ITEM 24 : WIRE COMMUNICATION AND SIGNAL SYSTEM

TELEPHONE SYSTEM

GENERAL

Electrical General Requirements apply to this Item with the additions and modifications specified herein.

DESCRIPTION OF WORK

The telephone/data system shall consist of an interior system of conduits, outlet, boxes, and junction boxes. While Local Telephone Company as provider for PABX interconnection for data /voice, router / Hub switch/ WI-FI modem with necessary Cat-6 cables.

These details as indicated in the plans should be coordinated with the local telephone company as the provider. Any deviation of the plans and specifications shall be brought to the attention of the Engineer for resolution.

PRODUCTS

CONDUIT AND FITTINGS

a. The 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. At all outlets of any 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 own expense. In general outlet boxes should be at least 100 mm 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.

LOCAL TELEPHONE COMPANY PROVIDER / INTERCONNECTION OF PABX SYSTEM

a. All components and connections of Telephone Company shall conform to EIA/TIA standards.

b. Cable terminals shall be the type acceptable to the Telephone Company. Terminals shall be Cat- 6 as required in the plans.

c. Intermediate Distribution Frame (IDF)

The Intermediate Distribution Frame (IDF) is a free-standing or wall-mounted rack for managing and interconnecting a telecommunication between end-user devices and the main distribution frame (MDF).

The IDF might be located on each floor or a multi-floor story building, which arranges cables along the walls in the MDF on the first floor. The MDF would contain wires connecting the telephone company with the service provider to one or another building.

The IDF can contain circuit termination equipment from various auxiliary components in central part of the office environments. In both LAN and WAN conditions. Additionally, IDF can handle different types of devices, including backup systems, hard disk drives, independent disk, coaxial cable, category-6, fiber optic cables, and networking devices, including hubs, switches and routers.

EXECUTION

INSTALLATION

The telephone installation shall be installed as shown in the approved plans.

MODEM /Wi-Fi network:

- Connect the cables. Once you've acquired a wireless router, you'll need to connect it to your existing Internet modem.
- Configure your router. Next, you'll need to use your computer to configure your router's default settings.
- Some modems encounter issues when paired with a specific Internet company (e.g., Comcast). Double-check your modem's compatibility with your current Internet subscription before buying (if possible). Calling your ISP is usually the best bet to figure this out.
- If you find that your modem won't work with your current subscription, try to exchange the modem for a different one that will work.

- The cable output resembles a metal cylinder with a small hole in the middle and screw threads all around the sides. You'll usually find cable outputs on the wall near the floor in the ticket booth and in some place in indoor area.

- In some cases, there will already be a cable connected to the cable outlet.
- The modem should be relatively high up (e.g., on top of the ceiling floor), and it will need to be close enough to the cable output that you can connect without stretching or bending the cable. You'll also need to have a power outlet nearby.
- A modem generally requires a coaxial cable to connect to the cable output, as well as a power cable to connect to an electrical outlet. Both cables should come with your modem, but if you bought it used, you may need to find replacement cables.

- If you plan on attaching the modem to a router, you will also need an Ethernet cable.

- Consider buying a longer coaxial cable if the one that you have is too short to allow you to mount your modem properly.
- Each modem is unique, and you may require additional setup outside of this capacity. Reading your modem's manual will help make you aware of any additional steps that you have to take to install the modem.

- In most cases, it's important to contact your ISP and inform them that you have a new modem. The support professional will ask you for some information regarding the modem to walk you through the first steps.

CONNECT YOUR PABX TO LOCAL NETWORK AND CONNECT LOCAL TELEPHONE LINES TO PABX.

- Connect your PABX to the network.

  Connect one end of an Ethernet cable to the LAN port of your PABX, and the other end to any port of your company's LAN switch/router.

- Power on your PABX.

  Plug the provided power cord or power adapter into the power inlet of the PABX, and the other end to a standard electrical wall socket.
  Wait for the system to boot up till the SYSTEM LED starts to blink.

- Connect your PABX to the telephony lines

HORIZONTAL CABLE

All horizontal cables shall be Category 6 network cables.

TELEPHONE / DATA OUTLETS

All modular jacks shall be data grade Cat- 6.

SHOP DRAWINGS

Prepare and submit complete shop drawings for the telephone layout system in accordance with the latest Local Telephone Company.

ITEM 25 : MECHANICAL GENERAL REQUIREMENT

GENERAL

This section applies to all Item of "MECHANICAL WORKS" except where specified in each individual section.

WORK DESCRIPTION

The work shall include the furnishing of equipment, materials, tools, labor, supervision, and other services required to install, complete, test and make operational the whole system as described on the Drawings and the Technical Specifications.

Specifically the work shall involve the following:

a. To supply, deliver, install, wires/cables, conduit, circuit breaker and make operational the variable refrigerant flow type inverter air conditioning units including bathroom exhaust fans for toilets as shown on the Drawings.

b. To supply and install the refrigerant piping system and condensate drain lines including necessary insulation and hangers.

c. To supply and install the electrical wiring connections from the AC supply provided by the Electrical Contractor which is located close to the point of installation. This shall include power and control wirings and interlocks with the thermostat control.

SUBMITTALS

Submit shop drawings, manufacturer's data and certificates for equipment, materials, and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Submittals shall include the manufacturer's name, trade name, catalogue model, or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable industry, and technical society publication references, years of satisfactory service, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish. Photographs of existing installations and data submitted in lieu of catalogue data are not acceptable and will be returned without approval. Submittals shall be a minimum of 5 print copies. Submittals of the contractor shall be reviewed and returned within a minimum of 21 days, each stamped with appropriate action.

1. Shop Drawings

Drawings shall be a minimum of 350mm x 500mm in size, with a minimum scale of 1:100 except as specified otherwise. Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment; and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.

2. Manufacturer's Data

Submittals for each manufactured item shall be manufacturer's brochure products, equipment drawings, diagrams, performance and characteristic curves, and catalogue cuts.

3. Standard Compliance

When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), Air Movement and Control Association, Inc. (AMCA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineers 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 testing and is approved by the Owner or his authorized representative. The certificate shall state that the item has been tested in accordance with the 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 reference standards listed. The edition or the revised version of such codes and standards current at the date twenty eight (28) days prior to date of bid submission shall apply. During Contract execution, any changes in such codes and standards shall be applied after approval by the Owner.

4. Codes, Inspection, Permits and Fees

a. The work under this contract shall conform to the latest requirements of:

1) Philippine National Building Code

2) Regulations of the Local Municipality

b. Nothing contained in these specifications or shown on the drawings shall be construed as to conflict with the National and local ordinances or laws. All such laws and ordinances are made a part of these Specifications.

c. All construction permits and fees for this work shall be obtained at the expense of the Contractor. The Contractor shall furnish the Owners and Engineers the final certificates of inspection and approval from the appropriate government authorities.

OPERATION AND MAINTENANCE MANUAL

Furnish an operation and maintenance manual for each item of equipment. Furnish three (3) copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual prior to the time that the equipment are performed and furnish the remaining manuals before the contract is completed. Inscribe the following identification on the cover: the words OPERATION AND MAINTENANCE MANUAL, the name and location of equipment or the building, the name of the Contractor, and the contract number. The manual shall include the names, addresses, and the telephone numbers of each subcontractor installing the equipment, and of the local representatives

for each item of equipment. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: wiring and control diagrams with data to explain detailed operation and control of each item of equipment; a control sequence describing start-up, operation and shutdown; description of the function of each principal item of equipment; the procedure for starting; the procedure for operating; shutdown instructions; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range, and frequency, safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list. The parts list for equipment shall indicate the sources of supply, recommended spare parts, and the service organizations which is reasonably convenient to the project site. The manual shall be complete in all respect for equipment, controls, accessories, and associated appurtenances provided.

POSTED OPERATING INSTRUCTIONS

Furnish approved operating instructions for each system and principal item of equipment for the use of the operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal item of equipment. Operating instructions shall be printed or engraved and shall be framed under glass or in an approved laminated plastic and posted where directed by the Owner. Operating instructions shall be attached to or posted adjacent to each principal item of equipment and include directions for start up, proper adjustment, operating, lubrication, shut down, safety precautions, procedure in the event of equipment failure, and other areas as recommended by the manufacturer of each item of equipment. Operating instructions exposed to the weather shall be made of weatherproof materials or shall be suitably enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

SAFETY

1. Rotating Equipment Safety

Couplings, motor shafts, gears and other exposed rotating or rapidly moving parts shall be fully guarded. The guards shall be cast iron or expanded metal. Guard parts shall be rigid and suitably secured and shall be readily removable without disassembling the guarded unit.

INSTRUCTION TO OWNER'S PERSONNEL

When specified in other sections, the Contractor shall furnish the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements of the equipment or system specified. Each instructor shall be thoroughly familiar with all the parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Owner for regular operation. The number of man-days (8 hours) of instruction furnished shall be as specified in other sections. When more than 4 man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications in the equipment or system are made under the terms of contract, additional instruction shall be provided to acquaint the operating personnel with the changes or modifications.

DELIVERY AND STORAGE

Equipment and materials shall be handled, stored, and protected to prevent damage before, during, and after installation, in accordance with the manufacturer's recommendations and as approved. Damaged or defective items shall be replaced without cost to the Owner.

STANDARD PRODUCTS/SERVICE AVAILABILITY

1. Materials and Equipment

Materials and equipment shall be standard products of manufacturer regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for seven years prior to bid opening. The seven year use shall include applications of equipment and materials under similar circumstances and of similar size as specified for the Project. The equipment shall be soled exclusively by a single, stable distributor with after sales capability.

2. Experience Required

The five (5) years experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogues, or brochures.

3. Alternative Service Record

Products having less than a five-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests can be shown.

4. Service Record

The equipment items shall be supported by service organizations. The Contractor shall submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall reasonably be convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

5. Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

SAFETY REQUIREMENTS

Belts, pulleys, chains, gears, couplings, projecting set screws, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded in accordance with OSHA 29 CFR 1910.219. High temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guardrails shall be provided where required for safe operation and maintenance of the equipment.

MANUFACTURER'S RECOMMENDATIONS

Where installation procedures or any part are required to be in accordance with the manufacturer's recommendations of the material being installed, printed copies of these recommendations shall be furnished to the Owners and Engineers prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

ELECTRICAL REQUIREMENTS

Electrical components of mechanical equipment and systems such as motors, starters, and controls shall be provided under this Item and shall be as specified herein and as necessary for complete and operable system. Extended voltage range motors will not be permitted. Interconnecting wiring for components of packaged equipment shall be provided as an integral part of the equipment.

ELECTRICAL MOTORS

1. All electrical motors of sizes and types as specified for driving air conditioning and ventilating equipment shall be furnished and erected under this section. All motors shall be of proper power and speed to suit the specified makes of equipment. If other makes of equipment are accepted in any case, the proper adjustment of motor speed and power including affected changes in electrical system circuit breakers and wiring must be included without additional cost to the Owner. Technical data shall be submitted for approval before the equipment is purchased.

2. All motor ratings shall be as specified on the drawings.

3. Generally, all motors shall be constant speed, squirrel-cage type motors and energy efficient except as otherwise listed on plans. Single phase motors shall be capacitor start induction-run or split phase type as approved for the service.

4. All belt-connected motors shall have adjustable bases and set screws to maintain proper belt tension, and shall be provided with proper belt guards.

5. All motors and accessories shall comply in all respect with NEMA Standards. Types shall be as required by Local Code.

6. All motors shall be furnished with type "B" insulation and tropical fungus proofing according to NEMA standards.

CHANGES IN WORK DUE TO APPROVAL OF ALTERNATE MATERIALS

Assure the cost of, and the entire responsibility for any changes in the work shown on the Contract Documents which may be occasioned by approval of materials proposed by the Contractor other than those specified.

GUARANTEE

Furnish the Owner a written guarantee covering the satisfactory operation of the mechanical installation in all its parts for a period of one (1) year after date of final acceptance of work. During this period, repair or replace any defective work, materials or equipment furnished and installed without any cost to the Owner. Include with this guarantee certificate of every material supplier engaged by this trade of the project.

AS-BUILT DRAWINGS

1. The Contractor shall, during the progress of work, keep record of all deviations of the actual installation from that shown on the Contract Drawings.

