

I. SUMMARY OF WORKS

1.0 Introduction

The Works in this Contract is for the New Construction of a THREE STOREY PSHS-SRC DORMITORY BUILDING II to be located at PSHS-SRC Campus Complex, Barangay Paraiso, City of Koronadal, South Cotabato. The PSHS-SRC PMO shall perform the construction management services including the management of project deliverables and all issues arising from this Contract Document.

1.1 Name of Project

Construction of a THREE STOREY PSHS-SRC DORMITORY BUILDING II to be located at PSHS-SRC Campus Complex, Barangay Paraiso, City of Koronadal, South Cotabato

1.2 Start and Completion Dates

The Contractor shall be held responsible for meeting intermediate dates as contained within the attached documents. Such dates are binding, and damages will apply to intermediate as well as end dates:

Start on Site : Based on date stipulated on Notice to Proceed
Punch listing : 30 days before completion
All Works Complete : 150 calendar days

1.3 Work Areas

All works shall be done within the confine of the lot boundaries. Provide temporary work enclosures on all sides affected by construction works. Provide appropriate announcement boards and signage, to include all construction permits and clearances.

2.0 Scope of Work – General

The Scope of Work includes the furnishing of all labors, materials, equipment, and tools including supervision necessary to complete all the Works stated herein. All Works are to be complete in accordance with the Contract Documents and as directed by the PSHS-SRC to result in a completely functional facility.

The Scope of Work shall consist of the following in accordance with the Drawings and Specifications, including Supplemental Agreement but is not limited to the following;

2.1 Site Works

- a. Health, Safety, & Environment
- b. Security
- c. Temporary Enclosures
- d. Clearing of site and disposal off-site debris, etc
- e. Construction safety, and providing of peripheral hoarding
- f. Soil treatment for subterranean termite control
- g. Excavation and backfilling for plumbing/sanitary and drainage including septic vault system
- h. Filling and grading, bedding, backfilling of structural excavations, and compaction
- i. Preparation of sub-grade for slab-on-grade and or pavements, and final site grading all as shown on Drawings.

2.2 Structural Works

- a. Structural concrete including steel reinforcements and formworks
- b. Structural steel and miscellaneous metal, and anchorages
- c. Masonry works
- d. Roof truss and framing works

2.3 Architectural Works

- a. Roofing, flashings, rain gutter, etc
- b. Installation of all doors (wooden, steel, and glass) and windows (fixed, awning, sliding)
- c. Painting works, general(Interior, cabinetries, and Exterior)
- d. Concrete finishes as shown or as indicated in drawings
- e. Tiling and wall finishes as indicated in Drawings
- f. Ceiling works as indicated in drawings
- g. Construction of drywalls/partitions as indicated in Drawings
- h. Installations of Hardware.

2.4 Plumbing/Sanitary Works

- a. General Plumbing Works for toilets as indicated in Drawings
- b. Construction of septic tank.
- c. Tapping of toilet drain to septic tank and connection of outflow to water collection areas or existing main drainage.
- d. Domestic water supply system to include pump installation, construction of cisterns and installation of stainless steel overhead storage tanks, and tapping to source.
- e. Installation of all Plumbing Fixtures (water closets, lavatories, urinals, sinks, footbaths etc) as indicated in drawing
- f. Construction of catch basins as indicated in drawings. Tapping of catch basins to main storm drainage.
- g. Installation of downspouts and construction of catch basins and tapping to existing storm drain
- h. Provision and installation of Siamese outlet, dry standpipe, fire house cabinet per floor.

2.5 Electrical Works

- a. Electrical wirings and cabling for lights & power supply
- b. Service Entrance and meter connections
- c. Grounding system
- d. Provision and installation Lighting fixtures, switches, receptacles, and outlets
- e. Conduits system and junction boxes
- f. Panel Boards
- g. Provision and installation of Emergency lights, Illuminated Exit signs as indicated in drawings

2.6 Mechanical Works, Fire Protection System

- a. Provision and installation of fire sprinkler system including cistern and pumps

2.7 Electronics and Communications

- a. Provision and Installation of complete CCTV system as indicated in drawings
- b. Provision and installation of public address system
- c. Provision and installation of Fire alarm switch and bells and Smoke Detectors

2.8 Specialty

- a. Provision of Modular toilet partitions as indicated in plans and drawings
- b. Construction of Lavatory Counters
- c. Provision and installation of Toilet Paper Holders
- d. Provision and installation of Liquid Soap Dispenser
- e. Provision and installation of Stainless Grab bars (for PWD toilet)
- f. Fabrication of modular Closets, Cabinets, and study tables
- g. Provision and Installation of interior signage

2.9 Moisture Protection

- a. Waterproofing of all toilet floors
- b. Waterproofing of all concrete gutter
- c. Waterproofing of utility deck
- d. Provision and Installation of roofing

2.10 Furniture

- a. Provision of double deck beds as indicated in BOQ
- b. Provision of closets
- c. Provision of study tables

2.11 Thermal Protection

- a. Provision and Installation of Roofing Insulation

2.12 Glass and Glazing

- a. All Glass works as indicated in drawings.
- b. All Mirrors for toilet

2.13 Land Development

- a. Landfill as indicated in drawings and BOQ

2.14 Pre-commissioning, Commissioning & Completion

- a. Method Statement
- b. Program
- c. Test Equipment
- d. Demonstration

e. Documentation

2.15 As-Built (Record) Drawings & Related Documents

3.0 GENERAL REQUIREMENTS

3.1 General

Unless otherwise definitely excluded, the Works to be executed and the materials and equipment to be supplied shall include all necessary provision for a complete and satisfactory working and or functional installation. **Minor items that are necessary in normally accepted trade practice with installations of this type though not specifically mentioned shall be included.**

3.2 Regulations, Permits & Certificates

- a. All works covered by this specification shall be complete and functional in all respects and shall comply with the rules, regulations and requirements of local authorities having jurisdiction over the installations and all other relevant statutory requirements.
- b. The Contractor shall apply from all local authority necessary permits and certificates. These shall include but are not limited to building permits and associated construction permits. The timing for the applications shall be such that, to the opinion of PSHS-SRC PMO, the overall work progress will not be affected.
- c. Upon completion of the Works, the Contractor shall carry out all necessary tests on the various systems of the installations as required by PSHS-SRC PMO or the local authorities, and shall apply for and obtain all certificates and approval from the relevant authorities for the work done and shall submit same to PSHS-SRC PMO.
- d. The Contractor shall arrange for local authorities inspections and obtain the required approval and permits or certificates from the local authority at a time as directed by PSHS-SRC PMO. The Contractor is to note that the contracted works will not be considered as practically complete prior to the receipt of the approval of certificates.

3.3 Materials & Workmanship

All materials and equipment used in the Works shall be new and best in quality, design and performance. All materials used shall be of the quality specified and where not specified shall be in accordance with the relevant Standards acceptable by the Architect.

All materials and work necessary for the efficient functioning of the installation shall be provided even if not explicitly mentioned in the Contract Documents

All works shall be carried out to the best engineering practice by fully competent tradesmen.

3.4 Survey Control & Setting Out

Contractor shall set out the works and employ methods, procedures, and appropriate plant or equipment to ensure that excavations and construction shall be completed within the tolerance specified in the Contract. The setting out and installation of all works shall follow the approved drawings except for approved site variations. The Contractor shall work from established datum for finish floor levels.

The Contractor shall ensure that all reasonable measures are taken to ensure that the survey control points are not disturbed from their correct positions. The Contractor shall immediately notify the PSHS-SRC PMO if a survey control point has been disturbed.

The Contractor shall plan their activities and coordinate with the PSHS-SRC PMO providing reasonable notice for survey control activities.

3.5 Delays

In the event the Contractor falls behind the Project Schedule, then he may be required to accelerate his work. In such cases, the Contractor shall immediately apply appropriate extra resources at his own expense until such time as the schedule slippage has been recovered.

3.6 Normal Working Hours

The Site is open for access from 6:00am to 7:00pm, Monday to Saturday. Contractor shall ensure that their personnel complete their work in a safe manner and leave the work site by not later than 7:00pm Monday to Saturday.

Site working hours will generally be from eight hours a day, six (6) days a week with 1 hour lunch break.

Work on the site outside those hours can only proceed if authorized in advance by the PSHS-SRC PMO and where approved the Contractor shall ensure that:

- No person shall work more than 14 hours within a 24-hour period

- Contractor shall maintain regular hours of work for all their personnel and provide a schedule of personnel movements to the PSHS-SRC PMO at the weekly progress meeting.

