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I. SCOPE OF WORK

The Contractor shall provide all materials and equipment and perform all the works necessary for the complete execution of all the electrical plans as shown on the Electrical Drawings, and as herein specified, or both, except as otherwise excluded and which, without excluding the generality of the foregoing shall include but not limited to the following principal items of work:

- a. Supply and installation of complete electrical conduit and wiring for light and power.
- b. Supply and installation of lighting fixtures, outlets and wiring devices;
- c. Supply and installation of electrical panels;
- d. Supply and installation of complete fire alarm system;
- e. Supply and installation of telephone system, terminal cabinets, station wiring and cables;
- f. Termination of all electrical system and the complete grounding system;
- g. Complete testing and commissioning of all electrical and auxiliary works; and
- h. If anything has been omitted for any item of work or materials usually furnished which are necessary for the completion of the entire work as outlined herein before, then such items must be and hereon included in this division of work.

II. EXECUTION AND INSTALLATION OF WORKS

The work under this contract shall be in accordance with the provisions of the latest edition of the Philippine Electrical Code and in compliance with the requirements of the local utility company.

III. CODES, INSPECTION, PERMITS AND FEES

All permits and electrical fees required for this work shall be obtained at the expense of the Contractor. The contractor shall furnish the Engineer 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.

IV. GUARANTEE

The Contractor shall guarantee that electrical system are free from all grounds and from all defective workmanship and materials and will remain so for a period of one year from the date of acceptance of the work. Any defects, appearing within the aforesaid period, shall be remedied by the Contractor at his own expense.

V. RECORD DRAWING

The Contractor shall, during the progress of work, keep a careful record of all changes where the actual installation differ from that shown on the Contract Drawings. Upon completion, the Engineer will be furnished at no cost a complete set of sepia prints on which the Contractor shall, in neat and accurate manner make a complete record of all changes and revisions to the original design, as installed in the completed work. This drawings shall be submitted to the Engineer for approval. After approval they shall become the property of the Authority. Final payment may be withheld until receipt of the approved record drawings.

VI. SHOP DRAWINGS AND SAMPLES

Prior to any installation woOrks, prepare and submit for approval shop drawings and cuts of all equipment, appliances and fixtures to be furnished. After final approval by the Engineer, a sufficient number of copies as directed shall be furnished for distribution. Fixture and device cuts and/or catalogues shall be clearly marked to indicate the items furnished.

Submit to the Engineer for approval, samples of conduit, wire, wiring device, finished plates and of any other items as may be requested by the Engineer.

VII. APPROVAL, SUBSTITUTION, etc.

Wherever, hereinafter the words “for approval” or approved (make type, size, arrangement, etc.) are used, especially in regard to manufactured specialties, etc. or wherever it is decided to be substituted by a different make or type of apparatus for which it is specified, all information pertinent to the adequacy and adaptability of the proposed apparatus, shall be submitted to the Engineer for approval.

VIII. WORKMANSHIP

The work thorough shall be executed in the best and most thorough manner under the direction of and to the satisfaction of the Architect who will interpret the 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.

IX. STANDARD OF MATERIALS

All materials shall be new and shall conform with the standards of Underwriter's Laboratories, Inc., IEEE, NEMA and Philippine Standard Agency (PSA) for every case where such a standard has been established for the particular type of materials in question.

All materials on all system shall comply with the specifications, unless specially excepted and all materials where not specified shall be of the best of their respective kind.

X. APPROVAL OF MATERIALS

All electrical materials shall be new and shall meet the requirements and shall bear the inspection label wherever standards have been established. Before any materials or equipment are ordered, the Contractor shall submit to the Engineer for approval, a complete list of the materials, apparatus, and equipment, in triplicate, giving the manufacturer's name, address, descriptive data, trade name of item, rated capacities, certified analysis, catalogue numbers, etc., and when called upon to do so, complete specifications and cut or drawings of each item, of whole or portion of list, as required by the Engineer which he proposed to use and install.

XI. GROUND TEST

The entire installation shall be free from improper grounds and from short circuits. Test shall be made in the presence of the Engineer. Each panel shall be tested with mains connected to the feeder and branches, all fixtures in place and permanently connected, lamps removed or omitted from the sockets and all switches closed. Each individual power feeder shall be tested with the power equipment connected for proper and intended operation. In no case shall the resistance be less than that allowed by Article 2.3 of the Philippine Electrical Code. Failure shall be corrected in a manner satisfactory to the Engineer.