2. Upon completion of work, the Contractor shall submit two (2) copies of the as-built drawings, signed by the Contractor's Registered Professional Mechanical Engineer and Owner Project Inspector, indicating the work as actually and finally installed, including new information not originally shown in Contract Drawings.

3. Approval of as-built drawings by the Engineer shall be a requirement for final acceptance of the completed works and of final payment.

QUALITY ASSURANCE

1. Surveys and Measurements:

   a. The Contractor shall base measurements, both horizontal and vertical, from established benchmarks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.

   b. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or intent of the drawings and specifications, he shall notify the Owner's representative and shall not proceed with his work until he has received instructions from the Owner's representative upon referring the matter to the Engineer.

2. Drawings and Minor Modification:

   a. Drawings are diagrammatic and indicate the general arrangement of the system and work included in the contract. Drawings are not to be scaled. The drawing and details shall be examined for exact location of fixtures and equipment by verifying actual site conditions.

   b. The Contractor shall follow drawings in laying out work and check drawing of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Owner's representative shall be notified before proceeding with installation, if directed by the Owner's representative, the Contractor shall, without extra charge, make reasonable modifications and the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

   c. Materials and Workmanship

   All materials and apparatus required for the work, except as specified otherwise, shall be new of first class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of materials is given, first class standard articled shall be furnished.

ITEM 26 : VARIABLE REFRIGERANT FLOW AIR-CONDITIONING SYSTEM

GENERAL

"Mechanical General Requirements" applies to this Item with additions and modification specified herein.

INTRODUCTION

Variable refrigerant flow (VRF) systems vary the flow of refrigerant to indoor units based on demand. This ability to control the amount of refrigerant that is provided to fan coil units located throughout a building makes the VRF technology ideal for applications with varying loads or where zoning is required. VRF systems are available either as heat pump systems or as heat recovery systems for those applications where simultaneous heating and cooling is required. In addition to providing superior comfort, VRF systems offer design flexibility, energy savings, and cost effective installation

VRF TECHNOLOGY

In a VRF system, multiple indoor fan coil units may be connected to one outdoor unit. The outdoor unit has one or more compressors that are inverter driven, so their speed can be varied by changing the frequency of the power supply to the compressor. As the compressor speed changes, so does the amount of refrigerant delivered by the compressor. Each indoor fan coil unit has its own metering device that is controlled by the indoor unit itself, or by the outdoor unit. As each indoor unit sends a demand to the outdoor unit, the outdoor unit delivers the amount of refrigerant needed to meet the individual requirements of each indoor unit .

ADVANTAGES OF A VRF SYSTEM

Control Means Comfort The key to providing comfort is to supply heating or cooling when and where it is required without swings in room temperature. In conventional systems, the compressor is either on or off, so even spaces that have individual controls experience fluctuations in room temperature as the compressor stops and then starts again to maintain the thermostat setting.

In a VRF system, since the speed of the compressor can be varied, the compressor does not cycle on and off, but operates continuously for longer periods. The required refrigerant flow is supplied to the indoor fan coil and once the set point is reached, the refrigerant flow is adjusted to maintain the room temperature smoothly without fluctuation. In addition to having distinct set points, the indoor unit fan speeds and louver positions can be changed to provide additional comfort in the space.

Design Flexibility

One of the major advantages of a VRF system is the flexibility provided by the diversity of multiple types and sizes of fan coils are available to fit for any application. The zoning layout for a VRF system, combining outdoor units, 4-way cassette type fan coils, and hi-wall type fan coils to create comfortable conditions for varying uses of 15 different spaces within the same building. When selecting a VRF system, keep in mind that not all systems have the same piping capabilities. Systems that offer expanded piping capabilities will maximize the application flexibility provided by the VRF technology. Important considerations when reviewing piping capabilities are: 1) the maximum elevation difference allowed between the highest and lowest indoor units on a single system and 2) the distance allowed from the outdoor unit to the farthest fan coil on the system.

Cost Effective

Installation depending on the application, the installation of a VRF system can be a cost effective alternative to traditional systems that require ductwork or large pipe sizes, and pumps and boilers in the case of chilled water systems.
Outdoor units are light in weight and have a small footprint. This means that they will fit in a service elevator, so no crane is required for lifting to a rooftop installation. In some cases, savings on the total construction cost can be achieved since the lightweight unit means that additional support structure in the roof is not required.

Energy Savings

All VRF systems provide energy savings by varying compressor speed and matching the output of the system as closely as possible to the load. In addition, VRF systems do not experience the same energy losses as systems that move conditioned air through ductwork. However, differences in design in the available outdoor units will influence the efficiency level that is achieve

GENERAL REQUIREMENTS

1. Air conditioning units, fan coil units (FCU) and Air-cooled condensing units (ACCU) shall be of Variable Refrigerant flow (VRF) or variable refrigerant volume (VRV) system.

   Air-cooled condensing units (ACCU) shall be 230volts, 3-phase and 60 hertz or as indicated in the equipment schedule. ACCU shall be of high heat and corrosion resistance.

   Fan coil units (FCU) shall be 230volts, 1-phase or 3-phase and 60 hertz as indicated in the equipment schedule. FCU shall be with washable air filters and wireless thermostat remote controller. FCU shall be of low noise level or as indicated in the equipment schedule and shall be provided with adequate vibration insulators.

2. Refrigerant Piping, Fittings and Accessories

   Refrigerant piping assembly as used in this section includes pipes, flanges, bolting, gaskets, valves, relief devices, fittings, and the pressure containing parts of other piping components. It also includes hangers and supports and other equipment items necessary to prevent overstressing the pressure containing parts.

   a. Piping

   ANSI 15 and ANSI B31.5. Compatible with fluids for which they are being used and capable of withstanding the pressures and temperatures of the service that they are handling.

   b. Tubing

   Refrigerant piping shall be seamless copper tubing, hard drawn, type K, ASTM B88. Tubing used for refrigerant service shall be cleaned, sealed, capped or plugged prior to being shipped from the manufacturer's plant. Fittings for copper tubing shall be wrought copper or bronze, brazing or solder joint type ANSI B16.18 or ANSI B16.22. Copper flared type tubing may be made only in annealed copper tubing ASTM B280 and in nominal sizes smaller than one- inch only for connection to equipment and no larger than 1-3/8 inches diameter for other connections. Flanges shall be of bronze ANSI B16.24.

3. Corrosion Prevention

Unless specified otherwise, equipment fabricated from ferrous metals that do not have a zinc coating shall be treated for prevention of rust with a factory coating or paint system that will withstand 125 hours in a salts-spray fog test except that equipment located outdoors shall be tested for 500 hours. The salt-spray fog test shall use a 20 percent sodium chloride solution. Immediately after completion of the test, the coating shall show no signs of blistering, wrinkling or cracking, no loss of adhesion, and the specimen shall show no signs of rust creep age beyond 1/8 inch on either side of the scratch mark. The film thickness of the factory coating or paint system applied on the equipment shall be not less than film thickness used on the test specimen.

4. Safety Standards

a. Design, Manufacture and Installation of Mechanical Refrigeration Equipment: ASHRAE Safety Code for Mechanical Refrigeration.

b. Machinery Guards: Fully guard drive mechanisms, or other moving parts. Provide guards fabricated of steel and expanded metal, rigidly mounted, and readily removed without disassembly.

5. Fans and Centrifugal Blowers

All fans and centrifugal blowers shall be of the type and capacity indicated and constructed in accordance with AMCA Standards. Wheels shall be dynamically and statically balanced and free from vibrations and noise. Fan wheels handling outside air shall have factory applied phenolic coating. All fans discharged up-blast or exposed to the weather shall be equipped with 11/2-inch casing drains and piped to the nearest floor drain. All fans with non-ducted inlets shall be provided with galvanized or aluminum automatic shutters. Centrifugal blower unit shall be complete with TEFC motor, grease fitting, belt guard and support as scheduled.

Fan shaft hot rolled or forged steel machined to close tolerances for proper bearing fit and provided with keys for impeller hubs and fan pulleys.
Fan outlet shall be removable angles and bolts for attaching canvas or other flexible connections.
Fan housing shall be provided with access panels
and drains

Ceiling mounted; ducted type exhaust fans shall be 230volt, 1-phase and 60 hertz or as indicated on equipment schedule.

MATERIAL REQUIREMENTS

Variable Refrigerant Flow Air–Conditioning System

1. General

Variable refrigerant flow (VRF) is a type of air conditioning system that uses a single refrigerant circuit to connect multiple indoor units to a single outdoor unit. VRF systems are also known as variable refrigerant volume (VRV) systems.
VRF systems are highly efficient and can be used for both heating and cooling

Each indoor fan coil unit has its own metering device that is controlled by the indoor unit itself, or by the outdoor unit. As each indoor unit sends a demand to the outdoor unit, the outdoor unit delivers the amount of refrigerant needed to meet the individual requirements of each indoor unit.

2. Performance Rating

Cooling capacity of unit shall meet the sensible heat requirements and total requirements indicated. In selecting unit size, make true allowance for "sensible to total heat ratio" to satisfy required sensible cooling capacity. Submittals shall include catalogue selection data which accounts for sensible to total heat ratio, entering air-conditions at evaporator, and condenser air-conditions.

3. Wall Mounted Air- Condition

Wall-mounted air conditioners, also known as split type air condition systems, cool a specific room or zone using an indoor unit mounted on the wall and an outdoor unit connected via refrigerant lines, offering efficient and space-saving cooling.

4. Floor Standing Air -Condition

Floor Standing Air Conditioner (Inverter type) runs with R410A refrigerant which considered to be Eco Friendly unit. Wind blows in multi-directional 3D air flow and have turbo function with self diagnosis features and LED display.

5. Air Conditioners, Ceiling Cassette Type Inverter

The air conditioning system has a 4-way air distribution with auto sweep, it can cool an adjacent room using of the 4-way airflow outlets The fresh air intake device and additional outlet grille can condition the air in an adjoining room using one of its 4-way airflow sides..

6. Compressors

The VRF systems available on the market today differ according to the number and type of compressor.

The 3 types of units that will be compared here are:

- Single Variable Speed Compressor
- Variable Speed Compressor Plus FixedSpeed Compressor
- Multiple Variable Speed Compressors

a.) Single Variable Speed Compressor In this system with a single, large-capacity scroll compressor, the same compressor starts and runs when there is demand and no redundancy is available if the compressor fails.

b.) Variable Speed Compressor Plus Fixed-Speed Compressor In this two-compressor system, the inverter-driven compressor always starts and ramps up until it reaches its maximum capacity at which time the fixed-speed compressor starts and the inverterdriven compressor ramps down. This system provides back-up capability.

c.) Multiple Variable Speed Compressors Outdoor units with multiple inverter-driven twin rotary scroll compressors, as shown in Fig. 5, offer the most complete set of advantages achievable with a VRF system. The system with 3 inverter-driven compressors also provides greater back-up capability. If one of the compressors fails, the system will continue to operate at 67% of its original capacity, and comfort will be maintained in the conditioned space until the faulty compressor can be replaced. The starting sequence of the compressors is rotated, equalizing their operating time and thereby minimizing excess operation of an individual compressor. Multiple inverter-driven compressors allow the unit to provide better part load performance without the need to use hot gas bypass. Under low-load conditions, the system has the

advantage of running only as many compressors at whatever speed is required to achieve the capacity necessary to satisfy the load and maintain comfort within the conditioned space.

7. Coils

a. Cooling coils shall conform to ARI 410 and to paragraph entitled, Cooling Coils. Coils shall be the type indicated or specified herein.

b. The air-cooled condenser coil shall be extended-surface fin-and-tube type with seamless copper or aluminum construction. Aluminum alloy conforming to ASTM B210, alloy 1100, shall be used for the tubes, and aluminum alloy conforming to chemical requirements of ASTM B209, alloy 7072, shall be used for fins and sheets. Fins shall be soldered or mechanically bonded to tubes and installed in a metal casing. Coils shall be air tested under water for leakage. After testing, dry coils for remote type units to remove free moisture, and cap to prevent entrance of foreign matter. Evacuate and seal coils at the factory.

8. Filter Boxes

Provide filter boxes with either hanged access doors or removable panels. Filter boxes shall have racks for filters arranged for angle pattern. Filters shall be of type indicated and shall conform to paragraph hereinafter entitled, "Filters".

