

## **ITEM 10 : TERMITE PROOFING, BUKBOK PROOFING**

### **GENERAL**

General Requirements contain provisions and requirements essential to these specifications; and apply to this Section, whether or not referred to herein.

### **SCOPE OF WORK**

The Contractor shall hire the services of an approved or accredited pesticide company to furnish all labor, materials, equipment, tools, plant, and services to complete the termite and "bukbok" proofing work hereinafter described.

### **EXAMINATION OF SITE**

Inspect the site of work and examine the premises to fully understand existing conditions with respect to the work involved. Prior to soil stripping, excavation or filling all termite mounds within the area should be demolished, removed and treated.

### **MATERIAL REQUIREMENTS**

#### **CHEMICALS AND EQUIPMENT**

For termite proofing, use Termiticide Concentrate acceptable to the PPA and should have license from Fertilizer and Pesticide Authority.

For "bukbok" proofing of kiln dried wood and for untreated wood, use chemical name accredited name/or acceptable to the PPA and should have valid license from Fertilizer and Pesticide Authority (FPA).

The pest control Contractor shall submit the specified chemicals in their original manufacturer sealed containers to the Project Inspector of inspection, sampling and safekeeping. Containers with broken seal shall not be accepted.

Dilution ratings (for Termiticide Concentrate):

1 part Termiticide Concentrate TC to 50 parts water

Pesticides - 1 : 100 concentration

Dilutions shall be done only at the jobsite in the presence of the Project Inspector. The strength of the mixture or solutions shall be made uniform by thorough stirring. All solutions prepared for termite proofing shall be used within 24 hours.

### **EXECUTION**

#### **CONTRACTOR LICENSE AND CERTIFICATION REQUIREMENT**

The pesticide company should have a valid license from Fertilizer and Pesticide Authority of the Department of Agriculture.

All pesticide shall be applied by or under the direct supervision of a certified pesticide applicator.

## ENVIRONMENTAL AND SAFETY CONDITIONS

Formulation, treatment, storage and disposal of pesticide shall be in accordance with label directions. Water for formulation shall be drawn only from site(s) designated by the Project Inspector, and the filling hose shall be fitted with a backflow preventor meeting local plumbing codes/standards. The filling operation shall be under the direct and continuous observation of the Project Inspector to prevent overflow.

## APPLICATION

### 1. Termite Control

Application of solution shall be done by means of power sprayers fitted with flow meters for accurate monitoring of actual quantity used. At the time of soil treatment application, the soil shall be preferably in a friable condition with low moisture content to allow uniform distribution of the treatment solution throughout the soil. Do not apply pesticide during or immediately following heavy rains, or when conditions will cause runoff and create an environmental hazard. Cover treated area with waterproof sheeting if concrete is not poured on the same day as the soil treatment. Take precautions to prevent disturbance of the pesticide barrier. Before the placement of structural components, re-treatment where soil or fill is disturbed after treatment. Apply pesticide prior to placement of gravel base, vapor barrier or waterproof membrane.

#### a. Slab on Grade Construction

Establish a horizontal pesticide barrier over areas intended for covering by floors, porches, attached entryways, garages, carports and terraces. Apply treatment solution with a low pressure coarse spray at the rate of four (4) liters solution per square meter. Apply at the rate of seven (7) liters solution per square meter if the fill is washed gravel or other coarse material. Establish a continuous chemical barrier in the voids of hollow block foundation or voids of masonry. Apply treatment at the rate of seven (7) liters per 3 linear meter. Make pesticide band at least 15 cm wide the pesticide evenly distributed throughout. Treat buildings constructed with basement slabs in the same manner.

#### b. Crawl Space Construction

Establish a vertical pesticide barrier inside of foundation walls, both sides of interior partition walls, around piers, plumbing, and rodding and utility conduits. Apply treatment solution by rodding or rodding and trenching the fill at the rate of 15 liters solution per 3 linear meter, and 30 cm deep from grade to bottom of foundation. Treat both sides of foundation and around all piers and pipes. Make treated barrier of fill at least 15 cm wide with the pesticide evenly distributed throughout.

#### c. Dry Pipes and Conduits

Establish pesticide barrier on various dry pipes and conduits such as electrical service entrance, raceways, pipe chase, vents. Use powder type termiticide by injecting it inside the pipe.

#### d. Termite Mounds

Demolish and treat all termite mounds within the property found after the construction.

**2. "Bukbok" Proofing**

Kiln-dried wood, plywood, tanguile, apitong, cabinets, dividers, and paneling shall be brushed generously with Pesticides before painting or varnishing.

**3. Sun-Dried Wood Treatment**

Sun-dried lumber to be used for ceiling joint runners, nailer, etc. shall be brushed with Pesticides before installation of plywood or ceiling panels.

**ENGINEERS**

The Contractor shall submit to the Engineer for approval, a copy of the pest control company's proposal and chemical application, method/procedure including the description of the equipment to be used before start of work.

**INSPECTION AND TEST**

Sampling shall be done only in the presence of the Project Inspector.

Amount of sample to be taken: 50 cc each.

**CONTRACTOR'S GUARANTEE**

Upon completion of work, and on a condition for final acceptance, the Contractor shall submit to PPA a written guarantee from the pesticide company which shall provide that:

1. The soil poisoning treatment shall prevent subterranean termites from attacking the building on its contents for a period of not less than five (5) years.
2. The Contractor shall thereby warrant all works in pest control that all materials and workmanship applied under the contract are of good quality in every respect and will remain as such for not less than five (5) years.

Should there be termite and "Bukbok" infestation within the one (1) year period the Contractor thereby agrees to do all necessary repairs on the damaged portions of the buildings caused by termite infestation to the satisfaction of PPA, at the Contractor's expense. Retreatment shall also be done by the Contractor after completion of the repairs and at his expense. Such repairs and corrective works shall be done within five days after a written notice from the Owner has been received by the Contractor.

Should there be infestation after the one (1) year period up until the five (5) year guarantee, the pesticide company agrees to do all the necessary repairs at their expense. The pesticide company shall conduct annual inspection of the building and surrounding to check any infestation during the guarantee period. Notice shall be given by the pesticide company to PPA in case there is presence of termites in the surroundings.

## ITEM 11 : CONCRETE WORKS

### GENERAL

General Requirements contain provisions and requirements essential to these specifications; and apply to this Section, whether or not referred to herein.

### SCOPE OF WORK

The work shall include reinforced concrete structures such as reinforced concrete footings with or without tie-beams, reinforced concrete columns girders, slabs, other cast-in-place and precast concrete including excavation and backfilling work.

The work shall consist of furnishing of all labor, materials, equipment and other incidentals necessary for the supply of concrete materials and the complete construction of the concrete structures for the building shown on the drawings in accordance with these specifications and as directed by the Engineer.

### GENERAL REQUIREMENTS

Concrete works shall conform with the requirements of "Reinforced Concrete" except noted otherwise in this Section.

### SHOP DRAWINGS

Together with requirements, the Contractor shall show the following in the shop drawings:

1. Surface finish
2. Fitting to be embedded

### MATERIAL REQUIREMENTS

1. Concrete shall consist of Portland cement, fine and coarse aggregates and water and shall conform with the requirements of "Reinforced Concrete".
2. Deformed bars to be used shall conform with the reinforcement requirements in Section of "Reinforced Concrete". The size shall be as shown on the drawings.
3. In lieu of the temperature bars on concrete ground slab, monofilament polypropylene synthetic fibrin fibers shall be used as admixture to prevent the formation of temperature / shrinkage cracks and increase impact resistance of ground slabs. The dosage rate shall be 0.91 kg. per cubic meter of concrete.

The supplier is required to submit a "Mill Certificate" that the materials delivered to site shall be proven to meet or exceed the following properties:

TECHNICAL PROPERTIES	Unit	Minimum
A. Physical Characteristics:		
Length	Mm	12
Shape	Microns	18

Density	gm nominal	0.91
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## FORMWORKS

### GENERAL REQUIREMENTS

Materials and construction of formwork shall be in accordance with formwork requirements in Reinforced Concrete.

### REMOVAL OF FORMWORK

The minimum stripping and striking time for formwork shall be as follows unless otherwise approved by the Engineer.

Conditions	Minimum Period
Vertical sides of beams, wall, piles, pile caps and columns lift not exceeding 1.2m	24 hours
Vertical sides of beams and walls, lift exceeding 1.2m	48 hours
Soffits of main slabs and beams (props left under)	5 hours
Removal of props from beams and main slabs and other works	10 days

## CONCRETE

### CLASSES OF CONCRETE AND USAGE

#### 1. Strength Requirement

Concrete strength shall conform with the requirements in Section of "Reinforced Concrete".

## SLUMP TEST

Tests shall be made in conformity with ASTM C 143, and unless otherwise specified by the Engineer, slump shall be within the following limits:

Structural Element	Slump for Vibrated Concrete	
	Minimum (mm)	Maximum (mm)
Precast concrete	80	180
Wall, column and beam, 25cm max. thickness	80	180
Concrete slab	80	150
Lean concrete	70	150

#### CONCRETE COVER FOR REINFORCEMENT

Minimum concrete cover for reinforcement shall be as follows:

Net Concrete Cover	Minimum Cover (mm)
Concrete cast against and permanently exposed to earth	75
Concrete exposed to earth or weather:	
Primary reinforcement	50
Stirrups, ties, and spirals	40
Concrete deck slabs:	
Top reinforcement	50
Bottom reinforcement	35
Concrete not exposed to weather nor in contact with ground:	
Primary reinforcement	40
Stirrups, ties, and spirals	25

#### CONSTRUCTION JOINTS AND WATERSTOPS

Construction joints shall be provided where shown on the drawings or when approved with written permission of the Engineer. Special care shall be used in preparing concrete surfaces at joints where bonding between two sections of concrete is required. Unless otherwise indicated on the drawings, such bonding will be required at all horizontal joints in walls.

Waterstop material shall be an elastomeric plastic compound, the basic resin of which shall be polyvinyl chloride, and containing any additional resins, plasticizers or other materials needed for the material to comply with the requirements specified.

The waterstop shall be fabricated by an extrusion process such that it will be dense, homogeneous, free from holes and other imperfections. The cross section of the waterstop shall be uniform and symmetrical along its entire length.

**Surfaces shall be prepared as follows:**

The surface of concrete upon or against which the placement of contiguous concrete or masonry is later required shall be struck off true to the elevations indicated on the drawings after the concrete has been placed. Thereafter as soon as the condition of the concrete permits it, and before the concrete has hardened appreciably, i.e. normally within 2 hours after being deposited, all water, scum, laitance and loose aggregate shall be removed from the surface by means of wire or bristle brooms in such a manner that the coarse aggregate is left lightly exposed, and the surface cleaned. No raking will be permitted.

The Contractor shall then take all necessary precautions to ensure that all surfaces thus prepared shall be kept free from storage piles, drippings, staining or foreign matter, which could adversely affect the concrete or the bond between the concrete layers.

Waterstops for all joints shall be continuous around the corners and at intersections, either in horizontal or vertical direction, as indicated on the drawings. Field splices and joints shall be made in accordance with the waterstops manufacturer's instructions, using a thermostatically controlled-heating iron.

## ITEM 12 : MASONRY WORKS

### GENERAL

General Requirements contain provisions and requirements essential to these Specifications and apply to this Section, whether or not referred to herein.

### SCOPE OF WORK

This Section includes the furnishing of all labor and materials to complete the work as shown on the drawings and specified herein. The works shall include but not necessarily be limited to the following:

1. Supply and installation of concrete hollow block (CHB) walls with reinforcement
2. Plastering
3. Installing temporary works like scaffolding, platforms, steps, etc.

### GENERAL PROVISIONS

The following publications of the issues below but referred to thereafter by basic designation only form a part of these specifications to the extent indicated by the reference thereto:

American Society for Testing and Materials (ASTM) Publications:

A 615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A 33 Concrete Aggregates

C 129 Specification for Non-Load Bearing Concrete Masonry Units C

144 Specification for Aggregate for Masonry Mortar

C 270 Mortar for Unit Masonry

### MATERIAL REQUIREMENTS

Materials shall conform to the respective specifications and other requirements specified below

#### CONCRETE HOLLOW BLOCKS (CHB)

CHB shall be of standard manufacture, machine vibrated with fine and even texture and well-defined edges and conforming with the requirements of ASTM C 129. Unless otherwise specified on the Drawings, It shall have a minimum compressive strength of 4.14 MPa (600 psi). CHB shall be non-load bearing uniform and essentially smooth as normally achieves by standard molding methods and shall be free from any cracks, flaws or other defects.

#### BEDDING MORTAR

Mortar shall be composed of 1 part of Portland cement, 3 parts of sand and ½ part of lime. It shall have a compressive strength of [14 MPa (2,000 psi)] at 28 days and shall comply with property specifications for type N mortar set forth in ASTM Specification C 270 and as modified herein,



proportioned and tested in an approved laboratory at the expense of the Contractor. When tested for water retention, the mortar shall have a flow after suction, of 75 percent or more when mixed to an initial flow of 125 to 140 percent. When tested for compressive strength, mortar shall be mixed to a flow of 100 to 115 percent. Aggregate for mortar shall conform to ASTM C 144.

## PLASTER

Plaster shall comply with the same specification as those for bedding mortar and will include the use of synthetic fibrous reinforcement of type and dosage recommended by the manufacturer.

## REINFORCING STEEL BARS AND RODS

Minimum yield strength of reinforcement shall conform with the specifications in Section of Reinforced Concrete.

## SAMPLES AND TESTING

1. The following shall be submitted for approval and in addition, representative samples shall be taken periodically from on-the-site stockpiles as required for testing or checking during the progress of the work.

Anchors and ties : Two of each type proposed for use

Concrete Hollow Blocks : Shapes, sizes and kinds in sufficient numbers to show full range of quality and texture.

2. Sampling and testing, unless otherwise specified, shall be performed by an approved independent commercial testing laboratory at the expense of the Contractor. Certified copies of laboratory test reports, including all test data, shall be submitted at least 10 days before delivery of the units or mortar materials represented by the tests to the project site.
3. Mortar shall be laboratory-proportioned and tested. Certified copies of approved laboratory-established proportions shall be submitted with the required test reports and test data. Approved laboratory-established proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in mortar for the work unless additional evidence is furnished that the mortar meets the specified requirements.

## EXECUTION

### 1. GENERAL

No unit having a film of water on its surface shall be laid. Masonry shall be laid plumb, true to line, with level courses accurately spaced. Bond pattern shall be kept plumb throughout. Corners and reveals shall be plumb and true. Vertical joints shall be shoved tight. Each unit shall be adjusted to final position while mortar is still soft and plastic. Any unit that is disturbed after mortar has stiffened shall be removed and relaid with fresh mortar. Courses shall be so spaced that backing masonry will level off, flush with the face work at all joints where ties occur. Chases and rake-out joints shall be kept free from mortar or other debris.

2. Anchorage to concrete. Anchorage to abutting columns shall be provided only where indicated. Details shall be as indicated including anchorage to underside of beams and slabs.
3. Cutting and fitting, including that required to accommodate the work of others shall be done by masonry mechanics. Wherever possible, full units of the proper size shall be used in lieu

of cut units. Cut edges shall be clean, true and sharp. Openings shall be carefully cut, formed or otherwise neatly made for recessed items and for electrical, plumbing, or other mechanical installations so that wall plates, cover plates, or escutcheons required by the installation will completely conceal the openings and will have bottoms in alignment with lower edge of masonry joints. Webs of hollow masonry units shall be cut to the minimum required for the installation. Reinforced masonry lintels shall be provided as indicated above openings over 300mm wide, for pipes, ducts and cable trays, unless steel sleeves are used.

**4. Embedded Items**

Spaces around built-in items shall be filled with mortar. Openings around flush-mounted electrical outlet boxes in wet locations shall be pointed flush with mortar including flush joints above the boxes. Anchors, ties, accessories, flashing, pipe sleeves and other items required to be built-in shall be built-in as the masonry work progresses. Anchors, ties, and joint reinforcement shall be fully embedded in mortar.

