.

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9.3 Types of Windows

9.3.1 Jalousie Window

Layer Type operation

This type of jalousie window shall be capable of locking the unit in any position and cannot be opened outside. Louver with glass slat clips and tilt gar casing shall be extruded aluminum sections, true to details with clear, straight, sharply defined profiles and green from defects impairing its strength or durability. Aluminum extruded section and strips shall be Type AA conforming to ASTM B 235-50T.

9.3.2 Steel Casement Windows

All steel windows shall be products of reputable and nationally known manufacturers approved by the Construction Officer. Unless otherwise indicated, all window frames shall be constructed to withstand a minimum 1225N/sq.m. wind load with the sashes in closed position. Windows shall be design for glazing from outside with continuous glazing heads.

9.3.3 Aluminum Frame Sliding/ Fixed Window

Aluminum frame glass Windows shall be provided with 6 mm. thick laminated colored or tinted glass; with standard aluminum tubular sections with powder coated finish; with upper transoms (if applicable) or fixed fan lights (also provided with 6 mm thick laminated colored or tinted glass) as indicated in the plans.. Also provide integral lock system. Details and sizes shall be in accordance with the plans and supplementary.

10. TILEWORKS

10.1 Floor Tiles

Tiles shall be standard grade and 6 mm thick. Color and pattern shall be as specified in the drawing or as approved by the Project Manager.

For all other floor finishes not indicated below, refer to schedule or call-out specifications of finishes indicated in the plan.

- 400 mm x 400 mm Unglazed Ceramic Tiles (Floors);
- 400 mm x 400 mm Glazed Ceramic Tiles (Walls);

10.2 Grout Materials

As required by the Project Manager or as follows:

Portland Cement Grout:

Scratch Coat: 1 part Portland cement to 5 parts damp sand to 1/5 part hydrated lime.

Mortar Bed: 1 part Portland cement to 5 parts sand to ½ part hydrated lime.

Bond Coat: neat Portland cement paste.

11. METAL WORKS

The work includes the furnishing, fabrication, and installation of Steel Grating for the drainage system.

11.1 Materials

Use 3/16 x 1 ½" x 1 ½" and 3/16" x 2" x 2" Angle bar as specified in the detailed plans and estimate.

11.2 Electrodes

Electrodes for are welding shall be E60, or E70, AWS D1.1

11.3 Galvanizing

Unless otherwise specified, galvanizing shall be of standard quality, hot-dipped process of 1.25 ounces per square foot of coating. Galvanized surface that are damaged prior to final acceptance shall be repaired using and approved repair compound to the satisfaction of the Project Manager.

12. SANITARY AND PLUMBING WORKS

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

12.1 Material Requirements

12.1.1 For cold water lines, Pn 10 Fusion Weld Polyprophylene Pipes. Provide coal tar with burlap for embedded pipe.

12.1.2 UPVC Pipe series 1000 conforming to ASTM D-2729 for all downspouts and sewer, waste & vent lines.

12.1.3 Water Closets shall be Tank Type Push Button Flush, Free Standing Combination round front bottom outlet siphon vortex or wash-down bowl with jet round front with close coupled tank with cover with complete fittings and mounting accessories.

12.1.4 Toilet lavatories be wall hung lavatory with rear overflow and cast-in soap dishes pocket hanger and integral China Brackets complete with twin faucets, supply pipes, P-trap and mounting

12.1.5 Pipes, plumbing fixtures, water lines, clean out and vents shall be supplied and installed in accordance with the approved workmanship.

12.1.6 Septic Tank

The septic tank shall be provided as shown on the plans including all pipe vents and fittings.

Various construction materials such as concrete masonry work shall conform to the corresponding Items of this specification.

Inlet and outlet pipes shall conform to the latest edition of the National Plumbing Code.

12.1.7 Water Supply Pipes and Fittings

A. Pipes shall be Pn 10 Fusion Weld Polypropylene Pipe conforming to specification requirements including Trims and Fittings.