No allowance of public holiday has been made for legal and special holidays.

The Contractor is assumed to be aware of the Site Normal Working Hours and to have made sufficient allowance for all necessary overtime and shift work as needed and as directed.

3.7 Works beyond Normal Working Hours

If the Contractor wishes to carry out work beyond or outside working hours, then an application shall be made to PSHS-SRC PMO in ample time to enable satisfactory arrangements to be made for inspecting the work in progress. During periods of darkness the Contractor shall provide lighting to the approval of PSHS-SRC PMO

3.8 Clean Installation

The Contractor shall be liable for clean installation works on the site and shall closely supervise compliance thereof. To assure clean installation works on the site, PSHS-SRC PMO will impose cleaning and gowning practices to the Contractor. The Contractor shall instruct all his staff, personnel of these obligations and provisions. The Contractor shall be liable for cleaning within the area of his scope of works and exact compliance thereof.

The Contractor shall provide adequate training to his personnel on site with respect to the ruling clean construction and clean installation practices. The Contractor shall be obliged to make their personnel to attend such training, supply by PSHS-SRC PMO or others.

The Contractor shall assign a person expressly dedicated to:

- a. The wet/dry cleaning of working areas on a daily basis;
- b. The removal of litter and waste from working areas to refuse containers off the site;
- c. The removal of excess materials and or waste materials from working areas

3.9 After Contract Award & Prior to Mobilization

After the Contract award and prior to Mobilization, the Contractor shall:

- a) Submit Safety Management Plan (SMP) specific to the project clearly stating how the Contractor intends to execute the Works. The SMP shall be supported by a description of the safety administration system to be maintained on the site and specific safe work procedures to be employed by the Contractor's personnel and sub-contractors
- b) Nominate a Site Safety Officer, supported by evidence of qualifications and experience
- c) Complete site entry documentation packages for all personnel including subcontractors

3.10 Upon Mobilization to Site

The Contractor shall submit the following to PSHS-SRC PMO prior to the commencement of work at site;

- a) Copies of all certificates of Competency for the Contractors and subcontractor personnel, to be presented at their site safety induction
- b) Names of persons authorized to operate cranes, to be used at site (if applicable)
- c) Names of authorized power tools operators.
- d) Copies of inspection certificates for any classified equipment the Contractor or subcontractor will bring on Site.
- e) Completed site access documentation for all vehicles and mobile plant including that of subcontractors
- f) Record of inspection and tagging of all Contractor and subcontractor owned electrical equipment
- g) A register of any hazardous substances the Contractor or subcontractors will bring to site supported by relevant Material Safety Data Sheets (MSDS)
- h) The Contractor shall table the above at the initial **kick-off meeting** convened by the PSHS-SRC PMO

Note:

Where a Contractor has not provided the required deliverables or the deliverable are not approved by the PSHS-SRC PMO, access to the Site or approval to commence work will be withheld.

3.11 PRIORITY OF DOCUMENTS

- a. The Contract agreement
- b. The letter of acceptance
- c. Agreed letters, minutes of meetings, and other communications during clarifications or negotiation prior to award.
- d. The General Conditions& Specification
- e. Building Plans
- f. Bill of Quantities
- g. Instruction to Bidders

II. CONSTRUCTION MANAGEMENT, RULES AND REGULATIONS

1.0 Site Management

All construction activities on site will be managed by the PSHS-SRC PMO.

Contractor will be advised of the person holding this position when requesting approval to mobilize to Site.

PSHS-SRC PMO shall be available to provide assistance to and work with Contractors in order to ensure effective communication; appropriate safety practices and procedures are implemented and maintained during the entirety of the Contract.

PSHS-SRC PMO, Health & Safety Officer and Discipline Supervisor shall conduct regular inspections and audits of Contractor's work practices and safety management systems in conjunction with the Contractor

PSHS-SRC PMO requires that all Contractors and their Sub-contractors demonstrate in the performance of their work, that their application of safety is an integral part of their normal business process and not as aspect that can be discarded by executive discretion in the interests of commercial expediency.

Contractors shall comply with the PSHS-SRC PMO site safety requirements

PSHS-SRC PMO may in his sole discretion suspend the work or any part thereof for such periods as he thinks fit if, in his opinion, the Contractor has failed or neglected to comply with the site safety requirements, applicable laws and regulations. In this event, the Contractor shall not be entitled to and shall not claim any extension of time for this Contract or additional compensation for delays due or attributed to the Contractor's failure or neglect.

Safety shall be the first agenda item at all formal meetings convened by the PSHS-SRC PMO with the Contractor(s).

2.0 Contractor's General Obligations

The Works as completed by the Contractor shall be wholly in accordance with the Contract and fit for the purpose for which they are intended, as defined in the Contract. The Works shall include any work which is necessary to satisfy Employer's requirements, or is implied by the Contract but which may be inferred to be necessary for stability or completion or the safe, reliable and efficient operation of the Works. The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations, of all methods of construction and of all the Works, irrespective of any approval or consent by the PSHS-SRC PMO or the duly designate Employer's representative.

3.0 Contractor's Representative

Unless the Contractor's representative is named in the Contract, the Contractor, shall upon the signing of the Contract, immediately submit to the Employer's Representative for consent of the name and particulars of the person the Contractor proposes to appoint. The Contractor shall not revoke the appointment of the Contractor's Representative without prior consent of the PSHS-SRC PMO.

The Contractor's Representative shall give his whole time to directing the construction activities. Except or otherwise stated in the Contract, the Contractor's Representative shall sign, receive (on behalf of the Contractor) all notices, official written correspondence, instructions, certificates, consents, approvals, and other communications under the Contract. The Contractor's Representative may delegate any of his powers, functions, and authorities to any competent person, and may at anytime revoke any such delegation. Any such delegation or revocation shall be in writing and shall not take effect until the Employer's Representative has received prior notice signed by the Contractor's Representative, specifying the powers, functions and authorities being delegated or revoked.

4.0 Contractor's Superintendence, and Personnel

The Contractor shall provide all necessary superintendence during the execution of the Works, and as long thereafter as the Employer's Representative may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. Such superintendence shall be given by sufficient persons having adequate knowledge of the operations to be carried out including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents for the satisfactory and safe execution of the Works

The Contractor shall employ only persons who are careful and appropriately qualified, skilled and experienced in their respective trades or occupations. The Employer's Representative may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative, who in the opinion of the Employer's Representative:

- a. Persist in any misconduct
- b. Is incompetent or negligent in the performance of his duties
- c. Fails to conform with any provision of the Contract, or
- d. Persist in any conduct which is prejudicial to safety, health, or the protection of the environment

If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.

5.0 Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful or disorderly conduct by or amongst his staff, labor, and to preserve peace and protection of persons and property in the neighborhood of the Works against such conduct.

6.0 Programme

The Contractor shall submit to PSHS-SRC PMO, for information, within the time as agreed during the Project kick-off meeting. The programme shall include the following:

The order in which the Contractor proposes to carry out the Works (including each stage of design (if any), procurement, manufacture or fabrication, delivery to Site, construction, erection, test and commissioning)

All major events and activities in the production of Shop Drawings

The sequence of all tests as herein specified

7.0 Progress Reports

Weekly progress reports shall be prepared by the Contractor and submitted to PSHS-SRC PMO in three (3) copies. The first report shall cover the period up to end of the week after the Commencement Date occurred. Progress report shall include:

- Photographs and detailed descriptions of progress including each stage of construction activities, fabrication, delivery to the Site, erection
- Records of personnel and Contractor's equipment on Site
- Copies of quality assurance documents, test results and certificates of materials
- Safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and
- Comparisons of actual and planned progress, with details of any aspects which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome aspects.

8.0 Contractor's Equipment

Unless otherwise stated elsewhere, the Contractor shall provide all his equipment necessary to complete the Works. All of the Contractor's equipment shall, when brought to the Site, be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any such Contractor's equipment without the consent of the PSHS-SRC PMO.

9.0 Matters Affecting the Execution of the Works

The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Contract Price. Unless otherwise stated in the Contract, the Contract price shall cover all his obligations under the Contract (including those under Provisional Sums, if any) or covered by Supplemental Agreement and all the things necessary for the proper execution and completion of the entire Works and the remedying of any defects.