**5. Unfinished work shall be stepped back for jointing with new work. Toothing may be resorted to only when specifically approved. Before laying new work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned.**

**6. Protection**

Surfaces of masonry not being worked on shall be properly protected at all times. At the end of each workday period and when rain is imminent, the top of exposed masonry shall be covered with a strong non-staining waterproof membrane well secured in place and in a manner that will prevent moisture. Adequate provisions shall be made during construction to prevent damages by wind.

**7. Mortar**

Materials shall be accurately measured in laboratory-established proportions and mixed with as much water as may be necessary to produce the wettest workable consistency possible. Mortar shall be placed in final position within one hour after mixing. Mortar not used or that has started to set within this time interval shall be discarded.

**8. Jointing**

Joints in exposed-to-view except control joints, joints to be pointed or caulked or sealed, and openings around flush-mounted electrical outlet boxes in wet locations shall be tooled slightly concave with the mortar thoroughly compacted and pressed against the edges of the units. Tooling shall be done when the mortar has been thumbprint hard. The tooled joint shall be finished to uniformly straight and true lines and surfaces, smooth and free of tool marks.

**9. Placing Reinforcing Steel**

Prior to placing grout, all reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout or other coating which might destroy or reduce its bond with grout. Details of reinforcement shall be as indicated in the drawings. Reinforcing shall not be bent or straightened in a manner injurious to the steel. Bars with kinks or bends not shown on the drawings shall not be used. Placement of reinforcement shall be inspected and approved prior to placing grout. One piece vertical bars extending from floor to floor or roof above shall be provided. Vertical bars shall be spliced only where indicated.

**a. Positioning Bars**

Vertical bars shall be positioned accurately at the centerline of the wall. A minimum clearance between the bars and masonry units of 12mm and between parallel bars of one diameter of the reinforcement shall be maintained. Vertical reinforcing shall be held in place using metal supports, centering clips, spacers, ties or caging devices located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement.

**b. Splices**

Splices shall be located only as indicated. Splices shall be staggered in adjacent bars at least 600mm. Bars shall be lapped a minimum of 40 diameters of the reinforcement.

**PAINTING AND CLEANING**

Mortar daubs or splashing, before setting or hardening, shall be completely removed from masonry unit surfaces that will be exposed or painted. Before completion of the work, all defects in joints or masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Masonry surfaces shall not be cleaned, other than removing excess surface mortar until mortar in joints has hardened. Masonry hardened surfaces shall be left clean, free of mortar daubs, dirt, stain and discoloration, including scum from cleaning operations and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

## ITEM 13 : FINISHES

### GENERAL

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

### SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete all finishing works and painting for the buildings as indicated on the drawings and as specified herein.

Wall, floor, ceiling and other finishing works shall include but are not limited to the following:

#### WALLS

1. Exterior
  - a. Aluminum composite panel for the exterior facade which is the upper portion of the wall with the PPA Building signage, the parapet wall of concrete canopy as specified in the plans
  - b. Plain cement finished painted with elastomeric paint.
2. Interior
  - a. Plain cement finished painted with elastomeric paint.
  - b. 300mm x 600mm vitrified glazed tiles for toilets.

#### FLOORS

1. 600mm x 600mm Vitrified ceramic unglazed tiles (F1) for
  - a. Security Check-in Area
  - b. Concessionaire's Area
  - c. Offices/ Ante Room / Hallway
  - d. Electrical & Control Room
  - e. Toilets / Janitor's Closet
  - f. Ecumenical Room
  - g. Mothers Nursing Area / Diaper Change
  - h. Passenger's Waiting Area
2. 600mm x 600mm Vitrified non-slip floor tiles (F2) for
  - a. Entrances
  - b. Stairs & Landings
3. Non-skid or rough cement finish for ramps (F3).
4. Waterproof finish for all roof deck.

**CEILING****1. Interior**

- 600m x 1200m x 0.70mm aluminum clip-in perforated ceiling panel, bone white or its equivalent (C1)
- 600mm x 600mm x 0.70mm aluminum clip-in perforated ceiling panel, bone white or its equivalent (C2)
- Painted finish underside of RC Slab (C3).

**SUBMITTAL**

1. Shop drawings for all finishing and painting works for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.
2. The Contractor, before placing order for the finishing materials shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.
3. Samples of all walls finishes, measuring not less than 1000mm x 1000mm shall be submitted to the Engineer for approval as to its finish texture and workmanship.

**MATERIAL REQUIREMENTS****WALL FINISHES AND COUNTERTOPS****1. Plain Cement Finish**

- a. Sand shall be clean and hard material. Sand shall be free from deleterious substances and conforming with the requirements of ASTM C 33.
- b. Cement shall be Portland cement conforming with the requirements of ASTM Designation C 150.
- c. Water shall be clean and potable.
- d. Bonding compound shall conform to ASTM C 631.
- e. Hydrate lime shall conform to ASTM C 206.
- f. Synthetic fibrous reinforcement shall conform to BS 5139 or ASTM C 1116.

**2. Wall Ceramic Tiles**

- a. Wall tiles shall be glazed ceramic tiles color as per Architect's approval.
- b. Trimmers and moulding shall be lustrous, glazed with size and color corresponding to wall tiles.
- c. Portland cement, sand, bonding compound, lime and water shall conform with the requirements.

**3. Granite Tiles**

- a. Black granite slabs for toilet countertops, fascia and splashboard. Dimensions as shown on the drawings.
- b. Shall be sound material with uniform and favorable working qualities and with very limited natural faults.
- c. Color, veining and quality shall be approved by Engineer.
- d. Veining shall run vertically on all vertical surfaces and direction of veining shall continue in same directions over horizontal surfaces except as directed by the Engineer.
- e. Sealer
  - e. 1. Shall be a commercial penetrating type free from harmful alkali or acid content specially prepared for marble work
  - e. 2. Shall have a Ph factor between 7 and 9
  - e. 3. Shall not discolor
  - e. 4. Shall produce a slip resistant surface
  - e. 5. Shall have a flash point not less than 35 °C
- f. Cleaning fluid
  - f. 1. Shall be commercial neutral liquid type especially prepared for marble work
  - f. 2. Shall have a Ph factor between 7 and 9
  - f. 3. Shall be free from crystallizing salts or water soluble alkaline salts
  - f. 4. Shall be biodegradable and phosphate free

**4. Aluminum Composite Panel**

Aluminum Composite Panel (ACP) is a lightweight durable panel made of laminated aluminum and polyvinylidene Fluoride (PVDF) to ensure the excellent durability of the surface finished. It also has a high degree of levelness to preserve the fine architectural design and can be roller bended to suit various design shapes. The laminated structure of ACP ensures exceptional strength of the panel. Total panel thickness shall be 4mm and aluminum skin thickness is 0.21mm.

**5. Phenolic Board Toilet Partition System**

Phenolic Compact Board also known as solid phenolic, is a paper fiber-based solid surface material that is warmer to the touch than typical acrylic or polyester materials.

Phenolic anti-bacterial water proof toilet partition 20 mm thick including stainless hinges, locks, bottom support, door knobs and coat hooks.

**FLOOR FINISHES****1. Vitrified Ceramic Unglazed Tiles**

- a. Vitrified ceramic unglazed floor tiles shall be color varies and as shown on the drawings or to be designated by the Architect.
- b. Portland Cement, sand and water shall conform with the requirements.

A finish coat shall be applied after the brown coat has set. The brown coat shall be moistened before application of the finish coat. Finish coat shall be floated to plumb, even planes and surfaces.

Final plaster finishes shall be rubber sponged.

d. Tolerance

The Contractor shall finish plaster work plumb, level, square and true within tolerance of 3mm in 3 meters, without cracks and other imperfections.

e. Patching and Cleaning

Upon completion of the building, and when directed, all loose, cracked, damaged or defective plastering shall be cut out and re-plastered in a satisfactory and approved manner.

2. Wall Tiles

a. Mortar Preparation

All mortar setting beds shall be mixed by volume in the proportion of 1 part Portland cement and 3 parts dry sand and not more than 1/10 part hydrated lime.

Mortar materials shall be measured in approved containers, which will insure that the specified proportions of materials will be controlled and accurately maintained during the progress of the work. Measuring materials with shovels, "shovel count", will not be permitted. Unless specified otherwise, mortar shall be mixed in proportions by volume, in an approved mortar box.

The quantity of water shall be controlled accurately and uniformly. The aggregates shall be introduced and mixed in such manner that the materials will be distributed uniformly throughout the mass. A sufficient amount of water shall be added gradually and the mass further mixed until a mortar of the elasticity necessary for purpose intended is obtained. Mortar boxes, pans and wall surfaces shall be kept clean and free from debris or dried mortar. The mortar shall be used before the initial set of the cement has occurred. Re-tempering of mortar in which cement has started to set will not be allowed.

b. Application of Wall Tile

Interior masonry shall be clean, thoroughly dry, sound and sufficiently rough to provide strong mechanical bond. Surfaces shall be evenly damped immediately prior to the application of the scratch coat.

Scratch coat shall be applied to masonry, as backing for wall tile, not less than 24 hours or more than 48 hours before starting the tile setting. The scratch coat shall not be less than 6 mm from the face of the masonry. The scratch coat shall be applied with sufficient pressure to ensure a proper bond with the base for the setting bed. While the mortar is still plastic, the scratch coat shall be cut with a trowel at all internal vertical angles for the depth of the coat with the full height of the tile bed and shall be cross-scratched, in 25 mm centers for the extent of the tile bed.

Immediately before the application of mortar setting bed, the scratch coat shall be moistened thoroughly but not saturated. Temporary screeds shall be applied to the

- c. Vitrified ceramic unglazed floor tiles shall be delivered in the manufacturer's original unbroken packages or containers that are labeled plainly with the manufacturer's name and brand. Containers shall be grade sealed. Materials shall be stored in dry weathertight enclosures, and shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.
2. Vitrified Non-slip floor finish or floor tiles for all stairs & entrance's landing and for the drop-off point.
3. Non-skid floor finished shall be applied to ramps.
4. Waterproof finish for all roof deck.

## **EXECUTION**

### **WALL FINISHES**

#### **1. Plain Cement Finish**

##### **a. Preparation of Surfaces**

All surfaces shall be cleaned and projections, dust, loose particles and other materials, which would prevent good bond, shall be removed.

Plaster shall not be applied directly to concrete and masonry surfaces coated with bituminous compounds and surfaces previously painted or plastered.

All surfaces shall be thoroughly wetted before plastering.

##### **b. Trial Mix**

A trial mix of at least three (3) different water-cement ratios for a proposed mix shall be prepared under full scale conditions and adequate workability. The proportions by weight of cement to the weight of sand shall not be less than one part of Portland cement to two parts of sand.

The proportion of cement-sand and water necessary to produce the cement plaster of the required consistency shall be subject to the approval of the Engineer. Such approval may be withdrawn at any time and a change in proportions may be required. Based on the approved mix proportions, the Contractor shall prepare a list showing the number of kilograms of the various materials to be used in the cement plaster finish mix.

No cement plaster finish shall be started without an approved trial mix by the Engineer.

##### **c. Cement Finish Application**

A brown coat with sufficient pressure shall be applied to fill the gaps, and to secure a good bond. Moistened for 48 hours, each coat of cement plaster shall be kept after application and allow to dry.



scratch coat with mortar to provide a true and plumb surface, the proper distance back from the finished wall line. The setting bed shall be applied, rodded and floated flush with the screeds over an area not greater than the area to be covered with the tile while the bed remains plastic. The thickness of the setting bed shall not exceed 15mm and the mortar shall not be re-tempered. The setting bed shall be cut with a trowel at all internal corners as specified for the scratch coat.

Mounted tiles shall be soaked in clean water a minimum of one hour before they are set. Absorptive mounted tiles shall be damped by placing sheets on a wetted cloth in a shallow pan before setting. A skim coat of neat Portland cement mortar, mixed with water to the consistency of a pasty, thick cream, shall be applied 0.8mm to 1.6mm thick to the mortar setting bed, or to the back of each tile as laid. The tiles shall then be pressed firmly on the setting bed and tamped until flush and in the plane of the other tiles. The tiles shall be applied before the mortar bed has taken its initial set.

Intersections and returns shall be formed accurately. Where cutting of tiles is necessary it shall be done at the internal angles of the walls or wainscots. Cutting and drilling tiles shall be done neatly without marring the surfaces. The cut edges of tiles against trim, built-in fixtures, and similar surfaces shall be ground and jointed carefully. The tiles shall fit closely with plumbing fixtures and around electric outlets, pipes and fittings, so that the plates or escutcheons will properly overlap the tiles. Wainscots shall be within one half of the heights indicated without cutting of the tiles.

Bases, caps, bull-nose corners, and all other trimmers moulded or shaped features, and accessories shall be backed thoroughly with mortar and set firmly into place. All lines shall be kept straight and true, and all finished surfaces brought to true and even planes, straight and plumb, and internal corners squared and external corners rounded.

Horizontal joints shall be maintained level and vertical joints plumb and in alignment. The completed work shall be free of broken, cracked, damaged or otherwise faulty tiles.

Joints shall be parallel and uniform in width, plumb, level and in alignment. End joints in broken-joint work shall be made as far as practicable, on the center line of adjoining tiles. Except in special arrangement and design, as indicated or specified, square tiles shall be set with straight joints, and oblong tiles shall be set with broken joints.

Joint widths shall be uniform and spaced to accommodate the tile in the given spaces with a minimum of cutting. Tiles shall be wetted, if they have become dry, before applying grout. Joints 3mm or less in width shall be grouted with a neat Portland cement grout of the consistency of thick cream. Other joints shall be pointed with mortar consisting of one part Portland cement and two parts pointing sand. The grout for walls and other vertical surfaces shall contain non-staining white Portland cement. Grout and pointing mortar shall be forced into joints by using trowel, brush or finger application.

Before the grout or mortar sets, the joints of cushion edge tiles shall be struck or tooled to the depth of cushion, filling all skips or gaps, and the joints of square edge tiles shall be filled completely flush with their surface. Dark cement shall not show through grouted white joints. Care shall be taken to avoid scratching glazed finishes. All mortar or grout shall be removed before it has set or hardened.

**c. Cleaning and Curing**

All completed tile work shall be thoroughly sponged and washed diagonally across joints, and finally polished with clean, dry cloth. Acid cleaning of unglazed tile, when necessary, shall not be done within ten days after setting tile. All metal shall be covered with an approved grease and the tile shall be wetted with clean water, before tile is cleaned with 10% muriatic acid solution. After acid cleaning, the tile shall be flushed with clean water, and the grease coating on metal shall be removed. Acid cleaners shall not be used on glazed tile.

**d. Protection**

Tiled walls outside corners (external angles) shall be protected with board corner strips in areas used as passage ways by workmen. Extreme care should be taken not to disturb walled tiled until mortar has fully set.

**3. Painting Works**

**a. Surface Preparation**

Allow new masonry to dry for 14 days (for exterior surfaces) to 28 days (for interior surfaces) under normal conditions before painting. Surface to be painted should be clean and dry, free from oil, grease, dirt, dust, contaminants, and all loose grit and mortar.

**Without mesh:**

1st Coat: Elastomeric Wall Covering Sealer

2nd and 3rd Coat: Elastomeric Wall Covering Basecoat

4th Coat: Elastomeric Wall Covering Topcoat

**With mesh:**

1st Coat: Elastomeric Wall Covering Sealer

2nd Coat: Elastomeric Wall Covering Basecoat  
Reinforcing Membrane: Fiberglass Matting

3rd and 4th Coat: Elastomeric Wall Covering Basecoat

5th Coat: Elastomeric Wall Covering Topcoat

**FLOOR FINISHES**

**1. Vitrified Ceramic Tiles**

**a. Mortar Preparation**

Mortar mix proportion and preparation shall be in accordance with the requirements.

**5. Cleaning and Protection**

Removed temporary protective films. Clean finished surfaces as recommended by aluminum composite panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt and sealant. Maintain in a clean condition during construction.

Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair

**6. Warranty****a. Workmanship Warranty**

The installer shall warrant the finished assembly to remain in its integrity under normal condition for a period of one (1) year. Normal condition shall not cover force majeure, deliberate vandalism, improvement repair works and the likes.

**b. Paint Finish Warranty**

The manufacturer shall warrant against fading, chalking, peeling, or cracking of paint finish for a period of ten (10) years.

**INSTALLATION OF DOORS****1. Surface Preparation**

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

**DOORS AND WINDOWS****DOORS**

- D-1 - 1.5mm thk. Aluminum Framed Powder Coated Finish with 10 mm thk. Reflective Tempered Glass Double Swing Door with Fixed Type Transom Window (1.70m x 2.68m)
- D-2 - 1.5mm thk. Aluminum Framed Powder Coated Finish with 10 mm thk. Reflective Tempered Glass Double Swing Door with Fixed Type Transom Window (1.50m x 2.68m)
- D-3 - 6mm Thk. Marine Plywood Finish Flush Door. (0.90m x 2.15m)
- D-4 - 6mm Thk. Marine Plywood Finish Flush Door. (1.0m x 2.15m)
- D-5 - 6mm Thk. Marine Plywood Finish Flush Door with vent louver. (1.0m x 2.15m)
- D-6 - 200 mm Thk. Phenolic door, Plain colored (0.60m x 1.75m)
- D-7 - 200 mm Thk. Phenolic door, Plain colored (0.60m x 1.75m)

## INSTALLATION OF WINDOWS

### 1. Surface Preparation

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

- W-1** 1.5mm thk. Aluminum Framed Powder Coated Sliding Type Window with 10mm Thk. Reflective Tempered Glass (W-1) (3.60m x 1.80m)
- W-2** 1.5mm thk. Aluminum Framed Powder Coated Sliding Type Windows with 10mm thk. Reflective Tempered Glass (2.40 m x 1.80m)
- W-3** 1.5mm thk. Aluminum Framed Powder Coated Sliding Type and Fixed Window with 10mm thk. Reflective Tempered Glass (1.20m x 0.50m)
- W-4** 1.5mm thk. Aluminum Framed Powder Coated Sliding Type Window with 8mm thk. Reflective Tempered Glass (1.20m x 1.80m)
- W-5** 1.5mm thk. Aluminum Framed Powder Coated Fixed Type Window (Cashier) with 10mm thk. Reflective Tempered Glass (1.20m x 1.20m)
- W-6** 1.5mm thk. Aluminum Framed Powder Coated Fixed Type Window with 10mm thk. Reflective Tempered Glass (1.50m x 2.10m)

## ITEM 14: PAINTING

### GENERAL

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

### SCOPE OF WORK

This Section covers the surface preparation, coating materials and application of coatings systems required for the Works.

The work shall consist of furnishing of all labor, materials, equipment and other incidentals necessary for the supply of painting materials and the complete painting of surfaces as shown on the drawings in accordance with this Specification and as directed by the Engineer.

The term paint as hereinafter used includes emulsion paints, varnishes, oils, pigments, thinner and dryers.

All exposed metal surfaces, except metal surfaces embedded in concrete, shall be painted unless otherwise specified.

### STANDARD

The following publications listed below, but referred to thereafter by basic designation only, forms a part of these Specifications to the extent indicated by the reference thereto:

Steel Structures Painting Council (SSPC) U.S. Specification JIS K 5628 Red-lead Zinc Chromate Anti-Corrosive Paint.

### SUBMITTAL

1. The Contractor shall submit work method statements with lists of materials to the Engineer for approval twenty eight days before the starting of works. This statement shall include following items:
  - a. Type of paint and manufacturer
  - b. Manufacturer's specifications
  - c. Storage and delivery of materials
  - d. Surface preparation
  - e. Finish painting and drying
  - f. Touch-up painting, if any
  - g. Equipment
2. The Contractor, before placing order for the painting materials, shall submit to the Engineer for approval samples of materials. No placing of orders for material shall be made without his approval.

### STORAGE AND DELIVERY

1. The Contractor shall deliver all material to the site in the original labeled sealed cans and containers, with labels intact and seal unbroken.
  - a. Seals shall remain unbroken until after inspection and acceptance of material by the Engineer.

- b. The Contractor shall deliver materials in ample quantities sufficiently in advance of the need to avoid any delay or interruptions in the works.
2. Paint in thinner shall be stored in accordance with the approved manufacturer's instructions.
- a. All regulations required for storage of paint shall be observed and all necessary safety signs required by governing codes shall be posted.
  - b. Any damage caused by failure to exercise proper precautions in paint storage shall be repaired.

## MATERIAL REQUIREMENTS

### PAINT

Paints for the protective coating system shall be the product of a manufacturer approved by the Engineer.

Paints for exterior finish must be with tile like durability and elegance, fast drying, solvent based acrylic, highly suitable for coastal or polluted areas with excellent anti-fungus properties and alkali resistance.

100% Acrylic, water based, quick-drying, easy to clean-up and environmentally friendly, resist dirt, stains, alkali, water, humidity, algae, mold and mildew growth and highly durable paint for interior finish.

An all-purpose synthetic quick dry paint for all types of wood and metal surfaces. It has high gloss, good color retention and outstanding durability.

For pipes, valves and equipment, galvanized and ungalvanized ferrous metal, use a 100% acrylic gloss paint, has excellent resistance to ultraviolet rays and resists chalking, cracking and color fading, dries fast and environmentally friendly.

### SCHEDULE OF PAINTING

Paint manufacturers shall be BOYSEN, DAVIES or approved equal.

Architectural Items	
a. Exterior Finishes	
1. On Concrete Walls	
Three Coats, Concrete Masonry Paint	Boysen Titan Superflex, Elastomeric Paint or approved equal
2. Unprimed Ferrous Metal	
First Coat	Boysen Red Oxide Primer, #310 or approved equal
Second & Third Coat	Boysen Quick Dry Enamel or approved equal

3. On Concrete Block Wall	
Masonry Neutralizer	Boysen Masonry Neutralizer #44 or approved equal
Three Coats Concrete Masonry Paint	Boysen Titan Superflex Elastomeric Paint or approved equal
4. On Wood	
First Coat Exterior Wood Primer	Boysen Flatwall Enamel or approved equal
Second & Third Coat Exterior enamel	Boysen Quick Drying Enamel or approved equal
b. Interior Finishes Location of the various finishes are listed in the Finish Schedule on the drawings or else will be confirmed by PPA	
1. On primer and coated metal two coats of interior semi-gloss enamel or as indicated in the Schedule finish	Boysen Red Oxide Primer #310, Boysen Quick Dry Enamel or approved equal
2. On Plaster	
First Coat	Boysen Masonry Neutralizer #44 or approved equal
Three Coats	Boysen Titan Superflex, Elastomeric Paint or approved equal
3. On Wood	
First Coat Enamel undercoater	Boysen Flatwall Enamel or approved equal
Second & Third Coat Exterior enamel	Boysen Quick Drying Enamel or approved equal
4. Wood Stain Finish	
First Coat Second & Third Coats Fourth & Fifth Coats	Boysen Oil Wood Stain , Boysen Lacquer Sanding Sealer #1254 Boysen Clear Gloss Lacquer #1250 or approved equal
c. Non – Architectural Items (Piping, valves, equipment, etc.)	
1. Piping, valves, equipment etc. in rooms are to be painted	
2. Galvanized pipes and ducts	
Primer – one coat	Boysen Red Oxide Primer, #310 or approved equal
Finish – one coat	Boysen Quick Dry Enamel or approved equal
3. Black steel pipes	
Primer – one coat	Boysen Red Oxide Primer, #310

Finish – one coat	or approved equal Boysen Quick Dry Enamel or approved equal
<b>4. Mechanical Items</b>	
a. Ungalvanized ferrous metal Primer – one coat  Finish – one coat	Boysen Red Oxide Primer, #310 or approved equal Boysen Quick Dry Enamel or approved equal or approved equal
b. Galvanized ferrous metal Primer – one coat  Finish – one coat	Boysen Red Oxide Primer, #310 or approved equal Boysen Quick Dry Enamel or approved equal or approved equal
c. Submerged galvanized ferrous metal Primer – one coat	Boysen Red Oxide Primer, #310 or approved equal
d. Buried miscellaneous ferrous surface valves, & flanged joints (excl. pipe) Primer – one coat	Boysen Red Oxide Primer, #310 or approved equal

**EXECUTION****SURFACE PREPARATION OF STEEL**

1. Steel surfaces shall be cleaned as follows:
  - a. All round welds, burrs and sharp surface projections shall be ground smooth and all weld splatter shall be removed prior to blast cleaning.
  - b. Sand abrasives, if used, shall be clean, and free from salt and extraneous matter. The sand shall pass through a 2.0mm test sieve, and be substantially retained on a 0.18mm test sieve, with at least 25 percent retained on a 0.355mm test sieve.
  - c. Metallic abrasive, if used, shall be sharp, hard and free from dust, and shall pass through a 1.8 mm test sieve.
  - d. Blast cleaning operations shall not be conducted on surfaces that will be wet after blasting and before coating, or when the surfaces are less than 10°C above degree points, or when the relative humidity of the air is greater than 95 percent.
  - e. Any oil, grease, soil, dust or other foreign matter deposited on the cleaned surfaces shall be removed prior to painting. In the event that rusting occurs after completion of the surface preparation, the surfaces shall be cleaned again in accordance with the specified method.
  - f. Particular care shall be taken to prevent the contamination of other corrosive chemicals before the application of the paint. Such contamination shall be removed from the cleaned surface by flash blasting and the paint applied immediately.



- g. Care shall be taken to prevent contamination of cleaned and painted surfaces by cleaning operations in an adjacent area.
- h. Surfaces not to be painted shall be suitably protected from the effects of cleaning and painting operations.

#### **SURFACE PREPARATION OF WOOD**

- 1. Wood surfaces shall be sanded to a fresh surface. Surface mould where present, shall be removed by washing, rubbing down and burning off as necessary. Resinous exudation and large knots shall be removed and replaced with filler or other materials approved by the Engineer.
- 2. Parts of timber to be enclosed in walls shall always be primed unless already impregnated. Priming shall be brushed on and a minimum of two coats applied to end grain. When the priming paint is hard, all cracks, holds, open joints, etc. shall be made good with hard stopping and rubbed down with fine abrasive paper. Priming of joinery shall be applied only on site after the Engineer has approved such joinery and before it is fixed. For internal surfaces primer coats shall be carefully flattened.

#### **SURFACE PREPARATION OF CONCRETE AND PLASTER**

Concrete and cement plaster surfaces to be painted shall be prepared by removing efflorescence, dust, dirt, grease, oil, asphalt, tar, excessive mortar and mortar dropping and by roughening to remove glaze. A zinc sulfate solution shall be applied before prime coat.

#### **SURFACE PREPARATION FOR FIBER CEMENT SURFACES**

Shall be dry and clean prior to application of the specified first-coat material. Oil, grease, or rust stains shall be carefully removed by the use of suitable solvent. Wire brushing will not be permitted. After the first coat has become dry and prior to application of finish coats, touch-up coats shall be applied to suction spots.

#### **ALUMINUM FRAMES FOR DOORS AND WINDOWS**

All metal surfaces shall undergo pre-treatment process which includes: desmutting, water-rinsing, degreasing/etching, water rinsing, zinc phosphating, water rinsing and acid rinsing.

Powder coating application, shall be factory applied and shall be done in one operation using an electro-static powder gun. The materials to be coated should be well connected to earth. Coating thickness should be kept to a minimum of 60 microns for exposed areas. On details which are to be treated mechanically after coating (drilling, sawing, etc.), the coating film must not exceed 100 microns.

The powder coating shall be oven cured in the range of 20 minutes at 220° C (metal temperature measured on the area with greatest metal thickness). The temperature variation in the oven should not exceed +/- 10° C.

#### **Handling**

Coated items should be cooled to no less than 40° Centigrade before handling. Precautions should be taken to avoid damages on the finished coating during stacking, storing and transportation.

## Storage and Delivery

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water and easily accessible for inspection and handling. Store materials neatly on the floor, properly stacked on non-absorptive strips or wood platforms. Protect finished surfaces during shipping and handling using manufacturer's standard method.

## WOOD REPAIR

Badly decayed areas shall be removed and repaired. Areas and pieces decayed beyond repair shall be replaced with new pieces that match originals in all respects. Moderately decayed areas, weathered, or gouged wood shall be patched with approved patching compounds, and shall be sanded smooth. The source or cause of wood decay shall be identified and corrected prior to application of patching materials. Wet wood shall be completely dried to a moisture content not exceeding 12 percent, as measured by a moisture meter, to its full depth before patching, unless otherwise authorized. Wood that is to be patched shall be clean of dust, grease, and loose paint.

### 1. Epoxy Wood Repair

Epoxy wood repair materials shall be applied in accordance with manufacturer's written instructions. Health and safety instructions shall be followed in accordance with the manufacturer's instructions. Clean mixing equipment shall be used to avoid contamination. Mix and proportions shall be as directed by the manufacturer. Batches shall be only large enough to complete the specific job intended. Patching materials shall be completely cured before painting or reinstallation of patched pieces.

### 2. Epoxy Consolidant and Epoxy Paste

Epoxy liquid wood consolidant shall be used:

1. To penetrate and impregnate deteriorated wood sections in order to reinforce wood fibers that have become softened or absorbent.
2. As a primer for areas that are to receive epoxy paste filler. Epoxy paste shall be used to fill areas where portions of wood are missing such as holes, cracks, gaps, gouges, and other voids.

## MIXING AND THINNING

Mixing and thinning of paint shall be done in accordance with the approved manufacturer's printed instructions. The pot life of each paint as stated by the manufacturer shall not be exceeded.

## WEATHER CONDITION

The paint shall not be applied when the relative humidity is above 85 percent. The paint shall not be applied in rain, wind, fog, dust or mist.

## APPLICATION

Workmanship shall be first class in every respect. All work shall be done in a workmanship manner so that the finished surfaces shall be free from runs, chop, ridges, waves, laps and unnecessary brush marks. All coats shall be applied in such manner as to produce an even film of uniform thickness. Edges, corners, crevices, welds and rivets shall receive special attention to ensure that

they receive an adequate thickness of paint.

All painting shall be done by thoroughly experienced workmen.

Safety regulations shall be adhered to at all times, including the wearing of respirators by persons engaged on assisting in spray painting. Adjacent areas and installation shall be protected by the use of cloths or other approved precautionary measures.

Plain enamel and varnish shall be applied carefully with good clean brushes or approved spraying equipment, except that the initial coat on any surface shall be applied with brush. Sufficient time shall be allowed between coats to assure thorough drying and each coat shall be in proper condition before receiving the next coat.

Sanding and dusting as required shall be performed between coats in varnishing work. Finish coat shall be smooth and free from runs, sags, and other defects. Exterior paint shall not be applied during rainy days.

All paint when applied shall provide a satisfactory film and smooth, even surface. Paint shall be thoroughly stirred and kept at a uniform consistency during application. Powdered metallic pigments added at the time of use shall be mixed by adding the powder in small increments to about one-third of the base paint or vehicle, with thorough mixing to obtain a smooth paste. The remainder of the base paint shall then be thoroughly stirred in.

Different brands of emulsion paints shall not be mixed prior to application of the materials.

Where necessary to suit conditions of surface temperature, weather and method of application, the package paint may be thinned immediately prior to application in accordance with the approved manufacturer's directions, but not in excess of 125 cc of suitable thinner per liter (one pint per gallon). Before using, the paint shall be mixed to a uniform consistency and shall be stirred frequently during application.

Paints other than water-thinned paints shall be applied only to surfaces which are completely free of moisture as determined by sight or touch and only such combinations of humidity to be painted as will cause evaporation rather than condensation.

Surfaces which have been cleaned, pretreated and/or otherwise been prepared for painting shall be primed or painted with one coat of finish paint as soon as practicable after such preparation has been completed, but in any event prior to any deterioration of the prepared surfaces.

