

ITEM 10M : ROOFING AND TINSMITHRY

SCOPE OF WORK

The work shall include but not limited to all labor, materials, tools, equipment and incidentals necessary to furnish and install the roofing sheets including fittings, flashing caps, ridge rolls, gutters and construction of concrete eaves and canopy excluding waterproofing, to provide completely sound water tight roof for the buildings as shown on the Drawings and specified herein.

MATERIAL REQUIREMENTS

ROOFING SHEETS

Roof Panel, Long span, pre-painted, pre-insulated roof panel system, composed of an exterior metal skin cladding using "snap on side overlap" fastening system and an interior liner cladding of either metal skin or aluminum kraft vapor barrier sandwiched between is, PIR "Polyisocyanurate" foam to provide a high level thermal insulation.

Base Metal thickness :	From 0.40 mm to 0.60mm (standard) a specific tonnage is required for non-standard thickness
Effective Coverage :	1000 mm
Rib Height :	33 mm
Rib Spacing :	250 mm
Length :	up to transportable length (long span), minimum chance of leaks
Material Finish :	Colorlume , Galvalume , PVDF Aluminum and Stainless
Insulation Thickness :	25mm thk
Insulation Materials :	Polyisocyanurate (PIR) / Polyurethane (PU)

EXECUTION

ROOFING SHEETS

1. Roof, Long span

Spacing of purlins is safe at 1.0m to 1.2m.

At least 28 days before laying of roofing sheet starts, the Contractor shall submit for approval of the Project-In-Charged, shop drawings indicating materials and method of installation. No roofing sheets laying work shall commence without the Project-In-Charged approval of the shop drawings and work method.

Laying shall start from the end opposite the side from where the prevailing monsoon is coming from. The first sheet shall be laid and installed with the turned-down edge towards the outside of the area to be covered. The next sheet shall be overlapped to the previous sheet in such a manner that the exposed edge is turned down, and the covered edge

is turned up. The overlapped edge in the side shall be with the rib having the anti-capillary groove. End and side laps including flashing shall be as approved by Project-In-Charged.

The straps shall be fixed and fastened with the fastener and washer as shown on the Drawings.

CONCRETE EAVES AND CANOPY

Construction of concrete eaves and canopy shall be in accordance with Reinforced Concrete as shown on the Drawings and as directed by Project-In-Charged.

Waterproofing shall be in accordance with "Concrete Waterproofing".

HANDLING AND STORAGE

Sheets shall be lifted directly and shall not be dragged over the other sheets or over rough surfaces.

When working on a roof, the workers should wear flat rubber-soled shoes.

Tools should be handled carefully to prevent them from sliding over the coated surface.

When installation work is completed, all metal off-cuts, used nails and other metallic scrap shall be removed from roof area.

When using drills, hacksaws, or files in the roof area, care shall be taken that metal particles and fillings are swept off the roof immediately.

If not required for immediate use, sheets or bundles shall be staked and clear off the ground. If left in the open, sheets shall be protected by loose tarpaulin or similar covers.

Bundles shall not be left exposed to the weather.

CONCRETE EAVES AND CANOPY MATERIALS

Concrete materials shall comply with the requirements in Concrete Works.

Reinforcing Steel bars shall likewise conform with the requirements in Concrete Works.

C CHANNEL

Aluminum C-channel is often referred to as architectural angle and channel. Aluminum C-channel has uses in many industries and is often an ideal choice due to its non-corrosive properties and structural strength. Aluminum C-channel is considerably less expensive than wood, is lighter in weight, insect resistant, and resists warping and cracking from water damage.

C-sections

Height: 100, 120, 150, 200, 250, 300 mm

Thickness: 1.0–3.0 mm

Minimum length 1600 mm

Maximum length 18000 mm

ITEM 10N : 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 waters

Pesticides - 1: 100 concentrations

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 stirring thoroughly. 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 pesticides shall be applied by or under the direct supervision of a certified pesticide applicator.

ENVIRONMENTAL AND SAFETY CONDITIONS

Formulation, treatment, storage and disposal of pesticides 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 solutions 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 meters. 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 samples 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 surroundings 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 100 : 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 Architect. Notify the Architect for any changes, clarifications and discrepancies.

For the room I.D. full size lettering layout and installation method shall be submitted to the Architect for approval before start of work.

MATERIAL REQUIREMENTS

1. PPA LOGO

- Hot dipped cut out 4.5 mm thick Metal sheet screwed at the back.
- 12.5mm thick Colored Acrylic Plastic Sheet for PPA Logo
- 1mm thick Acrylic Painted G.I. Metal Sheet Free Standing Lettering

2. 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, flash to the backwall surface.

ITEM 10P : CURTAIN GLASS WALL SYSTEM**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 item shall consist of furnishing all Low-e laminated glass aluminum curtain glass wall materials, labor, tools and equipment required in undertaking the proper installation and completion as shown on the Plans and in accordance with these specifications.

MATERIAL REQUIREMENTS**A. Aluminum**

1. Frames and panel members shall be fabricated from extruded aluminum sections true to details with clean, straight, sharply defined profiles and free from defects impairing strength, durability and appearance.
2. Extruded aluminum sections shall conform to the specification requirements of ASTM B-211.
3. Screws, nuts, washers, bolts, rivets, and other miscellaneous fastening devices shall be made of non-corrosive materials such as aluminum and stainless steel.
4. Hardware for fixing and locking devices shall be closely matched to aluminum section and adaptable to the type and method of opening.

B. Glass and Glazing

1. Low-e glass stands for low emissivity glass. One side of the glass has a special metal coating, known as low emissivity coating. Low-e glass is a type of insulating glass which increases the energy efficiency of the windows by reducing the transfer of heat or cold through the glass
2. All glass and glazing materials shall be delivered at jobsite with labels affixed indicating quality, make, type and thickness. Each glass in glazed position shall resist a design pressure of 244 kilograms per square meter.
3. Glazing materials for glass installation may be:
 - a. Bulk compound such as mastic that are elastic and non-skinning compound.
 - b. Putties – wood sash putty or metal sash quality.
 - c. Sealant – shall be chemically compatible with setting blocks, edge blocks and sealing tapes.
4. Setting and Edge Blocks shall be made of lead or neo-prene, chemically compatible with sealant.
5. Accessories like glazing clips, shims, spacer strips etc. shall be made from non-corroding metal accessories.

SPECIFICATIONS

GLASS WALL

- Supply and Installation of Aluminum Curtain Wall System with 16 mm thick Low-e Laminated Glass in Color Gray Tint or any approved equivalent.
- Low-e glass stands for low emissivity glass. One side of the glass has a special metal coating, known as low emissivity coating. Low-e glass is a type of insulating glass which increases the energy efficiency of the windows by reducing the transfer of heat or cold through the glass

CONSTRUCTION REQUIREMENTS

1. Safety precautions and procedure shall be observed in determining the sizes and in providing the required clearances by measuring the actual opening to receive the glass.
2. Movable items or parts shall be kept in a closed and locked position until after the glazing compound has thoroughly set.
3. All glass sheets shall be bedded, back puttied, secured in place and face puttied. Secure glass in aluminum frame with non-corrosive clips except where glazing beads are required.
4. Apply putty in a uniformly straight lines, with accurately formed bevels and clean cut corners, then remove excess putty from glass and frames.
5. Set glass in hollow metal doors and in metal frames of interior partitions in felt channels insets or bedded in putty to prevent any rattle.
 - a. Secure glass in wood doors and wooden frames with glazing stops.
 - b. Secure stops on doors with screws.
6. Glass breakage caused in executing the work or by faulty installation shall be replaced by the Contractor without extra cost.
7. Improperly installed glass which does not fully meet the requirements of its grade, will not be accepted and shall be replaced without extra cost.

A. Workmanship

1. All glass shall be accurately cut to fit openings and set with equal bearing on the entire width of plane.
2. Putty shall be neatly run in straight lines parallel with inside of glazing rebate.
3. Corners shall be carefully made. All excess putty shall be removed and surfaces left clean.
4. Apply a thin layer of putty to rebate and set glass. Apply putty by pressing into an even bed secured.
5. Place spring wire or angle glazing clips and run face putty. Remove excess putty from other side flush with edge of rebate.