10.0 Unforeseeable Sub-surface Conditions

If sub-surface conditions are encountered by the Contractor which in his opinion was not foreseeable, by an experienced contractor, The Contractor shall give notice to the Employer's representative so that the employer's representative can inspect such conditions. After receipt of such notice and after his inspection and investigation, the Employer's representative shall, if such conditions were not foreseeable by an experienced contractor, proceed to agree or determine:

- a. any extension of time to which the Contractor is entitled
- b. the additional cost due to such conditions, which shall be added to the Contract Price and shall notify the Employer accordingly.

11.0 Quality Assurance

Unless otherwise stated elsewhere, the Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. Such system shall be in accordance with the applicable Industry Codes and Standards. Compliance with the quality assurance system shall not relieve the Contractor of his duties, obligations and responsibilities.

12.0 Plant, Materials and Workmanship

All Plant, Materials to be supplied shall be manufactured, fabricated, and all work to be done shall be executed, in the manner set-out in the Contract. Where the manner of manufacture and execution is not set out in the Contract, the Work

shall be executed in a proper, workmanlike and careful manner, with properly equipped facilities and non-hazardous Materials, and in accordance with recognized good practice.

13.0 Inspection

Any inspection or check by the PSHS-SRC PMOs or representatives of the company of any materials or equipment or of the placing or setting of such materials or equipment during the progress of work shall not relieve the contractor of any of his responsibilities.

The Employer's Representative shall be entitled, during manufacture, fabrication and preparation at any places where work is being carried out, to inspect, examine and test the materials and workmanship, and to check the progress of manufacture, fabrication, of all Plant and Materials to be supplied under the Contract.

The Contractor shall give due notice to the PSHS-SRC PMO whenever such work is ready or about to be covered up or putting out of view. The PSHS-SRC PMO of Staff shall then carry out the inspection, examination, measurement, or testing without unreasonable delay, or notify the Contractor that it is considered unnecessary.

14.0 Testing

If the Contract provides for tests other than the Test after Completion, the Contractor shall provide all documents and other information necessary for testing and such assistance, labor, materials, electricity, fuel, stores, apparatus and instruments as are necessary to carry out such tests efficiently. The Contractor shall agree, with the PSHS-SRC PMO, the time, place for the testing of Plant or Material or any other parts of the Work as specified elsewhere in the Contract Documents. After tests are completed, the Contractor shall forward to the PSHS-SRC PMO duly certified copies of the tests for his review and acceptance.

15.0 Rejection

If, as a result of inspection, examination or testing, the PSHS-SRC PMO decides that any Plant, Materials, workmanship is defective or otherwise not in accordance with the Contract, the PSHS-SRC PMO may reject such Plant, Materials, or workmanship and shall notify the Contractor promptly, stating his reasons. The Contractor shall promptly make good of the defect and ensure that the rejected item complies with the Contract.

If the PSHS-SRC PMO requires such Plant, Materials, or workmanship to be retested, the test shall be repeated under the same terms and conditions. The cost of retesting as a result of the rejection shall be borne by the Contractor.

16.0 Substitute Equivalent Materials

If during the course of the Work certain materials required for the use in the Work become unobtainable despite the efforts of the Contractor, then it may offer a substitute equivalent or higher in quality materials for the approval of the Architect. These substitute materials nevertheless be suitable and appropriate for use in the Work. Acceptance or rejection of such substitute materials shall be at the sole discretion of the Architect. The Contractor shall not be entitled to any additional cost incurred as a result of any material substitution of higher quality or its efforts to locate such materials.

17.0 Site Rules

17.1 Security Program

The Contractor is responsible for the security of its workers, tools materials, and equipment on (and to and from) the jobsite and for keeping unauthorized persons off the Site.

Authorized persons shall be limited to the employees of the Contractor, employees of his Sub-contractor, and persons authorized by the Employer or PSHS-SRC PMO.

It is permitted to bring in or take out of the Site goods (materials, tools, equipment, appliances, etc.) that are the property of the Contractor, on the condition that these items are necessary to carry out the assigned works.

The Contractor shall ensure that all materials, tools, equipment, appliances, etc. are clearly marked and recognizable as his property.

It is forbidden to bring photographic, film and video equipment onto the premises.

Tools including personal tools are subject to inspection at the security gate on arrival and departure.

17.2 Construction Area Limits

PSHS-SRC PMO will designate the boundary limits of access roads, parking areas, and construction areas. Contractor's employee or workers shall not trespass in or on areas not so designated. Contractor shall be responsible for keeping all of its personnel out of areas not designated for Contractor's use. In the case of isolated work located within such areas, PSHS-SRC PMO will issue permits to specific Contractor personnel to enter and perform the Work.

17.3 Work Permit, Inspection Request Applications

Before commencement of the work on Site, the Contractor shall complete and apply for a Permit to Work (PTW) from PSHS-SRC PMO.

Before the start of activities with an increased level of risk, the Contractor shall apply for the applicable work permits from the PSHS-SRC PMO. The following work permits can be applied for:

- Permit to Excavate
- Permit to Work on Temporary Site Electrics
- Permit to Work on High Voltage Distribution
- Permit to Work on Mechanical Services
- Hot Work Permit
- Permit to Work in Confined Spaces
- Permit to Work at Location with Fire Risk
- Permit for Special Work
- Permit to Work Overhead
- Permit to Temporary Stop Work

17.4 Approval to Commence Work System

As part of the application procedure for the permits mentioned above and before commencing work, the Contractor shall complete a Permit to Work including the checklist (to be provided by PSHS-SRC PMO) attached to the Permit to Work together with any additional permits that may apply e.g. Hot Work Permit, Excavation Permit etc and submit a list with the work activities, the location, the tools and equipment, all potential hazards associated with the Work and the protective measures and provisions.

The Permit to Work shall be supported with the Contractor's Method Statement setting out how the work will be carried out or executed, Job Safety Analyses (JSA's) and the safety procedures that will be employed.

Review and approval of Permits will be by the PSHS-SRC PMO Discipline Supervisor or if unavailable, the PSHS-SRC PMO.

Approval of Permits to Work is contingent on the Contractor satisfying all relative requirements prior to start of work and when approved, the Contractor assumes responsibility for safe management and access control of the work area and activities the Permit to Work covers.

18.0 Contractor's Work Area

The Contractor will be allocated areas for materials lay down area, fabrication, offices and equipment. The Contractor must confine its storage and activities to these areas as nominated by the PSHS-SRC PMO.

The Contractor's work area shall be constructed and maintained by the Contractor at his own cost. Any access road constructed by the Contractor shall be adequate for applied traffic loads and to prevent damage to existing underground facilities. All temporary access roads are to be removed prior to completion, unless PSHS-SRC PMO directs them to be retained.

The Contractor shall provide proper and adequate drainage for its construction, storage, parking, and site fabrication areas including the necessary piping for disposal to designated ditches, or sewers. Temporary drainage facilities shall be removed upon completion of Work unless the PSHS-SRC PMO directs to have the facilities left in place. The Contractor shall be responsible for providing and operating any temporary pumps for keeping its area drained. The Contractor shall furnish and place any necessary surfacing material to avoid loss of time due to muddy conditions.

The Contractor or Subcontractor shall provide covered bins outside their workers area, workshops, offices and storage sheds in compliance with Environmental procedures.

19.0 Contractor's Office at the Site

During the performance of this Contract, the Contractor shall provide and maintain a suitable office at the Site that shall serve as his representative station to receive drawings, instructions, or other communication or articles. Any communication given to the said representative, or delivered at the Contractor's office at the Site of the Work in his absence, shall be deemed to have been delivered to the Contractor.

20.0 Entering and Leaving the Site

At all times when on Site, the Contractor's (and associated Subcontractors') employees shall conspicuously wear a Identification (ID) badge stating firm name, name of bearer, area clearance and period of validity.

The Contractor at his own cost shall provide the necessary ID to all of his employees and or Subcontractor's employees working either directly or indirectly under its supervision.

PSHS-SRC PMO shall provide for daily registration sheets to indicate presence on Site. Each employee of the Contractor is obliged to sign his/her presence on and off on the sheet every day.

At the request of Site security personnel or security guard, all Contractor employees may be subject to search and such request must be granted.

21.0 Use of Existing Building or Facility

- a. The Contractor under this contract will not be permitted to use the existing building or facility at the Site during the entirety of the Contract. The Contractor shall provide his own facilities such as toilet, first aid clinic, stores and the like. These facilities shall be maintained by the Contractor at his own expense.