The first coat of paint on all exterior surfaces shall be applied by brush. Interior prime coats and all other subsequent coats on either exterior or interior surfaces may be applied by brush or spray. Whenever spraying is permitted all areas inaccessible to spray painting shall be coated by brushing or other suitable means. Brushes to be used for application of water-emulsions shall be soaked in water for a period of 2 hours prior to use.

All cloths and cotton waste which might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day.

Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site or destroyed in a manner approved by the Engineer. Paint spots, or stains upon adjacent surfaces shall be removed and the entire job left clean and acceptable to the Engineer.

No smoking shall be permitted in the vicinity where painting is going on.

## **TOUCH-UP PAINTING**

Touch-up painting shall be done with the same paint as used for the original coat. The resulting minimum dry film shall be the same as for the original coat.

Touch-up painting shall include cleaning and painting of field connections, welds and all damaged or defective paint and rusted areas.

During touch-up painting, only loose, cracked, brittle or non-adherent paint shall be removed during cleaning. All exposed edges shall be feathered. Touch-up painting shall be performed in a manner which will minimize damage to sound paint. Rust spots shall be thoroughly cleaned and edges of the existing paint shall be scraped back to sound material.

## **DRYING**

1. No primer or paint shall be forced to be dried under conditions which will cause cracking, wrinkling, blistering, formation of pores which would detrimentally affect the condition of the paint.
2. No drier shall be added to the paint unless specified in the approved manufacturer's instructions.
3. Painted surfaces shall be protected from dust, dirt, and the elements of the weather until dry to the fullest extent practicable.
4. After drying, any areas of paint damaged from any cause shall be removed, the surface again prepared and then touched-up with the same paint and to the same thickness as the undamaged areas as specified in sub-section 4.14.3.7 above.

## **HANDLING**

1. Precautions shall be taken to minimize damage to paint films resulting from stacking for drying.
2. Paint which is damaged in handling shall be scraped off and touched-up with the same paint and in the same thickness as was previously applied to the damaged area at Contractor's expense.

## **INSPECTION**

1. All works and materials supplied under this Specification shall be subject to inspection by the Engineer.
2. The Contractor shall correct such works or replace such materials found defective under these Specifications at his own expense.

**ITEM 15 : CARPENTRY AND JOINERY WORKS****SCOPE OF WORK**

The work shall consist of furnishing all tools, labor, equipment and materials, unless otherwise specified to complete all carpentry and joinery works shown on the Drawings and specified herein.

**GENERAL REQUIREMENTS****a. Lumber Grades**

Lumber shall be of the best grade available, of the respective kinds required for the various parts of work; well seasoned, thoroughly dry and free from loose or unsound knots, sap, shakes or other imperfections impairing its strengths, durability and appearance. All exposed woodwork shall be smooth by dressed and sandpapered unless otherwise indicated or specified. Framing lumber shall be of the rough dimensions unless otherwise shown on the drawings.

**b. Substitution of Lumber**

Any lumber equally good for the purpose intended maybe substituted for the kind specified, subject to prior written approval of the Engineer. Provided, however, that in the substitution of the cheaper kind of lumber than that specified, a reduction in the contract price equal to the difference in the costs of the two kinds of lumber shall be made.

**c. Delivery and Storage**

The Contractor shall deliver lumber to the site in undamaged condition. Lumber shall be stacked in such a manner as to insure proper ventilation and drainage, and shall be supported at least 150 mm above-ground. Lumber shall be protected against dampness before and after delivery, and enough protection under cover in well ventilated enclosure, not exposed to extreme changes of temperature and humidity; and in a manner as to provide air-circulation around all surfaces of each pile to insure thorough air-seasoning. Lumber or millwork in buildings shall not be finished until concrete, masonry work and plaster are dry. Lumber shall be delivered at least thirty (30) days before use.

**d. Grading of Plywood**

Each sheet of plywood shall bear the mark identifying the plywood as to wood species, glue type and grade.

**MATERIALS****a. Lumber**

Lumber for various uses shall be one of the species listed for the purpose indicated unless otherwise specified in the drawing. For any use not specified, the lumber shall be the best commercial grade normally used for the purpose, subject to the approval of the Engineer.

All framings shall be done as far as possible with carefully fitted mortise and tenon joints.

All doors, windows, transoms, or other opening where so indicated on plans, shall have frames and sills of the dimensions shown or as hereafter detailed, and all frames coming in contact with concrete shall be anchored by means of 20-d nails, spaced not more than 0.20m, apart, all around the contact surfaces. All frames shall be rabbetted, molded and cut with saw and cut under for water drips.

<b>SPECIE</b>	<b>U S E</b>
<b>Yakal</b>	All door jambs, headers and transom bars, wood plates and all other woodwork in contact with concrete or masonry and where indicated.
<b>Apitong (pressure treated)</b>	All truss members and rafters and where indicated; all wood framings and carpentry, except when in contact with concrete.
<b>Tanguile (Kiln dried)</b>	All exterior and interior mill work, siding, finish and trim, frame work and all other wood works not specifically mentioned; except when in contact with concrete.

**b. Plywood**

Plywood shall conform to Commercial Standard PSI and shall be of local manufacture.

Plywood to be varnished shall be tanguile or kalantas veneers (as indicated), ribbon grained, water resistant, Class B and of the thickness indicated.

Plywood to be painted shall be tanguile veneer ordinary rotary-cut, water resistant, Class C and of thickness indicated.

Plywood exposed to the outside elements or where indicated shall be waterproof or marine plywood and of the thickness indicated.

**c. Laminates**

Decorative laminate is commonly used to surface kitchen counters, table tops, and cabinetry because of its resistance to stains, scratches, and heat.

The wood laminates shall be 3mm thick to be glued on 12mm thick plywood as specified on plans

**d. Fastenings**

Fastenings shall be common nails, glue or specified, flat-head wood screws (F.H.W.S.), rough-head wood screws (R.H.W.S.), bolts or lag screws where specified or called for shall be used. Conceal fastenings as much as possible; where not possible, locate them in inconspicuous places, where nailing is permitted through woodwork smooth-finished face, conceal nail heads.

**1. Nails**

Shall be of the smooth shank, zinc coated, common wire nails of local manufacture, and of types and sizes best suited for the purpose.

**2. Wood Screws**

Shall be brass or cadmium plated of the best available commercial quality, and of types and sizes suited for the purpose.

**PRESSURE TREATED LUMBER****a. Preservative Treatment**

All lumber indicated to be pressure treated, shall contain any of the following net retention of solid preservative.

- |    |                |   |  |
|----|----------------|---|--|
| a. | Boliden Salts  | - | 45.5 kg. dry chemical per cubic foot of wood |
| b. | Wolman Salts   | - | 0.31 kg. dry chemical per cubic foot of wood |
| c. | Tenalith Salts | - | 0.34 kg. dry chemical per cubic foot of wood |

The Contractor shall submit an affidavit signed by an official of the preservative treatment company to the Engineer. This affidavit shall indicate the net retention of solid preservatives obtained and shall certify that pressure treated lumbers have a moisture content that does not exceed 17 percent upon shipment from the treatment plant.

Where it is necessary to cut or bore pressure-treated lumber on the job, two coats of prepared concentrated preservatives solution shall be applied to the end-cut or bored surfaces.

**ROUGH CARPENTRY**

All work shall be well fitted, accurately set, and rigidly secured in place. Anchors and bolts (with nuts and washers) straps and tie rods shall be provided as required.

**a. Cutting and Fitting**

Cutting and fitting to accommodate other work shall be done in the required manner, and cut or damaged work shall be patched and made good.

**b. Framing and Structural**

Framing and structural lumber shall be well-seasoned, straight, square-edge stacks, and free from loose or unsound knots, bark edges or other defects that will impair its strength.

**c. Plates for Walls and Partitions**

Plates for walls and partitions shall be of the same width as the studs and shall form continuous horizontal ties.

Structural members shall not be cut, bored or notched for the passage of pipes or conduits without prior approval of the Engineer. All members damaged by such cutting or boring shall be reinforced by means of specially formed and approved sheet metal or steel shapes or remove or replaced with new member as directed.

Anchors, connectors and fastenings not indicated or specified otherwise shall be of the size and types necessary to suit the conditions encountered. Size, type and spacing of nails, screws or bolts for installation of manufactured building materials shall be as recommended by the product manufacturer unless indicated or specified otherwise.

Rough hardware, exposed to weather or in contact with exterior walls or masonry or slabs shall be zinc-coated except as specified otherwise.

All lumber surfaces in contact with concrete or masonry shall be given a brush coat of bituminous paint before installation.

## **JOINERY WORK**

All lumber used for the joinery work shall be of the kinds and grades specified and shall be of the contours, patterns and profiles indicated.

All joints shall be made, installed tight and securely fastened in a manner approved by the Engineer. Exterior joints shall be mitered and interior angles coped. Panels shall be fitted to allow for shrinkage, avoid swelling, and insure that the work remain in place without warping, splitting and opening of joints.

Interior trims shall be approved standard stock moldings, except where special patterns or profiles are indicated.

Joints for cabinet work shall be glued in addition to nails or other fastening device required. Nailing shall be concealed where practicable. Where face nailing is used, nails shall be set for putty stopping.

All exposed surfaces shall be machined or hand sanded finished to an even smooth surface. No hammer marks or other unsightly marks shall be allowed on any wood panel or veneer.



**ITEM 16 : SUPPLY AND INSTALL OF STAIR NOSING****GENERAL**

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

**SCOPE OF WORK**

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete supply and install of stair nosing for the buildings as indicated on the drawings and as specified herein.

**STAIR NOSING**

1. Supply and installation of 50mm x 10mm thick. Stair Nosing (Rigid Type)

**SUBMITTAL**

1. Shop drawings for all stair nosing for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.
2. The Contractor, before placing order for the finishing materials shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.

**ITEM 17 : MODULARS, TABLES, CHAIRS, AND GANG CHAIRS OF VARIOUS TYPE INCLUDING ACCESSORIES****GENERAL**

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

**SCOPE OF WORK**

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete supply of gang chairs for the buildings as indicated on the drawings and as specified herein.

**MODULARS**

<b><i>Modular System</i></b>	<b><i>Unit</i></b>	<b><i>Quantity</i></b>
Rectangular Worktop (1500mm x 600mm ) with grommet	pc	11.00
Stall countertop (1000mm X 400mm)	pc.	2.00

**CHAIRS**

<b><i>Chairs</i></b>	<b><i>Unit</i></b>	<b><i>Quantity</i></b>
Mid back Chair / Clerical Chair	set	15.00
4 - Seater Gang Chair	set	31.00
5 - Seater Gang Chair	set	24.00

**SUBMITTAL**

1. Shop drawings for all gang chair for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.
2. The Contractor, before placing order for the supply shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.

**EXECUTION**

All materials will be delivered and installed (if needed to be installed) on site.

## **ITEM 18 : SIGNAGES**

### **SCOPE OF WORK**

Furnish materials and perform labor to include miscellaneous works required for the installation of room identification for the toilets and port office.

### **SAMPLE AND SHOP DRAWINGS**

The Contractor shall submit samples for approval by the Engineer. For the room I.D. full size lettering layout and installation method shall be submitted to the Engineer for approval before start of work.

### **MATERIAL REQUIREMENTS**

#### **ROOM MARKERS**

Black acrylic letters, 38mm (1-1/2") high on white acrylic background, 63mm (2-1/2") high, with clear acrylic cover. Lengths shall be as required by the full notation therein.

### **EXECUTION**

#### **WORKMANSHIP**

Workmanship shall be executed in high quality comparable with artworks.

#### **MOUNTING**

For all mounted assemblies, appropriate mounting hardware and connectors which are concealed shall be sufficiently used.

Assemblies shall be mounted plumb, straight, level, and at prescribed heights.

#### **INSTALLATION**

Installation shall be done in a secure and permanent manner at prescribed heights and/or layout. The backwall shall not be mutilated. After the dowels are positioned, fill with expanding grout, or other approved fillers, and retouch, flashed to the backwall surface.

## **ITEM 19: FACILITIES AND DEVICE FOR PERSONS WITH DISABILITY**

### **SCOPE OF WORK**

The work shall consists of furnishing materials, tools, labor and incidentals necessary for the construction/installation of facilities and device for disabled persons as shown on the Drawings and in accordance with the Implementing Rules and Regulations of Batas Pambansa Bilang 344 and this Specification.

### **MATERIAL REQUIREMENTS**

#### **GRAPHIC SIGNS**

Graphic signs like the International Symbol of Access shall be fabricated from plastic materials, white color with either dark blue background. Letters and symbols shall be laminated and raised from the background.

#### **HANDRAILS**

Handrail for ramp shall be 50mmØ tubular stainless steel buff finished. It shall be provided with a small hole as of a Braille system.

#### **GRABRAIL**

Grab rail shall be manufactured from gauge 18 tubular stainless steel 50mmØ and provided with safety grip finish.

Flip up bar shall be 38mmØ tubular stainless steel buff finished.

### **CONCRETE MATERIALS FOR RAMPS**

1. Portland cement shall conform with the requirement of "Reinforced Concrete".
2. Aggregates shall conform with the requirements of "Reinforced Concrete".
3. Temperature bars shall have diameter of 10mm conforming with the requirements of "Concrete Works".

### **EXECUTION**

#### **GRAPHIC SIGNS**

1. Directional and information signs, indicating the location of the ramp for physically handicapped persons, shall be installed / placed at the front of the main entrance of the Terminal Building. The signed board size and dimensions shall be based on DOTr approved Standard Design, schedule 40, sign post and the text and arrow shall be in accordance with the International Symbol of Access "B". Manual (See attached drawings and tabulation).
2. Signs shall be placed at the entrance and exits of the ramps and toilets, installed at conspicuous locations. The signboards shall be based on DOTC approved Standard Design Manual (See attached drawings and tabulation).

**RAMP**

The ramp shall be constructed as shown on the drawings and with a nonskid surface and tactile strips.

**GRABRAILS**

Lavatories, urinals and water closets of the Terminal Building where indicated on the drawings shall be provide with grabrails. The position and distance from the floor shall be as shown on the drawings.

## **ITEM 20 : CONCRETE WATERPROOFING**

### **GENERAL**

General Requirements contain provisions and requirements essential to these specifications and apply to this Section, whether or not referred to herein.

### **SCOPE OF WORK**

The work shall cover the waterproofing requirements for building as shown on the drawings.

The work shall consist of furnishing all labor, materials, equipment and other incidentals necessary for the integral waterproofing works where required as shown on the drawings and in accordance with the requirements of these specifications as directed by the Engineer.

### **SUBMITTAL**

1. The Contractor shall submit for approval of the Engineer the name of the manufacturer nominated for the supply of materials and installation. Sub-contracting documents shall be submitted to the Engineer by the Contractor.
2. The Contractor shall submit the procedure of waterproofing application for approval of the Engineer.
3. Waterproofing materials shall be applied only by an experienced applicator and shall be applied in accordance with the approved manufacturer's application procedures or methods, approved by the Engineer.

### **PRODUCT HANDLING**

Materials shall be delivered and dosed to the batching plant/s in the sealed drums and packages bearing the manufacturer's name.

### **ALTERNATIVE**

No substitution of materials shall be made unless authorized in writing by the Engineer prior to starting the work of waterproofing.

### **MINIMUM GUARANTEE PERIOD**

The Contractor shall guarantee the work for a minimum guarantee period of ten (10) years. The Contractor shall make sub-contract agreement with approved manufacturer in which following conditions shall be included:

1. Minimum guarantee period of (10) years after the issuance of Take-Over Certificate.
2. The Contractor shall transfer all the rights to the Employer free of charge after the issuance of Taking-Over Certificate.

## **MATERIAL REQUIREMENTS**

All concrete such as Slab and Beam at Roof Deck, Cistern Tank and Water Tanks, shall be waterproofed by the addition of HYDROPHOBIC POREBLOCKING INGREDIENT (HPI) named 3CC product or approved equivalent complying with items 6, 7 and 8 of the minimum requirement stipulated below and approved by the Engineer. The dosage of 3CC shall be at the rate of 15 liters per cubic meter of concrete and shall be combined with SUPERPLASTICISER at the manufacturer's recommended rate.