B. Valves for water supply shall be bronze body with threaded ends ratted 21.0 kgf/cm. square. All valves are 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 in ferrous pipe 50 mm in diameter and smaller shall be malleable iron

12.1.8 Approved Alternate Pipes and Fittings

Pipes and fittings for sanitary and potable water lines as approved alternative shall be Galvanized Iron Pipes and Fittings Schedule 40 and Unplasticized Polyvinyl Chloride Pipes and Fittings (UPVC). Pipes and fittings shall be made of virgin materials conforming to specification requirements defined in ASTM D-2241 and PNS 65: 1986. Fittings shall be molded type

and designed for solvent cement joint connection for water lines and rubber O-ring seal joint for sanitary lines.

12.2 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 this work. Where actual condition necessities a rearrangement of the approve pipe layout for approval by the Project Manager.

12.2.1 Installation of Waste and Vent Pipes

12.2.1a Horizontal lines shall be secured strongly by hooks to the building frame and suitable brackets or chairs shall be provided at the floor which they start.

12.2.1b Vent pipes in roof spaces shall be run as closest possible to under side of roof with horizontal piping pitched down to stacks without forming traps. Vertical vent pipes connected into one main vent riser above the highest vented fixtures.

12.2.1c Where an end circuit vent pipe from any fixtures is connected to a vent line serving other fixtures, the connection shall be at least 1.20 m above the floor on which the fixtures are located.

12.2.1d Horizontal waste line receiving the discharge from two or more fixtures shall be provided with end vents separate venting of fixtures is noted on the plans.

12.2.1e All changes in pipe size on soil and waste lines shall be made with reducing fittings or recessed reducers. All changes indirection shall be made appropriate use of 45 degrees, wyes, half wyes, quarter bends or elbows may be used in waste lines where the change in direction of flow is the horizontal to the vertical and on the discharge from waste closets. Where it becomes necessary to use short radius fittings in other location the approval of the Project Manager shall be obtained prior to installation of the same.

12.2.1d Vent pipe shall be provided with Vent Cap (Studor) and flashed and made watertight at the roof with ferrule lead. Flashing shall be turned down into pipes.

12.2.2 Water Pipes, Fittings and Connections

All water piping inside the building and underground, 100-mm in diameter and smaller shall be schedule 40, series 1000 PVC pipes fittings.

12.2.2a The water piping shall be extended to all fixtures, outlets and equipment from the gate valves installed in the branch neat the rise.

12.2.2b The cold water system shall be installed with a fall towards a main shut off valve band drain. Ends of pipes and outlet shall be capped or plugged and left ready for future connections.

12.2.2c Mains and Branches

12.2.2d All pipes shall be cut accurately to measurements and shall be worked into place without springing or forcing. Care shall be taken so as to not to weaken the structural portions of the building.

12.2.2e. All piping above the ground shall be run parallel with the lines of the building unless otherwise indicated on the plans.

12.2.2f All service pipes, valves and fittings shall be kept at sufficient distance from other work to permit finished covering on the different services.

12.2.2g No water piping shall be buried in floors, unless specifically indicated on the Plans and approved by the Project Manager.

12.2.2h Changes in pipes shall be made with reducing fittings.

12.2.2i Drain Cocks

Pipe drain indicated on the drawing shall consist of 12-mm globe valve with renewable disc and installed at low points on the cold water piping so that all piping shall slope 100 in 30.5 m.

12.2.2j Threaded Pipe Joints

All pipes shall be reamed before threading. All screw joints shall be made with graphite and oil or with an approved granite compound applied to make threads only. Threads shall be cut not more than three threads on the pipe shall remain exposed.

12.2.2k Expansion and Contraction of Pipes

Accessible contraction-expansion joints shall be made whenever necessary. Horizontal runs of pipe over 15 m 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.