22.0 Existing Facilities or Under-ground installations

- a. Prior to the start of the Work or any part of the work, the Contractor shall give notice to the PSHS-SRC PMO for the purpose of verifying the location of existing underground installations (ie: drainage culverts or utility lines) that may be affected by the works under this Contract.
- b. Any damage to existing facility or underground installations previously identified or located shall be repaired or reinstated by the contractor without any additional cost to the Company.

23.0 On-Site Conditions

The following activities are strictly not allowed inside the premises of the construction site.

- o Living and cooking of any nature
- o Smoking, except at designated smoking points
- o Gambling of any kind throughout the work area.
- o Eating of foods except at designated eating area.
- o Bringing or taking of drugs of abuse, alcoholic drinks or liquors including at the car park under any circumstances. (Persons affected are not permitted on site and those caught will be dealt with accordingly)
- o Firearms, weapons of any kind, and pet animals including any or those persons which are under the age of 18 years.
- o Fighting on the construction site. Any persons caught fighting will be banned immediately from the construction site and shall turn over his ID badge to the site security.
- o Selling of any goods or giving gifts
- o Parking of bicycles, motor vehicles, scooters unless authorized by PSHS-SRC PMO. All such vehicles when permitted to enter site shall be parked in the designated area for this purpose. PSHS-SRC PMO shall not be held responsible or accountable of any loss or damage of such vehicles.
- o Visitor's or relatives of personnel are not allowed to enter the project site except at the designated receiving areas for all visitors.
- o Contractor's and or personnel vehicles are to be parked in the designated car park and are not to be taken on the job site at any time.

24.0 Wet Weather

In the event of wet weather, the Contractor or sub-contractor shall provide and place such means as is necessary, including the issue of wet weather gears, tarps, diverting water flow, use of pumps or other means to protect their personnel, plant, equipment, workplace facilities and the work area from rain.

25.0 Protection of the Environment, Prevention of Pollution

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations. The Contractor shall ensure that air emissions, surface discharges and effluent from the Site during the Contract Period shall not exceed the values indicated in the PSHS-SRC PMO environmental requirements, and shall not exceed the values prescribed by law.

The Contractor shall, at its own expense, take greatest care:

- a. to prevent the introduction of any substances or materials into any stream, or other body of water which may pollute water or constitute substances or materials deleterious to wildlife;
- b. to prevent discharge of air contaminants into the atmosphere in violation of the laws, rules and regulations of the government entities having jurisdiction;
- c. to prevent contamination of clean materials by waste material – environmental pollutants (paint, solvents, stripping agents, oil, grease, etc)

- d. to institute industry-accepted methods of dust control determined by PSHS-SRC PMO which are a cause from all excavations, haul, demolition works, waste disposal areas, construction and fabrication areas, and other areas such as continuous water sprinkling or any similar treatment acceptable to PSHS-SRC PMO. No separate payment will be made for dust control.

Mechanical plant or equipment which emit excessive noise, smoke, fumes, obnoxious liquids, gases, water will not be allowed to be used on Site

Constructing of surrounds of entire storage areas sufficient to contain or prevent overflows, leaks or spills of flammable liquids, drums or containers containing diesel fuel, oil, petrol, waste oil.

Environmental incidents shall be reported immediately to PSHS-SRC PMO.

26.0 Site Signs

Identification signboards and notices for safety or instruction are permitted on site only after review and approval of PSHS-SRC PMO for formal location and quantity.

Contractor shall post prominently signage indicating building permits and other compliances.

All posted safety and warning signs, barricades and tags on the construction site shall be obeyed at all times.

27.0 Construction Entrance

PSHS-SRC PMO will designate site entrance gate dedicated for Contractors use. This gate shall be manned by the Contractor's gateman to control site access of the Contractor's personnel and the gateman shall notify the receiving area when shipments are at the gate. No individual drive-in passes will be issued.

28.0 Utilities and Facilities

28.1 Power Supply

Power for the general use during the entirety of the Contract shall be the responsibility of the Contractor. The Contractor shall be responsible for arranging with the power utility firm in connecting into their existing power supply required by the Contractor. All costs incurred shall be borne by the Contractor. The Contractor will also be responsible for providing his portable construction power at times that no power is available from the utility firm to avoid disruption of work.

28.2 Water Supply

Water for construction purposes and potable water shall be the responsibility of the Contractor. The Contractor shall be responsible in coordinating with utilities firm for the connection of services to the construction site. The Contractor shall pay all costs associated with the connection and its consumption and shall allow for maintaining, and clearing same way on completion.

28.3 Toilets, Sanitary Facilities

The Contractor shall provide at its own expense all requisite approved sanitary facilities for its workmen, in an area selected or nominated by the PSHS-SRC PMO. These facilities shall be maintained and kept clean by the Contractor; on completion it shall completely dismantle and remove them. Any remaining refuse shall be disposed off site following PSHS-SRC PMO policies. It shall also fill in and disinfect all rubbish pits, latrines, etc and leave the entire area level and thoroughly clean.

29.0 Transport Costs

The cost of transporting the Contractor's equipment, construction plant, machinery services or construction items, transport of his personnel to and from Site, or any other goods, relating to the Works shall be borne by the Contractor.

The cost of loading and unloading of all materials, equipment, plant or other goods shall be borne by the Contractor.

Demobilizing and freight of the Contractors plant, and construction equipment from the Site is the responsibility and cost of the Contractor.

30.0 Damage to Existing Structure

The Contractor shall arrange to carefully expose any existing electric cables, water and sewer pipes, etc which may be encountered during the execution of the Work. It shall arrange to carefully support, and protect any such cables, or service pipes to the satisfaction of the PSHS-SRC PMO, in order that such services installation shall remain operative.

Any damage to the existing services installation, roads, fence, and other works, etc caused by the Contractor's workmen in the execution of their work or duties or otherwise shall be made good by the Contractor at its own expense.

The Contractor shall also take adequate precautions when excavating against or close to any existing structure. No excavation shall proceed in the vicinity of existing cables or service pipes or installations until the necessary permit to work has been issued to the Contractor. The Contractor shall provide adequate shoring or strutting to prevent the movement of any existing installation, as required by and to the satisfaction of the PSHS-SRC PMO.

31.0 Care of the Works

- a. The Contractor shall provide sufficient cover or protection to partially or virtually completed works. Any damage to the works shall be rectified or remedied by the Contractor at his own expense.
- b. The Contractor shall where necessary assign a full time watcher for this exercise without additional cost to the Company.

32.0 Test and Pre-commissioning

All works shall be subject to test from leaks using pressure testing in accordance with standard norms in the industry.

- a. Any non-conforming works shall be repaired by the Contractor without additional cost to the Company or any extension of contract time.
- b. The Contractor shall establish contemporary records of test and pre-commissioning which shall be submitted to the PSHS-SRC PMO or Owner's designate thereupon.

33.0 Acceptance Requirements

- a. Prior to acceptance of the Works by the PSHS-SRC PMO under this Contract, all works shall be fully operational, and free from any defect to the full satisfaction of the PSHS-SRC PMO and the Contract Owner.
- b. Upon acceptance, the Company will operate and maintain the system and will assume responsibility for maintenance and custodial service of the entire system except otherwise stipulated in the Conditions of Contract.

34.0 Rates of Wages and Conditions of Labor

The Contractor shall pay rates, and observe conditions of labor, not less favorable than those established for the trade or industry where the work is carried out. If no such established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions not less than favorable than the general level of wages and conditions observed by employers whose trade or industry is similar to that of the Contractor.

35.0 As-Built (Record) Drawings

The Contractor shall maintain a neat and accurately marked set of As-Built Drawings which shall be provided to the PSHS-SRC PMO for review and approval prior to final acceptance of the Work.

The As-Built Drawings shall represent the Work as constructed and document changes to the Work shown on the Project Plans, and shall show the actual as-constructed conditions of installed or modified systems, equipment, and material.

The As-Built (Record) Drawings shall show, by field measured dimensions, the exact locations of all underground work, including all piping and components, and the final elevations and locations of all improvements constructed, modified or adjusted. Record

Drawings shall be available for inspection by the PSHS-SRC PMO at all times and shall be updated at least weekly with all Field or Site Instructions and other written directives, Contract Change Orders, and Contract adjustments shown thereon and initialed by the Agency. Progress payments or portions thereof may be withheld if As-Built Drawings are not kept up to date.