Furthermore, concrete containing 3CC shall comply strictly with the following minimum requirements:

1. The concrete cement (OPC) content shall not be less than 350 kg per cubic meter or minimum of 300 kg per cubic meter of Ordinary Portland Cement (OPC) and 80 kg per cubic meter of Fly Ash (using Fly Ash) or Concrete Compressive Strength shall be at least 30 MPa.
2. The water content shall be reduced to adjust for the 3CC usage and maintain the required workability; however the water/cement ratio must not exceed 0.45
3. Steel Reinforcement shall be using hard rib deformed bars.
4. Other details of 3CC concrete shall be conforming to current recommendations and requirements.
5. A trial mix must be conducted prior to construction and the cement content is to be stated on the premix concrete dockets.
6. The concrete shall contain HYDROPHOBIC POREBLOCKING INGREDIENT(HPI) named 3CC in such a way that the concrete shall have a corrected 30 minute water absorption of not greater than 1.50 % as measured by BS 1881:Part 122:1983 except that the age at test shall be 7 days.
7. The product to be used must be proven by an independent authority to have had no reduction in performance after field exposure for a minimum of 15 years.
8. The 3CC concrete performance shall be warranted for 10 years including construction joints, pipe projections and tie rod points.
9. The Engineer reserves the right to require the concrete as placed and cured in the actual structure to comply with the water absorption limit within 7 days of placement. The Contractor shall provide costing for water absorption testing by an independent laboratory, and if so required, samples shall be taken during construction as directed by the Engineer. These samples shall be tested according to BS 1881: Part 122:1983 and shall conform with the water absorption requirement. The Engineer further reserves the right to take cores from the structure to confirm compliance.

## **CURING COMPOUND**

Curing of HPI Concrete shall be using CALCURE B or approved equivalent

## **WATERSTOP**

All construction joints, pipe projections, floor drains and tie rod points shall be using waterstop, a controlled expansion waterstop, an active butyl rubber based waterstop which activates after approximately 5 - 10 days of constant exposure to water. The waterstop material should not expand prematurely and should not absorb water from the fresh concrete poured against it.

## **FLOODTESTING**

Floodtest for a duration of 48 hours shall be undertaken upon completion of waterproofing installation to determine any leakage or defect on the materials and/or workmanship.



## **ITEM 21 : STEEL AND METAL WORKS**

### **GENERAL**

General Requirements contain provisions and requirements essential to these specifications; and apply to this Section, whether or not referred to herein.

### **SCOPE OF WORK**

The work includes the furnishing of all labor, materials, equipment and other incidentals necessary for the fabrication and installation of structural steel and miscellaneous metal works as specified in relevant items of these specifications and as indicated on the drawings.

### **SUBMITTAL**

1. Before placing orders for materials for the steel and metal works, the Contractor shall submit to the Engineer for approval shop drawings for all steelwork. All project shop drawings shall show the dimension of all parts, method of construction, bolts, welding sectional areas and other details.
2. The detail of connections shown on the shop drawings shall be such as to minimize formation of pockets to hold condensation, water or dirt. A minimum gap between abutting angles and the like shall be provided wherever possible to eliminate any traps and facilitate maintenance painting.
3. No materials shall be ordered nor fabrication commenced until the shop drawings are approved by the Engineer.

### **STORAGE OF MATERIALS**

Structural materials, either plain or fabricated, shall be stored above the ground upon platforms, skids, or other supports. Materials shall be kept free from dirt, grease, and other foreign matter and shall be protected from corrosion.

### **MATERIAL REQUIREMENTS**

1. Unless specified herein all steel structures and metals shall conform with the requirements of "Steel and Metal Works." Connections where details are not specified or indicated herein, shall be designed in accordance with the American Institute of Steel Construction (AISC), Manual of Steel Construction, latest edition.
2. Structural steel works consisting of channels, gusset plates and other structural steel shape shall be as indicated on the drawings and shall be structural carbon steel conforming to ASTM A 36. Shapes shall be as given in AISC, Manual of Steel Construction.
3. High strength structural bolts, shall conform to ASTM A 325, Types 1 or 2. Nuts shall conform to ASTM A 560, Grade A, heavy hex style, except nuts 38 mm (1-1/2 inch) may be provided in hex style. Washers shall conform to ANSI B 18.22.1, Type B.
4. Electrodes for arc welding shall be E70 series conforming to American Welding Society Specifications A5.1.
5. Tests are required under the ASTM Standards for steel to be used in the Works and shall be carried out in the presence of the Engineer and at least four (4) days notice must be given to him of the dates proposed for such tests. Four (4) calendar days notice on which fabricated steelwork will be ready for inspection in the Contractor's yard.

6. Standard bolt shall conform to ASTM A 307 Carbon Steel Externally Threaded Standard Fasteners.

## **EXECUTION**

### **QUALIFICATION**

Qualification of steel fabricators, erectors and welders shall comply with the requirements.

### **FABRICATION REQUIREMENTS**

1. **Workmanship**

Fabrication shall be performed within the permissible tolerance by the approved fabricator. All workmanship shall be of the best quality with respect to internationally recognized standards of practice.

2. **Cutting**

Low-carbon structural steel may be cut by machine-guided torch instead of by shears or saw. Harmful notches, burrs, irregularities, etc., shall not be developed at the cut surface.

3. **Contact Faces**

Contact surfaces between bases or other elements bearing directly upon bearing plates shall be ground or milled as necessary for full effective bearing. Edges for welding shall likewise be properly prepared.

4. **Bolt Holes**

Bolt holes shall be according to engineering practice and as specified in these specifications. Gas burning of holes will not be permitted.

5. **High Strength Bolt Assembly Preparation**

Surfaces of high strength bolted parts in contact with bolt heads and nuts shall not have a slope of more than 1:20 with respect to a plane normal to the bolt axis.

Where the surface of a high strength bolted part has a slope of more than 1:20, a beveled washer shall be used to compensate for lack of parallelism.

High strength bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible materials.

When assembled, all joint surfaces including those adjacent to washers shall be free of scale except tight mill scale, and shall be free from dirt, loose scale, burrs, and other defects that would prevent solid seating of parts.

Contact surfaces of friction-type joints shall be free from oil, paint, lacquer or galvanizing.

6. **Welding**

All welding shall be done only by welders certified as to their ability to perform in accordance with accepted testing requirement.

Welding of parts shall be in accordance with structural standards and the Standard Code for Arc and Gas Welding in Building Construction of AWS, and shall only be done where shown, specified, or permitted by the Engineer.

Damage to galvanized areas by welding shall be thoroughly cleaned with wire brushing and all traces of welding flux and loose or cracked zinc coating shall be removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight. As an alternative to the above, the Contractor may submit for approval the use of a galvanizing rod or galvanizing solder to repair damaged areas.

The welding machine shall be a stable welder, and have suitable functions for the dimension of materials to be welded. The auxiliary tools used for welding shall perform sufficiently and adequately.

The welding machine used for field welding shall be of readily adjustable for electric current.

## 7. Shop Assembly

Structural units furnished shall be assembled in the shop. An inspection shall be made to determine that the fabrication and the matching of the component parts are correct.

Jigs shall be used for the assembly of units as much as possible to maintain appropriate position of mutual materials.

Approval of the Engineer shall be required when drilling temporary bolt holes or welding temporary support to the assembled structure.

The tolerances shall not exceed those allowed by codes and each unit assembled shall be closely checked to insure that all necessary clearances have been provided and that binding does not occur in any moving part.

In order to maintain accurate finished dimensions and shape, appropriate reverse strain or restraint shall be provided as required. Assembly and disassembly work shall be performed in the presence of the Engineer, unless waived in writing by the Engineer any errors or defects disclosed shall be immediately remedied by the Contractor.

Before disassembly for shipment, component parts of the structures shall be match marked to facilitate erection in the field.

## FABRICATION TOLERANCES

### 1. Dimensional Tolerances for Structural Work

Dimensions shall be measured by means of an approved calibrated steel tape at the time of inspection. Unevenness of plate work shall not exceed the limitation of the standard mill practice as specified in the American Institute of Steel Construction, "Manual of Steel Construction".

### 2. Camber

Reverse camber in any structural steel members in excess of 1/1,000 of the span length shall cause rejection. The minimum dead load camber for any structural steel member shall be as allowed by Code, or otherwise specified.

## INSPECTION AND TEST OF WELDING

### 1. Inspection of Welding

Inspection of welding shall be executed for the following work phases.

#### a. Before Welding

Scum, angle of bevel, root clearance, cleaning of surface to be welded, quality of end tab, drying of welding rod.

#### b. During Welding

Welding procedure, diameter of coil and wire, type of flux, welding current and voltage, welding speed, welding rod position, length of arc, melting, cleaning of slag of each level under surface chapping, supervision of welding rod.

#### c. After Execution of Welding

Assurance of bead surface, existence of harmful defects, treatment of crater, quality of slag removal, size of fillet, dimension of extra fill of butt welding, treatment of end tab.

### 2. Testing of Welding

Twenty percent (20%) of welds contributing in the overall strength of the structure and which will be inaccessible for the inspection in service shall be tested.

Welding shall be tested by ultrasonic test to the extent specified herein or as directed by the Engineer.

Where partial inspection is required, the ultrasonic test shall be located at random on the welds so as to indicate typical welding quality.

If ten percent (10%) of the random ultrasonic tested indicate unacceptable defect, the remaining eighty percent (80%) of the welding shall be tested. Repair welding required shall be ultrasonic tested after the repairs are made.

## CORRECTIONS

In lieu of the rejection of an entire piece or member containing welding which is unsatisfactory or which indicates inferior workmanship, corrective measures may be permitted by the Engineer whose specific approval shall be obtained for making each correction. Defective or unsound welds or base steel shall be corrected either by removing and replacing the entire weld, or as follows.

1. Excessive convexity or overlap shall be reduced by grinding.
2. Undercuts, lack of weld shall be repaired with necessary reinforcement of weld after removal of any foreign materials such as slag, dust, oil, etc.
3. Any defects such as slag inclusions, incomplete fusion, or inadequate joint penetration, shall be completely removed, cleaned and re-welded.

4. Cracks in welds or base steel, shall be removed to sound steel throughout their length and 5cm beyond each end of the crack, followed by welding. The extent of the crack, depth and length, shall be ascertained by the use of acid etching, magnetic particle inspection or other equally positive means.

The removal of welded steel shall be done by chipping, grinding, oxygen cutting, oxygen gouging, or air carbon arc gouging and in such a manner that the remaining welded steel or base steel is not nicked or undercut. Defective portions of the welding shall be removed without substantial removal of the base steel.

## INSTALLATION

### 1. Installation Program

#### a. Prerequisite Condition

Prior to executing steel fabrication and field installation, the Contractor shall prepare a comprehensive installation program including engineering supervision organization, fabrication procedures, field installation procedures, material application, machinery applications, inspection procedure, scope and standard of quality judgment, and submit to the Engineer for approval.

#### b. Special Technical Engineering

Special technical engineering different from contract specifications can be applied upon receiving approval of the Engineer.

### 2. Installation Requirement

#### a. Setting of Anchor Bolt and Others

- a. 1. Anchor bolts shall be set in accurate position by using templates.
- a. 2. The setting method shall be proposed to the Engineer for his approval before setting starts.
- a. 3. The threads of bolt shall be cured with an appropriate method against rust and/or any damage before tightening.
- a. 4. Non-shrink mortar shall be placed under base plates, well cured to obtain the sufficient strength before bearing loads are applied to base plates.

#### b. Temporary Bracing

- b. 1. Temporary bracing shall be installed as necessary to stay assemblies and assume loads against forces due to transport, erection operations or other work.
- b. 2. Temporary bracing shall be maintained in place until permanent work is properly connected and other construction installed as necessary for support, bracing or staying of permanent work.
- b. 3. Extent and quality of temporary bracing shall be as necessary against wind and other loads, including seismic loads not less than those for which the permanent structure is designed to resist.

**c. Adequacy of Temporary Connections**

During erection, temporary connection work shall be securely made by bolting and/or welding for all dead load, wind and erection stresses.

**d. Alignment**

No permanent bolting or welding shall be done until the alignment of all parts with respect to each other shall be true within the respective tolerances required.

**e. Field Welding**

e. 1. Any shop paint or surfaces adjacent to joints where field welding is to be executed shall be wire brushed to remove paint/primer.

e. 2. Field welding shall conform to the requirements specified herein, except as approved by the Engineer.

**f. High Strength Bolts**

Final tightening of high strength bolts shall be done by using manufacturer's power operated equipment without any overstress to the threads.

**g. Correction of Errors**

g. 1. Corrections of minor misfits by use of drift pins, and reaming, chipping or cutting will be permitted and shall be provided as part of erection work.

g. 2. Any errors to be corrected or adjusted, preventing proper assembly, shall be immediately reported to the Engineer, and such corrections or adjustments shall be made as necessary and approved by the Engineer.

g. 3. Cutting or alterations other than as approved will not be permitted.

**h. Erection**

h. 1. Erection and installation shall be as per approved shop drawings.

h. 2. Each structural unit shall be accurately aligned by the use of steel shims, or other approved methods so that no binding in any moving parts or distortion of any members occurs before it is finally fastened in place.

h. 3. Operations, procedures of erection and bracing shall not cause any damage to works previously placed nor make overstress to any of the building parts or components. Damage caused by such operations shall be repaired as directed by the Engineer at no extra cost to the Employer.

## **GALVANIZING**

### **PREPARATION**

All mild steel parts exposed to weather shall be hot-dipped galvanized after fabrication in accordance with the requirements of ASTM A 123 or ASTM A 153. Prior to galvanizing, the surfaces shall be cleaned of dirt, weld splatter, grease, slag, oil, paint or other deleterious matters. The steel surfaces shall be chemically de-scaled and cleaned with the same abrasive blast or other suitable method as approved by the Engineer.

## COATING

The zinc coating shall consist of uniform layers of commercially pure zinc free from abrasions, cracks blisters, chemical spots or other imperfections, and shall adhere firmly to the surface of the steel. The weight of zinc coating per square meter of actual surface shall not be less than 550 grams. Any surface damaged subsequent to galvanizing shall be given two coats of approved zinc rich paints.

## PAINTING

This work shall consist of the preparation of the metal surfaces, the application, protection and drying of the painted surfaces, and supplying of all tools, tackle, scaffolding, labor and materials necessary for the entire work. Painting shall be applied in the field or shop as approved by the Engineer.

Unless otherwise specified or approved, all painting work for structural steel shall comply with the requirements of this Section.

### SHOP PAINTING

All structural steel shall be given a shop primer after fabrication and cleaning before delivery to the site.

All steel work shall be thoroughly dried and cleaned of all loose mill scale, rust and foreign matters by means of sand blasting or other suitable methods approved by the Engineer before shop painting shall be applied. Each individual piece shall be painted prior to assembly. Portions where field welding or field contact with concrete is required shall not be painted.

Except for galvanized surfaces and items to be encased in concrete, clean ferrous metal surfaces shall be given one coat of Amerlock 400 Epoxy Primer at 100 Microns or approved equal. Additional coat shall be applied to surfaces that will be concealed or inaccessible for finish painting by Amerlock 400, Top Coat at 150 Microns with color or equivalent.

### FIELD PAINTING

After erection, the Contractor shall thoroughly prepare and clean the entire surface of all structural steel from all dirt, grease, rust or other foreign matters. The entire surface of all members shall then be field painted.

## MATERIALS

### 1. Structural Steel Work

- a. After surface preparation, steelwork shall be given one coat of approved prefabricating primer.
- b. Before final assembly of steelwork at the fabricator's shop, two shop coats of special red lead primer shall be applied to the surface of sections to be in permanent contact, meeting faces and all other concealed surfaces. After final assembly, but before delivery to the project site, the steelwork shall likewise be given two shop coats of special red lead primer.