- Valves shall be provided on all supplied fixtures as herein specified.
- The cold water connection to the return circulation connection shall have and a check valve.
- All connection to domestic hot water heaters shall be equipped with unions between valve and tanks.
- Valve shall not be installed with its stem below the horizontal. All valves shall be gate valves unless otherwise indicated on the Plans.
- Valves p to and including 50-mm diameter shall be threaded ends; rough bodies and finished trimmings, except those on chromium plated brass pipe.
- Valves 63 mm in diameters and larger shall have iron bodies, brass mounted and shall have either screws or flange ends.
- Hose bibs shall be made of brass with 12.5-mm inlet threads, hexagon shoulders and 19 mm male.

12.2.3 Fixtures, Equipment and Fastenings

12.2.3a All fixtures and equipment shall be supported and fastened in a safe and satisfactory workmanship as practiced.

12.2.3b All fixtures where required to be wall mounted on concrete or concrete hollow block wall, fasten with brass and expansion bolts. Expansion bolt shall be 6-mm diameter with 20-mm threads to 25 m into solid concrete, fitted with loose tubing to sleeves of proper length to acquire extreme rigidity.

12.2.3c Insert shall be securely anchored and properly flushed into the walls. Inserts shall be concealed and rigid.

12.2.3d Bolts and nuts shall be horizontal and exposed. It shall be provided with washers and chromium plate finish.

12.2.4 Plates and Flashing

12.2.4a 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 steel on ferrous pipes.

12.2.4b 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.

12.2.4c. Roof areas penetrated by vent pipes shall be rendered watertight by lead sheet flashing and condor flashing. It shall extend at least 150 mm above the pipe and 300 mm along the roof.

12.2.5 Bathroom and Toilet Accessories

a. Shower head and fittings 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 for disabled people.
c. Floor drains shall be made of steel beehive type, measuring 10cm x 10 cm and provided with detachable stainless strainer, expanded metal lath type.
d. Toilet paper holder and soap holder shall be vitreous china or approved equal wall mounted. Color shall reconcile with the adjacent fixture and facing tiles.
e. Faucets shall be made of stainless steel for interior use.
f. Hose bibs shall be made of bronze cast finish.

12.3 Drainage System Test

12.3.1 The entire drainage and 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 water or a full 30 minutes during which time there shall be no drop greater than 102 mm.

12.3.2 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 required pressure.

12.3.3. If and when the Project Manager 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 designated representative.

12.4 Water Test on System

12.4.1. Upon completion of the roughing-in and before connecting fixtures the entire cold water piping system shall be tested at a hydrostatic pressure 1 ½ times the expected working pressure in the system during operation and remained tight and leak-proofed.

12.4.2. Where piping system is to be concealed the piping system and in the presence of the Engineer of his duly designated representative.

12.5 Defective Work

12.5.1. All defective materials replaced and tested will be repeated until satisfactory performance is attained.

12.5.2. Any material replaced for the satisfactory performance of the system made shall be at the expense of the Contractor.

12.5.3. Caulking of screwed joints or holes will not be permitted.

12.6 Disinfection

12.6.1. The entire water distribution system shall be thoroughly flushed and treated with chlorine before it is operated for public use.

12.6.2. Ids-infection materials shall be liquid chlorine or hydro-chloride and shall be introduced in a manner approved as practice or potable water.

12.6.3. Valves for the water distribution system shall be opened and closed several times during the 16 hours chlorinating treatment is done.