9. Mixing Boxes

Mixing boxes shall be of physical size to match the basic unit and include equal sized flanged openings, each sized to handle full air flow. Arrangement of openings shall be as indicated. Provide openings with dampers of opposed blade type. All damper shafts shall be connected together by one continuous linkage bar. Arrange dampers for manual operation so that when one starts to close from its opened position, the other starts to open from its closed position.

10. Controls

a. Condenser Controls

Provide load pressure control to insure condensing temperature for proper system operation at all ambient temperatures down to 40°F.

b. Condenser Start-up Control Provide condenser with a start-up control package which permits start-up compressor regardless of low ambient temperatures. Package shall temporarily bypass system low pressure-start to permit start-up whenever minimum ambient temperature is below design evaporator coil suction temperature.

11. Refrigerant Circuits

Entire refrigerant circuit shall be dehydrated, purged, and charged with refrigerant and oil at factory. Factory oil charge shall be the full amount required for operation. Factory charge for refrigerant shall be the full amount required for operation.

12. Corrosion Protection

Units shall be factory corrosion protected in accordance with paragraph entitled, Corrosion Prevention.

EXECUTION

INSTALLATION

Application and installation practices for VRF air-conditioning systems shall conform to the requirements of an acceptable industry standard for installation.

1. General

Install equipment and components in a manner to insure proper and sequential operation of the equipment and its controls. Installation of equipment not covered herein or in manufacturer's instructions shall be installed as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supported vibration isolators, stands, guides, anchors, clamps, and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise shown in the drawings. Set anchor bolts and sleeves accurately using properly constructed templates. Anchor bolts shall be of adequate length and provided with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grouted-in with a non-shrinking type of grouting mortar. Locate equipment so that working space is available for all necessary servicing such as shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

Air–Condition System must be installed as shown in the approved plans.

2. Variable Refrigerant Flow Air-Conditioning System

Install system as indicated, in accordance with the requirements of ASHRAE 15-76 and as recommended in the manufacturer's installation and operational instructions.

3. Electrical Work

Electric motor driven equipment specified herein shall be provided complete with motors, motor starters, and controls. Electrical equipment and wiring shall be in accordance with "Electrical General Requirements" . Motor starters shall be provided complete with properly sized thermal overload protection and other appurtenances necessary for the motor control wiring required for controls and devices but not indicated.

4. Piping

a. Piping Sleeves
Pipe sleeves shall be as Galvanized Iron, Schedule 20.

b. Provide refrigerant driers, sight glass liquid indicators, moisture indicators, and strainers in refrigerant piping for remote installations when not furnished by the manufacturer as part of the equipment.

c. Locate strainers close to equipment they are to protect. Provide a strainer in the common refrigerant liquid supply to two or more thermal valves in parallel when each thermal valve has a built-in strainer. Install strainers with screen down and in direction of flow as indicated on strainers body.

d. Solenoid valves shall be installed in horizontal lines with stem vertical and with flow in direction indicated on the valve. If not incorporated as internal part of the valve, provide strainers upstream of the solenoid valve. Provide service valves upstream of the solenoid valve, upstream of the strainer, and downstream of the solenoid valve. Remove the internal parts of the solenoid valve when brazing the valve.

5. Auxiliary Drain Pans, Drain Connections, and Drain Lines

Provide auxiliary drain pans under all drain pans of the units located above finished ceilings or over mechanical or electrical equipment where condensate overflow over unit drain pan may cause damage to ceilings, piping, and equipment below. Provide drain lines for all drain and auxiliary drain pans. Trap the drain from bottom pan of air-conditioning units to insure complete pan drainage. Drain lines shall be full size of opening.

6. Air Filters

Provide access panels for all concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.

7. Inspection Plates and Test Holes

Inspection plates and test holes where required in casings for air balance measurements shall conform to SMACMA High Pressure Low Velocity Duct Construction Standards. Test holes shall be a factory-fabricated, air-tight, non-corrosive test hole with screw cap and gasket. Extend cap through insulation.

8. Flashing and Pitch Pockets

Provide flashing and pitch pockets for equipment support and roof penetrations and flashing where piping or ductwork passes through exterior walls.

FIELD TESTS AND INSPECTIONS

1. Tests

All tests shall be performed and materials and equipment required for test shall be furnished by the Contractor. Tests after installation and prior to acceptance shall be performed in the presence of a representative of the Owner and subject to his approval. Equipment and material certified as having been successfully tested by the manufacturer in accordance with referenced specifications and standards will not require retesting before installation. Equipment and materials not tested at the place of manufacturer will be tested before or after installation, as applicable, where necessary to determine compliance with referenced specifications and standards.

2. Leak Testing

Upon completion of installation of the air-conditioning equipment, test all factories as well as field refrigerant piping with an electronic-type leak detector to acquire leak tight refrigerant systems. If leaks are detected at the time of installation or during the guarantee period, remove the entire refrigerant charge from the system, correct the leaks and retest the system.

3. Evacuation, Dehydration, and Charging

After system is found to be without leaks, evacuate the system using a reliable gauge and a vacuum pump capable of pulling a vacuum of at least 1 mm lig absolute. Evacuate system in strict compliance with the triple evacuation and blotter method or in strict accordance with

equipment manufacturer's printed instructions. System leak testing, evacuation, dehydration, and charging with refrigerant shall comply with the requirement contained in an acceptable industry standard.

4. Start-Up and Operation Tests

The air-conditioning system and its components shall be started and initially placed under operation and checked to see that it is functioning correctly. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence. The operational test shall be not less than 8 hours.

5. Performance Tests

Upon completion of evacuation, charging, start-up, final leak testing, and proper adjustment of controls, the system shall be performance tested to demonstrate that it complies with the performance and capacity requirements of the specifications and plans. Test the system for not less than 8 hours, during which time hourly readings shall be recorded. At the end of the test period, the readings shall be averaged and the average shall be considered to be the system performance.

6. Sound Tests, VRF Air-conditioners Type

Sound pressure level measurements shall be conducted on units designated by the Owner. Calculate sound power levels by ASHRAE Systems Handbook and Product Directory. Submit test results and calculations.

ITEM 27 : EXHAUST EQUIPMENT

EXHAUST EQUIPMENT

GENERAL

"Mechanical General Requirements" applies to this Item with additions and modification specified herein.

SCOPE OF WORK

1. Furnish materials that are new, of first-class quality.
2. Install all materials in strict accordance with the manufacturer's instructions and specifications.

PRODUCTS

MATERIAL REQUIREMENTS

1. Bathroom Ceiling Mounted Exhaust Fan

The exhaust fans shall be of the built-in ceiling type, ceiling mounted, suitable for operation. Sizes and capacities are based on models or approved equal. Brand and models indicated herein is for the purpose of establishing product quality, capacities and dimensions. Other brands satisfying the same shall likewise be accepted, subject to the approval of the owner and Engineer In-Charge. The capacities of the units shall be as shown on the Drawings.

2. Wall Mounted Propeller Exhaust Fan (Optional)

The wall-mounted propeller exhaust fan shall be direct-drive three blade type with a steel mounting plate. Capacity of the fan shall be as shown on the drawings. Fan blades shall be constructed of steel or aluminum. The fan hub shall be of heavy construction and shall be of steel or semi-steel, and the blades shall be riveted to the hub. Fan blade shall be quiet in operation and shall be statically and dynamically balanced at the factory. Motor and Drive shall be of the condenser motor type, tightly sealed and dust proof with non-lubricating ball bearings. The fan shall be provided with automatic shutters to prevent air from re-entering the fan when fan is off. The fan control switch shall be located as near as possible to the fan.

EXECUTION

1. Install the fan securely to the ceiling.
2. Install back-draft dampers and check to make sure they are free to open and close.
3. Connect power and check rotation of fan.

ITEM 28 : ELECTRICAL WORKS (PORT LIGHTING, COVERED WALKWAY & GUARDHOUSE)

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 Philippine National Standard	- -	(PEC) (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 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.

c) 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.

d) 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.

e) The materials and equipment to be furnished shall be standard products of reputable manufacturers engaged in the reproduction of such materials and equipment.

f) All permits and electrical fees required for this work shall be obtained at the expense of the Contractor. The Contractor shall furnish the Engineer-in-Charge, the final Certificates of Inspections and approval from the proper government authorities after the completion of work. The Contractor shall prepare all as- built plans and all other paper works as required by the enforcing authorities.

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

The existing solar lamp post and its location will be re-installed as shown in the approved plans.

INTERIOR WIRING SYSTEM (PUMPHOUSE & COVERED WALKWAY)

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)
5. Device Plates
6. Insulated conductors
7. Duplex convenience outlet and utility / junction boxes

INTERIOR LIGHTING SYSTEM & ACCESSORIES

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.

PRODUCT

a. Vertical downlight recess mounted type without glass cover with lamp holder, 220V, E27, 18-watt LED bulb, daylight

b. Weatherproof housing 1 * 1200 mm T-8 LED Tube Light (industrial type)

c. 3-prong duplex convenience outlet with grounding

d. Two gang switches

e. Three gang switches

EXECUTION

INSTALLATION

For Pumphouse, Covered Walkway and Port Lighting System the interior lighting and wiring installation system must be installed as shown in the approved plans.

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

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

WORKMANSHIP

The work throughout shall be executed in the best and most thorough manner under the direction of and to the satisfaction of the Registered Electrical Engineer or Master Electrician, who will interpret the intent meaning of the drawings and specifications 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 29 : DISTRIBUTION TRANSFORMER

SCOPE OF WORK

The work to be done shall consist of supply, and delivering and installing a distribution transformer completed in accordance with all the materials submitted by Surigao del Norte Electric Cooperative (SURNECO), including labor, tools and equipment and all incidental work as found necessary.

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. American National Standard Institute - (ANSI)
2. Institute of Electrical and Electronics Engineers - (IEEE)
3. National Electrical Manufacturer Association - (NEMA)
4. Philippine Electrical Code - (PEC)
   Philippine National Standard - (PNS)

b) Materials Requirements

- Distribution Transformer,
- Conventional
- Pole Type
- Oil Immersed
- Self –Cooled
- Single Phase, 1Ø, 60hz
- 65 °C Temperature rise

Capacity	:	Coordinate with local electric cooperative (Transformer- KVA)
Primary Voltage	:	7.62 / 13.2 Y kV 2-2.5% taps FCAN and 2-2.5% taps FCBN Available on tap changer for de-energized operation
Primary BIL Rating	:	95kV
Secondary Voltage	:	120 /240V
Secondary BIL Rating	:	30kV
Percent Impedance	:	ANSI Standard
HV/LV Conductor	:	Copper / Aluminum
Insulating Fluid	:	Mineral Oil
Core	:	Silicon Core
NLL	:	190W
LL	:	650W

c) Standard Test Reports:

1. Routine Tests:

- Turn Ratio Test
- Voltage Ratio Test
- No Load Loss & Load Loss Test
- Impedance Voltage Test
- Applied Potential Test
- Induced Potential Test

2. Type of Test:

- Impulse test
- Temperature Rise Test

PRODUCTS (DISTRIBUTION TRANSFORMER)

External Features:

- High Voltage Bushing
- Low Voltage Bushing
- Tank and Cover
- Pressure Relief Valve
- Tank and Low Voltage Grounding Provision
- Externally Operated No-Load Tap Changer
- Radiators

Internal Features:

- Core Coil Assembly
- Winding Material
- Insulating Di-Electric Fluid
- Coil Support

PRODUCTS (GENERAL DESCRIPTION)

1. **High Voltage Bushing**, the cover mounted and tank - wall high voltage bushing is made of wet processed porcelain suitable for both copper and aluminum conductors.

2. **Low Voltage Bushing**, single or double eyebolt or spade terminal made of wet process porcelain.

3. **Tank and Cover**, manufactured from hot-rolled steel sheets and pressure tested to ensure a leak free enclosure. Grit blasted or chemically treated to remove every trace of scale, rust or oil, for better paint adhesion. Outer and inner surfaces are primed with epoxy primer for rust prevention and the outer surface is coated with polyurethane.

4. **Pressure Relief Valve** gradually releases excess pressure and is designed for outdoor condition.

5. **Tank and Low Voltage Grounding Provisions**, provided to help prevent damage to the transformer during electrical surges.