### 2. Galvanized Steelwork

All galvanized steelwork shall be treated with zinc chromate two-pack etch primer followed by one coat of non-etch zinc chromate primer.

### 3. Miscellaneous Metal Work

Unless otherwise specified in other Sections of the Specifications or shown on the drawing, miscellaneous metal works such as ladders, structural steel ladder rungs, etc. shall be given two shop coats of epoxy primer and two coats of epoxy enamel.

## CONSTRUCTION METHODS

### 1. Cleaning of Surfaces

Surfaces of metal to be painted shall be thoroughly cleaned; removing rust, loose mill scale, dirt, oil or grease, and other foreign substances. Unless cleaning is to be done by sand blasting, all weld areas, before cleaning is started, shall be neutralized with a proper chemical, after which they shall be thoroughly rinsed with water.

Three methods of cleaning are provided herein. The particular method to be used shall be as directed by the Engineer.

### 2. Hand Cleaning

The removal of rust, scale, and dirt shall be done by the use of metal brushes, scrapers, chisels, hammers or other effective means. Oil and grease shall be removed by the use of gasoline or benzene.

Bristle or wood fiber brushes shall be used for removing loose dirt.

### 3. Sandblasting

All steel shall be cleaned by sandblasting. The sandblasting shall remove all loose mill scale and other substances. Special attention shall be given to cleaning of corners and re-entrant angles. Before painting, sand adhering to the steel in corners and elsewhere shall be removed. The cleaning shall be approved by the Engineer prior to any painting which shall be done as soon as possible before rust forms.

### 4. Flame Cleaning

All metal, except surface inside boxed members and other surfaces which shall be inaccessible to the flame cleaning operation after the member is assembled, shall be flame cleaned in accordance with the following operations.

- a. Oil, grease, and similar adherent matter shall be removed by washing with a suitable solvent. Excess solvent shall be wiped from the work before processing with subsequent operations.
- b. The surface to be painted shall be cleaned and dehydrated (free from occluded moisture) by the passage of oxyacetylene flames which have an oxygen to acetylene ratio of at least 1.0. The oxyacetylene flames shall be applied to the surfaces of the steel in such a manner and at such speed that the surfaces are dehydrated; dirt, rust loose scale in the form of blisters or scabs, and similar foreign matters are freed by the rapid, intense heating by the flames. The number arrangement and manipulation of the flames shall be such that all parts of the surfaces to be painted are adequately cleaned and dehydrated.
- c. Promptly after the application of the flames, the surfaces of the steel shall be wire brushed, hand scraped wherever necessary, and then swept and dusted to remove all free materials and foreign particles.



- d. Paint shall be applied promptly after the steel has been cleaned and while the temperature of the steel is still above that of the surrounding atmosphere.

## 5. Weather Conditions

### a. Exterior Coatings

Coatings to surface shall not be applied during foggy or rainy weather, or under the following surface temperature conditions: below 4°C, or over 35°C, unless approved by the Engineer.

### b. Interior Coatings

Coatings shall be applied when surfaces to be painted are dry and the following surface temperatures can be maintained: between 18 to 35°C during the application.

## 6. Application

- a. Paint shall be factory tinted and mixed. All paint shall be field mixed before applying in order to keep the pigments in uniform suspension.

### b. Field Painting

When the erection work is complete, including all bolting and straightening of bent metal, all adhering rust, scale, dirt, grease or other foreign materials shall be removed as specified above.

As soon as the Engineer has examined and approved each steel and metal works structures, all field bolts, all welds, and any surfaces from which the top or first coat of paint has become worn off, or has otherwise come defective shall be cleaned and thoroughly covered with one coat of paint.

Surfaces to be bolted and surfaces which shall be in contact with concrete, shall not be painted. Surfaces which shall be inaccessible after erection shall be painted with such field coats as are required. When the paint applied for retouching the shop coat has thoroughly dried, and the field cleaning has been satisfactorily completed, such field coats as are required shall be applied. In no case shall a succeeding coat be applied until the previous coat is dry throughout the full thickness of the paint film. All small cracks and cavities which were not sealed in a watertight manner by the first field coat shall be filled with a pasty mixture of red lead and linseed oil before the second coat is applied.

The following provision shall apply to the application of both coats. To secure a maximum coating on edges of plates or shapes, bolt heads and other parts subjected to special wear and attack, the edges shall first be striped with a longitudinal motion and the bolt heads with a rotary motion of the brush, followed immediately by the general painting of the whole surface, including the edges and bolt heads.

The application of the second field coat shall be deferred until adjoining concrete work has been placed and finished. If concreting operations have damaged the paint, the surface shall be re-cleaned and repainted.

**c. General Manners**

Painting shall be done in a neat and workmanlike manner. Paint may be applied with hand brushes or be spraying, except aluminum paint which preferably shall be applied by spraying. By either method the coating of paint applied shall be smoothly and uniformly spread so that no excess paint shall collect at any point. If the work done by spraying is not satisfactory to the Engineer hand brushing shall be required.

**d. Brushing**

When brushes are used, the paint shall be so manipulated under the brush as to produce a smooth, uniform, even coating in close contact with the metal or with previously applied paint, and shall be worked into all corners and crevices.

**e. Spraying**

Power spraying equipment shall be used to apply the paint in a fine spray. Without the addition of any paint, the sprayed area shall be immediately followed by brushing, when necessary, to secure uniform coverage and to eliminate wrinkling, blistering and air holes.

**f. Removal of Paint**

If the painting is unsatisfactory to the Engineer the paint shall be removed and the metal thoroughly cleaned and repainted.

**ITEM 22 : PLUMBING AND SANITARY WORKS****SCOPE OF WORK**

The work covered for this section shall consist of furnishing all labor, tools, equipment, materials and incidentals necessary for the complete installation, testing and operation of the plumbing and sanitary system within the buildings and premises in accordance with these Specifications and as shown on the drawings or as directed by the Engineer. The septic tank and their effluent and discharge pipelines shall be part of other section of these specifications.

**MATERIAL REQUIREMENTS****SUBMITTAL**

1. The Contractor shall submit his work method statement with necessary shop drawings to the Engineer for approval twenty eight (28) days before the start of the works.

Shop drawings shall be dated and shall contain the name of the project and location of the subject item in the shop drawing which is to be installed.

The Engineer will review and approve or return for correction all shop drawings with reasonable promptness. The Contractor shall make any corrections required and file with the Engineer three (3) corrected copies of the shop drawings.

2. The drawings shall indicate the general arrangement of all pipings, however, where actual conditions necessitate re-arrangement in opinion of the Contractor and/or the Engineer, the Contractor shall prepare and submit to the Engineer for approval, twenty eight (28) days before placing the order for materials, shop drawings of the proposed re-arrangement. Because of the small scale of the drawings, shop drawings to indicate all offsets, fittings and accessories shall be prepared. The Contractor shall carefully examine the drawings and shall carefully investigate actual structural and finish conditions affecting all his work.
3. The Contractor shall be responsible for the proper fitting of materials, equipment and accessories without substantial alteration and at no cost to the Employer.
4. The Contractor shall be responsible for the proper coordination of the work and shall provide all necessary clearance where necessary.

**STANDARDS**

Use of materials shall further be governed by other requirement imposed on other sections of these Specifications. Materials shall be subject to tests necessary to ascertain their fitness if the Engineer so requires. All works shall comply with the pertinent provisions of the Plumbing Code of the concerned city or town, the Code on Sanitation of the Philippines, and/or the National Plumbing Code of the Philippines.

## **MATERIALS**

### **1. Identification of Materials**

Each length of pipe, fittings, traps, fixtures and devices used in the plumbing work shall have cast, stamped or indelibly marked on it, the approved manufacturer's trademark or name, the weight, type and class of product when so required by the standards mentioned above.

### **2. Alternative Materials**

Use of any material not specified in this Specification may be allowed provided such alternate has been approved by the Engineer and provided further that a test, if required, shall be done by an approved agency in accordance with generally accepted standards.

### **3. Soil, Waste, Drain, Vent Pipes and Fittings**

Soil, waste and vent pipes shall be unplasticized Polyvinyl Chloride (uPVC) pipes. Diameter shall be as indicated on the Drawings. It shall conform to ASTM D 1784 or ASTM D 2729.

Drainage pipes shall be reinforced concrete pipes (RCP), diameter shall be as indicated on the Drawings.

### **4. Jointing Material**

The joint material for uPVC pipes shall be PVC solvent cement as recommended by the approved pipe manufacturer.

### **5. Water Supply Pipes**

Water supply pipes shall be polypropylene random-80 (PPR-80) pipes PN 20 conforming to DIN Standards DIN 1988/DIN 8078, German made. Jointing shall be fusion welded.

### **6. Cleanouts, Plugs and Tee**

Cleanouts shall be of the same material as the pipe to be fitted. Cleanouts installed in connection with uPVC hubs and spigot pipes shall consist of a long sweep quarter bend of  $\frac{1}{4}$  as shown on the drawings.

### **7. Pipe Sleeves**

Pipe sleeves shall be installed and properly secured in place at all points where pipes passes through masonry or concrete. Pipe sleeves shall be uPVC pipe, Schedule 40.

### **8. Downspout**

All downspout shall be unplasticized polyvinyl chloride (uPVC) pipe class DWV conforming to ASTM D2729 or ASTM D1784 for sanitary pipes, Series 1000.

**9. Splash Block**

Provide splash blocks at the outlet of downspout emptying at grade which shall be made of pre-cast concrete, with smooth finished counter sunk dishes sloped to drain away from the building. Dimensions as shown on the Drawings.

**10. Roof Strainers**

The Contractor shall provide fittings and install 100mm G.I. mesh wire strainers where shown or indicated on the drawings and/or where the Engineer directs. Each strainer shall fit the size of the corresponding downspout which is to be installed.

**11. Shower, Floor and Urinal Drain**

Shower and floor drains shall be made of stainless steel non-tilting grate, perforated or slotted. Urinal drains shall be cast iron dome type drain.

**12. Pipe hangers, Inserts and Support**

- a. Pipe hangers shall be wrought iron, malleable iron pipe hangers spaced not over 1.5meters apart for uPVC pipes and 3.0meters apart for iron pipes. Chain straps, perforated bars or wire hangers will not be permitted.

Hangers shall have short turnbuckles or other approved means of adjustment. Turnbuckles may be omitted on hangers where space does not permit their use. Trapeze hangers may be used in lieu of separate hangers for pipes running parallel to each other and close together.

- b. Inserts shall be of cast iron or cast steel and shall be of a type to receive a machine bolt head or nut after installation.

- c. Wrought iron clamps or collars shall be used to support vertical runs of pipes.

**13. Unions**

Union pipe 50mmØ and smaller shall be malleable iron. Union on water piping 63mmØ and larger shall be flanged pattern and shall be of galvanized (zinc coated) cast iron. Gaskets for flange unions shall be of best quality fiber plastic or leather.

**14. Valves**

Valves shall be cast bronze or brass body. Chrome plated finish for all fixture taps and faucets and natural finish for all others, like hose bibbs, gate valves and which are not tapped directly to a plumbing fixture. Concrete valve boxes shall be installed where required and will be of sufficient size for operating the valve.

**15. Fixtures**

- a. Water Closets

All water closets for toilets as shown on the drawings shall be TANK TYPE, white with complete fittings and mounting accessories.

**b. Lavatories****b. 1. Lavatory (Wall Hung)**

Shall be vitreous china, wall hung lavatory with rear overflow holes, fitting ledge suitable for single faucet holes on centers complete with faucet, standard fittings, trap and lavatory brackets and other accessories.

**b. 2. Lavatory (Countertop Lavatory)**

Shall be vitreous china, oval or round shaped countertop lavatory with front overflow hole, complete with faucet, supply valve and fittings with P-trap. Fitting ledge suitable for single hole on center.

**c. Urinals**

c. 1. Urinals for all comfort buildings shall be built-in urinal trough as shown on the drawings.

c. 2. Urinals shall be vitreous china, wall-hung washout urinal, flushing rim, integral trap, 19mm top and shall be provided with water saving flush system.

**d. Service Sinks**

Service sinks where indicated or shown on the Drawings shall be stainless steel, with single bowl and with complete U.S. or Japan imported fittings.

**e. Slop Sinks**

Slop sink shall be concrete in ceramic tile finish with concealed hanger and faucet, as specified in plan.

Hose bibb shall be of brass finish.

**f. Soap Holder**

Soap holder and toilet paper holder shall be vitreous china, wall mounted. All toilet/bath rooms will be provided with soap holder, toilet paper holder and chrome plated towel racks.

**g. Faucet for lavatory**

Faucet for lavatory shall be in chrome-finish.

**h. Grab Bar**

Grab bar shall be tubular stainless steel, 50mmØ or as specified in the drawings.

**i. Bidet Spray Combination**

Installed in every cubicle near on the water closet, colored white or its equivalent

**16. Concrete, Reinforcing Steel, Pipe and Steel Plate**

Materials for wash pits, catch basins and manholes shall conform to the requirements as follows:

- a. Concrete materials shall conform with the requirements in "Concrete Works" and shall be Class C concrete with a 28-day minimum compressive strength of 21 MPa (3,000 psi).
- b. Reinforcing steel shall be as shown on the drawings and shall conform with the requirements of reinforcing steel bars in "Concrete Works."
- c. Pipes shall be as shown on the drawings and shall comply with the relevant item of the particular pipe.
- d. Steel plates shall be as shown on the Drawings and shall comply with Section "Steel and Metal Works".

**17. Non-reinforced Concrete Pipe**

Non-reinforced concrete pipe shall be as shown on the Drawings and shall conform with the requirements of non-reinforced concrete pipes AIC latest edition. Concrete shall be with a 28-day minimum compressive strength of 20.7 MPa.

**18. Valve for Drinking Fountain**

Valve where drinking fountain will be connected shall be polished brass pipe and shall have red enameled handle.

**EXECUTION**

All installation works shall be in conformity with the National Plumbing Code of the Philippines (NCP).

**EXCAVATION, TRENCHES AND BACKFILLING**

1. Trenches for all underground pipelines shall be excavated to the required depth. The bottom of trenches shall be tamped hard and graded to secure the required fill. Bell holes shall be excavated so that pipes will rest on solid ground for their entire length.

Rocks where encountered, shall be excavated to a depth of 150mm below the bottom of the pipe and before the pipe is laid, the space between the bottom of the pipe and the rock shall be filled with sand. Sewer and water pipes shall be laid in separate trenches.

2. After pipelines have been tested, inspected and approved by the Engineer and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris.

Materials for backfilling shall consist of acceptable excavated soil, borrow of sand, gravel or other materials approved by the Engineer and shall be free from trash, lumber or other debris. Backfilling shall be placed in horizontal layers not exceeding 150 mm in thickness and properly moistened to approximate optimum requirements. Each layer shall be compacted by hand or machine tamper or by other suitable equipment to a density that will prevent excessive settlement or shrinkage.

Backfilling shall be brought to a suitable elevation above grade to provide for anticipated settlement and shrinkage thereof.

Water pipes shall have a sand cushion 150mm below and above the pipes.

## **INSTALLATION OF SOIL, WASTE DRAINS OR VENT PIPES**

### **1. Horizontal Drainage Pipe and Vent Piping**

Horizontal waste pipes 75mmØ and smaller shall have a minimum grade of 6.5mm per 0.30m and for 100mmØ and larger, 3.2mm per 0.30m. All main vertical soil and waste stacks shall be extended full size above the roof line as vents, except where otherwise specifically shown.

Where practicable, two (2) or more vent pipes shall be connected together and extended as one pipe through the roof. Vent pipes in roof spaces shall be run as close as possible to the underside of roof with horizontal piping pitched to stacks using fittings as required without forming traps in pipes.

Vertical pipe vents may be connected to a vent line carrying other fixtures. The connection shall be at least 1.20m above the floor on which the fixtures are located to prevent the use of vent lines as waste. Horizontal waste lines receiving the discharge from two (2) or more fixtures shall be provided with vents, unless separate venting of fixtures is noted.