13. ELECTRICAL WORKS

13.1 WORK INCLUDES

1) To secure and pay for the electrical permits, certificates, and other related permits. (if applicable)
2) To secure and pay for the service charges and other fees required by the local electric utility company for the energization of the proposed transformer bank. (if applicable)
3) To secure and pay for the insurance required for the project. (if applicable)
4) Roughing-in and wiring for lighting and power system.
5) Supply, installation, testing, and commissioning of distribution transformer and construction of elevated transformer pad. (if applicable)
6) Supply, installation, testing and commissioning, of generator sets and grounding system. (if applicable)
7) Supply and install/cause to install primary metering. (if applicable)
8) Supply and install/cause to install metal post with LED parking lights.
9) Supply and install/cause to install perimeter lights.
10) Supply, installation, and testing of automatic transfer switches, manual transfer switches, panel boards, and disconnect switches. .(If applicable)
11) Supply and installation of underground feeder system included in the plan to powerhouse.(If applicable)
12) Supply and installation of boxes, pull boxes, auxilliary gutters, wire gutters, bus bar gutters, circuit breaker gutters and the like.
13) Supply and installation of lighting fixtures, switches,and power outlets.
14) Supply and installation of hangers and supports of conduits for power, feeder and sub-feeder system and auxiliary system.
15) Painting of electrical works covering conduits, boxes, hangers, gutters, and the like.
16) Testing for electrical system:
    Insulation resistance test

    Ground resistance test

Continuity test

Operational test

Polarity check

Phase balancing check

13.2 CODE REGULATIONS

All materials and equipment to be used in the electrical installations and construction shall be in accordance with the provisions of the latest edition of the Philippine Electrical Code and the pertinent ordinances of the municipality wherein the project is located.

All work shall comply with the rules and regulations of the local power utility company in so far as they are concerned in providing the respective permanent services to the building.

13.3 DRAWINGS AND SPECIFICATIONS

The electrical plans and these specifications are meant to be complementary to each other, and what is called for in one shall be as binding as if called for by both.

Any permanent conflict between the electrical plans and these specification and any unclear points of controversial matter in either shall be referred to the owner's assigned representative for final decision.

Upon final completion of the work herein described, the electrical contractor shall furnish the Owner two (2) copies of the "As-built" plans for future reference and maintenance purposes.

The electrical plans indicate the general layout of the complete electrical system, arrangement of feeders, circuit outlets, switches, controls, panel boards, service equipment and other work. Field verification of the scale dimensions on the plane must be made, since actual locations, distances and levels will be governed by actual field conditions.

The Electrical Contractor shall check architectural, structural and plumbing plans if necessary to resolve such conflicts. The Electrical Contractor shall notify the architect and secure approval and agreement on necessary adjustments before installation is started.

13.4 PERMITS AND INSPECTION

The Electrical Contractor shall obtain all necessary permits and certificates of electrical inspection from the proper government authorities concerned, required both for the performance of the work involved and the operation of the system upon completion of the work.

The Electrical Contractor shall pay all the fees necessary to secure the above-mentioned permits and certificates.

The Electrical Contractor shall at his own expense, reproduce the electrical plans to the necessary scale and size, complete them with all the necessary information and requirements as maybe required by the government authorities concerned with the approval of plans.

The Electrical Contractor shall coordinate with the local power company regarding the power facilities and secure approval of the power requirements.

13.5 MATERIALS AND WORKMANSHIP

All materials to be used shall be brand new, with trade name, unused, and shall in every case be the best where such standards have been established for the particular type of materials used.

Trade/brand name of materials indicated in the specifications are recommendatory in nature and are included for the purpose of uniformity in bids. If trade/brand names other than those indicated are to be used during construction, brochures and samples shall be submitted to the owner's representative for approval.

Only skilled workmen using proper tools and equipment shall be employed during the entire course of the installation work. All workmanship shall be of the best quality and all works shall be done in accordance with the best engineering practice of the trade involved.

13.6 WIRING METHOD

Lighting and Power Branch Circuit – uPVC pipes concealed in ceilings and double walls and/or embedded in concrete walls/slabs. All uPVC pipes ran underground outside of buildings shall be buried not less than 40mm below nat. grd. line and enclosed in concrete envelope. All concrete envelopes passing under roadways or areas accessible to vehicles shall be steel reinforced up to 1.0m from the edge of the roadway.

Low Voltage Service Entrance and All Feeders – rigid steel conduit, exposed/concealed in ceiling/double walls, embedded in concrete walls/slabs or ran underground encased in concrete.