XII. PERFORMANCE TEST

Is shall be the responsibility of the Contactor to test all system, of the entire electrical installation for proper operational condition. This condition shall apply to the power and lighting installation as well as low voltage and alarm control, signal and communication system. Where sequence operation is required, the Contractor shall test for proper sequence of the entire electrical installation for satisfactory working condition as approved by the Engineer.

XIII. SUPERVISION OF ELECTRICAL WORK

General Electrical Work: Furnish full-time service of one or more experienced licensed Electrical Engineer, well qualified in directing and overseeing all phases of work and of types required.

Equipment: Furnish services of manufacturer's representative or other special qualified persons as necessary to supervise equipment installation when regular full-time supervisions are not otherwise fully familiar thereof.

Supervisory Personnel: Maintain at premises of work for as long as necessary to continuously supervise all of various phases of work required, including installations and for instruction of Engineer operations and for instruction of operating personnel.

XIV. COMPLETION REQUIREMENT

Remove waste and debris resulting from this work, as work progresses and upon completion. Service and adjust moving of mechanical parts for smooth, quiet and proper operating condition. Touch-up abraded or damaged prime painting or galvanizing and leave clean and ready for finishing work required.

XV. TRADE/NAME BRANDS

Trade/brand names of equipments are intended only to show to required degree of standardization on which the design of the particular work is based and also to avoid ambiguous description of the equipment. The indication of the trade/brand names, thereof shall in no way be considered to limit the acceptability of other products of equal or better performances, functions, reliability and durability.

XVI. LIGHTING SYSTEM

The Contractor shall provide labor and materials for the installation of lighting systems to be included but not limited to the following:

- a. A system of exterior and interior lighting including all feeders, branch circuits and connections to all lighting outlets and fixtures.
- b. All distribution and lighting panels completed.
- c. If anything has been omitted in any item of work or material usually furnished which are necessary for the completion of the lighting system work as outlined hereunder, then such items must be and hereby included in this section of the work.

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- d. The Contractor shall provide and install all lighting fixtures of the size and type as indicated in the drawings.
- e. All fixtures shall be wired and installed completely including all lamps and/or tubes, transformers, ballasts, supports, brackets, canopies, globes, and other parts and devices necessary for the complete installation and operation.

XVII. FLOURESCENT FIXTURES AND LAMPS

All fluorescent fixture units shall be complete with lamps, daylight, pre-heat, 15 to 40 watt tubes, high power factory type ballasts, heavy duty lampholders.

Ballasts shall be high power factor, not less than 0.85, pre-heat type as manufactured by General Electric Company, Phillips or equivalent.

Fixtures with disturbing noise level shall be removed and replaced as directed by the Engineer.

XVIII. LIGHTING SYSTEM EXECUTION

The lighting system shall be completed in every respect, all as indicated in the plans or specified. Fixtures in general shall be supported by means of heavy factory formed steel straps attached to the outlet boxes, attached by means of threaded stem with locknuts or be means of machine screws or formed straps.

Each lighting outlet shall have standard deep 100 mm. octagonal or square box for each ceiling and bracket fixture installation. Each box shall finish flush against concrete and plaster walls or ceiling, except for exposed work. All materials shall be as indicated.

XIX. RELAMPING

The Contractor shall furnish and install all lamps for the entire lighting fixture installations and shall replaced all broken or burned out lamps up to time that the Owner takes final acceptance of the work.

XX. WALL SWITCHES

Wall switches shall be rated at 10 amperes, 250 volts, one-way or three-way as required. The type of switch shall be tumbler or snap on as required. National brand or equivalent. Where switches are installed surface mounted, they shall be installed in type FS conduit fittings and provided with surface mounting covers.

Switches shall not be during switching operations.

Wall switches shall be mounted 1400 mm. from finish floor.

XXI. RECEPTACLES

Receptacles outlets shall be for flush mounting, duplex rated at 15 Amperes, 125/250 volt connection, National or equivalent. Type and color of receptacle outlet plates shall be as selected by the Engineer and appropriate samples of outlet and plates shall be submitted prior to purchase of device. Weatherproof outlet shall be National or Eagle brand. Wall receptacles shall be mounted 300mm from floor finish unless otherwise indicated in the plan.