B. Cleaning

Clean all glass on both sides after putty has been applied completely. Do not disturb edge of putty with scraper. At completion of work leave glass and glazing works free from cracks and rattles and clean on both sides.

SUBMITTAL

1. Manufacturer's technical data for products and processed used in curtain wall system.
2. Shop Drawings showing details of fabrication and installation for curtain wall system required including plans, elevations, and sections, profiles of mullion frames, fittings, connections, and anchors.

QUALITY ASSURANCE

1. Fabricator/installer to be accepted by the manufacturer.
2. Fabricator/installer to have work similar in scope and size to this project.
3. Take field measurements prior to completion of shop fabrication. Coordinate fabrication schedule with construction progress to avoid delay of work. Field fabrication should be allowed to ensure proper fit and keep it to minimum with majority of fabrication being done under controlled shop conditions.
4. The Glass Curtain Wall Contractor, shall coordinate with the "Sakayan Festival" Theme Contractor/ Supplier and with the Project- In - Charged prior to the execution of the design for the proper installation and completion of the system.

PREPARATION

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work. Notify consultant thru writing of conditions unfavorable to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

EXECUTION

Installation

Installation of Curtain wall system shall be in accordance with approved shop drawings and manufacturer's installation and directions.

ITEM 10Q : SUPPLY AND INSTALL OF PHOTOLUMINESCENT SIGNS AND MARKINGS

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 photoluminescent signs and markers for the buildings as indicated on the drawings and as specified herein.

PHOTOLUMINESCENT SIGNS AND PATH MARKERS

Signs and markers are designed to be used in and about buildings to identify and ensure visibility escape routes for compliance with the performance based on Codes (Building & Fire Codes). The signs will be clearly visible and readily understandable under all conditions of foreseeable use, including emergency conditions.

SUBMITTAL

1. Shop drawings 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 Project-In - Charged for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without approval.

MATERIALS

Pictogram (290mm X 162mm) /(420mm X 230mm)
 Bracket: Ceiling Mount (420mm X 230mm)
 Bracket: Flag Mount (230mm X 133mm)
 Double Sided Pictogram Directional (420mm X 230mm)
 Pictogram W/ Protective Clear coat(420mm X 230mm)
 Evacuation Map
 Path Marker
 Guidance Strip
 Handrail Strip
 Step Nosing - 75.2mm x 33.2mm - 3060mm, loose insert for hidden fixers.

EXECUTION

For versatility the signs and markers can be installed using fixers (screws) or adhesive tape.

The installation method used should be determined by the condition of installation surface screws should be used if there is any doubt about adhesion.

ITEM 11 : 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. Slope Sinks

Slop sink shall be 24"x20" acid resisting enamel on Cast-Iron with concealed hanger and faucet.

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. Bath and shower fitting

Bath and shower fitting shall be chrome-finish.

i. Towel Rail

Towel rail shall be tubular stainless steel, 2.7mmØ, and 0.54m long or as specified in the drawings.

j. Curtain rod

Curtain rod shall be tubular stainless steel, 19mmØ or as specified in the drawings.

k. Grab Bar

Grab bar shall be tubular stainless steel, 25mmØ or as specified in the drawings.

l. 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 (NPCP).

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 at 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 ($1\frac{1}{2}$) 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 ²	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 12: SEWAGE WASTEWATER TREATMENT FACILITY**GENERAL**

Supply and installation of full sewage treatment facility (STP) including pipings, pumps, and equipment applies to this section with all parts and scope of work specified herein.

SCOPE OF WORK

The Contractor shall furnish, install and place in operating condition a sewage wastewater treatment facility capable of treating up to 200 cubic meters per day. Scope of work includes the installation of all components of the system including all pipings (approximately 340m), lift pumps, blowers, regulating tanks, and a fully enclosed carbon steel container compact sewage treatment equipment and electrical works for the pumps tapped to the existing facility or to the designated tapping point.

Contractor shall provide concrete foundation (slab) 300mm thick at the bottom of regulating tank as well as 300mm thick concrete foundation below the STP tanks and above the regulating tanks (see detail).

Aside from equipment supply and commissioning, Contractor shall also provide a full monthly maintenance service plan to clean, maintain, and offer full warranties (parts and effluent quality) to the service equipment for a minimum of one (1) year and renewable yearly thereafter.

Total surface area space to be used above ground (STP only) shall be no more than 13.5m x 5.5m (L x W).

TYPE OF SYSTEM

The STP shall be utilizing biological conventional activated sludge (CAS) plus Membrane Bio-Reactor (MBR) technology in order to fully treat all the sewage water from toilets and kitchen of the Passenger Terminal Building (PTB). The PTB shall treat the sewage water as to meet the new DENR DAO 2016-08 effluent standards.

No.	Parameters	unit	Effluent Limits (Class B Levels)
1	Ammonia as NH ₃ -N	mg/L	0.5
2	BOD	mg/L	30
3	COD	mg/L	60
4	Color	TCU	100
5	Nitrate as NO ₃ -N	mg/L	14
6	pH (Range)	-	6.0-9.0
7	Phosphate	mg/L	1
8	Surfactants (MBAS)	mg/L	3
9	Temperature	°C change	3
10	Total Suspended Solids	mg/L	85
11	Oil & Grease	mg/L	5
12	Fecal Coliforms	MPN/100mL	200

SYSTEM OPERATION

Sewage treatment facility shall be modular and made from compact carbon steel containers package modules with separate steel regulating tanks. The system shall be a complete sewage

treatment plant which includes anaerobic, aerobic, membrane bioreactor (MBR) ultrafiltration, sludge, and clean water tanks, as well as circulation pipings and a control room.

Lifting pumps shall be placed in the two septic tanks installed with a powerful pump sufficient to transport the sewage water from the two (2) septic tanks going to the sewage treatment facility approximately two hundred thirty (230) meters away from the farthest septic tank. The distance between the 2 septic tanks is around sixty-nine (69) meters while the nearest septic tank to the proposed wastewater treatment facility is one hundred sixty-one (161) meters.

The sewage water will then enter the regulating tanks to be placed underground below the above ground STP equipment. Float switches will indicate when the regulating tanks are full and lifting pumps will then pump the sewage water from the regulating tanks into the above ground STP where it will go through the treatment processes of nitrification/denitrification via the biological treatment components (CAS) using air blowers and an air distribution system. It will then be treated using the membrane bio-reactor tanks (MBR) in the ultra-filtration range to filter out suspended solids, colloidal material, sewage microbes, and bacteria. Circulating reflux pumps within the system will ensure the MLSS levels are in check. MBR shall have automatic backwashing function using oxalic acid.

The sewage water shall stay in the system for approximately twenty (20) hours before going to the clean water tank and then discharged to the designated drainage point. The distance from the STP to the discharge point (sea) is seventy-nine (79) meters.

EXCLUSIONS

The Contractors scope of work shall exclude the excavation for the laying of the pipe lines as well as excavations for the underground regulating tanks (approximately L=9.5m x W=5.5m x H=3.3m). Pipe lines excavations shall be deep enough for a three (3) inches UPVC pipes according to local standards (please see detail at the construction plans).

MATERIAL REQUIREMENTS

CONTAINER STEEL HOUSING

The main STP equipment shall be housed in a Q235 Carbon Steel material coated with 3 layers of epoxy paint for anti-corrosion protection. The container shall have accessible hatch covers on top of each of the STP tanks for maintenance purposes. It shall also provide valves for drainage of each tanks when necessary for maintenance.

REGULATING TANKS

The regulating tanks shall be housed in a Q235 Carbon Steel material coated with 3 layers of epoxy paint for anti-corrosion protection and is to be placed underground. These tanks shall be 80 cubic meters in volume and shall be able to fit in an excavation measuring approximately 9.5m x 5.5m x 3.3m (L x W x H).