6. **Externally Operated No-Load Tap Changer**, provides up to five (5) primary voltage for convenient changing of high voltage tap connection at no –load.
7. **Radiators**, made of hot-rolled steel sheets, are provided for higher KVA units for added cooling surface.

8. **Core Coil Assembly** uses a superior transformer insulation system and is permanently centered in the tank using a close fitted steel frame. Materials used for our coils are either silicon-iron for our blue and silver series or Amorphous metal for our gold line.

9. **Winding Material**, distribution transformer uses a combination of standard copper-aluminum or copper-copper winding materials.

10. **Insulating –DI- Electric Fluid**, used are either mineral oil or an environment friendly high fire point fluid.

11. **Coil Support** used compatible materials to hold the coil in place and restraint it during short circuit-circuit conditions. Core clamps and clamp angles are also used to ensure that the core and windings are effectively secured even during mechanical stresses.

EXECUTION

INSTALLATION

The installation of the concrete pad transformer is in accordance with the rules and regulations of the requirements of the local electric cooperatives of Surigao del Norte.

GROUNDING

Ground all exposed non-current-carrying metallic parts of electrical equipment.

WORKMANSHIP

The work throughout shall be executed in the best and most thorough manner under the direction of and to the satisfaction of the Registered Electrical Engineer or Master Electrician, who will interpret the intent meaning of the drawings and specifications 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 30 : SOLAR PANEL CONNECTED ON GRID

SCOPE OF WORK

The scope of works includes Supply, Installation, Testing and Commissioning of Roof-Deck Mounted On-Grid PV Solar Panel. All necessary, feasibility study, Civil work, Mounting of Module Structures, PV Module Installation, Inverter Installation, DC/AC Cabling and interconnections, Installation of Lightning Arrester and Earthing System according to standards, Net Metering, and repairs of all necessary inspections from Surigao del Norte Electric Cooperative (SURNECO), as part of Pre-Commissioning, if any, and Commissioning of PV Solar Panel shall be subject to supplier scope including labor, tools and equipment and all incidental work if required.

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. Philippine Energy Regulatory Commission - (PERC)
2. Department of Energy - (DOE)
3. Renewable Energy Law (RA No. 9513) - (REL)
4. Philippine Electrical Code - (PEC)
   Philippine National Standard - (PNS)
5. Confederation of Solar Developers of the Philippines - (CSDP)
6. Philippines Solar Power Alliance - (PSPA)

b) Materials Requirements of Solar Panel PV

1. Solar PV modules and array
2. Module mounting structure
3. Junction Boxes
4. Power Conditioning Unit
5. DC & AC Switches
6. Cables and installation accessories
7. Earthing and lightning protection
8. Solar Meter and Net Meter

Solar PV Modules and Array:

Solar modules shall be Crystalline (Mono/Poly) (or) Thin Film (or) Concentrator PV modules type. The peak power output of the PV Module shall be min 550Wp under STC. Module Voc shall be minimum 40.10V. The power output of the PV module must be reported under standard test conditions (STC).

The mechanical structure shall withstand gusts of wind / cyclonic wind up to 185 km/hr from the back side of the panel.

Module Junction box (weatherproof), where the module terminals shall be interconnected and output taken, shall be designed for long life outdoor operation in harsh environments as per the relevant specifications and protected against surges. It should have a provision for "Opening" for replacing the cable, if required.

The modules must be installed according to the supplier's work oriented.

PV modules used in solar power must be warranted for output wattage, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years.

Module Mounting Structure:

The PV modules will be mounted on roof deck which can withstand loads of modules and high wind velocities up to 185 km per hour. The support structure used in the solar power will be hot dip Galvanized Iron (G.I).

The "Mounting Structure" should have the following features:

• The modules support structure shall be Mild Steel /hot dipped Galvanized Iron for holding the PV modules. The size of angle iron is prescribed by the supplier.

• Each panel frame structure shall be so fabricated as to be filled on the roof deck on its legs. The legs of the structure shall be fixed in the roof deck. The foundation shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly and shall withstand a maximum wind speed of 185 km/hr.

• All nuts and bolts should be made of good quality Stainless Steel.

• The structure should be designed to allow easy replacement of any module.

• The array structure should be so designed that it will occupy minimum space without sacrificing the output from the SPV panels.

• The minimum clearance of the lowest part of the module structure and the developed ground level shall not be less than 500 mm.

Junction Boxes:

The junction boxes must be dust proof, vermin proof, and waterproof, and they must be manufactured of FRP / Thermoplastic. The terminals must be linked to a copper bus bar configuration of appropriate size. The junction boxes must have sufficient cable entry ports with proper cable glands for both incoming and outgoing cables. For simple identification, suitable markings must be supplied on the bus bar, and cable ferrules must be installed at the cable termination positions. Each main junction box must include an adequate rated blocking diode. The junction boxes must be of high quality.

Power Conditioning Unit (PCU):

As SPV array produces direct current electricity, it is necessary to convert this direct current into alternating current and adjust the voltage levels to match the grid voltage. Conversion shall be achieved using an electronic Inverter and the associated control and protection devices. All these components of the system are termed the "Power Conditioning Unit (PCU)". In addition, the PCU also houses MPPT (Maximum Power Point Tracker), an interface between Solar PV array & the Inverter,

DC & AC Switches

DC SIDE:

- MCB of suitable rating shall be provided for connection and disconnection of array & PCU for maintenance purposes.
- Switches and Circuit Breakers on the DC side shall be DC rated or they shall be sufficiently de-rated, if AC rated switches are used.

AC SIDE:

MCB of suitable rating shall be provided for connection and disconnection of PCU & load.

Cables and accessories:

All the cables shall be supplied conforming to IEC 60227/IS 694 & IEC 60502/IS 1554 shall be of kV grade as per requirement. Only PVC copper cables shall be used.

The size of the cables between array interconnections, array to junction boxes, junction box to PCU, PCU to AC Distribution Box etc. shall be selected to keep the voltage drop and losses to the minimum. Permissible Wire Drop on DC side shall be <= 1%

Earthing and Lightning Protection:

Earthing: The array structure of the PV shall be grounded properly using an adequate number of earthing kits. All metal casing or shielding of solar power shall be thoroughly grounded to ensure safety of solar power.

Lightning: The SPV solar power

The SPV solar power shall be provided with lightning & over voltage protection. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can be lightning, atmosphere disturbances etc.

Solar Meter and Net Meter:

A separate Energy Meter called Solar Meter shall be provided at the output of PCU to record energy generation from the Solar power System. (This energy meter should not be integrated with PCU). Solar energy meter means a unidirectional meter to be installed at the delivery point of the solar power energy system to measure the solar power generated electricity. This Energy Meter should be tested along with the Net Meter.

Net meter: As per (Renewable Energy and Net Metering) Regulations 2020, net metering system is to be provided to the solar power consumer. Net meter means the bidirectional energy meter to be installed at the interconnection point of the consumer with the network of distribution licensee. Energy meters should be installed and maintained in accordance with the provisions of the local electric cooperative. The Contractor /supplier shall maintain the Metering System as per coordination with local electric cooperative. The defective meter shall be immediately tested and rectified/ replaced. A solar meter and bidirectional energy meter suitable for the installed solar power shall be supplied and installed by the contractor after testing and sealing from respective suppliers. Energy Meters must be provided with the necessary data cables if required. The solar

energy meter and net energy meter shall be of accuracy as given and CT and PT shall be utilized according to metering regulations 2006 and their amendment.

Mechanical and Design Specification or Equivalent
Mono-Crystalline PV Modules (550W)

Cell Type	Gallium – doped Mono c-SI PERC, Half cut cells, 182mm
No. of cells	144
Glass	3.2mm, high transmission, AR coated , tempered
Encapsulation	EVA
Back cover	White back sheet
Junction box	IP 68 rated
Frame	35mm anodized Aluminum Alloy
Cable	1* 4mm^2, 350mm length customized
Connectors	MC 4 /MC 4 compatible
Dimension	2278mm * 1133mm * 35mm
Weight	27kg
Hail resistance	Max Ø25mm at 23 m/s
Wind load	2400 Pa / 244 kg/m^2
Mechanical load	5400 Pa / 550 kg/m^2

Temperature Ratings

Operating Temperature (°C)	- 40 to+ 85
Temp. coefficient of P_{max} (% / (°C))	-0.35
Temp. coefficient of V_{oc} (% / (°C)	-0.275
Temp. coefficient of I_{sc} (% / (°C)	-0.045
Non. operating temp. NOCT (°C)	45+/- 2

Electrical Specifications (STC) AE550MD-144

Normal Max. Power P_{max} (Wp)	550
Maximum operating voltage V_{MPP} (V)	42.57
Maximum operating current I_{MPP} (A)	12.92
Open circuit voltage V_{oc} (V)	51.44
Short circuit current I_{sc} (A)	13.67
Module efficiency n (%)	21.31

*STC Standard test condition (Irradiance 1000 W/m^2, Cell temperature 25 °C and air mass of AM 1.5)

Electrical Specifications (NOMT*) AE550MD-144

Normal Max. Power P_{max} (Wp)	414
Maximum operating voltage V_{MPP} (V)	40.10
Maximum operating current I_{MPP} (A)	10.34
Open circuit voltage V_{oc} (V)	47.80
Short circuit current I_{sc} (A)	10.94

EXECUTION

INSTALLATION

The installation of solar power PV modules on the roof deck must be installed as supplied, delivered and installed according to the supplier.

WORKMANSHIP

The work throughout shall be executed in the best and most thorough manner under the direction of and to the satisfaction of the Registered Electrical Engineer or Master Electrician, who will interpret the intent meaning of the drawings and specifications 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 31 : PROJECT BILLBOARD