Unless otherwise specified in the Special Provisions, the Contractor shall submit two (2) sets of As-Built Drawings to the PSHS-SRC PMO at the final inspection. These As-Built Drawings shall include certification by the Contractor that the As-Built Drawings are a true representation of the Work as actually constructed. The Work will not be formally accepted until the As-Built Drawings are provided to and approved by the PSHS-SRC PMO. Final payment or a portion thereof may be withheld if final As-Built Drawings are not provided.

Full compensation for As-Built Drawings is included in the prices paid for the various items of work and no separate payment will be made.

36.0 Safety, Health, Environment, Security and Community

- a. The Contractor shall adhere to PSHS-SRC -HSEC policies and Procedures during the entirety of the Work.
- b. General housekeeping during and upon completion of the work shall be observed by the contractor.
- c. Work will be considered incomplete unless the HSEC requirements are adhere to the satisfaction of the PSHS-SRC PMO.

- d. The Contractor shall at his own expense employ watchmen to provide security of his personnel and materials from loss, damage or any cause. The Company shall be responsible for such loss, pilferage, damage or of any kind during the execution of the Works.

37.0 Coordination

All works shall be properly coordinated with the Owner, Architect and the PSHS-SRC Project Engineer, and all contractors of other works e.g. IT/Communication, ventilating system (optional),etc., for proper implementation of the Drawings and Specifications.

III SAFETY RULES

1.0 Dissemination and or Distribution of Safety Rules, Safety Inductions

The Contractor shall make sure all its employees working either directly or indirectly under its supervision are informed of and comply with the applicable safety rules, including those stated in this document.

All personnel of the Contractor who will be working on the site shall undergo Safety Induction provided by PSHS-SRC PMO.

No personnel of the Contractor is permitted to enter site and perform work without first receiving the appropriate safety induction and on completion issued an induction card.

The Safety Inductions are:

- Construction Induction – for all personnel working in areas under the control of the PSHS-SRC PMO
- Commissioning Induction – a refresher induction that covers tags, isolations and commissioning procedures immediately prior to the start of the commissioning phase of the Project.
- Additional inductions may be conducted to suit project requirements.

2.0 PSHS-SRC PMO HSEC Guidelines

The Contractor is responsible for meeting the requirements of PSHS-SRC PMO Health, Safety, Environmental and Community guidelines and procedures. Notwithstanding the provisions contained in this section, shall form the basis of HSEC management of the Project.

3.0 Safety Organization

All Contractors working on this project shall have in effect a safety plan and shall designate a Full Time Safety Officer.

- a. The Contractor's Safety Officer shall be responsible for initiating the Contractor's safety program, ensuring that jobsite safety requirements and procedures are being accomplished, conducting safety inspections of Work being performed, conducting safety meetings with craft employees and submitting a weekly report to PSHS-SRC PMO documenting safety activities. The Safety Officer will also be responsible for a continual survey of its operations, to ensure that probable causes of injury or accident are controlled and that operating equipment, tools and facilities are used, inspected and maintained as required by applicable safety and health regulations.
- b. PSHS-SRC PMO have the right to stop work whenever safety violations are observed which could jeopardize the well being of personnel and equipment. The expense of any such work stoppage and resultant standby time shall be for the Contractor's account. The failure or refusal of a Contractor to correct an observed violation may result in the termination of the Contract, and / or the dismissal from the jobsite of those responsible for such failure or refusal.
- c. The Contractor shall provide to PSHS-SRC PMO a copy of all reports made to government agencies or insurance companies relating to any jobsite accident or injury during the Contractor's performance of the work.
- d. Contractor shall provide a minimum of one (1) full time Safety Officer for every fifty (50) craft personnel assigned to the Work. The nominated Safety Officer will be responsible for insuring that the rules and regulations governed by applicable laws and the safety rules and regulations are implemented and enforced. If a conflict should arise between the Government regulations and these safety rules, the more stringent of the regulations will apply.
- e. The Safety Officer will work closely with PSHS-SRC PMO and construction management & safety team and shall form part of the Site Safety Team.

4.0 Safe Working Conditions

- a. The Contractor shall set up sufficient and appropriate warning and safety signs to inform its personnel and others of hazardous conditions or operations. The Contractor shall take adequate measures in the work area, in consultation with PSHS-SRC PMO, to ensure dangerous situations and/or work are barricaded or shielded properly. After verification of completion of the hazardous operations or termination of hazardous conditions, the warning and safety signs, covers, barricades and tags shall be removed by the responsible supervisor of the Contractor.

- b. Efficient and correct temporary lightning provisions shall be required in all rooms/areas where work is performed.

5.0 Safe Operations & Maintenance of Tools and Equipment

- a. No plant or machinery, hand tools or any other type of equipment are to be operated without effective guards
- b. All cranes shall be provided with the required swing radius protection. Clear and standard crane signals must be used at all times by licensed personnel. Prior to operating or directing the operation of cranes, ensure equipment has current approval and work is carried out by certified personnel.
- c. All earthmoving and compaction equipment shall be provided with acoustic and light signaling devices in accordance with the local regulations. These devices shall warn all other personnel that equipment is operating and or moving. An additional signal person shall be required when the operator has an obstructed view.
- d. All tools, regardless how small or large, shall be in good working condition and inspected before use. Equipment with missing or defective parts or guards shall be immediately modified or repaired or will not be used and or shall be removed from site.
- e. The operators of machinery and cranes, lifting and hoisting equipment shall be qualified and where appropriate, possess a license to demonstrate their qualification to operate.
- f. All plant, machinery, equipment or tools must be properly maintained, inspected and tested regularly per manufacturer's recommendations, statutory requirements or as directed by PSHS-SRC PMO. Contractor shall keep a maintenance and inspection record or log of all mechanical and electrical equipment on the Site for inspection by PSHS-SRC PMO, or external auditors or relevant Authorities.

6.0 Safe Handling & Storage of Materials

- a. In cases where materials and products are used which can lead to an increased level of risk, measures shall be taken to ensure that these materials and products are transported, stored and processed safely and in accordance with the vendors' printed instructions. PSHS-SRC PMO should approve these measures before hand.
- b. All building materials shall be stored or stacked in a safe and orderly manner so as not to obstruct any passageway or place of work. Any material stored inside the building under construction shall not be placed within 2.00 meters of any hoist way or floor openings or within 1 meter of exterior wall if wall does not extend beyond the top of the stored material.
- c. Fuel and oil shall be processed safely following vendor's printed instructions and in an approved container, and stored in designated locations authorized by PSHS-SRC PMO.

7.0 First Aid and Clinic

- a. The Contractor shall provide for and maintain its own first aid kit and clinic at a prominent and easy accessible location on the construction site. The first aid kit shall be appropriate for the number of employed persons and the type of work to be performed.
- b. The Contractor shall assign at least one person in its workforce trained in basic first aid at all times during working hours on the construction site. This person shall be responsible for maintaining the first aid kit up to the requirements for the type of work being performed.
- c. All construction personnel requiring first-aid treatment are to contact the Contractor's Safety Officer who will render treatment.

8.0 Emergency Response and Fire Protection

All personnel, when attending the construction safety induction will be instructed on the Site Emergency Response Procedures. Evacuation alarm and the location of evacuation muster points.

Contractor shall provide and maintain readily accessible fire extinguishers in all their workplace and shall regularly inspect all their fire extinguishers to ensure they are serviceable at all times.

9.0 Gravitational Hazards

Fall prevention is required in situations with possibility of a fall or 2 meters or higher. Adequate provisions such as barricades, nets, cover, rails, etc shall protect the workers on the roof, on scaffolds and or elevated platforms.

- a. All work platforms, suspended or otherwise, shall conform to statutory regulations. Among other requirements, the following must be noted:
- b. All working platforms shall be closely boarded, planked or constructed in metal decking
- c. Strip formworks and the like (timber, plank, plywood, etc) shall not be used as a stage for working platform
- d. Working platform shall:

- i. be at least 650 mm wide if used to provide footing for not more than 2 persons and to support loads and materials not exceeding 25 kgf per bay
 - ii. be at least 860 mm wide if supporting more than 2 persons per bay and weight of tools exceeds 25 kgf but not more than 100 kgf per bay
 - iii. be at least 1.1 meters wide if used to support any higher working platform
 - iv. Not be used to support more than 4 persons and the total weight of tools and materials exceeding 100 kgf per bay.
 - v. the maximum average loading on any working platform in any 1 bay shall not exceed 220 kgf per sq meter for persons and materials for metal scaffold and 75 kgf per sq meter for persons and materials for timber scaffold of All hoists and scaffolding are to be the standards of the Occupational Health and Safety Association or the current governing local laws
- e. Defective scaffolds shall not be used
 - f. Bamboos or bamboo poles are not allowed or permitted to be used on site.
 - g. All deep excavations shall be provided with adequate safety railings and no materials or equipment shall be stored as close to the excavation edge
 - h. Buildings under construction where the height is above 15 meters shall be provided with peripheral overhead protection. Except for the designated entrance/exit point, other areas at ground level shall be guarded from inadvertent entry. At building entry/exit points, adequate overhead protection shelters shall be provided to ensure a safe means of access and egress to the workers workplace.