LIFTING PUMPS

Two submersible lifting pumps shall be placed in both septic tanks powerful enough to transport sewage water from the passenger facility to the STP approximately 115 meters in distance. The minimum power of each pump shall be no less than 5kw (6.5HP) and shall be capable of transporting 30cu.m/hr of sewage water. Float switches shall also be provided to allow for automatic switching of the lift pumps.

A third submersible lifting pump shall be placed inside the clean water tank of the STP to provide clean water transportation to the discharge point. This pump shall have a minimum of 2kW (2.5HP) power.

PIPES

Contractor shall supply and install (excluding excavation) the pipings for the STP system made from UPVC material three (3) inch in diameter with the minimum thickness of 2.3mm. The pipe lines shall be rated at minimum Mpa 1.0 of pressure. Total length of pipelines from the two septic tanks to the STP and to the discharge point is approximately 340 meters.

SEWAGE TREATMENT FACILITY REQUIREMENTS AND MATERIALS

A fully enclosed, compact, and modular sewage treatment facility shall be provided housed in carbon steel. This facility shall utilize CAS and MBR technologies to effectively treat the wastewater and meet the DENR DAO 20160-08 effluent standards. This facility shall, at the *minimum*, include the following components and specifications.

AIR BLOWERS

Two steel housed air blowers with at least 5.50kW (7HP) of power each. One blower shall be operational while the other on standby at any given time. Each air blower shall automatically alternate in operations as to balance the usage.

AIR DISTRIBUTION SYSTEM

The air distribution system shall be made from ABS pipelines to distribute air to the aerobic and membrane tanks.

MEMBRANE CARTRIDGES

The membranes shall be Polyvinylidene Fluoride (PVDF) hollow fiber material in the ultrafiltration range. Cartridges shall be housed in stainless frame with easy access for inspection. Minimum lifetime of membranes shall be three (3) years included in the warranty.

The membrane shall utilize a permeate pump with a minimum of 2.20kW (3HP) power to transfer the pre-filter water into the clean water tank. There shall also be a 3.0kW (4HP) backwash pump to provide automatic back wash cleaning of the membranes using oxalic acid.

CIRCULATION PUMPS

Mixed liquor and sludge reflux submersible pumps shall be in place to recirculate the sewage water within the system. Each pump shall be at the minimum 0.75kW (1HP) in power.

BIO MEDIA

Bio-media to house biological flocs and facilitate microbe digestion shall be included made from elastic Polypropylene (PP) material. This material shall be placed in both the anoxic and aerobic tanks.

CONTROL ROOM

The STP facility shall include a control room with access door to house the electrical control panel, pumps, and acid container for membrane backwashing use. A door lock shall be provided for security purposes to the designated Pollution Control Officer (PCO) or maintenance personnel.

EXECUTION

PRODUCTION

All STP components shall be manufactured and delivered within 90 days.

INSTALLATION

1. General

Installation of all system components and pipes shall be in accordance with the manufacturer's instructions and as specified and shown.

2. Electrical

Electrical supply shall be provided by the end user using 220v, 3-phase, 60hz. Electrical connection from the equipment and pumps shall be performed by Contractor and connected through the control box.

3. Plumbing

All the water inlet pipes, outlet pipes, sludge return pipes should be connected according to the drawings submitted by Contractor. There should be a fresh water tap water source nearby for filling up and washing the unit when necessary.

4. Mechanical Installation

The regulating tanks shall be placed and installed by Contractor underground on top of specified concrete slab. The STP containers shall be placed on top of the regulating tank on top of another concrete slab placed on top of the regulating tanks. A crane with minimum of 10 tons lifting capacity shall be provided by Contractor.

FIELD TEST

1. Conduct testing specified herein in the presence of the Project Engineer.

2. Acceptance Test

After installation has been completed, Contractor shall conduct an acceptance test, to demonstrate that the equipment operates in accordance with specification requirements. The Contractor shall notify the Project Engineer, 2 weeks prior to performance of tests.

3. Sludge Seeding

Contractor shall provide sludge from local wastewater treatment plant is introduced to speed up the biological breakdown of wastewater and grow bacteria.

4. Normal Operations

The Contractor shall conduct effluent testing at the minimum of 30 days after installation to check if the equipment is treating the wastewater normally. A maximum of 90 days after installation shall be provided by end user for the equipment to be able to meet the effluent standards. During this period the Contractor shall be responsible for the operations and training of the sewage treatment facility to PCO and relevant personnel.

WARRANTY

- 1) All equipment and installation shall have a one-year warranty from the delivery date for the mechanical parts based on correct installation and maintenance.
- 2) Within one-year guarantee period, if there is any default of the mechanical parts, Contractor shall deliver the parts for free. If due to incorrect operation caused the mechanical damage, Contractor will replace the parts based on the parts price list.
- 3) Warranty repairs or replacements does not include travel and accommodation of technician or engineer and shall be charged to the client.

MONTHLY AFTER SALES SERVICE PLAN

Contractor shall provide a minimum of 1 year after sales service after installation of STP. The contract is for the full operation and warranty of the sewage wastewater treatment facility.

At the minimum the following scope of work shall be provided.

High Effluent Standards

Contractor shall ensure that the equipment can meet regulatory standards while under the service contract.

Unlimited Warranty While Under Service

The service plan shall provide unlimited warranty of parts and accessories. This means any damage caused by normal wear and tear or manufacture defect shall be repaired at no additional cost (excluding technician travel and/or accommodation if needed).

This includes membrane inspection only and does not include membrane cartridges replacement if needed after inspection.

Bi-monthly Technician Visit and Routine Maintenance

The service plan includes a bi-monthly technician visit to inspect all the parts are in good working order and perform routine maintenance and effluent wastewater analysis.

Monthly Effluent Parameters Report

Contractor shall provide at the end of each month within the contract year an effluent parameters report to make sure the unit is meeting the required standards or if it is needing modification. This report shall be provided via paper or electronic copy.