XXII. OUTLET AND SWITCH BOXES

At all outlets or whatever kind of all systems, there shall be provided suitable outlet boxes or other fittings specially designed to receive the type of devices to be mounted thereon.

All outlet boxes shall be pressed metal boxes with metal thickness not less than gauge 18.

All metal parts of outlet boxes shall be galvanized and shall have covers having thickness as the box with screws attached.

Boxes installed in damp or wet locations shall be specifically approved for the purpose and shall be so placed and constructed as to prevent moisture from entering or accumulating within the box.

In walls or ceiling constructed of wood, concrete or other similar materials, boxes and covers shall be flushed with finished surfaces. Number of wires and devices contained in the box shall be in accordance with the Code. Where necessary flush square outlet boxes shall be fitted with extension rings or raised coverlets.

Boxes shall be securely and rigidly fastened to surface upon which they are mounted, or embedded in concrete or masonry, and shall be supported from a structural member or building either directly or by using substantial and approved metal braces.

Outlet boxes installed exposed other than in wet location shall have thickness not less than gauge 16 while boxes concealed above closed ceiling and those embedded in masonry shall have a thickness of gauge 18, hot dipped galvanized.

Standard outlet boxes shall be of the octagonal, square or rectangular shapes and only deep types no less than 54 mm. depth shall be used for installation.

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XXIII. CONDUITS

Unplasticized Polyvinyl Chloride (PVC) conduit shall be schedule 40, uniform thickness. It shall be compression and impact resistant, non corrosive, weatherproof as manufactured by Emerald or equivalent. The material shall not deteriorate when exposed to sunlight, rain and other elements.

Liquidtight flexible materials metallic conduit shall be raintight suitable for wet and damp locations complete with special fittings and connectors approved for the purpose.

XXIV. INSTALLATION OF CONDUIT SYSTEM

Conduit shall be installed and supported in a rigid and satisfactory manner.

No conduit shall be used in any system smaller than 15 mm. (1/2 inch.) diameter trade size, nor shall have more than four quarter bends in any one run between outlets and/or fittings. When necessary pullboxes shall be provided as directed by the Engineer

All cut ends of conduit shall be reamed to remove rough edges. Where a conduit enters a box or fitting, bushing shall be provided to protect wire from abrasion, unless design of box or fittings is such as to afford equivalent protections.

Raceways shall be installed at right angles or parallel to building lines. Conduit shall be firmly fastened within 0.3m. of each outlet box fitting or cabinet by means of standard lumps and intermediately spaced not more than 1.0 meter. All clamps, bolts, straps, etc. shall be galvanized and painted metal.

Support and braces may be welded to structural steel after specific approval by the Engineer. When running over concrete surfaces, the screws shall be held in place by expansion sleeves.

XXV. WIRES AND CABLES

600 volt grade wire shall be copper, hard drawn and annealed and shall be 98% conductivity.

Wire or cable for lighting and power systems shall be plastic insulated type TW, THW or THHN as note on plans or as specified. All wires 3.5 sq.mm. and larger shall be stranded unless noted on plans.

No wire smaller than 3.5 sq.mm. shall be used except where otherwise specified. Control leads for motors shall be type THW, unless otherwise indicated.

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All wires shall be color coded (Black, Red, Yellow, Green) wires and cables shall be as manufactured by Phelps Dodge, Philflex or equivalent.

Underground conductors shall have distinct insulation color from grounded and grounding wires. Grounding wires and cables shall be colored green or white or as approved by the Engineer.

XXVI. CABLE CONNECTORS

The connection of conductors from size 8 sq.mm. and larger shall be made copper, solderless, pressure type connectors. Connection shall be done without damaging the individual cable strands. Connectors shall be provided where required, with high impact phenolic insulators or fish paperboards separators.

XXVII. INSTALLATION OF WIRE AND CABLE

Conductors or cable shall not be installed in conduits, raceway until such systems has been completed, not it be installed until the inside of conduit has been cleaned.

The Contractor shall exercise due care to prevent damage to conductors, insulation or sheeting when pulling wires and cables.

All feeder cables installed shall be continuous from origin to panel or equipment terminations without running splices in handhole or pullbox except where taps and splices are approved by the Engineer using suitable connectors.