All Other Auxiliary Layout – uPVC pipes concealed in ceilings/double walls and/or embedded in concrete walls/slabs.

Use flexible metal pipe for connection between junction boxes inside ceiling and lightings and other fixtures using approved fittings.

All boxes, cabinets and other equipments shall be flush-mounted unless specified/approved otherwise.

All boxes for lighting outlets, convenience outlets, tumbler switches and other devices shall be galvanized pre-painted and approved products of reputable manufacturers. Cut ends of conduits shall be reamed and cleaned to remove burr and sharp edges. Threads cut on conduits shall be the same thread dimensions as factory cut conduit threads. Conduits joints shall be made straight and true. Elbows and offsets and changes in direction and runs shall be uniform. Bends shall be made without kinking or destroying the cross-sectional contours of the conduits. Conduit terminals shall be provided at outlet boxes and cabinets with locknuts and bushing. Conduits shall be continuous from outlet and from outlet to pull boxes and cabinets in the manner that the conduit system shall be electrically continuous.

Where conduit runs are exposed, they shall be supported at an interval of not more than 0.75 m maximum with proper clamps and bolts or expansion shields or other means of support.

All splices, taps, junction in wires larger than 8.0 sq.mm. shall be done with solderless connectors of suitable sizes and properly insulated with rubber tapes and protected by friction tapes, so that the insulation strength shall at least be equal to the insulation of the conductors they join.

Unless otherwise specified, the type of wires to be used shall either be THW or THHN.Smallest size of wire to be used for lighting and power unless otherwise indicated shall be 3.5 sq.mm.

13.7 FEEDERS

Feeders shall be laid out in accordance with the riser diagram shown in the electrical plans.

Unless otherwise specified type THW or THHN wires shall be used for feeder lines. The wires and conduits sizes shown in the electrical plans shall be the minimum sizes to be used.

13.8 WALLS SWITCHES AND RECEPTACLES

All wall switches shall be flush type and mounted 1.40 meters above finish floor line unless otherwise specified.

Convenience outlets shall be grounding type, wall flushed, mounted 0.30 meter above finished floor line or finished counters unless otherwise specified in the plan. Ground fault circuit interrupter protected convenience outlets shall be used in bathrooms, lavatories, sinks, laundry areas and the like.

13.9 MAIN SWITCHES, TRANSFER SWITCHES, PANELBOARDS

The cabinets for the above shall be of standard sizes and shall be gauge #16. Circuit breakers shall be 250 Volts, AC, rated 75C, interrupting ratings specified in the plan shall be followed at all times.

13.10 LIGHTING FIXTURES

Install all lighting fixtures and lamps as specified and as shown on plans, Fluorescent lamps shall either be 48 inches/40 watts or 24 inches/20 watts, standard cool white or daylight with the minimum light output of 3,000 lumens. Use high power factor ballast.

All fluorescent fixtures housing shall be of US Gauge 22 minimum.

Submit one sample of each type of fixtures to the Architect for approval prior to manufacturing and installation.

13.11 DISTRIBUTION TRANSFORMER

The Electrical Contractor shall supply and install distribution transformers, pole line hardware for the receiving pole and pole at midspan, transformer pads and grounding system as indicated/specified in the plan. He shall also supply service metering instruments and accessories, and at his expense, shall submit these to the local electric utility company for connection.

Materials for the works mentioned above shall be from manufacturers accredited/acknowledged by the local electric utility company.

14. PAINTING WORKS

The work covered by this section consists of furnishing all labor, equipment, tools and materials in performing all operations in connection with painting and finishing, including protective coating of metal surfaces, complete in accordance with the specifications and the applicable drawings.

14.1 Color and Samples

The Project Manager shall in accordance with the color schemes shown in the drawings or as direct all colors.

Sample panels of selected colors, as least (1) meter square in area shall be prepared for approval by the Project Manager prior to the application.