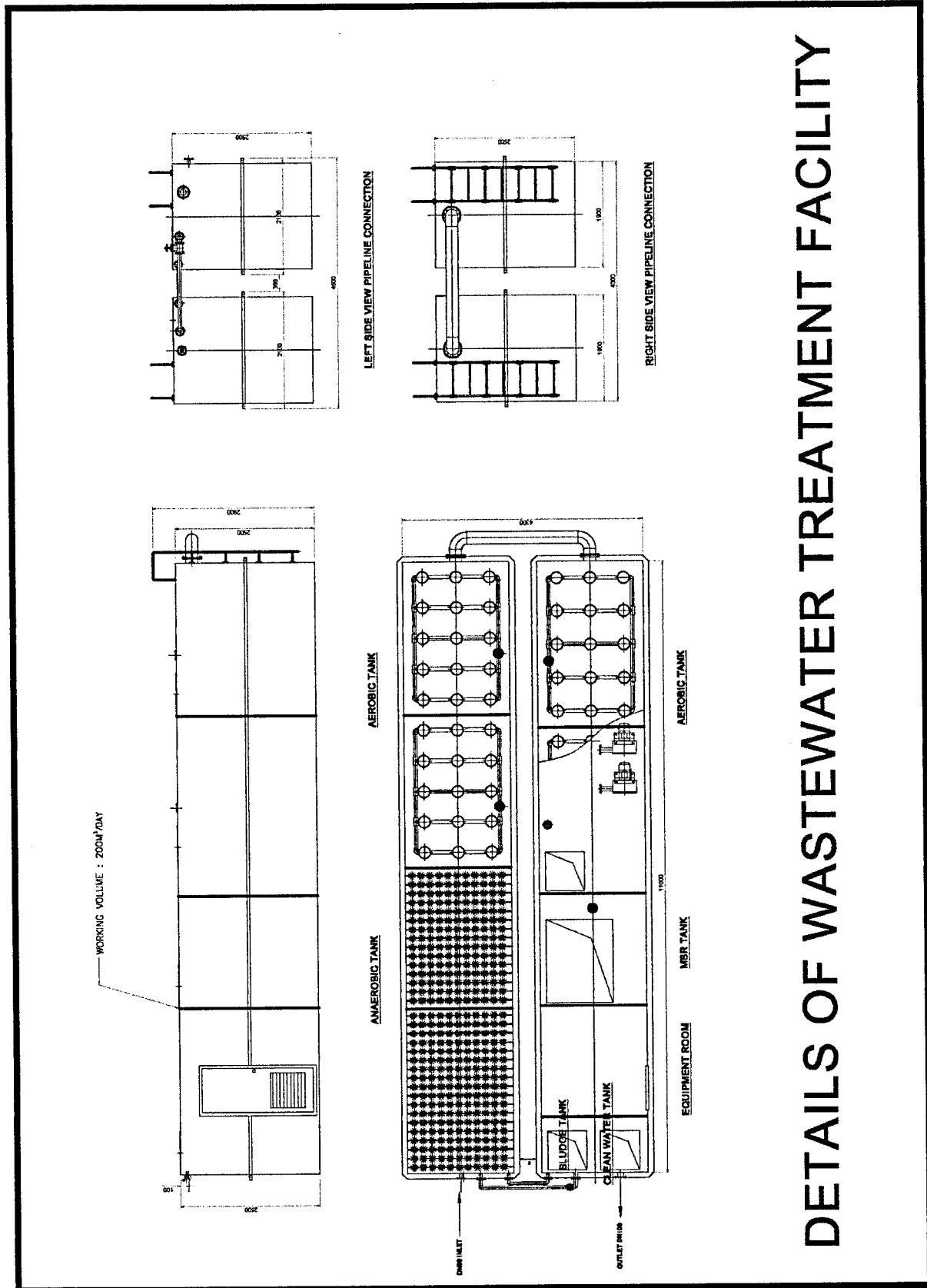
Accumulated Solids Removal and Disposal

Under the service plan the Contractor shall also provide accumulated solids (sludge) removal from the STP whenever needed (excluding septic tank) at no extra charge to end user.

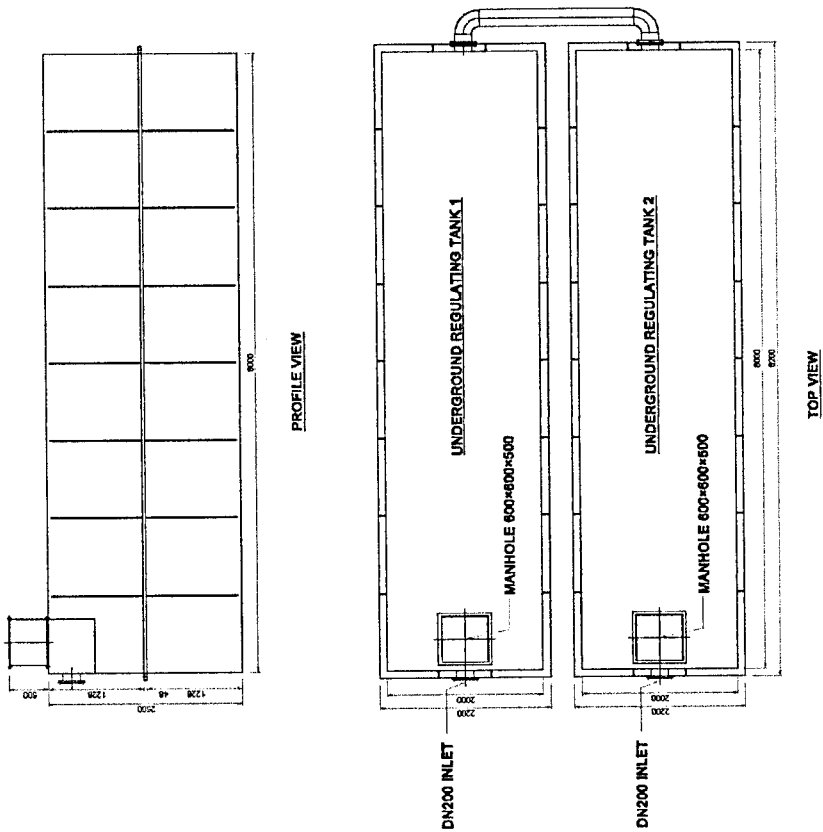
EFFLUENT STANDARDS

The entire sewage treatment facility shall pass the new DENR DAO 2016-08 Class B level effluent standards in accordance with the Clean Water Act 2004.

See attached drawings for details of the wastewater treatment plant, underground regulating tank & concrete foundation support.



DETAILS OF WASTEWATER TREATMENT FACILITY



DETAILS OF UNDERGROUND REGULATING TANK

CONCRETE FOUNDATION SUPPORT



**ITEM 13 : 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: 6,919 ltrs./ 1,828 gallons
Diameter: 190 cm/ 75 inches
Length: 283 cm/ 111 inches
Thickness: 0.6 mm
S/S Grade: 304

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. Location: Roof deck
Description: Constant pressure booster pump
Function: Booster pump
Power: 3.0 hp.
Flowrate: 100 Gpm
Specs: 230 volts, 60 HZ, 3 PH, 3600 RPM
2. Location: Ground Floor (Pump House)
Description: Vertical turbine transfer pump
Function: Transfer pump
Power: 7.5 hp.
Flowrate: 150 Gpm
Specs: 400 volts, 60 HZ, 3 PH 3600 RPM

EXECUTION

All materials will be delivered and installed on site.

ITEM 14 : PORT LIGHTING SYSTEM

SCOPE OF WORK

The work to be done shall consist of furnishing, delivering, and installing electrical materials / fixtures completed in accordance with all the details of the electrical works as shown on the drawings including materials, labor, tools and equipment and all incidental works as found necessary.

Refer to electrical plans/drawings for location and extent of work involved.

GENERAL REQUIREMENTS

- a) All work shall be done in accordance with the requirements of the publications and agencies having jurisdiction, as well as the requirements of the approved standards.
 1. National Fire Protection Association - (NFPA)
 2. National Electrical Manufacturer Association - (NEMA)
 3. Underwriter Laboratories, Inc. - (UL)
 4. Philippine Electrical Code - (PEC)
Philippine National Standard - (PNS)
 5. Federation Specification:
Circuit Breaker, Molded Case, Branch
Circuit and Service
 6. American National Standard Institute - (ANSI)
 7. American Society for Testing and Materials - (ASTM)
 8. Illuminating Engineering Society - (IES)
 9. Light Emitting Diode - (LED)
- b) The electrical power of the Port lighting system will be connected to the Concrete Pedestal Post. While the supply voltage should be 230 volts, single phase (1Ø), and 60 hertz.
- c) The Contractor shall employ a licensed Registered Electrical Engineer or Master electrician to perform or to supervise and to conduct the continuous inspection of all electrical work.
- d) The Contractor shall first obtain approval from the Authority before procurement, fabrication or delivery of electrical materials to the site. Partial submittals will not be acceptable and will be returned without review. Submittals shall include the Manufacturer's Name, Trade Name, Place of Manufacture, Catalog Model or Number, Nameplate Data, Size, Layout Dimensions, Capacity, Project Specification and Paragraph Reference, Technical Society Publication References and other information necessary to establish contract compliance of each item to be furnished.

- e) All excavations fill and backfill, and concrete works involved herein, shall be carried to the required elevations and shall conform to the provisions of specification under Earthwork and Concrete Construction of this tender document.
- f) The materials and equipment to be furnished shall be standard products of reputable manufacturers engaged in the reproduction of such materials and equipment.
- g) The Contractor shall furnish and install electrical materials as shown in the drawings. A licensed Electrical Engineer or Master Electrician is required to implement the installation of the electrical system.
- h) Electrical installation shall conform to the requirements of Philippine Electrical Code (PEC) and the other approved standards.
- i) The contractor shall install all electrical work with the supervision of the qualified Registered Electrical Engineer (REE) or Master Electrician. All electrical installation applications regardless of capacity and voltage whether new, addition or revision shall be accompanied by electrical plans signed and sealed by a duly licensed Professional Electrical Engineer (PEE).