Wires and cables for power and lighting shall be in separate conduit from any wires or cables for communication and signal systems.

Where cable passes through building exterior walls and underground identification tags of non-corrosive materials shall be stamped on each end and every route. Wires and cables inside panelboards and control boxes shall be binded by means of plastic straps in a neat and orderly manner.

XXVIII. GROUNDING SYSTEM

The following electrical systems and equipment shall be grounded:

- a. Enclosures, casing and metallic bases of all electrical equipment including transformer cases and neutrals, electric motors, electric generators, water heaters, and others.
- b. All power panel from Main Distribution Panel to Lighting Power Panels shall have suitable and effective grounding.

- c. Wire trays, bus and cable ducts. Metallic conduits and boxes shall be grounded where required as indicated in the plans.

XXIX. INSTALLATION OF GROUNDING SYSTEM

Provide and install, where required in the plans, copper clad electrodes size not less than 25 mm. diameter x 3 m.

The grounding system shall be tied to the grounding rods and at least two separate points in the metal structures of the building or in the underground water mains metallic piping. The connection shall be made as close to earth as possible. The resistance of the combined system shall not exceed 5 M ohms. From the system ground, wires of required size shall run to each equipment, panel raceway and device requiring ground to make a complete and permanent connection.

XXX. OUTDOOR FACILITIES

The Contractor shall furnish and install the complete service entrance in accordance with the plans.

Power for each facility shall be fed through cables laid out in a concrete underground duct of Class B concrete which shall envelope the conduits at least 75 mm. all around. The duct bank shall be adequately reinforced at portions subject to heavy loads such as Roadways.

Conduits for outdoor underground use shall be as indicated in the plans.

No splicing of cable shall be allowed in any underground conduit duct or handhole.

Concrete handholes shall be reinforced concrete construction with concrete cover of sufficient thickness to prevent distortion upon application of normal load. It shall be provided with drain facilities to ensure non-settlement of water or any liquid thereon. No splicing of cables shall be allowed in handholes.

XXXI. LIGHTING AND POWER PANELS

Electrical panel and cabinets shall be dead front construction furnished with trim flush or surface mounting as required. Cabinet and panels shall be of code gauge steel with gutters at least 100 mm wide. Doors shall be swing type and shall have latches and locks.

All protective devices shall meet NEMA and Underwriter Laboratories Inc. specifications. In multiple circuit breaker, all poles shall be interrupted simultaneously during fault conditions.

All busbars and current carrying parts shall be high conductivity copper and shall have current density not more than 1.5 amperes per sq.mm. of cross-sectional area and shall be heavier where for mechanical strength. Supply with non-ferrous or galvanized bolts, nuts, washers and other required attachment devices.

Each and every panel shall be provided on the inside of the door, with directory frame protected by a transparent plastic window, containing typed card indicating the member and designation of the circuits.

All panels and switchboard shall have grounding bus or lugs with pressure type terminals of sufficient quantity and size and so located inside as to permit easy termination of cables.

Panels, switchboards and MCC's shall be painted with coat of antitrust primer and finish coat of baking enamel paint preferably colored gray.

XXXII. CIRCUIT BREAKERS

Circuit breakers shall consist of quick-make, quick break operating mechanism, thermal magnetic trip unit on each pole and enclosed in a molded phenolic case. The thermal magnetic trip unit shall provide time delay overload and instantaneous trip short circuit in any one pole.

Rating of circuit breaker shall be suitable for each service application shall be specified as to rated voltage, current, type, frame, size and frequency as manufactured by Westinghouse or equivalent.

XXXIII. INSPECTION TESTS

Inspection and tests shall be conducted by the Contractor in the presence of the Engineer or the Owner's representative. These tests shall be for the normal operation of the entire electrical system of the project. The decision made by the Engineer for correction on any item or work, alteration of incorrect installation, or replacement of defective materials, or any other defects as found by him shall be final and must be complied by the Contractor within forty-eight (48) hours after receipt of the official written communication before final acceptance can be made.

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XXXIV. TEMPORARY LIGHT AND POWER

The Contractor shall provide, install and maintain adequate incoming service transformer, light feeders, branch circuits, outlets, lamps and fixtures, as required for performance of the work by all trades engaged in the construction of the building structures and installation.

Section 8
Electrical Works