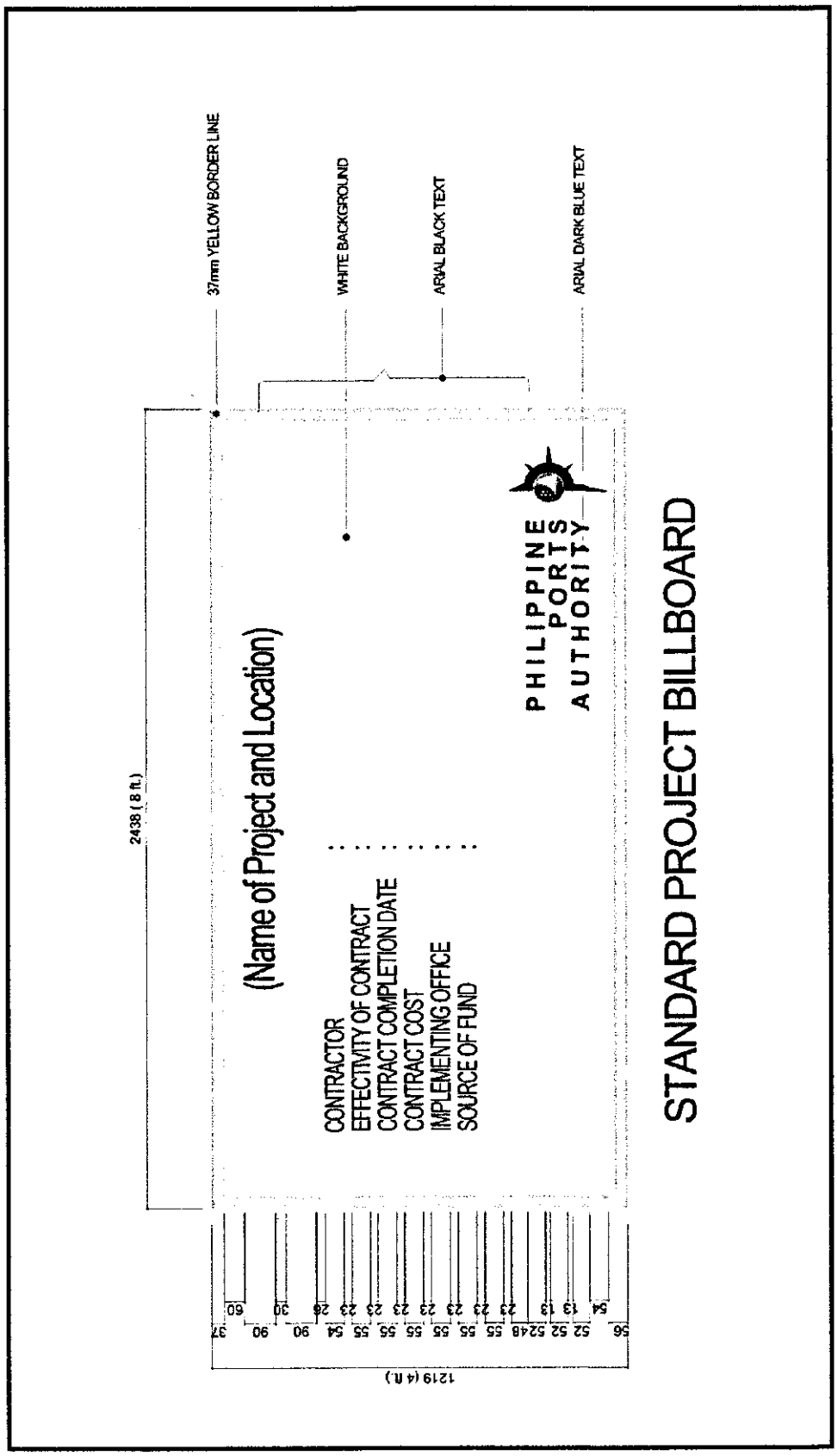
SPECIFICATION

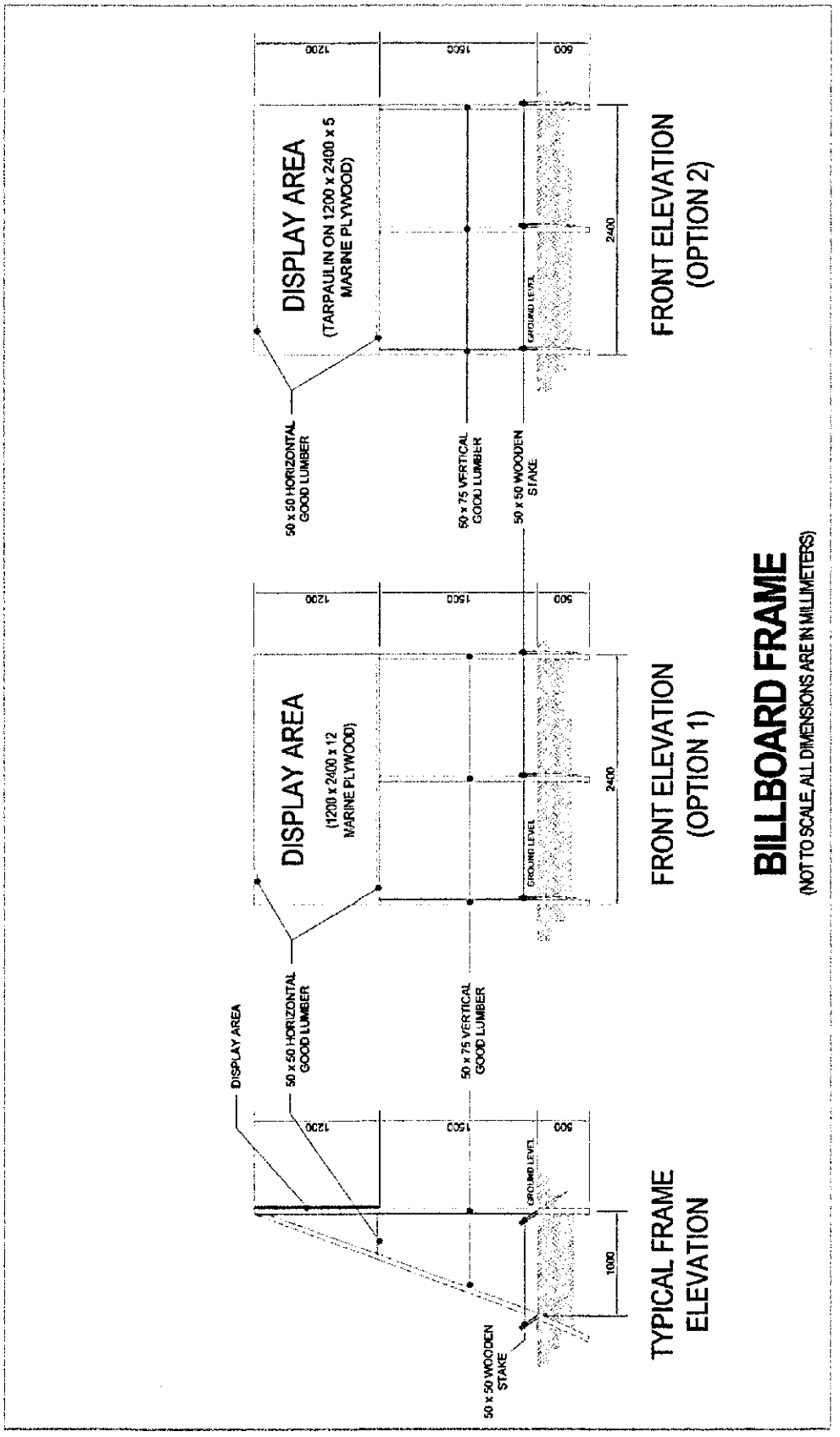
The Project Billboard shall be installed at location(s) designated by the Engineer.

The size and specifications of materials for the standard billboard shall be 4ft. x 8ft. (1,200mm x 2,400mm) using ½ inch (12mm) marine plywood or tarpaulin poster on 3/16 inch (5mm) marine plywood.

Project billboards shall not contain Name(s) and/or picture(s) of any personages.

See attached drawings for further details of the standard billboard.


STANDARD PROJECT BILLBOARD
PHILIPPINE PORTS AUTHORITY
(Name of Project and Location)
CONTRACTOR
EFFECTIVITY OF CONTRACT
CONTRACT COMPLETION DATE
CONTRACT COST
IMPLEMENTING OFFICE
SOURCE OF FUND
37mm YELLOW BORDER LINE
WHITE BACKGROUND
ARIAL BLACK TEXT
ARIAL DARK BLUE TEXT
2438 (8 ft.)
1219 (4 ft.)


BILLBOARD FRAME
(NOT TO SCALE, ALL DIMENSIONS ARE IN MILLIMETERS)
FRONT ELEVATION
(OPTION 2)
DISPLAY AREA
(TARPAULIN ON 1200 x 2400 x 5
MARINE PLYWOOD)
50 x 50 HORIZONTAL
GOOD LUMBER
50 x 75 VERTICAL
GOOD LUMBER
50 x 50 WOODEN
STAKE
GROUND LEVEL
1200
1500
600
2400
FRONT ELEVATION
(OPTION 1)
DISPLAY AREA
(1200 x 2400 x 12
MARINE PLYWOOD)
50 x 50 HORIZONTAL
GOOD LUMBER
50 x 75 VERTICAL
GOOD LUMBER
GROUND LEVEL
1200
1500
600
2400
TYPICAL FRAME
ELEVATION
DISPLAY AREA
50 x 50 HORIZONTAL
GOOD LUMBER
50 x 75 VERTICAL
GOOD LUMBER
GROUND LEVEL
1200
1500
600
1000
50 x 50 WOODEN
STAKE

ITEM 32 : SAFETY SIGNAGES AND BARRICADES

DESCRIPTION

This work includes the furnishing and installing of safety signages and barricades in accordance with the specifications and to the details shown below in the drawings, or as directed by the Engineer.

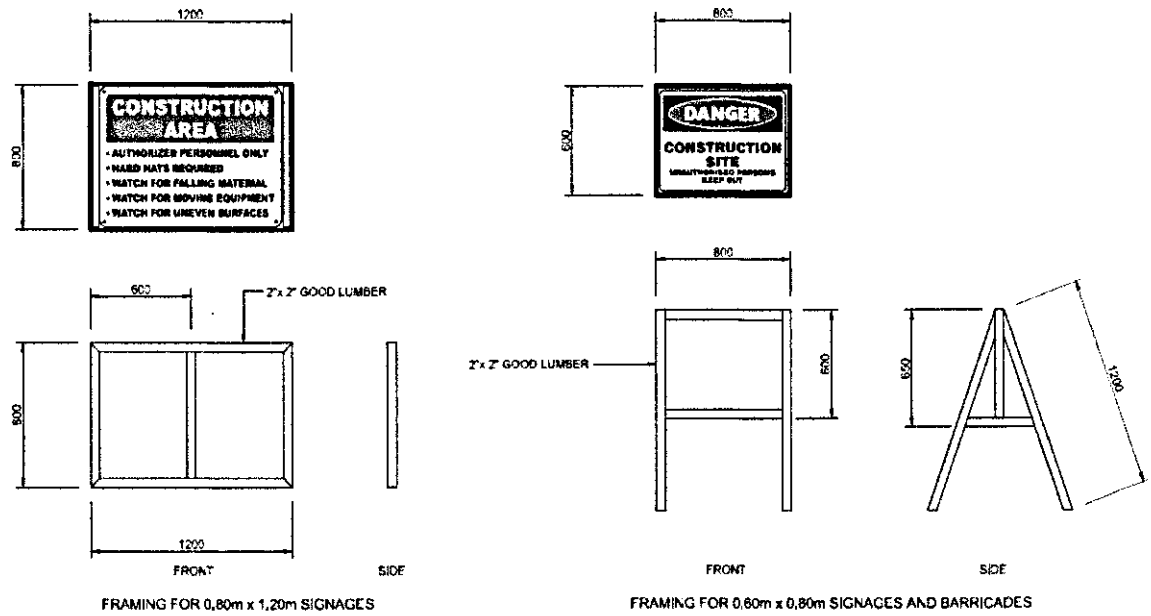
SPECIFICATION

The Signage's and Barricades shall be installed at location(s) designated by the Engineer.

The sizes of the standard signages shall be 2-2/3ft x 4ft (800mm X 1,200mm) for fixed type and 2ft x 2–2/3ft (600mm x 800mm) for mobile type. For barricade standard 2ft x 2–2/3ft (600mm x 800mm) shall be provided.

The materials to be used for signages and barricades are ½ inch (12mm) marine plywood or tarpaulin poster on 2" x 2" (50mm x 50mm) good lumber frame (see drawing below).

The printing or painting shall be the discretion of the Engineer.



STANDARD PLAN FOR SIGNAGES AND BARRICADES

SECTION VII

DRAWINGS
(APPROVED PLANS)

DRAWINGS AND APPROVED PLANS
(SEE ISSUED APPROVED PLANS)

LIST OF DRAWINGS:

MARINE STRUCTURE

MS-01 OF 14 - DEVELOPMENT PLAN, VICINITY MAP, GENERAL NOTES, DESIGN PARAMETERS

MS-02 OF 14 - GENERAL PLANS FOR EXISTING AFFECTED STRUCTURES, EXISTING LATERAL DRAINAGE TO BE DECOMMISSIONED, TYPICAL REINFORCEMENT DETAIL FOR EXISTING LATERAL DRAINAGE TO BE CLOSED

MS-03 OF 14 - GENERAL PLAN FOR UPGRADING OF EXISTING PORT OPERATIONAL AREA

MS-04 OF 14 - SECTION A, B, C & D

MS-05 OF 14 - SECTION E, F, G, H & I, PROPOSED STAIRS, SECTION Y & X, RETAINING WALL, RETAINING WALL-Z

MS-06 OF 14 - SECTION 1 & 2, CONTINUOUS MOORING BLOCK 3, REINFORCEMENTS LAYOUT FOR CONTINUOUS MOORING BLOCK 3, SECTION X, Y, & Z

MS-07 OF 14 - MOORING BLOCK 1 DETAIL, MOORING BLOCK 2 DETAIL, DETAIL OF RC CURB ON MOORING BLOCK

MS-08 OF 14 - LAYOUT PLAN FOR DRAINAGE LINE AND COVERED WALKWAYS, TYPICAL DETAIL OF UPGRADED LATERAL DRAINAGE, TYPICAL DETAIL OF CONVERTED LATERAL DRAINAGE TO CONCRETE LATERAL DRAINAGE, TRENCH GRATE FRAMING

MS-09 OF 14 - CATCH DRAIN SECTIONAL ELEVATION (UPGRADED), CATCH BASIN FRAMING, TYPICAL DETAIL OF UPGRADED, MAIN DRAINAGE, RETAINING WALL -D, DETAILS Z