MATERIAL REQUIREMENTS

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

PRODUCTS

WIRES AND CABLES

The conductor material to be furnished and installed shall be copper wire Heat-Resistant Thermoplastic (THHN/THWN-2). All conductors should be rated 600-volt insulation and should be standard for all sizes.

CONDUIT AND FITTINGS

Underground PVC conduit shall be polyvinyl chloride with concrete covered. It shall be manufactured to schedule 40 outside diameter. All fittings and bends shall be solvent bonded using manufacturers' recommended product.

LED FLOODLIGHT FIXTURE 200 WATT

Specifications:

Rated	: 200-watt LED Floodlight Fixture or equivalent
Input Voltage	: AC 85-265 / 50-60 HZ
Luminous Flux	: 26000-28000 LM
Color Temperature	: Daylight (5500-6500K)
Optional	
CRI	: Ra>70
PF	: > 0.95
Beam Angle	: 120 degrees
IP Grade	: IP 66 / IP 65
Material	: Die Cast Aluminum

SWITCHES:

Weatherproof die cast aluminum toggle switch (NEMA-3R) attached to Single Angle Bar Floodlight Steel Tapered Lamp Post.

CONCRETE DUCT BANK

The contractor shall construct concrete duct bank as shown in the approved plan.

SINGLE ANGLE BAR FLOODLIGHT STEEL TAPERED LAMP POST

Lamp Post shall be 10.0 m ht. Single Angle Bar Floodlight steel tapered lamp post, furnished installed and tested as shown on the approved plans. The post/s shall be dimensioned for a wind velocity of 185 km/hr. It should be locally fabricated or manufactured. The post shall be Hot-Dipped Galvanized, prime-coated with red lead and shall be painted at site with the final coating preferably aluminum paint to be approved by the Engineer.

PANEL BOARD

Panel board shall conform as shown on the approved plans with respect to supply characteristics, rating of main lugs or main circuit breaker, number and ratings and capacities of branch circuit breakers.

Panel board shall consist of a factory completed dead front assembly mounted in an enclosing NEMA-3R cabinet consisting of code gauge galvanized sheet steel box with trim and door.

Main and branch circuit breakers for panel board shall have the rating, capacity and number of poles as shown on the approved plans. Breakers shall be thermal magnetic type solid state-type with interrupting capacity of 10,000 amperes symmetrical minimum. Breaker terminal shall be UL listed as suitable for type of conductor provided. Breaker shall be the bolt-in type (that is, bolted to the current carrying bus). Plug-in circuit breakers are not acceptable.

EXECUTION

INSTALLATION

Single Angle Bar Floodlight Steel Tapered Lamp Post shall be installed as shown on the approved plans.

Pole Setting: Depth as shown on the approved plans.

Construction of lamp post foundation shall be in accordance with the shape and dimensions as shown on the approved plans.

Excavations / backfilling required before /after installation of lamp post foundation with the trench shall conform to the provisions of Earthwork and Concrete construction.

Concrete Pedestal shall be reinforced concrete with appropriate weatherproof fittings as constructed as shown in the approved plan. Reinforced concrete materials shall conform to the requirements of concrete. Concrete shall be of 21 Mpa (3000 psi) compressive strength.

Metering: the local utility company of Port of Zamboanga, Zamboanga City Electric Cooperative (ZAMCELCO) is responsible for the supply and installation of measuring equipment, and its accessories, but it is part of the contractor's responsibility and expense to contact them about this.

WORKMANSHIP

The work throughout shall be executed in the best and most thorough manner under the direction of and at the satisfaction of the Registered Electrical Engineer or Master Electrician, who will interpret the intent meaning of the drawings and specification and shall have the power to reject any work and materials which in his judgment, are not in full accordance therewith.

TESTING OPERATIONS

When the electrical installation is completed, the Contractor shall test the installed electrical materials and equipment in the presence of a Registered Electrical Engineer or Master Electrician. The system shall be free from any defects, shorts or grounds. The Contractor at no extra cost shall furnish all necessary instruments and personnel required for the testing.

GUARANTEE

Upon completion and before final acceptance of the work, the Contractor shall furnish the Engineer with a written guarantee stating that all works executed are free from defects on materials and workmanship. The guarantee shall be for a period of one year from the date of final acceptance. Any work that becomes defective during the said period shall be corrected / replaced by the Contractor at his own expense in a manner satisfactory to the Authority.

ITEM 15 : ELECTRICAL WORKS**GENERAL DESCRIPTION**

The work to be done under this Item of Specifications consists of fabrication, furnishing, delivery and installation, complete with all details of electrical work, in the subject area and all work materials related to the proper completion of the installation, except for those parts of the work that are expressly stated to be performed by others. All works shall be in accordance with the governing Codes and Regulations and the Specifications, unless the same are inconsistent with such codes, etc., as may later govern. The requirements regarding the materials and equipment required for the complete installation of the work specified herein and indicated in the drawings. The Specifications are intended to provide a broad outline of the equipment required but are not intended to include all design details and construction specifications.

WORK INCLUDED

The work to be done under this Item 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 these specifications but not limited to the following items of works.

- a. All works and material for complete lighting and power systems including cables and conduits, circuit breakers, panel board and connection to all lighting fixtures and power outlets, air conditioning, switches, supports and accessories.
- b. All steel support for conduits, wires, panel board, boxes, lighting fixtures, etc. as indicated or as required for the completion of the installation.
- c. Termination of all electrical systems and the complete grounding system.
- d. A complete testing and commissioning of all electrical and auxiliary systems. The Contractor shall provide all necessary testing instruments.
- e. All items incidental to and or required for the proper completion such as painting of boxes, conduits and the likes.
- f. Coordination with other companies/offices including handling of all material related to material testing and application of electrical permits at the expense of the Contractor.
- g. Preparation of necessary shop drawings required for the proper execution of the works subject to the approval of the Engineer.

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 with each item to be furnished.

- a. Shop Drawings

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

1. Drawings shall be a minimum of 210 mm x 297 mm in size or in size A3 size, except as specified otherwise.
2. 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 ensure a coordinated installation.
3. Wiring diagrams shall identify circuit termination and the internal wiring for each item of equipment and its interconnection.
4. Drawings shall indicate adequate clearances for operation, maintenance and replacement of equipment devices. If the layout is disapproved, revise the layout and resubmit.

b. Manufacturer's Data

Submittals for each manufactured item shall include manufacturer's descriptive literature, equipment drawings, diagrams, performance and characteristic curves and catalog cuts. Each submittal has the manufacturer's name, trade name, catalogue model or number, name plate data, size, layout dimensions, capacity, specification references and all other information necessary to establish contract compliance.

c. Standard Compliance

When material or equipment must conform to the standards of organizations such as American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturer's Association (NEMA) and Underwriters Laboratories (UL), proof of such conformance shall be submitted to the Engineer for approval.

If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable tests and is approved by the Engineer. The certificate shall state that the item has been tested in accordance with specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval.

The certificate shall identify the manufacturer, the product and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

DELIVERY AND STORAGE

Equipment and materials should be properly stored and adequately protected and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored and protected in accordance with the manufacturer's recommendations and as approved by the Engineer. Electrical conduits shall be stored to provide protection from the weather and accidental damage. Cables shall be sealed, stored and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather. Damaged or defective items shall be replaced with new items at no cost to the Owner.

CATALOGUED PRODUCTS

Materials and equipment shall be catalogued by products of manufacturers regularly engaged in production of such materials or equipment and shall be at manufacturer's latest standard design that

complies with the specification requirements. When two or more units of the same type, class and size of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer. Each major component of equipment shall have the manufacturer's name, address and the model of the serial number on a nameplate securely affixed in a conspicuous place; the name plate of the distributing agent will not be acceptable.

MANUFACTURERS' 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 materials.