10.0 Electrical Hazards

- a. All portable electrical hand tools and appliances used at site shall comply with the following safety requirement;
 - Support voltage of 230 volts or lower
 - Be fully insulated or of doubts insulation construction
 - Be connected to a power source, operating with an ELCB of 30mA tripping sensitivity and tripping time of 0.1 second
- b. Electrical installations and the wiring distribution system on site shall be inspected at least once a month and tested in accordance with the requirements of the relevant code before the installation is energized
- c. All AC welding machines must be equipped with low voltage shock preventers which shall effectively reduce the open circuit secondary voltage to a safe level of 25 volts
- d. Power cabling shall be secured correctly at high levels. Cables shall by preference not run on the floor. Only tested power cabling joints are allowed. Bare cable/wire connections shall be prohibited.
- e. Only connections from electric power panels, switch boxes, junction boxes or other approved means shall be made. Cables shall not be spliced or tied into temporary lighting cables or power cables/wires.
- f. Electric leads shall not be over-extended and shall be switched off at the point of power supply and removed when not in use. Leads shall be supported clear of floors by use of stands or other suitable means or run through protective covers in turn do not create hazard.
- g. Metal ladders, scaffoldings, or metal platforms shall not be used when working on electric power panels, MCCs or other potential live parts.

11.0 Fire Hazards

- a. Adequate and appropriate measures shall be taken to prevent the occurrence of a fire and /or an explosion when a naked flame has to be used. PSHS-SRC PMO shall be consulted on this matter
- b. No cooking of foods is permitted on site and no open fires will be permitted elsewhere on the Site.
- c. Adequate fire protection or suppression system shall be provided as necessary. In particular, a suitable fire extinguisher shall be available in hot work areas. Approved flash-back arrestors shall be provided for oxy-acetylene used for gas cutting operations.
- d. Bringing to Site of flammable liquids will not be permitted without prior approval from PSHS-SRC PMO. Indoor storage of flammable liquids is also not permitted.
- e. The Contractor shall maintain a clearly defined area for storage of petrol, diesel, gasses, etc. The Contractor shall provide the area with appropriate signs and adequate fire extinguishers.

12.0 Welding and Grinding

- a. Welding operations shall be screened to protect all personnel against welding flashes.
- b. Welding, cutting, burning, soldering and grinding equipment shall be inspected daily before use. During the operation of this equipment and other machining operations, adequate fire prevention precautions shall be taken.

This includes removal and or covering of flammable and combustible materials, protection of adjacent areas, number and type of portable fire extinguishers and similar measures and provisions.

- c. At the end of each working day, all hoses and manifolds shall be removed from the bottles and be capped off. Oxygen and acetylene cylinders shall be stored separately by a fire resistant barrier or at a safe distance from hazardous areas. All compressed gas cylinders shall be held and secured upright and capped when not in use. All cylinders once empty shall be immediately removed from the construction site.

13.0 Hazardous Products

- a. Prior to bringing in any hazardous products to the Site, the Contractor must first obtain prior approval from the PSHS-SRC PMO. The Contractor shall submit to PSHS-SRC PMO the corresponding Material Safety Data Sheet for reference.
- b. The use of any hazardous material in the course of the Contractor's work shall be made familiar with the precautionary safety measures and provisions and be trained in handling those materials. All safety procedures shall be followed to the latter.
- c. Without prior approval from PSHS-SRC PMO, no indoor storage of hazardous chemicals is allowed.

14.0 Ventilating

The Contractor shall;

- a. Ventilate storage spaces containing hazardous, volatile or high temperature sensitive materials
- b. Provide adequate ventilation whenever harmful airborne contaminants are produced in areas occupied during construction. Fans, blowers, ductwork or other approved equivalent means shall be installed and the hazardous agents are exhausted safely to the outside. Sufficient fresh outside air shall be routed to the work areas where necessary;
- c. Dispose of materials in a manner that will not result in harmful exposure to persons or disrupt or otherwise affect the operations of existing facilities.

15.0 Confined Space Hazards

No entry will be permitted to confined spaces until:

- a. Means of entry and exit are agreed
- b. Quality of air supply has been checked for oxygen deficiency, combustibility and toxicity. Work in confined spaces includes tanks, ductwork, shafts, crawling spaces and places where there is oxygen deficiency, difficult exit or escaping, high temperatures as well as the production of harmful gases and contamination, etc can occur.

16.0 Cable Trays and Pipe Racks

Under no circumstances shall cable trays or pipe racks be used as work platforms or cable ladders for access by personnel.

17.0 Reporting of Incidents, Investigations and Statistics

The Contractor and or Subcontractor shall ensure that employees report all incidents, immediately to their Supervisor, whether the incident has involved injury or not.

The Contractor and or Subcontractor shall immediately report any incidents to PSHS-SRC PMO and shall conduct an incident investigation and table a report at the Contractor's next progress meeting with the PSHS-SRC PMO or within 24 hours, whichever comes first.

Where the incident is of a type which requires notice to any statutory Authority, the Contractor shall give any such notices in accordance with the relevant statutory regulations within two (2) day of accident occurring, and supplies copies of notice to PSHS-SRC PMO.

18.0 Personal Protection Equipment (PPE) and Dress Code

All the employees working either directly or indirectly under the supervision of the Contractor shall use personal protection in order to perform the work safely and in compliance with the ruling Codes and regulations. The Contractor shall provide at his own expense his personnel with any required personal protection.

Prior to admittance to the work site, the Contractor shall provide all of his personnel assigned to the Work with the following minimum personal protection equipment;

- a. Skull guard or safety helmet (to be approved by PSHS-SRC PMO)
- b. Safety Shoes (leather steel capped, medium cut to be approved by PSHS-SRC PMO)
- c. Safety boots and or rain boots

- d. Safety glasses (with side shields and plastic lenses)
- e. High visibility vest
- f. A long-sleeved shirt with collar
- g. Trousers (wearing of ripped trousers and or short pants will not be permitted)

Storage and proper use and maintenance of these PPEs shall be in accordance with the manufacturer's instructions and recommendations. The Contractor shall ensure that the workers are familiar with these instructions through training.

All employees of the Contractor are obliged to wear an approved hard hat or safety helmet and other PPE's listed above.

In addition, employees are required to wear approved safety belts, harnesses and or lifelines at all times when working on elevated areas. The safety line shall be attached when working above a height of more than 2.5 meter

Approved gloves shall be worn for protection of hands and or arms when handling chemicals such as solvents, acids and caustics, petroleum, oil, grease, or other toxic or hazardous chemicals.

Protection against exposures to harmful gases, vapors, fumes, dust and similar airborne contaminants or agents shall be afforded to all employees and ensure adequate ventilation, approved masks or personal respiratory equipment.

The Contractor shall ensure that the workers wear the PPE's and other equipment where required in the above work situations and ensure that the equipment is in good order and condition.

Workers exposed to sound pressure or noise levels above 85 dB (A) shall wear approved hearing protection (earplugs, earmuffs, hearing bands, etc). The Contractor is obliged to provide hearing protection available above an equivalent sound or noise level of 80 dB (A).

19.0 Safety Committee and Related Activities

A Safety Committee shall be established, representing PSHS-SRC PMO and the Contractor. This safety committee shall meet each week.

Contractor shall nominate at least one (1) representative of a supervisory level to attend all safety committee meetings, all weekly safety site inspections and all joint safety inspections

Contractors shall also conduct weekly tool box meeting as part of their responsibility to create safety awareness and to communicate site safety requirements of their workers.