14.2 Workmanship

Skilled workers shall do all work in a workmanlike manner. Paints shall be evenly applied and free from sags, runs, crawls and other defects. All coats shall be of proper consistency and well brushed out or rolled on so as to show a minimum brush or rolled marks. Brushes or rollers shall be clean and in good condition.

All coats shall be thoroughly dry before the succeeding coat is applied. Allow at least twenty-four (24) hours or more between applications of coat. For exterior painting during rainy season, allow one (1) week drying time before the succeeding coat is applied.

Painting coats as specified are intended to cover surfaces perfectly, its surfaces are not fully covered, further coats shall be applied to attain the desired evenness of the paint application. All finishes shall be uniform as to sheen, color and texture. Paint may be applied by spray method, except when, in the opinion of the spraying in any particular application would produce unsatisfactory results. The Contractor shall provide all drop cloths and other covering requisite to the protection of the floors and other work.

Each surface shall be inspected carefully before applying any finish; and if surface is not in proper condition, they shall be notified to that effect in writing, otherwise the Contractor shall be held responsible for any defects in the finishes arising there from. Should a coat of paint be applied to a certain area and defects shall be knocked out and re-plastered by the Contractor and repainted to the satisfaction of the Project Manager.

14.3 Inspection of Surfaces

The Contractor shall inspect all surfaces to be painted and all defects shall be remedied before starting the work before starting the work. No work shall be started unless the Contractor shall have made certain the dryness of the surfaces. Test shall be made, in the presence of the Project Manager, to verify the dryness of surfaces to be painted.

14.3.1 Concrete Surfaces

(a) Surface Preparation

Before applying paint, concrete and cement surfaces shall be allowed to dry thoroughly. Clean surfaces of all dirt, alkali and grease before commencing work.

Treat all surfaces with a solution of two (2) kilos of zinc sulfate to four (4) liters of water and sufficient phenolpthalien to act as color warning. Presence of alkali is indicated when phenolplthalien turns red and further treatment is required to neutralize it. Allow the surface to dry at least three (3) days and remove and loose crystals from the surface before finishing.

(b) Finishing:
For exterior and interior concrete surfaces and all other surface with cement plaster finish, use flat latex paint with the specified brand approved by the Project Manager.

First Coat- Apply flat concrete paint thinned with ½ liter water per 4 liters of paint; tint with latex tinting color to closely match color of topcoat or use premixed paint. Dry for 3 to 6 hours.

Intermediate Coat- Repair all minor surface imperfection with paint putty made by mixing paint with patching compound powder. Let it dry for 24 hours, and then smoothen the surface with sand paper, before applying the intermediate coat.

Final Coat- Apply semi-gloss or gloss paint tinted with latex tinting color to the shade specified.

Ducco or semi-ducco finish shall be applied using the appropriate paint sprayer by a well experienced painter.

14.3.2 Wood Surfaces

(a) Surface Preparations
Plane the surface of wood with sandpaper to remove roughness, loose edges, slivers, slingers then clean to remove dust. All frames in contact with concrete or plaster shall be treated with an anti-termite solution or solution or equivalent before applying paints. Set the nail heads into the wood, fill holes, cracks and defects. Dry for three (3) hours and clean surface with sandpaper to smoothen the surface.

(b) Finishing

For all wood work, use gloss latex house paint with the specified brand approved by the Project Manager.

First Coat- Apply paint thinned with ½ liter water per 4 liters of paint.

Second Coat- Apply latex thinned with latex tinning colors to the shade specified for 4 to 6 hours.

15. SIGNAGES AND MARKINGS

The contractor shall provide all necessary signages and markings before and during construction.

All warning signs must be placed in areas where there are dangers in construction activity

Sinages and markings must be visible and readable and can easily be seen by people.

16. MOBILIZATION/ DEMOBILIZATION

The contractor upon receipt of the notice to proceed shall immediately mobilize and transport his plant, equipment, materials and employees to the site and demobilize or remove the same at the completion of project.

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