WORKMANSHIP

The work throughout shall be executed in the best and most thorough manner under the direction of the Contractor and to the satisfaction of the Owner and Engineers, who will jointly interpret the meaning of the drawings and specifications and shall have the authority to reject any work materials which, in their judgment, are not in full accordance therewith

The Contractor shall have on file, for ready access and reference, a set of drawings indicating all work as actually installed incorporating in the same all changes and additions. Upon the termination of the Contract, he shall prepare a set of tracings indicating thereon the Electrical Work as actually and finally installed. These drawings shall be turned over to the Engineers.

The Contractor shall be responsible for keeping stocks of material and equipment stored at the premise in a neat and orderly manner. The exposed surfaces of wirings, conduiting system or equipment which have become covered with dirt, plaster or other material during handling and construction shall be thoroughly cleaned by Contractor before such surfaces are prepared for final finish, painting or concealment within the building structure.

The Contractor shall employ skilled craftsmen experienced in installation of the types of electrical materials and equipment specified. Use specialized installation tools and equipment as applicable. Produce acceptance installation free of defects.

MATERIALS / 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 are 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 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

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

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 Port of Zamboanga, Zamboanga City and the requirements of local Power Company of Zamboanga City Electric Cooperative. (ZAMCELCO)

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 Final Electrical Inspection (CFEI) 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, three phase (3Ø) wire, and 60Hz or as per system requirements as shown in the plan.

CLEANING UP

The Contractor shall remove all dirt, debris, and rubbish and waste materials caused by him in the process of his work. He shall also remove all tools, temporary power installation, scaffolding and surplus materials after completion and acceptance of work.

MATERIAL REQUIREMENTS

NAMEPLATES

Provide laminated plastic nameplates for each panel board, 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.

INTERIOR WIRING SYSTEMS**SUBMITTALS**

- a. Shop Drawings: Submit for the following:
 - 1. Location of panel boards and circuit breaker
 - 2. Conduit support / hanger's installation drawing
- b. Manufacturer's data: Submit for the following:
 - 1. Circuit Breakers
 - 2. Switches
 - 3. Conduit and fittings (each type)
 - 4. Device Plates
 - 5. Insulated conductors
 - 6. Utility / Junction boxes
 - 7. 3 Prong duplex Convenience Outlet with grounding
 - 8. Floor Duplex Convenience Outlet
 - 9. Weatherproof Convenience Outlet

PRODUCTS**CONDUIT AND FITTINGS**

- a. Conduit shall be polyvinyl-chloride conduit (PVC), where specified, shall be heavy wall, high impact resistant Schedule 40, with factory made bends, couplings and fittings. PVC cement for joints shall be of the same brand as for the PVC pipe.
- b. No conduits shall be used in any system smaller than 20mm (1/2") diameter electric trade size, nor shall have more than four (4) 90-degree bends in any one run and where necessary, pull boxes shall be provided as directed.
- c. No wire shall be pulled into any conduit until the conduit system is completed in all details, in the case of concealed work until all rough plastering masonry has been completed, and in the case of exposed work until the conduit work has been completed in every detail.
- d. The ends of all conduits shall have been tightly plugged to exclude plaster, dust and moisture while the construction of the building is in progress. All conduits shall be reamed to remove all burrs.

OUTLETS, BOXES AND FITTINGS

- a. All outlets of whatever kind, for all systems, there shall be provided a suitable fitting, which shall be either a box or other device especially designed to receive the type of fitting to be mounted thereon.
- b. The Contractor shall consult with the Engineer as to the nature of the various fittings to be used before installing his outlet fittings, and shall conform strictly in the use of fittings, to the

nature of the appliance to be mounted on them, so that the work, when the completed will be a finished design.

- c. All outlets on concealed conduit work provide galvanized pressed steel outlet boxes on standard make. These boxes shall be in all cases standard and where such boxes are not available on the market, special boxes shall be secured by the Contractor at his owned expense. In general outlet boxes should be at least 100mm in diameter, 53mm deep and No. 16 minimum gauge.

JUNCTION AND PULL BOXES

- a. Junction and pull boxes, of code gauge steel, galvanized shall be provided as indicated or as required for facilitating the pulling of wires and cables. Pull boxes as finished places shall be located and installed with permission and to the satisfaction of the Engineer.
- b. All junction and pull boxes on exposed conduit work shall be provided with hubs for threaded pipe entry and covers provided with neoprene gaskets.

WIRES AND CABLES

- a. All wires shall be copper, soft-drawn and annealed, shall be 100% conductivity, shall be smooth and true of a cylindrical form and shall be within the actual size called for.
- b. All wires and cables shall comply with the requirements of the Underwriters Laboratories, the ASTM and ICEA as they apply for the usage.
- c. Wires and cables for power and lighting system shall be plastic insulated for 600 volts working pressure type "THHN/THWN-2" unless otherwise noted on plans or specified.
- d. Tag Marking

In general, branch circuit conductors and cables shall be properly marked by means of a printed tag taped on each wire indicating origin/load and or panel(s) where load is connected.

- e. Splices and Termination Components

If applicable, for wire connectors and for insulating tape. Connectors for 5.5 mm² and smaller diameter wires shall be insulated, pressure-type in accordance with (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

DEVICE PLATES

Provide one piece device plates for outlets and fittings to suit the devices installed. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel or cast metal having round or beveled edges. Plates on finished walls shall be satin finish stainless steel or brushed –finished aluminum, minimum 0.03 inch thick. Screws shall be machine type with countersunk heads in a color to match the finish of the plate. The use of sectional type device plates will not be permitted. Plates installed in wet locations shall be sealed in gaskets. Device plates for telephone and intercommunication outlets shall have a 3/8-inch bushed opening in center.

WALL SWITCHES AND PLATES

Wall switches in general should 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.

WALL RECEPTACLE AND PLATES

- a. Receptacle outlets shall be 15 amperes, 230 volts, 2 pole, 3 wire parallel slot, grounding type. Parallel slot outlet rated 15 amps. 125 v grounded types 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.

PANELS AND CABINETS

- a. Standard panels and cabinets, as much as possible shall be used and assembled on job. All panels shall be dead front construction, furnished with trims for flush or surface mounting. Cabinets shall be of code gauge steel with gutters at least 100mm wide and if necessary, it must be made wider. The trim for all panels shall be finished in industrial grey enamel over a rust inhibitor.
- b. Lighting panels shall be equipped with branch circuit breakers as required and mains as noted on Plans or Panel Schedule.
- c. Panel board main bus work shall be ampacity rated to equal or exceed overcurrent protective device immediately ahead of it. All buss work shall be properly secured to withstand available short circuit forces at the location.
- d. Distribution panels shall be of the same type as lighting panels except equipped with one pole, two poles and three poles air circuit breakers of sizes, voltages ratings and interrupting capacity as called for on plans.

INDIVIDUAL BREAKERS

- a. Provide individual circuit breakers were indicated on plans. Voltage ratings shall be suitable in each case of service application. Enclosures shall be General Purpose, NEMA type I, except where specifically noted on plans or assembled on panel cabinets.

All protective devices should meet NEMA and U.L specifications. Short circuit rating shall be as indicated on the plan.

- b. Circuit breakers shall consist of a quick-make, quick -break type entirely trip-free operating mechanism with contacts, arc-interrupter, and thermal magnetic trip unit for each pole, all enclosed in a molded-phenolic case. The thermal magnetic trip unit shall provide time-delayed overload protection, and in case of overload or short circuit current in any one pole the circuit trips instantaneously. Circuit breaker shall be trip indicating, when tripped position of breaker handle midway between "ON" and "OFF" positions.
- c. All circuit breakers shall be bolt-on type unless noted otherwise.
- d. All circuit breakers rated above 225 amps shall have interchangeable trip units. Unless otherwise specified, minimum interrupting rating for 230 volts circuit breakers shall be 10,000 amperes.

PANELBOARD BUSES

All bus panels 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 lapping. Provide separate ground bus for connecting grounding conductors; bond to steel cabinet.

EXECUTION

INSTALLATION

a. Wiring Methods

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

b. 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.