20.0 Housekeeping

- a. Contractors shall at all times keep their work areas clean and neat, tidy and safe condition and remove from site and the vicinity with any rubbish, and other hazards removed promptly and properly disposed of.
- b. Fire hazards such as garbage, oil rags and flammable materials must be eliminated by prompt removal or other corrective actions
- c. All protruding nails, metals, bolts or any hard object that may cause injury shall be bent or removed or protected.
- d. The Contractor shall assume full responsibility for correct discarding or disposal of construction waste according to PSHS-SRC PMO policy and to the local regulations.
- e. Upon completion of the Work, the Contractor shall promptly remove from site all of his equipment, materials, scaffolding and like items, leaving the site and the vicinity clean, safe and ready for use.
- f. In the event the Contractor fails to maintain its work area as described above and in a manner satisfactory to PSHS-SRC PMO, or to effect such cleanup or removal immediately after receipt of written notice to do so, PSHS-SRC PMO shall have the right without further notice to the Contractor to perform such cleanup and remove such items on behalf of, at the risk of and at the expense of the Contractor. PSHS-SRC PMO may store items removed at a place of its choosing on behalf of the Contractor and at the Contractor's risk and expense. The Contractor shall be back-charged for the costs incurred of such cleanup, removal and storage.

21.0 Equipment Maintenance

Maintenance work on the Contractor's equipment shall to be undertaken within a designated area, approved by the PSHS-SRC PMO, and which is located away from watercourses and other sensitive environmental areas.

Used oil from maintenance work must be collected in suitable trays or containers and transferred to a used drum stored in a bounded storage area designated by PSHS-SRC PMO.

Where refueling of equipment is to be in the field or within the construction area, use of spill response kit is a must.

22.0 Footnotes

In cases of doubt and in situations not defined in this document, the Contractor should contact PSHS-SRC PMO.

Statutory regulations and Local Standards are to be taken as a minimum guide only. Where requirements exceed these, PSHS-SRC PMO's requirements shall be met. Should the Contractor require clarification on any safety matters, discuss them with PSHS-SRC PMO.

IV. TECHNICAL SPECIFICATIONS

1.0 Scope of Work

The **Work** shall consist of the furnishing, installation of materials, provision of sufficient labor, tools and equipment, transport vehicles, supervision, security of his own resources including materials, tools, equipment, etc and all incidentals necessary for the satisfactory completion of the **PROPOSED CONSTRUCTION OF THE THREE STOREY PSHS-SRC DORMITORY BUILDING II** as shown on attached Drawings and as stipulated in the Contract Documents.

References:

All Works shall be referred to the following Codes and Standards, norms and best Engineering Practices.

1. National Structural Code of the Philippines, 2010 Latest Edition
2. National Building Code of the Philippines (NBCP) and its Revised IRR
3. American Concrete Institute (ACI)
4. American Society of Testing Materials
5. Uniform Building Code (UBC)
6. Other relevant Industry Codes, Standards & Norms.

2.0 Execution

- a. The Contractor shall be required to provide the following minimum essential equipment;
 - 2-bar cutter (manual)
 - 1-lot minor tools/hand tools
 - 2-Tile Cutters
 - 2-unit 1-bagger concrete mixer, engine driven
 - 2-concrete vibrator, at least 1-1/2 vibrator tip, oscillating type
 - 1-standby power generator set as back-up
 - 1 unit payloader
 - 1 unit backhoe
 - 2 unit dump trucks
 - 1 unit Utility vehicle
 - 1 unit jackhammer
 - 1 unit Submersible pump with hose
 - 1 unit fan blower
 - 1 unit air compressor
- b. The Contractor shall execute the Work in accordance with the condition of the Contract Documents
- c. All works shall be properly coordinated with PSHS-SRC PMO assigned/supervisory personnel/project engineer.

3.0 Setting out Works

The Contractor shall be responsible in setting out reference lines, elevations (lines and grades) prior and during the execution of the Works. All references shall be maintained and protected by the Contractor at his own expense. Disturbed references shall be restored to its original position without extra cost to PSHS-SRC PMO.

4.0 Excavation and Backfilling

- a. Excavation shall be as to the dimensions or limits shown on the Drawings. Excavation beyond the normal limits shall not be paid for.
- b. Backfilling may only proceed when concrete has sufficiently cured. Where works has to proceed in adjacent areas. Observe enough care during backfilling not to disturb or damage the newly placed concrete.

5.0 Concrete Works (Refer applicable Sections on Chapter 4 of the NSCP) for Quality of Materials, Workmanship, execution, acceptance, etc.

- a. General: Provide all labor, materials, equipment, transportation, and services required to complete all work specified herein indicated or as shown on the Drawings.
 - Work includes but is not limited to:
 - a.1 Construction footings, tie beams, columns, slabs, beams, roof beams, concrete gutters etc.

- a.2 Septic Vault, Catch basins, manholes
- b. Standards: Except as modified by governing Codes and by Contract Documents, comply with the provisions and recommendations of the following, latest Edition:
 - 1. ANSI American National Standards Institute
 - 2. ASTM American Society for Testing of Materials
 - 3. ACI American Concrete Institute
 - 4. NBCP National Building Code of the Philippines and its revised IRR
 - 5. NSCP National Structural Code of the Philippines
- c. All materials for concrete shall be from approved source by the Engineer-In-Charge.
 - c.1 Reinforced concrete- 4000 psi @ 28-days. Concrete mix shall be subject to adjustment to attain the required strength or desired mix consistency, subject to approval of the Engineer-in-Charge.
 - c.2 Portland cement, Type 1
 - c.3 Manufactured or river-run gravel for structural concrete, $\frac{3}{4}$ " max properly graded
 - c.4 Washed sand for structural concrete
 - c.5 Water: Use potable water free from alkaline or deleterious substance that may affect the strength of concrete. Use of rain water will not be permitted.
 - c.6 All materials shall be free from clay, lumps or any deleterious object or matter that will impair the strength of concrete.
 - c.7 Mixing of concrete shall be in accordance with current industry standards or best practices.
 - c.8 Slump of concrete shall not exceed 3 inches
 - c.9 Placement of concrete shall be in accordance to standard norms, when using portable concrete mixers.
 - c.10 Cure concrete sprinkling water and wetted continuously for 7-day period
- d. Steel Reinforcements
 - d.1 Main Steel reinforcements shall be ASTM A615, deformed steel bars, Grade 60. Stirrups shall be ASTM Grade 40.
 - d.2 Supply, fabricate and install reinforcing steel as shown on Drawings. Placing of steel reinforcements shall be in accordance with current industry (local) code (or ACI-347)
 - d.3 Tie wires shall be Gauge 16
 - d.4 Provide concrete spacers or plastic spacers to meet the required concrete cover as shown on Drawings.
 - d.5 Steel reinforcements shall be free from mill scales, rusts, oils, contamination that will impair the bonding property to concrete.
- e. Formworks
 - e.1 All forms shall be designed by the Contractor for a safe construction activity and installed to dimensions shown on the Drawings.
 - e.2 All materials for formworks shall be durable and free from warps, de-lamination and shall produce a neat surface upon stripping.
 - e.3 All joints shall be free from mortar leak during placement of concrete
 - e.4 Stripping of forms shall only commence after the concrete has gained sufficient strength (min of 7 days) for major structural elements.

6.0 Masonry Works (Refer to Chapter 7 of the NSCP for Hollow Masonry Units)

- a. All CHB walls to be demolished must be removed completely from bottom of beam or topmost blocks down to the floor level. In no case shall unsupported CHB walls be retained whether it is above or below the ceiling line.
- b. Provision of door and window openings on existing CHB walls must be done with the use of electric concrete cutter to prevent impacts that might result to cracks on the existing walls. Lintel beams shall be constructed to support the remaining CHB walls above door and window headers.
- c. Closing of existing openings on existing CHB walls. All new CHB reinforcing bars must be properly anchored/attached to the reinforcing bars of the existing CHB walls. Adequate trimmer bars of size & length shall be provided within the new openings as indicated in drawings.
- d. Deliver to site CHB units undamaged and free from breakage to edges or corners.
- e. Concrete hollow block units shall be nominal 100 x 200 x 400 or 150 x 200 x 400 (as indicated in plan) stretcher blocks, all cells grouted with steel reinforcements shown on Drawings, (350min) psi when tested to applicable ASTM Standards and Industry norms.
- f. Erect CHB units to plumb and true to alignment within acceptable tolerance.
- g. Mix proportion for grouting and setting bed shall be 1: 4 (Cement: sand), maximum proportion. The Contractor shall make necessary adjustments to suit project requirements without extra cost to the Company.
- h. Damaged unit masonry shall not be used
- i. The Contractor shall provide and maintain extra units or numbers at site without extra cost to PSHS-SRC PMO.

- j. All masonry units and associated materials shall satisfy test requirements of ASTM C190, C140), non- load bearing test.
- k. Install all CHB based on anchorage details as shown in drawings.