MS-10 OF 14 - TYPICAL PERIMETER FENCE PANEL, ELEVATION OF PERIMETER FENCE, SECTION, DETAIL OF RETAINING WALL -F, DETAIL OF COLUMN, DETAIL OF LINTEL BEAM, DETAIL OF PRECAST CONCRETE VERTICAL MEMBERS

MS-11 OF 14 - PAVEMENT JOINT LAYOUT, TYPICAL PAVEMENT JOINTS LAYOUT, DETAIL OF PAVEMENT JOINTS

MS-12 OF 14 - COVERED WALKWAY FLOOR PLAN, COVERED WALKWAY REFLECTED CEILING PLAN, COVERED WALKWAY TYPICAL FRONT ELEVATION, COVERED WALKWAY TYPICAL SIDE ELEVATION, COVERED WALKWAY TYPICAL BLOW-UP CROSS SECTION

MS-13 OF 14 - DETAIL OF CONCRETE SIDEWALK, TYPICAL FOUNDATION PLAN, TYPICAL ROOF FRAMING PLAN, SCHEDULE OF STEEL SECTION, DETAIL OF COLUMN/FOOTING (C1-F1)

MS-14 OF 14 - 35 TON MOORING TEE HEAD, 25 TON MOORING TEE HEAD

ANNEX A - TOPOGRAPHIC AND HYDROGRAPHIC SURVEY, PLAN OF PORT OF LIPATA, LIPATA, SURIGAO CITY, SURIGAO DEL NORTE, DATE SURVEYED: JUNE 27 & 28, 2019

ARCHITECTURAL

A-01 of 40 - TABLE OF CONTENTS

A-02 of 40 - EXTERIOR PERSPECTIVES, INTERIOR PERSPECTIVES

A-03 of 40 - SITE DEVELOPMENT PLAN, VICINITY MAP

A-04 of 40 - GROUND FLOOR PLAN

A-05 of 40 - SECOND FLOOR PLAN

A-06 of 40 - ROOF DECK FLOOR PLAN

A-07 of 40 - ROOF FLOOR PLAN

A-08 of 40 - FRONT ELEVATION, REAR ELEVATION

A-09 of 40 - LEFT SIDE ELEVATION, RIGHT SIDE ELEVATION

A-10 of 40 - SECTION THRU A-A', SECTION THRU B-B'

A-11 of 40 - GROUND FLOOR REFLECTED CEILING PLAN, CEILING DETAIL 1, CEILING DETAIL 2, LEGEND

A-12 of 40 - SECOND FLOOR REFLECTED CEILING PLAN, CEILING DETAIL 3, WPC BAFFLE CEILING SPACING, LEGEND

A-13 of 40 - ROOF DECK REFLECTED CEILING PLAN, LEGEND

A-14 of 40 - GROUND FLOOR WALL PARTITION LAYOUT, LEGEND

A-15 of 40 - SECOND FLOOR WALL PARTITION LAYOUT, LEGEND

A-16 of 40 - ROOF DECK WALL PARTITION LAYOUT, LEGEND

A-17 of 40 - GROUND FLOOR PATTERN LAYOUT, ENTRANCE MATTING DETAILS, LEGEND

A-18 of 40 - SECOND FLOOR PATTERN LAYOUT, LEGEND

A-19 of 40 - ROOF DECK FLOOR PATTERN LAYOUT, LEGEND

A-20 of 40 - SCHEDULE OF DOORS

A-21 of 40 - SCHEDULE OF WINDOWS AND GLASS PANELS

A-22 of 40 - GLASS CURTAIN WALL SYSTEM

A-23 of 40 - GLASS CURTAIN WALL SYSTEM

A-24 of 40 - BLOW-UP OF RAMP & RAILING @ FRONT PORCH

A-25 of 40 - BLOW-UP OF RAMP & RAILING @ BOARDING AREA

A-26 of 40 - BLOW-UP OF RAMP & RAILING @ RIGHT SIDE PORCH

A-27 of 40 - BLOW-UP OF RAMP & RAILING @ LEFT SIDE PORCH, HANDRAIL CONNECTION-1 DETAILS, HAND RAIL CONNECTION-2 DETAILS

A-28 of 40 - TYPICAL DETAIL OF FIRE EXITS STAIR

A-29 of 40 - EMPLOYEE'S STAIR DETAIL

A-30 of 40 - BLOW-UP DETAILS OF FEMALE PUBLIC TOILET

A-31 of 40 - BLOW-UP DETAILS OF MALE PUBLIC TOILET

A-32 of 40 - BLOW-UP DETAILS OF MALE & FEMALE PWD TOILET, BLOW-UP DETAILS OF ALL INCLUSIVE TOILET (ARRIVAL)

A-33 of 40 - BLOW-UP DETAILS OF VIP ROOM TOILET, BLOW-UP DETAILS OF CLINIC'S TOILET

A-34 of 40 - BLOW-UP DETAILS OF ALL INCLUSIVE TOILET, BLOW-UP DETAILS OF MALE & FEMALE TOILET (TMO)

A-35 of 40 - BLOW-UP DETAILS OF MALE & FEMALE TOILET & BATH, FLIP-UP BAR DETAILS (TYP.), GRAB BAR DETAILS (TYP.), MIRROR DETAIL (TYP.)

A-36 of 40 - BLOW-UP DETAIL OF TMO PANTRY'S COUNTER, BLOW-UP DETAIL OF SERVICE AREA'S COUNTER, BLOW-UP DETAIL OF VIP LOUNGE / FAMILY AREA-KITCHEN'S COUNTER

A-37 of 40 - BLOW-UP DETAIL OF QUARTER'S COUNTER, BLOW-UP DETAIL OF TERMINAL TICKETING BOOTH'S COUNTER

A-38 of 40 - PPA LOGO DETAIL, PORT SIGNAGE DETAIL, BLOW-UP DETAIL OF ALUMINUM LOUVERS

A-39 of 40 - DRY WALL DETAILS, FLOOR STANDING FCU CASING DETAIL, FOOT BATH DETAIL, DRINKING FOUNTAIN DETAILS, INDOOR PLANTBOX DETAILS, PLANT BOX BLOW-UP DETAIL

A-40 of 40 - BLOW-UP DETAILS OF CHARGING STATION, BLOW-UP DETAILS OF VERTICAL ALUMINUM LOUVERS

STRUCTURAL

S-01 of 26 - GENERAL NOTES

S-02 of 26 - PILE LAYOUT PLAN, SCHEDULE OF 400mm x 400mm PSC PILES

S-03 of 26 - FOUNDATION PLAN

S-04 of 26 - WALL FOUNDATION PLAN

S-05 of 26 - SECOND FLOOR FRAMING PLAN

S-06 of 26 - ROOF DECK FRAMING PLAN

S-07 of 26 - ROOF FRAMING PLAN

S-08 of 26 - CANOPY FRAMING PLAN

S-09 of 26 - SECOND FLOOR SUSPENDED SLAB LAYOUT PLAN

S-10 of 26 - ROOF DECK SUSPENDED SLAB LAYOUT PLAN, ROOF SLAB LAYOUT PLAN (STAIRS)

S-11 of 26 - DETAIL OF WALL FOOTING – 1, DETAIL OF WALL FOOTING – 2, DETAIL OF FOOTING TIE BEAM, DETAIL OF RETAINING WALL-1, DETAIL OF RETAINING WALL-2, LINTEL BEAM DETAILS, STIFFENER COLUMN DETAIL, DETAIL OF PILE CAP 1 (PC-1), DETAIL OF PILE CAP 2 (PC-2)

S-12 of 26 - DETAIL OF FOOTING-1 (C-2/F-1), DETAIL OF FOOTING-1 (C-3/F-1), DETAIL OF FOOTING-2 (C-4/F-2), SLAB AND RAMP DETAILS, DETAIL OF 30mm THK. STIFFENER PLATE, TYP. DETAIL OF STEP-UP

S-13 of 26 - TYP. DETAIL OF CONCRETE SLAB EDGING, TYP. DETAIL OF SLAB REINFORCEMENT BAR, TYP. DETAIL OF CHB WALL AT SUSPENDED SLAB, TYP. DETAIL OF PARAPET WALL, TYP. DETAIL OF ZOCALO WALL, TYP. DETAIL OF FIRE WALL

S-14 of 26 - TYP. STEEL BEAM CONNECTION DETAIL, SCHEDULE OF STEEL SECTION PROPERTIES

S-15 of 26 - TYP. STEEL BEAM CONNECTION DETAIL, SCHEDULE OF STEEL SECTION PROPERTIES

S-16 of 26 - TYP. STEEL BEAM CONNECTION DETAIL, SCHEDULE OF STEEL SECTION PROPERTIES

S-17 of 26 - TYP. STEEL BEAM CONNECTION DETAIL, SCHEDULE OF STEEL SECTION PROPERTIES

S-18 of 26 - TYP. STEEL BEAM CONNECTION DETAIL, SCHEDULE OF STEEL SECTION PROPERTIES

S-19 of 26 - TYP. RAFTER STEEL BEAM DIAGRAM

S-20 of 26 - TYP. STEEL BEAM RAFTER CONNECTION DETAIL, DETAIL of 13mm DIA. SAG ROD, DETAIL OF 20mm THK. GUIDE/CORVEL STEEL PLATE

S-21 of 26 - TYP. STEEL BEAM RAFTER CONNECTION DETAIL, DETAIL OF 12mm DIA. SAG ROD, DETAIL OF 20mm THK. GUIDE/CORVEL STEEL PLATE

S-22 of 26 - TYP. STEEL BRACING LAYOUT AT GRID 1 & 9, TYP. STEEL BRACING LAYOUT AT GRID "A", CONNECTION DETAIL OF STEEL BRACING, DETAIL OF 16mm THK. SHEAR STEEL PLATE

S-23 of 26 - TYP. ELEVATION DETAIL OF CANOPY AT GRID "A", TYP. ELEVATION DETAIL OF CANOPY AT GRID "G"

S-24 of 26 - TYP. DETAIL OF STAIR FOOTING, TYP. DETAIL OF STAIR CONNECTION, TYP. DETAIL OF STAIR LANDING, TYP. DETAIL OF STAIR STEPS

S-25 of 26 - DETAILS OF 400mm x 400mm PRE-STRESSED CONCRETE PILE

S-26 of 26 - DETAIL OF 300mm THK. PCC PAVEMENT, 300mm THK. PCC PAVEMENT LAYOUT PLAN

ELECTRICAL

E-01 of 14 - GROUND FLOOR LIGHTING LAYOUT PLAN, LEGEND

E-02 of 14 - GROUND FLOOR POWER LAYOUT PLAN, LEGEND

E-03 of 14 - GROUND FLOOR POWER LAYOUT PLAN, LEGEND

E-04 of 14 - SECOND FLOOR LIGHTING LAYOUT PLAN

E-05 of 14 - SECOND FLOOR POWER LAYOUT PLAN

E-06 of 14 - SECOND FLOOR AIRCONDITION POWER LAYOUT PLAN

E-07 of 14 - ROOFDECK LIGHTING LAYOUT PLAN

E-08 of 14 - ROOFDECK ACCU POWER LAYOUT PLAN

E-09 of 14 - SCHEDULE OF LOADS, RISER DIAGRAM

E-10 of 14 - SCHEDULE OF LOADS, RISER DIAGRAM, SINGLE LINE DIAGRAM

E-11 of 14 - LIGHTNING PROTECTION LAYOUT PLAN, AIR TERMINAL ROD

E-12 of 14 - SERVICE ENTRANCE LAYOUT PLAN, LEGEND

E-13 of 14 - CONCRETE PEDESTAL POST, DETAIL OF HANDHOLE, DETAIL OF DUCTBANK

E-14 of 14 - DETAIL OF TRANSFORMER CONCRETE PAD, TYP. DETAIL OF COLUMN/FOOTING, REINFORCEMENT DETAIL OF CONCRETE DECK, GENERAL NOTES