1. Where conduits rise through floor slabs, curved portion of bends shall not be visible above finish slab.
2. Conduit Support:

Conduit shall be supported 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 conduits only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth of the proof test load. Fasteners attached to concrete ceilings shall be vibration resistant and shock resistant. Holes cut to depths of more than 40mm in reinforced concrete beams or to depths 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 conduits supports in suspended ceilings in dry locations.
3. 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 obstructions.
4. The Contractor shall install pull wires in empty conduits in which wire is to be installed by others. The pull wire shall be 2.0mm² zinc-coated steel or plastic having not less than 91 kgs tensile strength. Leave not less than 300mm of slack at each end of the pull wire.

5. Conduit Installed in Concrete Floor Slabs

Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduits horizontally for at least three diameters, except in cabinet locations. Curved portions of bends shall not be visible above the finish slab. Increase slab thickness as necessary to provide minimum 25 mm 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.

6. 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 walls of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by PEC and NFPA 70.

7. Flexible Connection:

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

c. 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 2.1meters above interior floors and walkways, or when installed in hazardous areas. Boxes in other locations shall be sheet steel, except that aluminum 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 mm² 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 no separate support except were 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.

1. 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 100mm², except that 100 by 50mm boxes may be used where only one raceway enters outlet.

2. Pull Boxes:

Pull boxes shall be constructed of not less than the minimum size required by PEC and NFPA 70 of code-gauge aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Boxes shall be furnished with screw-fastened covers. Where several feeders pass through common pull boxes, the Contractor shall tag the feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

d. Mounting Heights

The Contractor shall mount panelboards, and circuit breakers, and main disconnecting panel so the height of the 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. The Contractor shall measure mounting heights of wiring devices and outlets to center of device or outlet.

e. Conductor Identification

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

f. Splices

Make splices in accessible locations. Make splices in conductors 5.5 mm² and smaller diameter with insulated, pressure-type connector. Make splices in conductors 8.0 mm² and larger diameter with solderless connector and cover with insulation material equivalent to conductor insulation.

g. 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 alignment tolerance of 3mm. Use of sectional-type device plates is not permitted. Plates installed in wet areas must be gasketed.

h. 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 by ASTM E 814.

i. 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.

1. Grounding Conductor

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

2. Resistance

Maximum resistance-to-ground of grounding system shall not exceed 10 ohms under normally dry conditions. Where the resistance obtained exceeds 10 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.

a. Devices Subject to Manual Operation

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

b. Test on 600-volt wiring

Test 600 volt wiring to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 14mm² (6 AWG) and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 25,000 ohms.

c. Grounding System Test

The Grounding system shall be tested to ensure continuity and resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to the Engineer and indicate location of rods as well as resistance and soil conditions at the time measurements were made.

INTERIOR LIGHTING

SUBMITTALS

Data, shop drawings showing mounting heights, and reports shall employ the terminology, classifications, and methods prescribed by the IES Lighting Handbook, as applicable, for the lighting system specified.

a. Manufacturer's Data

1. LED Panel Light, Recessed Mounted Type w/ Frosted Glass Cover (1200 x 300 mm) Daylight
2. LED Panel Light, recessed mounted type with frosted glass cover (600 x 600 mm) Daylight
3. LED Striplight daylight, 10w/m
4. LED Pendant Light, 38-40 watt, black hanging linear light
5. Vertical Downlight Recessed Mounted
6. Vertical Downlight Surface Mounted
7. Outdoor ground mounted spotlight 10-12 watt
8. Square Downlight Recessed Mounted

PRODUCT**LED PANEL LIGHT**

- a. LED Panel Light – (1200x300 mm and 600x600 mm)

LED Panel Light is the general lighting alternative for those who want to incorporate cost-efficiency, brighter lighting, and elegant design. Available in different sizes, shapes and color temperatures the LED panel is your “go to” lighting solution for that classy feel at a low price. Built within a sturdy case the array of LED diodes emit light in unison as they are concentrated; And bounced through layers of material which enhance and diffuse the light in uniformity. The housing not only ensures protection from adverse environmental conditions; but also serves as a heat sink to minimize thermal output keeping the area cool.

LED panel lights have a long lifespan (42 times longer than incandescent bulbs). And, contain no harmful gasses or toxins like its fluorescent counterparts. Whether you want to give that savvy look to your office; ensure excellent lighting for your school or even light up your home (kitchen, common rooms / living space and/or study) and achieve that luxurious feel your friends will surely envy, our LED panel lights are the perfect cost-effective, eco-friendly and energy efficient solution for you. Above all, LED Panel lights are the great application for hotels, offices, balcony, and many more.

LED Panel Light have a wide range of applications from lighting households, schools, and offices, illuminating covered parking lots, warehouses, cold storage rooms and practically anything that can fit the standard fluorescent lamp ballast/fixtures.

LED STRIP LIGHT

- b. LED Strip Light often used or connected to an existing landscape lighting system. Great accent lighting for stairs, railings, and overhangs etc.,
The most versatile LED product in the market, ranging from accent lighting, cove lighting, mood lighting, back-lit signage, and other customized lighting requirements.
Applications include classy under cabinet lighting for your kitchen, car undercarriage or motorcycle chassis lights.
Different types and different colors, indoor or outdoor LED strip lights; and you can be sure these products will fit your fancy with the reliability and brightness you can expect from LED-based lighting.

LED PENDANT LIGHT

- c. LED Pendant Light is a modern lighting design that brings special illumination for your rooms and offices. Relaxing ambiance provided by this LED Pendant Light gives an unwinding feeling for commercial facilities. This LED Pendant Light is a stylish alternative to downlight lightings application. These Pendant Lights fit very well in residential, offices, restaurants, stores, and industrial decorative lightings.

VERTICAL DOWNLIGHT RECESSED MOUNTED TYPE

- d. This fixture with glass cover looks very simply but provides protection to LED bulbs. Metal sheet housing gives durability, while mirrored reflection brings additional lighting effects. They are equipped with a glass cover that provides a smart overhead illumination solution, very modern and contemporary for decoration. It's best for indoor lighting.

VERTICAL DOWNLIGHT SURFACE MOUNTED TYPE

- e. Surface Downlight – the housing or frame of this fixture is made of steel plate and with powder coating under high temperature. It is resistant to abrasion as well as pressure, not easy to be tarnished. As you will notice, it specializes in light reflectors that is made by high

quality pure aluminum. Endurable lamp holder for extremely high temperatures guarantees the safety and durability of the LED light bulbs. The other parts like springs, elastic slices and other tightening fittings make the down light firmly recessed and easy to install.

OUTDOOR GROUND MOUNTED SPOTLIGHT

- f. Working voltage compatible with most low-voltage landscape lighting systems, Thick aluminum body and glass lens cover design withstand rainy and snowy weather; IP65 waterproof design, which greatly improves the stability of outdoor lighting and long-term use 90° Beam Angle, 270-degree adjustable head offer the best lights for the walls, trees, flags & fences; widely used for garden, yard, patio, pathway, driveway and outdoor decoration. Simply insert the light spike stand into a suitable position on the ground; no extra tools needed.

SQUARE DOWNLIGHT RECESSED MOUNTED

- g. LED Panel Light Square Daylight are the general lighting alternative for those who want to incorporate cost-efficiency, brighter lighting, and elegant design. Available in different sizes, shapes and color temperatures the LED panel is your "go to" lighting solution for that classy feel at a low price. Built within a sturdy case the array of LED diodes emit light in unison as they are concentrated; And bounced through layers of material which enhance and diffuse the light in uniformity. The housing not only ensures protection from adverse environmental conditions; but also serves as a heat sink to minimize thermal output keeping the area cool. LED panel lights have a long lifespan (42 times longer than incandescent bulbs). And contain no harmful gases or toxins like its fluorescent counterparts. Whether you want to give that savvy look to your office; ensure excellent lighting for your school or even light up your home (kitchen, common rooms / living space and/or study) and achieve that luxurious feel your friends will surely envy, that LED panel lights are the perfect cost-effective, eco-friendly and energy efficient solution for you. Above all, LED Panel lights are the great application for hotels, offices, balconies, and many more. They designed specifically so that can easily transition to LEDs without necessarily revamping the current lighting setup. LED Panel Light have a wide range of applications from lighting households, schools, and offices, illuminating covered parking lots, warehouses, cold storage rooms and practically anything that can fit the standard fluorescent lamp ballast/fixtures.