### **2. Fittings**

All changes in pipe sizes on soil waste lines shall be made with reducing fittings or recessed reducers. All changes in direction shall be made by the appropriate use of forty five (45) degree 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 water closets.

Where it becomes necessary to use short radius fittings in any location, the approval of the Engineer shall be obtained before they are installed.

### **3. Joints**

#### **a. PVC Soil Pipe**

All joints in uPVC soils, waste and vent pipe shall be accomplished by the use of PVC solvent cement.

b. All joints for uPVC shall be accomplished by applying the manufacturer's recommended solvent before connection to the pipe.

### **4. Cleanouts**

Cleanouts at the bottom of each soil stack, waste stack and where else indicated shall be the same size as the pipe.

Cleanouts on floors shall be by uPVC plug adapter fit into the hub and fitted with uPVC screw plugged flush with the floor.



Cleanout shall be provided at every change in direction greater than 45 degrees.

**5. Flashings**

All pipes passing through the roof shall be provided with lead flashings. All flashings shall be built to 40 lbs. bituminous felts and shall extend up to the pipe and down-over to top of pipe at least 150mm and along the roof not less than 300mm and shall lap over flashing to make a weatherproof joint.

**6. Traps**

Each fixture and piece of equipment requiring connections to the drainage system, except fixtures with continuous waste shall be equipped with a trap. Traps shall be specified to be supplied with the fixtures. Each trap shall be placed as near to the fixtures as possible. Traps installed on threaded pipes shall be recessed drainage pattern.

**7. Pipe Sleeves, Hangers and Supports**

Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through masonry or concrete except unframed floors on earth.

Pipes shall not be permitted to pass through footings or beams unless noted on the drawings.

Pipe sleeves in floors shall extend not less than 25mm and not more than 50mm above the finished floor. After installation of the pipe, the space around the pipe shall be packed with plastic material and made watertight. Flashing shields for sleeves passing through waterproofing membrane shall be thoroughly mopped into the membrane. The space between the pipe and sleeves shall be made watertight by inserting approved sealing and caulking materials.

**INSTALLATION OF WATER PIPES, FITTINGS AND CONNECTIONS**

**1. Gate Valves and Outlets**

Gate valves shall be installed close to the point of connection to the existing service line outside the building. The piping shall be extended to all fixture outlets and equipment from the gate valves. Outlets where indicated shall be capped or plugged and left ready for future connections.

**2. Mains, Branches and Runouts**

All runs of piping shall be installed as shown on the drawings. The piping shall be cut accurately to measurements, and installed at the building site by the Contractor and shall be worked into place without springing or forcing. Care shall be taken not to weaken the structural portions of the buildings.

All pipes above ground shall be run parallel with the lines of the building unless otherwise shown on the drawings. Branch pipes from service lines may be taken off on top of mains, bottom of mains or side of mains, using such cross over fittings as may be required by structural or installation conditions.

All service pipes, valves and fittings shall be kept at sufficient distance from the other work to permit finished covering not less than 6.5mm from such other work and not less than 13mm between finished covering on different services. No water piping shall be buried in floors unless specifically indicated on the drawings or approved. Changes in pipe sizes shall

be made with reducing fittings.

The use of long screws and bushings is prohibited.

### 3. Joints

Joints and connections in the plumbing system shall be gas-tight and watertight for the pressures required by test.

After cutting and before threading all pipes shall be reamed and shall have burrs removed. All screwed joints shall be applied with an approved graphite compound or TEFLON tape to facilitate connections. Threads shall be full cut and not more than three threads on the pipe shall remain exposed.

Caulking of threaded joints or top to prevent leaks shall not be permitted.

Unions shall be provided where required for disconnection. Threaded swing bolts shall be used for branch connections to risers and mains.

### 4. Unions

Where required unions shall not be concealed in walls, ceilings or partitions.

### 5. Tests

The following tests shall be conducted by the Contractor at his expense under the supervision of the Engineer.

#### a. Tests for Drainage and Venting System

The entire drainage and venting system shall have necessary openings plugged to permit the entire system to be filled with water to the level of the highest vent stack above the roof. The system shall hold the water for 30 minutes with a drop not greater than 100mm.

#### b. Sterilization

The entire water supply piping system shall be sterilized with a solution containing not less than fifty (50) parts per million of available chlorine, either liquid chlorine or a solution of sodium hypochlorite. The sterilizing solution shall remain in the system for a period of not less than 8 hours during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chloride content is not more than 0.2 parts per million.

#### c. Pressure Test for Water Lines

1. After the pipe have been installed, the joints completed and with joints exposed for examination, all newly installed pipe or any valve section, thereof, shall be subjected to hydrostatic pressure one and one half (1½) the designed working pressure of the system or as specified by the Engineer.

2. The duration of each pressure test shall be at least 20 minutes unless otherwise specified by the Engineer.
3. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. During the filling of the pipe and before applying the test pressure, all air shall be expelled from the pipeline. To accomplish this, tap shall be made if necessary, at the highest point of the pipe under test and after completion of the test, the taps shall be tightly plugged unless otherwise specified. During the test, all exposed pipes, fittings, valves, joint and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound materials at his expense. The test shall then be repeated until satisfactory results are obtained.

d. **Leakage Test for Water Lines**

1. Leakage test shall be conducted after satisfactory completion of the pressure test and shall consist of an examination of all exposed joints for leakage as well as an overall leakage test of the completed pipeline.
2. The pressure to be maintained during the test shall be the designed working pressure of the system.
3. Leakage test shall be made only after a minimum of 24 hours after the pipe to be tested has been filled with water.
4. The duration of each leakage test shall be two hours unless otherwise specified by the Engineer.
5. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation shall be applied by means of a positive displacement type pump and reservoir connected to the pipe in a manner satisfactory to the Engineer.
6. Before starting the leakage test, all air shall be expelled from the pipe. All exposed pipes, fittings, valves and joints shall be examined for leakage during the test.
7. Allowable leakage rate per 100 joints per inch of Pipe Diameter at Pressure Stipulated.

PRESSURE		LEAKAGE RATE	
psi	kg/cm <sup>2</sup>	liters/hr.	liters/2 hrs.
50	3.50	1.45	2.90
75	5.30	1.75	3.50
100	7.00	2.05	4.10
125	8.80	2.30	4.60
150	10.50	2.50	5.00
200	14.00	2.90	5.80

**e. Defective Work**

1. If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated until satisfactory to the Engineer.
2. All repairs to piping shall be made with new materials at the expense of the Contractor.
3. No caulking of screwed joints or holes will be accepted.

**ASSEMBLY, INSTALLATION AND CONNECTION OF FIXTURES**

Fixtures shall be supported and fastened in a satisfactory manner. Where secured to concrete or masonry work walls, fixtures and equipment shall be fastened with brass bolts or machine screws in lead-sleeve type anchorage units or with brass expansion bolts. Expansion bolts shall enter 7.5 cm into solid concrete or masonry works and shall be fitted with loose tubing or sleeves of proper length to bring expansion sleeves into the solid concrete masonry walls.

Where wood screws are used, screws shall go into solid pieces set between studs. Where through-bolts are used, bolts shall be provided with plates or washers at back set, so that they will be concealed by plaster. Bolts and nuts shall be hexagonal and exposed nuts, cap nuts, and screw heads shall be provided with chromium plated brass washers.

**PROTECTION OF FIXTURES**

Pipe openings shall be closed with caps or plugs during installation. Fixtures shall be tightly covered and protected against dirt, water and chemical injury. At the completion of all works, all fixtures shall be thoroughly cleaned and delivered in a condition satisfactory to the Engineer.

**FIXTURES AND FASTENING**

All fixtures shall be supported and fastened in a satisfactory manner as follows:

1. Where secured to concrete or concrete hollow block walls, they shall be fastened with one quarter inch brass bolts with twenty threads to the inch and of sufficient length to extend at least 7.5 cm into solid concrete or hollow block work, fitted with loose tubing or sleeve insert and shall be securely anchored and installed flush with the finished wall and shall be completely concealed when the fixtures are installed.
2. Where through-bolts are used, they shall be provided with plates or washers back set so that heads, nuts and washers will be concealed by plaster. Bolts and nuts shall be hexagonal. Exposed bolts, nuts, capnuts and screw heads shall be provided with chromium plated brass washers.

**GUARANTEE**

Upon completion and before final acceptance of the equipment installation, the Contractor shall furnish the Engineer a written guarantee stating that all equipment installed under this Section free from defects. The guarantee shall be for a period of one (1) year from the date of final acceptance of the work. Any part of the equipment that becomes defective during the term of the guarantee shall be replaced, renewed and/or made good by the Contractor, at his own expense and in a manner satisfactory to the Engineer.

Guarantees made by the approved manufacturers or suppliers beyond one year, shall be transferred to PPA without any expense on his part.

#### **CLEANING UP**

Upon completion of the work, all parts of the installation shall be thoroughly cleaned of grease, metal cuttings and sludge which may have accumulated during the testing operation.

#### **PLUMBING, FIXTURES AND TOILET ACCESSORIES INSTALLATION**

All installation works shall be as shown on the drawings and shall conform to the applicable standards set forth by the Philippine National Plumbing Code. All fixtures shall be fastened and/or supported in accordance with the given requirements.

**ITEM 23 : SUPPLY, DELIVER AND INSTALL OF STAINLESS STEEL WATER TANK, WATER PUMPS, AND PRESSURED TANK****GENERAL**

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

**SCOPE OF WORK**

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete supply of water tank, water pump and pressured tank for the building as indicated on the drawings and as specified herein.

**Water Tank/ Pressure Tank/ Water Pump****STAINLESS STORAGE TANK**

1. Design: Horizontal Cylindrical with B.I. Stand  
Capacity: 2,000 ltrs./ 526 gallons  
Diameter: 123 cm/ 48 inches  
Length: 191 cm/ 75 inches  
Height: 148 cm/ 58 inches  
Thickness: 0.6 mm  
S/S Grade: 304  
Fittings: 1" diameter (inlet/ outlet/ air vent/ drain)
2. Design: Horizontal Cylindrical with B.I. Stand and B.I. Exterior Ladder  
Capacity: 15,143 ltrs./ 4,000 gallons  
Diameter: 240 cm/ 87 inches  
Length: 443 cm/ 174 inches  
Height: 253 cm/ 99.5 inches  
Thickness: 1.2 mm  
S/S Grade: 304  
Fittings: 1" diameter (inlet/ outlet/ air vent/ drain)

**PRESSURE TANK**

1. Rated Size: 450 gallons  
Tank Volume: 119 gallons/ 450 liters  
Diameter: 66 cm.  
Height: 153 cm.  
Connectors: 1 ¼ inches  
Pressure: 125 psi

**WATER PUMP**

1. Power: 2.0 hp.  
Capacity: 80 lpm @ 30 meters tdh  
Pipe: 1 inch suction/ 1 inch discharge  
Specs: 220 volts, 60 HZ, 3500 RPM

**EXECUTION**

All materials will be delivered and installed on site.

**ITEM 24 : ELECTRICAL GENERAL REQUIREMENTS****GENERAL****APPLICATION**

This section applies to all sections of "Electrical Division" of this project except as specified otherwise in each individual section.

**WORK INCLUDED**

The work to be done under this division shall include the furnishing of all tools, labor, supervision, equipment, fixtures and all necessary materials, each complete and in proper working condition unless one or other is specifically excluded or stated otherwise in this specifications but not limited to the following items of works.

- a. All works and material for a complete lighting and power systems including cables and conduits, circuit breakers, panel board and connection to all lighting fixtures and power outlets, motor appliances, switches, supports and accessories.
- b. All excavation works, backfilling, dewatering, removal of surplus earth, preparation of formworks and pouring of concrete envelopes as indicated on the drawings or as required to complete the installation.
- c. All steel support for conduits, wires, panel board, boxes, lighting fixtures, etc. as indicated or as required to complete the installation.
- d. A complete grounding system as required by the governing codes.
- e. A complete testing of all electrical systems.
- f. All items incidentals to and or required for the proper completion such as painting of boxes, conduits and the likes.
- g. Coordination with other trade Contractors.
- h. Coordination with other companies/offices including handling of all materials related to material testing and application of electrical permits.
- i. Preparation of necessary shop drawings required for the proper execution of the works subject to the approval of the Engineer.

**WORK INCLUDED UNDER ELECTRICAL WORKS**

The work includes the furnishing of the following:

1. Supply, deliver and install of all motors, pumps and their associated control equipment.
  - a. All electrical system installation consists of motor and branch circuit breakers.
  - b. All motor controllers as indicated to be supplied with equipment.
  - c. Structural foundation of the above.

## SUBMITTALS

Obtain approval before procurement, fabrication or delivery of items to the job site. Partial submittals will not be entertained and will be returned without review. Submittals shall include the manufacturer's name, trade name, place of manufacturer, catalogue model of number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference and technical society publication references, and other information necessary to establish contract compliance of each item to be furnished.

### 1. Shop Drawings

In addition to the requirements of the contract clauses, shop drawings shall meet the following requirements:

- a. Drawings shall be a minimum of 210 mm x 297 mm in size or in A3 size, except as specified otherwise.
- b. Drawings shall include wiring diagrams and installation details indicating the proposed location layout and arrangement, control panels, accessories, and other items that must be shown to assure a coordinated installation.
- c. Wiring diagrams shall identify circuit termination and the internal wiring for each item of equipment and its interconnection.
- d. Drawings shall indicate adequate clearances for operation, maintenance and replacement of equipment devices. If the layout is disapproved, revise the layout and resubmit.

### 2. Manufacturer's Data

Submittal for each manufactured item shall be current descriptive literature of catalogued products.

### 3. Publication Compliance

Where equipment or materials are specified to conform to industry and technical society publications of organizations such as American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM) and Underwriters Laboratories, Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In each of the publications referred to herein, consider the advisory provisions to be mandatory as though the word "shall" had been substituted for "should" wherever it appears. Interpret reference in these publications to the authority having jurisdiction, or words of similar meaning, to mean the Engineer. In lieu of the label or testing, submit a certificate from an approved independent testing organization, adequately equipped and component to perform such services, organization's test methods and not the item conforms to the specified organizations publications. The edition or the revised version of such codes and standards current at the date twenty eight (28) days prior to date of bid submission shall apply. During Contract execution, any changes in such codes and standards shall be applied after approval by the Owner.

## CERTIFICATES OF COMPLIANCE

Submit manufacturer's certifications as required on products, materials, finish and equipment indicated in the Technical Sections. Certifications shall be documents prepared specially for the contract. Pre-printed certifications and copies of previously submitted documents are not acceptable. The manufacturer's certification shall name the appropriate products, equipment or materials and the publication specified as controlling the quality of the item. Certification shall not contain statement to imply that the item does not meet requirements specified such as "Good As", "Achieves the same end use and results as materials formulated in accordance with referenced



publications" or "Equal or exceeds the service and performance of the specified materials". Certifications shall simply state that the item conforms to the requirements specified; and shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official, authorized to sign certificates of compliance.

## **OPERATION AND MAINTENANCE MANUALS**

Submit as required for systems and equipment indicated in the Technical Sections. Furnish three (3) copies, bound in hardback binders or an approved equivalent. Furnish one complete manual prior to performance of system or equipment tests, and furnish the remaining manual prior to contract completion. Inscribe the following identification on the cover: the word "Operation and Maintenance Manual", the name and location of the system equipment, building, name of Contractor and contract number. Include in the manual the names, addresses and telephone numbers of each sub-Contractor installing the system or equivalent and the local representatives for the system or equipment. Include a table of contents and assemble the manual to conform to the table of contents with the tab sheets placed before instruction covering the subject. The instructions shall be legible and easily read with large sheets of drawings folded in the manual shall include the following:

- a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the system or equipment.
- b. A control sequence describing start-up, operation and shut-down.
- c. Description of the function of each principal item of equipment.
- d. Installation and maintenance manual.
- e. Safety precaution
- f. Diagrams and illustrations
- g. Testing methods
- h. Performance data
- i. Lubrication schedule including type, grade, temperature range and frequency

List qualified permanent servicing organization for support of the equipment, including addresses and certified qualifications.