TEL/CATV-01 of 03 - GROUND CATV/TELEPHONE LAYOUT PLAN

TEL/CATV-02 of 03 - SECOND CATV/TELEPHONE LAYOUT PLAN

TEL/CATV-03 of 03 - CATV SINGLE LINE DIAGRAM, TELEPHONE SINGLE LINE DIAGRAM, NOTES ON CATV AND TELEPHONE, LEGEND

BGM-01 of 03 - GROUND FLOOR BGM LAYOUT PLAN

BGM-02 of 03 - SECOND FLOOR BGM LAYOUT PLAN

BGM-03 of 03 - BGM SINGLE LINE DIAGRAN, NOTES ON BGM, LEGEND

FDAS-01 of 03 - GROUND FLOOR FDAS LAYOUT PLAN

FDAS-02 of 03 - SECOND FLOOR FDAS LAYOUT PLAN

FDAS-03 of 03 - FDAS SINGLE LINE DIAGRAM, NOTES ON FDAS, LEGEND

SP-01 of 01 - SOLAR PANEL LAYOUT PLAN

PL-01 of 02 - PORT LIGHTING LAYOUT PLAN, LEGEND

PL-02 of 02 - DETAIL OF LAMP POST FOUNDATION, SINGLE ARM STEEL TAPERED LAMP POST, SPECIFICATION, LOAD SCHEDULE, RISER DIAGRAM, GENERAL NOTES, SPECIFICATION

ECW-01 of 01 - LIGHTING AND POWER LAYOUT PLAN, LEGEND, SCHEDULE OF LOAD, RISER DIAGRAM

MECHANICAL

ME-01 of 09 - GENERAL NOTES , ABBREVIATIONS, DRAWING INDEX, LEGENDS & SYMBOLS, SHEET METAL THICKNESS AND REINFORCEMENT SCHEDULE

ME-02 of 09 - EQUIPMENT SCHEDULE

ME-03 of 09 - GROUND FLOOR AIRCONDITIONING SYSTEM LAYOUT

ME-04 of 09 - SECOND FLOOR AIRCONDITIONING SYSTEM LAYOUT

ME-05 of 09 - GROUND FLOOR VENTILLATION SYSTEM LAYOUT

ME-06 of 09 - SECOND FLOOR VENTILLATION SYSTEM LAYOUT

ME-07 of 09 - ROOFDECK PLAN/ ACCU LOCATION

ME-08 of 09 - SUPPLY AIR DUCT ELEVATON DETAIL

ME-09 of 09 - MISCELLANEOUS DETAILS

FIREPROTECTION

FP-01 of 09 - GENERAL NOTES , ABBREVIATIONS, DRAWING INDEX, LEGENDS & SYMBOLS, MATERIAL SPECIFICATIONS, EQUIPMENT SCHEDULE, PIPE SLEEVE SCHEDULE, SITE DEVELOPMENT PLAN

FP-02 of 09 - GROUND FLOOR FIRE PROTECTION LAYOUT

FP-03 of 09 - SECOND FLOOR FIRE PROTECTION LAYOUT

FP-04 of 09 - ROOF DECK FIRE PROTECTION AND FIRE EXTINGUISHER LAYOUT

FP-05 of 09 - GROUND FLOOR FIRE EXTINGUISHER LAYOUT

FP-06 of 09 - SECOND FLOOR FIRE EXTINGUISHER LAYOUT

FP-07 of 09 - FIRE PROTECTION SYSTEM RISER DIAGRAM, FIRE PUMP ROOM BLOW UP PLAN, FIRE PUMP ROOM LONGITUDINAL SECTION, DETAILS OF PIPE SLEEVE, DETAILS OF PIPE HANGER, DETAILS OF FLUSHING CONNECTION

FP-08 of 09 - MISCELLANEOUS DETAILS-1

FP-09 of 09 - MISCELLANEOUS DETAILS-2

PLUMBING

P-01 of 13 - DETAILS OF SEPTIC TANK, DETAILS OF AREA DRAIN, GENERAL NOTES AND SPECIFICATIONS, MATERIAL SPECIFICATIONS

P-02 of 13 - SITE PLUMBING SYSTEM PLAN, LEGENDS

P-03 of 13 - GROUND FLOOR SEWER AND STORM WATER DRAINAGE PLAN, LEGENDS

P-04 of 13 - SECOND FLOOR SEWER AND STORM WATER DRAINAGE PLAN, LEGENDS

P-05 of 13 - ROOF DECK SEWER AND STORM WATER DRAINAGE PLAN, LEGENDS

P-06 of 13 - SEWER ISOMETRIC LAYOUT, LEGENDS

P-07 of 13 - STORM WATER DRAINAGE ISOMETRIC LAYOUT, DETAIL OF TRENCHING, BEDDING & BACKFILLING OF PIPES, FIXTURE MOUNTING DETAILS, SCHEDULE OF PIPE (SEWER LINE)

P-08 of 13 - GROUND FLOOR WATER DISTRIBUTION LAYOUT PLAN, LEGENDS

P-09 of 13 - SECOND FLOOR WATER DISTRIBUTION LAYOUT PLAN, LEGENDS

P-10 of 13 - ROOF DECK WATER DISTRIBUTION LAYOUT PLAN, LEGENDS

P-11 of 13 - WATER DISTRIBUTION ISOMETRIC LAYOUT (POTABLE WATER), DETAILS OF WATER METER, DETAIL OF VSTR, SCHEDULE OF PIPE (WATER LINE)

P-12 of 13 - WATER DISTRIBUTION ISOMETRIC LAYOUT (NON-POTABLE WATER), HOSE BIBB CONNECTION DETAIL, URINAL CONNECTION DETAIL

P-13 of 13 - COVERED WALKWAY STORM WATER DRAINAGE LAYOUT, COVERED WALKWAY STORM WATER DRAINAGE ISOMETRIC LAYOUT

PUMPHOUSE

PH-01 of 07 - PERSPECTIVE, SITE DEVELOPMENT PLAN, FLOOR PLAN, FLOOR PLAN (CISTERN TANKS)

PH-02 of 07 - ROOF PLAN, REFLECTED CEILING PLAN, FRONT ELEVATION, RIGHT SIDE ELEVATION, REAR ELEVATION, LEFT SIDE ELEVATION

PH-03 of 07 - SECTION THRU A-A', SECTION THRU B-B', SECTION THRU C-C, SCHEDULE OF DOORS, AND WINDOWS

PH-04 of 07 - FOUNDATION LAYOUT PLAN, RETAINING WALL & SLAB LAYOUT PLAN, ROOF DECK & ROOF BEAM LAYOUT PLAN, DETAIL OF SIDE WALL, TYP. DETAIL OF STEP-UP, GENERAL NOTES

PH-05 of 07 - DETAIL OF CHAMBER HOLE, RETAINING WALL DETAIL, DETAIL OF COLUMN, DETAIL OF MANHOLE COVER, TYP. DETAIL OF STIFFENER BEAM, TYP. DETAIL OF ROOF BEAM

PH-06 of 07 - LIGHTING AND POWER LAYOUT PLAN, LEGEND, SCHEDULE OF LOAD, RISER DIAGRAM

PH-07 of 07 - PUMP HOUSE PLUMBING PLAN, WATER SUPPLY SCHEMATIC DIAGRAM, DETAIL OF FLOAT VALVE, DETAIL OF LADDER RUNG, DETAIL OF AIR VENT, GENERAL NOTES AND SPECIFICATIONS, SCHEDULE OF EQUIPMENT, LEGEND AND SYMBOLS

ANNEX SHEETS

ANNEX-01 of 04 - CCTV SITE DEVELOPMENT PLAN

ANNEX-02 of 04 - GROUND FLOOR CCTV LAYOUT PLAN

ANNEX-03 of 04 - SECOND FLOOR CCTV LAYOUT PLAN

ANNEX-04 of 04 - ROOF DECK CCTV LAYOUT PLAN

SECTION VIII

BILL OF QUANTITIES and ATTACHMENTS

BID SUMMARY

LIPATA PORT IMPROVEMENT PROJECT

Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO.	DESCRIPTION OF WORK	AMOUNT (Pesos)
BILL NO. 1	GENERAL EXPENSES	
BILL NO. 2	REMOVAL, EXCAVATION AND DISPOSAL WORKS	
BILL NO. 3	UPGRADING OF PORT OPERATIONAL AREA	
BILL NO. 4	PORT OPERATIONS BUILDING	
BILL NO. 5	REIMBURSABLE ITEMS	1,050,000.00
	BID PRICE	

Name of Firm

Name of Bidder/Authorized Representative
(Signatory's Legal Capacity)

Date

BILL OF QUANTITIES
LIPATA PORT IMPROVEMENT PROJECT
Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
BILL NO.	**1 GENERAL EXPENSES**				
1.01	Mobilization, demobilization and cleaning	lot	1		
1.02	Rental of temporary site office and residence for the Engineer and staff	mo.	32		
1.03	Maintain temporary site office and residence for the Engineer and staff	mo.	32		
1.04	Provide Construction Safety and Health Program in the execution of the project	mo.	32		
	TOTAL FOR BILL NO. 1				

Name of Bidder/Authorized Representative
(Signatory's Legal Capacity)

BILL OF QUANTITIES
LIPATA PORT IMPROVEMENT PROJECT
Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
BILL NO.	**2 REMOVAL, EXCAVATION AND DISPOSAL WORKS**				
2.01	Excavate and backfill existing fill materials piror to the construction of building foundations, transformer pad, septic vault, STP electrical works, and walkway foundations	cu.m.	971		
2.02	Remove and dispose existing concrete pavement	sq.m.	1,456		
2.03	Remove existing weight bridge and turn over to the authority as directed by the engineer	set	1		
2.04	Remove existing solar lamp post	no.	58		
2.05	Remove existing mooring bollard and turn over to the authority	no.	7		
2.06	Remove existing trench grate located in decommission drainage and turn-over to the authority	l.m.	217		
2.07	Remove, dispose and clearing of existing passenger terminal building and turn-over materials with value to the authority	sq.m.	2,195		
2.08	Remove, dispose and clearing of existing ticketing office and turn-over materials with value to the authority	sq.m.	15		
2.09	Remove and clearing of existing damaged covered walkway and fence and turn-over materials with value to the authority	l.m.	83		

Name of Bidder/Authorized Representative
(Signatory's Legal Capacity)

BILL OF QUANTITIES
LIPATA PORT IMPROVEMENT PROJECT
Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
2.10	Remove and dispose portion of existing ramp pavement for upgrading	sq.m.	324		
2.11	Remove and dispose portion of existing pavement prior for installation of retaining wall mooring block 1 & 2, and shear key	cu.m.	14		
2.12	Chip-off portion of existing deflector wall prior for installation of retaining wall-z	cu.m.	4		
2.13	Chip-off portion of existing decommision and lateral drainage	cu.m.	32		
2.14	Remove existing catch basin cover	no.	8		
2.15	Remove existing steel main drainage line cover	l.m.	122		
2.16	Remove existing trench grates	l.m.	476		
2.17	Clearing and grubbing existing greenery/vegetation	sq.m.	534		
	TOTAL FOR BILL NO. 2				

Name of Bidder/Authorized Representative
(Signatory's Legal Capacity)

BILL OF QUANTITIES
LIPATA PORT IMPROVEMENT PROJECT
Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
BILL NO.	**3 UPGRADING OF PORT OPERATIONAL AREA**				
3.01	Supply and place 3,500 psi concrete for the retaining wall, mooring block, rc curb, perimeter fence, drainage upgrade, stairs, pedestal post foundation and decommission of existing lateral drainage	cu.m.	613		
3.02	Supply and install steel reinforcement for the retaining wall, mooring block, rc curb,perimeter fence, drainage upgrade, stairs, pedestal post foundation and decommission of existing lateral drainage	kg.	68,355		
3.03	Supply and place gravel bedding	cu.m.	14		
3.04	Supply, spread and compact aggregate sub-base course	cu.m.	2,290		
3.05	Supply, spread and compact aggregate base course	cu.m.	2,227		
3.06	Construct portland cement concrete pavement (300mm thk) including dowel bars and construction joint	sq.m.	11,131		
3.07	Supply and deliver to site mooring bollard (25 Tons, T-head) including accessories	set	1		
3.08	Supply and deliver to site mooring bollard (35 Tons, T-head) including accessories	set	6		
3.09	Install mooring bollards (T-head type) and accessories	set	7		

Name of Bidder/Authorized Representative
(Signatory's Legal Capacity)