DOUBLE HEAD COB, RECESSED BOX TYPE DIRECTIONAL DOWN LIGHT

- h. Double head COB recessed box-type directional downlights are architectural lighting fixtures featuring two independently adjustable light heads in a single rectangular frame. Utilizing Chip-on-Board (COB) technology, they provide high-lumen, anti-glare, and precisely controlled spotlighting for residential or commercial applications. Available options include 24° (Narrow for spotlights), 36° (Medium), and 60° or 90° (Wide for general area washing). typically features 355° horizontal rotation and 30° to 90° vertical tilt for precise directional control.

The Contractor shall provide the type of materials as shown in the plan.

LED BULB

Being the next modern, energy-efficient lighting, it offers brighter lights than both its predecessors improving on lower wattage at the same brilliance and longer life spans. This is definitely a lot of savings in terms of lower electricity bills and maintenance costs.

Powered by light emitting diodes and circuitry, the advantage is that it eliminates the harmful chemicals found in your typical compact bulb. LED making it non-hazardous and also Eco-friendly. With a very low defect rate of 1% a year and lifetime of over 30,000 hours. Therefore, this product will stand the test of time.

Specifically designed that can easily transition to LEDs without necessarily revamping your current lighting setup. LED bulbs have a wide range of applications from lighting households, schools, and offices, illuminating covered parking lots, warehouses.

This LED Bulb provide each and every household or business in the Philippines access to energy efficient and environmentally friendly lighting alternatives set at reasonably low and affordable prices.

EXECUTION

INSTALLATION

Installing or retrofitting a T-8 tube light ensures optimal performance. This guide is intended for qualified electricians or lighting technicians.

It is the responsibility of the contractor to install, maintain and operate the device in such a manner as to comply with all state and local laws, ordinances and regulations.

No power to the fixture at source. Ensure you are working with standard T-8 Fluorescent Light fixture; unpack the LED Tube Light; Open the fixture housing; Re-connect the Hot (L) wire to one end and Neutral (N) wire to the other end; Check to ensure wiring is done correctly then close the fixture housing; Affix warning labels to fixtures near socket so they are visible to tube light installers. Re-connect power to the fixture and turn on switch.

Recessed and semi-recessed fixtures may be supported from suspended ceiling support system ceiling tees if the ceiling system support rods or wires are provided at a minimum of four rods or wires per fixture and located not more than 150 mm from each corner of each fixture. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes are indicated to be centered in the acoustical panel, support such fixtures independently or with at least two 20mm metal channels spanning, and secured to, the ceiling tees. Providing rods or wires for lighting fixture supports under this section of the specifications. Additionally, for recessed fixtures, provide support clips securely fastened to ceiling grid members, a minimum of one at or near each corner of each fixture.

GROUNDING

Ground non-current-carrying parts of equipment as specified in "Interior Wiring Systems." Where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

FIELD TESTS

The Contractor will provide electric power and apparatus / instruments required and carry out the field tests.

a. Operating Test

Upon completion of the installation, conduct an operating test to show that the equipment operates in accordance with the requirements of this section.

b Insulation Resistance Test

Perform as specified in "Interior Wiring Systems", both before and after connection of fixtures and equipment.

b. Ground Resistance Tests

Perform as specified in "Interior Wiring System."

ITEM 16 : GROUNDING SYSTEM AND LIGHTNING PROTECTION**GENERAL****REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American National Standards Institute (ANSI)

ANSI C135.30 (1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

2. Institute of Electrical And Electronics Engineers (IEEE)

IEEE Standard 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Potentials of a Ground System

3. National Fire Protection Association (NFPA)

NFPA 70 (2007) National Electrical Code
NFPA 780 (2007) Lightning Protection Code

4. Underwriters Laboratories (UL)

UL Elec Const Dir (2007) Electrical Construction Materials Directory
UL 96 (2005) Lightning Protection Components
UL 96A (2007) Installation Requirements for Lightning Protection Systems
UL 467 (2007) Grounding and Bonding Equipment

5. Institute of Integrated Electrical Engineer (IIEE)

PEC (2002) Philippine Electrical Code

6. Philippine National Standard (PNS)

BS (2002) Bureau of Standard

RELATED REQUIREMENTS

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

1. System Requirements

Materials shall consist of standard products of a manufacturer regularly engaged in production of lightning protection systems and shall be manufacturer's latest UL approved design. Lightning protection system shall conform to PEC, NFPA 70, NFPA 780, UL 96 and UL 96A.

SUBMITTALS

1. Shop Drawings

Overall lightning protection system for each major component

2. Test Reports

Grounding system test
Lightning protection system inspection

3. Certificates

UL listing or label

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.

1. Installation Drawings

- a. Submit installation shop drawing for the overall lightning protection system. Drawings shall include physical layout of the equipment, mounting details, relationship to other parts of the work, and wiring diagram.
- b. Submit detail drawings for each major component to include manufacturer's descriptive and technical literature, catalogue cuts, and installation instructions.

2. UL Listing or Label

Submit proof of compliance, label of acceptable evidence. In lieu of label or listing, submit written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that items have been tested and conform to requirements and testing methods of Underwriters Laboratories.

SITE CONDITIONS

Contractor will become familiar with details of the work, verify dimensions in the field, and advise the Engineer of discrepancies before performing work. Deviations from contract drawings will not be made without prior approval of the Engineer.

MATERIAL REQUIREMENTS

MATERIALS

Do not use a combination of materials that form an electrolytic couple of such nature that corrosion is accelerated in presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, provide conductors with protective coatings or oversize conductors. Where mechanical hazard is involved, increase conductor size to compensate for hazard or protect conductors by covering them with or tubing made of nonmagnetic material.

1. Main and Bonding Conductors

NFPA 780 and UL 96

2. Copper

Provide copper conductors on non-metallic stacks that do not weigh less than 144.83 kg per 300 meters and provide cable such that the size of any strand in the cable is not less than 2.0mm².

COMPONENTS

1. Air Terminals

Provide terminals in accordance with UL 96. Support air terminals by suitable brace, with guides, not less than one-half the height of the terminal.

2. Ground Rods

Provide ground rods made of copper-clad steel conforming UL 467. Provide ground rods that are not less than 20mm in diameter and 3000mm in length. Do not mix ground rods of copper-clad steel, stainless steel, galvanized ferrous, or solid copper on the job.

3. Connections and Terminations

Provide connectors for splicing conductors that conform to UL 96, class as applicable. Conductor connections can be made by clamps or welds (including exothermic). Provide style and size connectors required for the installation.

4. Connector Fittings

Provide connector fittings for "end-to-end", "Tee", or "Y" splices that conform to NFPA 780.

5. Lightning Protection Components

Provide bonding plates, air terminal supports, clips, and fasteners that conform to UL 96 classes as applicable.

EXECUTION

INTEGRAL SYSTEM

Lightning protection system consists of air terminals, down conductors, ground connections, grounding electrodes and ground loop conductor. Electrically interconnect lightning protection system to form the shortest distance to ground. Do not use non-conducting parts of the structure as part of the building's lightning protection system. Conductors are required to be in protective sleeves.

1. Air Terminals

Air terminal design and support conforming to NFPA 780. Rigidly connect terminals to, and make electrically continuous with, down conductors by means of pressure connectors or crimped joints of T-shaped malleable metal. Provide pressure connector or crimped joint with a dowel or threaded fitting to connect ground rod conductor with air terminal. Set air terminals at ends of structures not more than 610mm from ends of ridges. Where non-metallic spires is present, mount air terminal to the side. In addition, where spires project more than 3050mm above the building, conductors continue from air terminal to nearest down conductor securely connect thereto.

2. Down Conductors

Make down conductors electrically continuous from air terminals to grounding electrodes. Equally and symmetrically spaced down conductors about the perimeter of the structure. Protect conductors where necessary, to prevent physical damage or displacement to the conductor.