## **POSTED OPERATING INSTRUCTIONS**

Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include diagrams, control diagrams and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Attach or post the operating instructions adjacent to each principal system and equipment including start-up, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction recommended by the manufacturer of each system for operating instruction exposed to the weather. Operating instructions shall not fade when exposed to the weather and shall be secured to prevent easy removal or peeling.

## **INSTRUCTIONS TO PERSONNEL**

Where indicated in the technical sections, furnish the services of competent instructors to give full instructions to personnel in the adjustment, operation and maintenance of systems and equipment,

including safety precautionary measures. Each Contractor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work, instructions shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Engineer for regular operation. The number of man-days (8 hours) of instruction shall be as specified in each individual section.

#### **DELIVERY AND STORAGE**

Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations and with the requirements of NFPA 70B, Appendix 1, titled "Equipment Storage and Maintenance during Construction". Replace damaged or defective items with new one.

#### **CATALOGUE PRODUCTS/SERVICE AVAILABILITY**

Materials and equipment shall be current products by manufacturers regularly engaged in the production of such products. Products shall have been in satisfactory commercial or industrial use for two (2) years prior to bid opening. The two (2) year period shall include applications of equipment and materials under similar circumstances and of similar size. The two (2) year period shall be satisfactory completed by a manufacturer's catalogue or brochures. Products having less than two (2) year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturer's factory or laboratory tests is furnished. The equipment items shall be supported by service organization, which are reasonable convenient to the equipment on a regular and emergency basis during the warranty period of the contract.

#### **MANUFACTURER'S RECOMMENDATIONS**

Where installation procedures or any parts thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendation prior to installation. Installation of the items shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

#### **MATERIALS/SUBSTITUTION/TESTS**

All materials to be installed shall be brand new and shall conform to specifications except as otherwise noted on the drawings. All materials where not specified shall be of the best of their respective kind. Samples of said material including its manufacturer's data shall be submitted for approval. Necessary tests on the installations shall be made by the Contractor in the presence of the Engineer. These tests shall include but not limited to ground test, performance test, phase sequence test, etc. Records of approved tests result shall be relayed to the Engineer in writing. This Contractor shall within ten (10) days after the award of the contract, submit a list of materials he proposes to use. All materials installed without prior approval shall be at the risk of the Contractor.

#### **COORDINATION/GUARANTEES/SUSPENSION OR DELAY**

The Contractor shall be familiar with the specifications of the other trades and coordinate with them thoroughly so that he can arrange his work and dispose his materials without interfering the work of other Contractors. The Contractor shall guarantee that the electrical systems shall be free from all defects of workmanship and of materials, and that it will remain so for a period of one year from the date of acceptance by the Engineer. Any remedy to correct defects deemed to be caused by such shall be made at the expense of the Contractor. The Contractor shall not suspend or delay the work without justifiable cause. Subsequent delays shall be deemed as a sufficient cause for penalties or termination of contract in which the Engineer shall have the right to take-over the work and all materials on the site and make arrangements necessary to complete the work. It shall be the sole responsibility of the Contractor to ensure that the Electrical sub-contractor conducts coordination of his activities to other trades.

## **SLEEVES / INSERTS / CUTTING / PATCHING/BACKFILL**

The Contractor shall provide all openings, sleeves, also inserts in walls, floors, and beams as required for his work. All unused openings shall be grouted in. The Contractor shall do all patching requirements necessary and these shall be done so as to exactly match the surrounding area without the evidence of alteration or patching. The Contractor shall provide all necessary backfill on all excavation works of his doing.

## **TEMPORARY LIGHT AND POWER**

The Contractor shall make all arrangements and pay for the provisions of the necessary electrical power of the type and capacity required for the performance of the work of all trades engaged in the construction of the building.

## **CODES, INSPECTION, PERMITS AND FEES**

The work under this contract is to be installed according to the requirements of the latest edition of the Philippine Electrical Code, the rules and regulations of the local authorities of Southern Leyte Electric Cooperative (SOLECO).

All necessary permits and electrical fees required for this work shall be obtained by and at the expense of the Contractor. The contractor shall furnish the Engineers and the Owner final certificate of electrical inspection and approval from the proper government authorities after completion of the work. The Contractor shall prepare all as-built and all forms and documents required by the approving authorities.

Power service application including drawings for the work shall be obtained by and at the expense of the Contractor. The Contractor shall comply with all requirements of the utility company regarding service applications.

## **ELECTRICAL CHARACTERISTICS**

The electrical characteristics for this project shall be 230v, 3-wire, 3Ø, 60Hz or as per system requirements as shown in the plans.

## **MATERIAL REQUIREMENTS**

### **NAMEPLATES**

Provide laminated plastic nameplates for each panel board, equipment enclosure, relay, switch, and device. Each nameplate inscription shall identify the function and when applicable, the position. Nameplate shall be melamine plastic, 3.2mm thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the black core. Minimum size of nameplates shall be 25mm x 38mm. Lettering shall be a minimum of 6mm, high normal block style.

## **EXECUTION**

### **NAMEPLATE MOUNTING**

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet metal screws or two rivets.

### **PAINTING OF EQUIPMENT**

#### **1. Factory Applied**

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test, except equipment specified to meet requirements of ANSI C37.20 shall have a finish as specified in ANSI C37.30.

#### **2. Field Applied**

Paint electrical equipment as required to match finish or to meet safety criteria.

**ITEM 25a : INTERIOR WIRING SYSTEMS****GENERAL**

"Electrical General Requirements," applies to this section with additions and modifications specified herein.

**SUBMITTALS****1. Shop Drawings****a. Panel board****2. Manufacturer's data****a. Circuit breakers****b. Switches****c. Conduit and fittings (each type)****d. Ground rods****e. Device plates****f. Insulated conductors****g. Outlet and junction boxes****3. Test Reports: Submit test results for approval in report form.****a. 600Volt - wiring test****b. grounding system test****4. Quality Assurance**

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears. Interpret reference in these standards to "authority having jurisdiction," or words of similar meaning, to mean Engineer.

**MATERIALS AND EQUIPMENT REQUIREMENTS**

Materials, equipment, and devices shall, as minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70. All items shall be new.

**CONDUIT AND FITTINGS****1. Rigid Steel Conduit (RSC): Hot dip galvanized: ANSI C80.1.****2. Flexible Metal Conduit: UL 1.****a. Liquid Tight Flexible Metal Conduit (Steel): UL 360.****3. Rigid Plastic Conduit: PVC schedule 40 in accordance with UL 651.**

**4. Fittings for Metal Conduit, and Flexible Metal Conduit: UL 514B.**

Ferrous fittings shall be hot dip galvanized in accordance with UL 514.

a. Fittings for RSC: Shall be threaded-type. Split couplings are not acceptable.

b. Fittings for Rigid Non-metallic Conduit: NEMA TC3.

**OUTLET BOXES AND COVERS**

UL 514, hot dip galvanized for ferrous metal.

**CABINETS, JUNCTION BOXES, AND PULL BOXES (WITH VOLUME GREATER THAN 100 CUBIC INCHES) UL 50, hot dip.**

**WIRES AND CABLES**

Wires and cables shall meet applicable requirements of PEC, NFPA 70 and UL for types of insulation, jackets, and conductors specified or indicated. Wires and cables manufactured more than 6 months prior to date of delivery to site shall not be used.

**1. Conductors:** Conductor  $3.5\text{mm}^2$  and smaller shall be solid,  $5.5\text{mm}^2$  and larger shall be stranded. All conductors indicated shall be copper.

a. Equipment Manufacturer Requirements:

If manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

b. Minimum Conductor Sizes:

Minimum size for branch circuits shall be  $3.5\text{ mm}^2$

**2. Color Coding**

For 230 volt, 3-phase (3Ø), 3- wire, 60 hertz

Phase A - Black

Phase B - Red

Phase C - Green

**3. Insulation:**

Unless specified for indicated otherwise or required by PEC and NFPA 70, power and lighting wires shall be 600volt, Type THHN / THWN.

**4. Bonding Conductors:**

ASTM B1, solid bare copper wire for sizes  $8.0\text{ mm}^2$  and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes  $14\text{ mm}^2$  and larger diameter.

**DEVICE PLATES**

Provide UL listed, one-piece device plates for outlets and fittings to suit the devices installed. For metal outlets and fittings, plates on unfinished walls and on fittings shall be of zinc-

coated sheet steel or cast metal having round or bevelled edges. Plates on finished walls shall be urea or phenolic, minimum 2.5mm wall thickness. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine type with countersunk heads in a color to match the finish of the plate. Use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

## SWITCHES

### 1. Switches

Totally enclosed with bodies of thermosetting plastic and mounting strap. Wiring terminals shall be screw-type, side-wired. Switches shall be rated quiet-type AC only, 250 volts, with current rating and number of poles indicated.

#### WALL SWITCHES AND PLATES

Wall switches in general shall be rated 10 amperes at 230 volts or with ampere and voltage ratings as required. Switches shall be flush mounting and of the rocker type, spring operated. The type of switches shall be tumbler operation and the color, plating and appearance of wall plates shall be as selected by the Engineer. Appropriate samples shall be submitted prior to purchase of wall switches and face plates.

### 2. Receptacles

UL 498 and NEMA WD 1, heavy duty, grounding type. Ratings and configurations shall be as indicated. Wiring terminals shall be screw type, side-wired. Connect grounding pole to mounting strap.

#### WALL RECEPTACLE AND PLATES

- a. Receptacle outlets shall be 15 ampere, 230 volts, 2 pole, 3 wire parallel slot, grounding type. Parallel slot outlet rated 15 amps, 125v grounded type shall be acceptable for use with 230v system. Locking type and other special purpose outlets shall be as indicated in the plans.
- b. Provide weatherproof receptacle plate cover for each convenience receptacle outlet indicated as weatherproof.

#### SPECIAL PURPOSE RECEPTACLES:

Receptacles serving as indicated are special purpose. Provide ratings as indicated. Furnish one matching plug with each receptacle.

## PANEL BOARD

UL 67 and UL 50. Panel board for use as service disconnecting means shall additionally conform to UL 869. Panel board shall be circuit breaker equipped unless indicated. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. Where "space only" is indicated, make provisions for the future installation of a breaker sized as indicated. Panel board locks shall be keyed same. Directories shall be typed to indicate load served by each circuit and mounted in a holder behind transparent protective covering.

## 1. Panel board Buses

All buses shall be copper support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide a separate ground bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

## 2. Circuit Breakers (Bolt-On)

Ambient-compensated thermal magnetic-type solid state-type with interrupting capacity of 10,000 amperes symmetrical minimum. Breaker terminals shall be UL listed as suitable for the type of conductor provided. Plug-in circuit breakers are unacceptable.

### a. Multi-Pole Breakers

Provide common trip-type multi-pole breakers with single operating handle. Breaker design shall be such that an overload in one pole automatically causes all poles to open.

## ENCLOSED CIRCUIT BREAKERS

UL 489. Individual moulded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit interrupting rating as indicated. Enclosure type as indicated.

## GROUNDING AND BONDING EQUIPMENT

UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 20mm and minimum length of 3 meters.

## NAMEPLATES

Provide as specified in "Electrical General Requirements."

## EXECUTION

### INSTALLATION

Electrical installation shall conform to requirements of PEC, NFPA 70 and to requirements specified herein.

## 1. Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

## 2. Wiring Methods

Provide insulated conductors installed in conduits, except where specifically indicated or specified otherwise or required by PEC and NFPA 70 to be installed otherwise. Provide insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Provide insulated, grounding conductors installed in conduits or raceways.

- a. Service Entrance Conduit: Rigid Steel Conduit (RSC), conduit underground: PVC schedule 40. The underground portion shall be encased as indicated.



- b. Underground Conduit (other than service entrance) PVC where non-metallic conduit is used, shall be converted to plastic – coated rigid steel conduit before rising through floor slab; plastic coating shall extended at least 152mm above floor.

### 3. Conduit Installation:

Unless indicated otherwise, conceal conduit within finished walls, ceilings, and floors. Keep conduit a minimum of 150mm away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits in crawl space under slab as if exposed.

- a. Where conduits rise through floor slabs, curved portion of bends shall not be visible above finish slab.

#### b. Conduit Support:

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded studs, or spring tension clamps on steelwork. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceilings shall be vibration resistant and shock resistant. Holes cut to depth of more than 40mm in reinforced concrete beams or to depth of more than 20mm in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations.

- c. Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of all obstructions.

- d. Install pull wires in empty conduits in which wire is to be installed by others. Pull wire shall be plastic having minimum 91 kgs tensile strength. Leave minimum 300mm of slack at each end of pull wire.

#### e. Conduit Installed in Concrete Floor Slabs

Locate so as not to adversely affect the structural strength of the slabs. Install conduit within middle one-third of the concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters except at cabinet locations. Curved portions of bends shall not be visible above the finish slab. Increase slab thickness as necessary to provide minimum 25mm cover over conduits. Where embedded conduits cross expansion joints, provide suitable watertight expansion fittings and bonding jumpers. Conduit larger than 25mm trade size shall be parallel with or at right angles to main reinforcement; when at right angles to the reinforcements, the conduit shall be closed to one of the supports of the slab.

- f. Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by PEC and NFPA 70, where insulated bushings are used, and where bushing cannot be brought into firm contact with the box; otherwise, use minimum single locknut and

bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by PEC and NFPA 70.

**g. Flexible Connection**

Provide flexible connection of short length, 1.8 meters maximum for recessed and semi-recessed lighting fixtures.

**4. Boxes, Outlets, and Supports:**

Provide boxes in wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when installed exposed up to 2.1 meters above interior floors and walkways, or when installed in hazardous areas. Boxes in other locations shall be sheet steel, except that aluminium boxes may be used with aluminum conduit. Each box shall have the volume required by PEC and NFPA 70 for the number of conductors enclosed in the box. Boxes for mounting lighting fixtures shall not be less than 100 mm<sup>2</sup> or octagonal, except that smaller boxes may be installed as required for fixture configurations as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature. Fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports, or make adequate provisions for distributing load over ceiling support members. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved type fastener maximum 600mm from the box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

- a. Boxes for use with raceway systems shall be minimum 40mm deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 100mm<sup>2</sup>, except that 100 by 50mm boxes may be used where only one raceway enters outlet.

**b. Pull Boxes:**

Construct of at least minimum size required by PEC and NFPA 70 of code-gauge aluminum sheet steel except where cast-metal boxes are required in locations specified herein. Furnish boxes with screw-fastened covers. Where several feeders pass through common pull box, tag the feeders to indicate clearly the electrical characteristics, circuit number, and panel designation.

**5. Mounting Heights**

Mount panelboards, and circuit breakers, so height of operating handle at its highest position is maximum 1.8 meters above floor. Mount lighting switches 1.4 meters above

finished floor, receptacles 300mm above finished floor and other devices. Measure mounting heights of wiring devices and outlets to center of device or outlet.

#### 6. Conductor Identification

Provide conductor identification within each enclosure where a tap, splice, or termination is made.

#### 7. Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Plates shall be installed with an alignment tolerance of 3mm. Use of sectional-type device plates are not permitted. Plates installed in wet locations shall be gasketed.

#### 8. Electrical Penetrations

Openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings shall be sealed to maintain fire resistive integrity as tested per ASTM E 814.

#### 9. Grounding and Bonding

In accordance with PEC and NFPA 70. Ground all exposed, noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and non-metallic raceways, and conductor of wiring systems. Make ground connection to driven ground rods on exterior of building. Where ground fault protection is employed, ensure that connection of ground does not interfere with correct operation of fault protection.

##### a. Grounding Conductor:

Provide insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated, green conductor for grounding conductors installed in conduit or raceways.

##### b. Resistance:

Maximum resistance-to-ground of grounding system shall not exceed 25 ohms; contact the Engineer for further instructions.

#### FIELD QUALITY CONTROL:

Furnish test equipment and personnel and submit written copies of test results. Give the Engineer five (5) working days notice prior to each test.

##### 1. Devices Subject to Manual Operation:

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.