BILL OF QUANTITIES
LIPATA PORT IMPROVEMENT PROJECT
Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
3.10	Re-install newly removed trench grate	l.m.	476		
3.11	Re-install newly removed steel main drainage line cover	l.m.	122		
3.12	Re-install newly removed catch basin cover	no.	8		
3.13	Supply, fabricate and install trench grate framing, main drainage, and catch drain cover framing	kg.	19,320		
3.14	Construct Covered Walkway including appurtenances	l.m.	69		
3.15	Relocate and re-install newly removed solar lamp post including accessories	set	39		
	TOTAL FOR BILL NO. 3				

Name of Bidder/Authorized Representative
(Signatory's Legal Capacity)

BILL OF QUANTITIES
LIPATA PORT IMPROVEMENT PROJECT
Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
BILL NO.	4 PORT OPERATIONS BUILDING				
4.01	Supply and deliver to site 400mm x 400mm PSC Piles	l.m.	780		
4.02	Handle, pitch and drive 400mm x 400mm Vertical PSC Piles	l.m.	780		
4.03	Cut/chip and dispose newly driven PSC Piles up to required elevation	no.	65		
4.04	Subgrade preparations	sq.m.	3,557		
4.05	Supply and apply soil treatment	sq.m.	2,355		
4.06	Supply, spread and compact aggregate sub-base course	cu.m.	4,368		
4.07	Supply and place lean concrete	cu.m.	6		
4.08	Construct 100mm thick CHB wall including reinforcement	sq.m.	774		
4.09	Construct 150mm thick CHB wall including reinforcement	sq.m.	2,362		
4.10	Supply & place 4,000 psi. concrete for building structure and transformer concrete pad	cu.m.	675		
4.11	Supply & install steel reinforcement for building structure				
	a) Steel Reinforcement (Grade 40)	kg.	32,089		
	b) Steel Reinforcement (Grade 60)	kg.	51,668		

Name of Bidder/Authorized Representative
(Signatory's Legal Capacity)

BILL OF QUANTITIES
LIPATA PORT IMPROVEMENT PROJECT
Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
4.12	Supply, fabricate & install structural steel for columns and beams	kg.	452,550		
4.13	Supply & install Pre-insulated panels, Pre-painted Hi-rib Main Roofing-Single Metal (Rib-type) (0.6mm PPGL) with UPI Board 25mm thk on Louver Vent	sq.m.	1,466		
4.14	Construct 4,000 psi. concrete slab and ramp on-fill including reinforcement	sq.m.	2,640		
4.15	Supply, place and compact gravel bedding for building foundations, slab on grade, transformer concrete pad, septic vault, area drain and electrical works	cu.m.	322		
4.16	Supply and install Drywall partition	sq.m.	267		
4.17	Supply, fabricate and install indoor Plantbox including laminates and other accessories	lot	1		
4.18	Supply, fabricate and install Hanging and Counter cabinet including painting and other accessories	lot	1		
4.19	Supply, fabricate and install Floor Standing FCU Casing including painting and other accessories	lot	1		
4.20	Supply and place 13mm thick cement Plaster finish	sq.m.	3,891		
4.21	Supply and apply Elastomeric paint (2-coats)	sq.m.	4,700		

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BILL OF QUANTITIES
LIPATA PORT IMPROVEMENT PROJECT
Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
4.22	Supply and apply Flat latex paint (2-coats)	sq.m.	1,087		
4.23	Supply and apply Quick dry enamel paint (2-coats)	sq.m.	359		
4.24	Supply and apply water proofing	sq.m.	1,897		
4.25	Supply and place 0.80mm thk. Wood Grain Laminated	sq.m.	249		
4.26	Supply and install 1.2m x 0.6m Porcelain tile finish white marble	sq.m.	865		
4.27	Supply and install 0.6m x 0.6m Porcelain tile finish various design	sq.m.	1,470		
4.28	Supply and install 0.6m x 0.6m Unglazed Ceramic tile finish light gray	sq.m.	413		
4.29	Supply and install 0.6m x 0.6m non-slip tile finish	sq.m.	293		
4.30	Supply and install 0.3m x 1.5m Porcelain tile finish, wood look	sq.m.	244		
4.31	Supply and install 20-22mm aluminum profile entrance matting	sq.m.	22		
4.32	Supply and install 0.3m x 0.6m Glaze Ceramic wall tiles	sq.m.	739		
4.33	Suppy and place Non-skid / Rough Cement Floor Finish	sq.m.	109		
4.34	Supply and install Tactile Paving	sq.m.	36		
4.35	Supply and install granite countertop and splash board	sq.m.	49		

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Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
4.36	Supply and install Aluminum Composite Panels and accessories	sq.m.	2,399		
4.37	Supply and install 12mm thk. Gypsum board on 0.40mm thk galvanized steel ceiling suspension system at 0.40m O.C. (furring) carrying channel) and suspension rod	sq.m.	1,087		
4.38	Supply and install 50mm x 100mm PVC Baffle Ceiling with 100mm Spacing	sq.m.	1,087		
4.39	Supply and install Mineral Fibre Acoustic Lay-in Panel on Galvanized Steel Exposed grid and framing finished 0.60m x 0.60m x 19mm	sq.m.	292		
4.40	Supply and install 0.4mm thk. Pre-formed/Pre-painted ribbed type spandrel metal ceiling	sq.m.	348		
4.41	Supply, fabricate and install aluminum and stainless steel materials, buffed finish including skirting, glass railings, clear tempered glass, horizontal louver and other accessories	lot	1		
4.42	Supply and install fabricated 1.5 mm thk. Aluminum Framed Doors and Windows, including clear tempered glass window and other accessories	lot	1		
4.43	Supply and install fabricated Marine Plywood Finish Flush Doors including door jambs, hinges, locksets and other accessories	lot	1		
4.44	Supply and install fabricated Metal doors and Cold rolled steel emergency exit Doors with panic pushbar lock including jumbs and accessories	lot	1		

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Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
4.45	Supply and install fabricated PVC Doors and wooden doors including jambs, hinges, locksets and other accessories	lot	1		
4.46	Supply and install fabricated 12mm thk. Glass Partition including accessories	lot	1		
4.47	Supply and install fabricated 16mm thk. Low-E laminated glass curtain wall system including accessories	lot	1		
4.48	Supply, fabricate and install Phenolic anti-bacterial water proof Toilet partition 12mm thk, including stainless hinges, lock indicators, bottom support door knobs, ledge, coat hooks and other accessories	lot	1		
4.49	Supply and install toilet fixtures including accessories	lot	1		
4.50	Supply and install water line pipes and fittings including other accessories	lot	1		
4.51	Supply and install sewerage pipes and fittings including accessories.	lot	1		
4.52	Supply and install drainage pipes and fittings including accessories.	lot	1		
4.53	Construct septic vault including fittings and accessories	no.	2		
4.54	Construct area drain including accessories	no.	23		
4.55	Construct Pumphouse including appurtenances	lot	1		

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Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
4.56	Supply, deliver and install wires and cables of various sizes	lot	1		
4.57	Supply, deliver and install conduit pipe including fittings of various sizes	lot	1		
4.58	Supply, deliver and install wiring devices	lot	1		
4.59	Supply, deliver and install protective devices	lot	1		
4.60	Supply, deliver and install lighting fixtures	lot	1		
4.61	Supply, deliver and install lightning protection and accessories	lot	1		
4.62	Supply, deliver and install auxiliary system:				
	a) Community Antenna Television (CATV)	lot	1		
	b) Background Music / Paging Alarm (BGM/PA)	lot	1		
	c) Fire Detection Alarm System (FDAS)	lot	1		
	d) Telephone System	lot	1		
4.63	Supply, deliver and install airconditioning unit and other apurtenances	lot	1		
4.64	Supply, deliver and install Ventillation unit and other apurtenances	lot	1		
4.65	Supply and install fire protection system including testing, commisioning, fire extinguishers and other accessories	lot	1		

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Port of Lipata, Lipata, Surigao City, Surigao Del Norte

NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
4.66	Construct Reinforced Concrete for duct bank, handhole, pedestal post and lamp post foundation	lot	1		
4.67	Supply and install Photoluminescent signs & path marking for emergency route including its accessories	lot	1		
4.68	Supply and deliver office furnitures, gang chairs, and drinking fountain	lot	1		
4.69	Supply, deliver and install PPA Logo and signages including accessories	lot	1		
4.70	Supply, deliver and install distribution transformer including accessories and other incidental expenses	lot	1		
4.71	Supply deliver and install solar panel grid tied system including framing, incidental expenses, assistance in net metering application, and other accessories	lot	1		
4.72	Supply deliver and install wastewater treatment facility including accessories	lot	1		
	TOTAL FOR BILL NO. 4				

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NO. (1)	DESCRIPTION OF WORK (2)	UNIT (3)	QTY. (4)	UNIT PRICE (Pesos) (5)	AMOUNT (Pesos) (4) x (5)
BILL NO.	**5 REIMBURSABLE ITEMS**				
5.01	Secure approval of environmental Compliance Certificate (ECC) Application, Clearance and other necessary documentary requirements	lot	1	1,050,000.00	1,050,000.00
TOTAL FOR BILL NO. 5					**1,050,000.00**

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BASIS OF PAYMENT FOR WORK ITEMS INCLUDED IN THE PROPOSAL

The work items included in the proposal and the basis of payments are as follows:

BILL NO. 1
GENERAL EXPENSES

Item 1.01 Mobilization, demobilization, and cleaning

The quantity to be paid for shall be the minimum equipment requirement enumerated in the bid documents mobilized, demobilized and cleaning of the site and accepted by the Engineer. The contract lump sum price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to mobilize and demobilize all the minimum equipment requirement enumerated in the bid documents including cleaning of the site. Fifty percent (50%) of the total amount shall be payable after the mobilization activity while the remaining (50%) payable after demobilization and cleaning.

Item 1.02 Rental of temporary site office and residence for the Engineer and staff

The quantity to be paid for shall be the actual rental of site office and residence for the engineer and staff and accepted by the Engineer. The contract unit price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary for the provision of temporary site office and residence for the engineer and staff.

Item 1.03 Maintain temporary site office and residence for the Engineer and staff

The quantity to be paid for shall be the actual services rendered in maintaining the site office and accepted by the Engineer. The contract unit price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the maintenance of the temporary site office and residence as well as other expenses such as provision for electric power, telephone bill, potable water supply, janitorial and security services.

Item 1.04 Provide construction safety and Health Program in the execution of the project

The quantity to be paid for shall be the actual implementation of construction safety and health program and accepted by the Engineer. The contract unit price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the implementation of the Construction Safety and Health Program, as required and approved by the Department of Labor and Employment (DOLE).

BILL NO. 2
REMOVAL, EXCAVATION AND DISPOSAL WORKS

Item 2.01 **Excavate and backfill existing fill materials prior to the construction of building foundations, transformer pad, septic vault, STP, electrical works, and walkway foundations.**

The quantity to be paid for shall be the actual volume in cubic meter of existing fill materials to be excavated and backfilled prior to the construction of building foundations, transformer pad, septic vault, STP electrical works, and walkway foundations in accordance with the plans and specifications and accepted by the Engineer. The contract unit price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Item 2.02 **Remove and dispose existing concrete pavement**

The quantity to be paid for shall be the actual area in square meter of existing concrete pavement to be removed including disposal in accordance with the plans and specifications and accepted by the Engineer. The contract unit price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Item 2.03 **Remove existing weight bridge and turn over to the authority as directed by the engineer**

The quantity to be paid for shall be the actual set of existing weight bridge to be removed and turned over to the authority as directed by the engineer in accordance with the plans and specifications and accepted by the Engineer. The contract unit price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Item 2.04 **Remove existing solar lamp post**

The quantity to be paid for shall be the actual number of existing solar lamp post to be removed in accordance with the plans and specifications and accepted by the Engineer. The contract unit price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Item 2.05 **Remove existing mooring bollard and turn over to the authority**

The quantity to be paid for shall be the actual number of existing mooring bollard to be removed and turned over to the authority in accordance with the plans and specifications and accepted by the Engineer. The contract unit price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work.

Item 2.06 **Remove existing trench grate located in decommission drainage and turn-over to the authority**

The quantity to be paid for shall be the actual length in linear meter of existing trench grate located in decommission drainage to be removed and turned over to the authority in accordance with the plans and specifications and accepted by the Engineer. The contract unit price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work.