7.0 Wood works

- a. All timber materials where required shall be seasoned timber or hard wood (door jambs, cabinet frames, etc) and other wood works and shall be free from warps, knots, cracks or any defect that will impair the strength of the system.
- b. All members shall be applied with anti-termites control or Solignum or approved equal.
- c. Supply planed finish (S4S) timber as indicated on Drawings

8.0 Structural Steel and Metal Works (Refer Chapter 5 of the NSCP)

- a. Materials steel and metals for the Works shall meet the requirements of ASTM A36, hot-rolled shapes and plates.
- b. All steels shall be primed with epoxy based paint with -2- finish coats, grey colored paint. Substrate preparation shall meet the requirements of the applicable Clauses of the Steel Structures Painting Council, for industrial type of construction. All surfaces shall be free from mill scale, rusts, oils or any contaminants detrimental to adhesion of paint.
- c. Welding works shall be in accordance with Structural Welding Code (American Welding Society-D1.1, latest edition). Welding electrodes shall be as indicated in drawings, minimum, meeting the requirements of AWS A.5. All welders shall meet the qualifications under the AWS Codes and standards.
- d. All Works under this item shall be subject to verification by the Engineer prior to commencement of fabrication. Contractor is to submit SHOP DRAWINGS for Architect's/Engineer's review prior to execution.
- e. Roof framing
 - e.1 Trusses/Rafters shall be constructed, erected, and properly anchored to the roof beams or columns as indicated in drawings

9.0 Architectural Works

Furnish materials and labor and all incidentals necessary for the completion of all architectural works shown on Drawings and as herein specified.

a. Floor Finishes

a.1 Tile works

General : All surfaces to receive tiles, shall be free from loose plaster, where required, existing setting mortar bed shall be stripped, removed to allow proper setting of tiles to desired finished elevation. No separate payment for trimming existing mortar bed and shall be deemed included elsewhere.

- a.1.1 Floor finish for all common areas and offices shall be Grade AAA 60cmx60cm polished non-skid porcelain tiles or approved equivalent. Material shall be subject to review and approval of the Architect. Contractor to submit samples for color and texture selection prior to delivery and installation.
- a.1.2 Floor Finishes for all toilets shall be 30cmx60cm porcelain tiles for all toilet cuttings on both ends of the walls shall be of equal width.
- a.1.3 Grout shall be ABC type, color to match color of tiles or as directed by the architect.
- a.1.5 Setting bed or mortar shall be dry mixed, sand-cement mix with water added to produce the desired consistency and slurry mix for adhesion. Use Redifix tile adhesive for areas that are less than 1.5inches from finish floor line.
- a.1.6 All exposed corner edges shall be provided with PVC tile trims for toilets.
- a.1.7 All stair nosing shall be 1"x2" brass stair nosing
- a.1.8 No human traffic or construction loads shall be applied to all newly installed tiles, allow setting mortar and adhesive to cure prior.

b. Wall Finishes

b.1 Painting

- b.1.1 Painting works shall be as indicated on Drawings and described in the Bill of Quantities. Includes substrate preparation, application of neutralizers, putty, sanding, cleaning, protection, etc. to provide a strong or durable paint coating, following manufacturer's written instructions and acceptable trade practices. Provide materials that are suitable for the job and or type of construction.
- b.1.2 Paint materials shall be of the brand specified herein or approved equal by the Architect.
- b.1.3 Examine substrate and conditions under which painting will be performed. Proceed with the work only when conditions are satisfactory.
- b.1.4 Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

- b.1.5 Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall into wet, newly-painted surfaces.
- b.1.6 Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
- b.1.7 Ferrous Metals: Clean non-galvanized ferrous-metal surfaces that have not been shop coated; remove mortar, plaster, grease, dirt, rust, loose mill scale and other foreign substances by solvent or mechanical cleaning methods that comply with the recommendations of the Steel Structures Painting Council, before priming coat is applied.
- b.1.8 Paint system:

1. Exterior Surfaces:

1.1 Perimeter Concrete Facade

- Concrete, concrete masonry, rendered smooth
- One (1) coat of Acrylic Concrete Primer and Sealer by roller, let dry for 2 hours.
- Putty surface imperfections, hairline cracks with Concrete Putty using putty knife.
- One (1) coat Acrylic Concrete Primer and Sealer by roller let dry for 2 hours
- Finish with two coats Latex Semi Gloss by roller allow two hours interval between coats.

2. Interior Surfaces:

2.1 Interior Walls

- Concrete, concrete masonry, rendered smooth
- One (1) coat of Acrylic Concrete Primer and Sealer by roller, let dry for 2 hours.
- Putty surface imperfections, hairline cracks with Concrete Putty using putty knife.
- One (1) coat Acrylic Concrete Primer and Sealer by roller let dry for 2 hours
- Finish with two coats latex semi gloss paint by roller allow two hours interval between coats.

3. Ceilings:

3.1 All cement board ceiling surfaces shall be painted as follows;

- Apply one coat of **DS 1350 Acrylic Concrete Primer Sealer** by brush, roller or spray. Let it dry for 2 hours.
- Repair surface imperfections with **DS 5000 Concrete Putty** using putty knife let it dry for 2 hours and sand.
- Apply one coat of **DS 1350 Acrylic Concrete Primer Sealer** by brush, roller or spray. Let it dry for 2 hours.
- Finish with two coats of **STAY CLEAN Premium Washable Paints** by brush, roller or spray allow 2 hours between coats
- Reduction / Cleaning - **Water**

4. Cabinetries, Closets, counters, doorjambs and doors:

4.1 All wooden Cabinetries, Closets, Counters, door jambs and doors shall be painted as follows;

- Apply one coat of **DS 5-700 Liquid Tile Undercoat Primer** by brush, roller or spray and let it dry
- When Necessary, Putty surface imperfections, hairline cracks with **DS 5-1000 Liquid Tile Putty Filler or DS 5-700 DS 5-900 Liquid Tile Cast** using putty knife. Let it dry for 4 hours and sand.
- Apply one coat of **DS 5-700 Liquid Tile Undercoat Primer** by brush, roller or spray and let it dry.
- Finish with two coats of **AQUA GLOSS-IT Water Based Quick Dry Enamel** Allow 2 hours in between coats
- Reduction / Thinning / Cleaning – Use **DS 5-70 Liquid Tile Reducer**

5. Steel:

5.1 Structural Steel

- Apply one coat of DS 900 Wash Primer (mix 4 parts by volume of DS Wash Primer base to 1 part of DS wash Primer Catalyst)
- Apply two coats of DS 940 Zinc chromate Yellow
- Apply two coats of Silver Aluminum Paint

5.2 Architectural Steel

- Apply one coat of DS 900 Wash Primer (mix 4 parts by volume of DS Wash Primer base to 1 part of DS wash Primer Catalyst)
- Apply one coat of DS 940 Zinc chromate Yellow
- If necessary apply Home Buddy Filler by using spatula
- Apply one coat of DS 940 Zinc chromate Yellow
- Apply two coats of DS 5-515 Liquid Tile Topcoat Semi Gloss

c. **Dry Walls**

c.1 Gypsum Board. Supply / install materials where indicated on Drawings. All gypsum dry wall as indicated in plan shall be from 12.50mm gypsum moisture resistant boards on 2"x4" ga. 24 metal studs spaced at 0.40m x 0.40m on centers attached with 1-3/4 metal screws. All joints shall be filled up with joint compound, putty and cover with jointing tape. Boards with broken edges, lacerations etc will not be permitted to be installed. The Contractor shall replace rejected materials upon written instruction from PSHS-SRC PMO or where practical oral notice to the Contractor notifying such defect shall deem official instructions.

c.2 Fibre Cement Board. Supply materials where indicated on Drawings. Fibre cement board shall be stored in elevated and well protected area. Boards with broken edges, lacerations etc will not be permitted to be installed. The Contractor shall replace rejected materials upon written instruction from PSHS-SRC PMO or where practical oral notice to the Contractor notifying such defect shall deem official instructions. All fibre cement board shall be from 4.5 mmx1.2mx2.4m fibre cement board mounted on 2"x4" ga. 24 metal studs spaced at 0.40m x 0.40m on centers with flat head metal screws anchored to structural members with 12mm round bars

d. **Suspended Ceilings**

d.1 All ceilings at main building (except to be retained as indicated in drawing) shall be from 4.5 mmx1.2mx2.4m fibre cement board on ga. 24 Galvanized iron 2"x4" metal studs anchored with 12mm round bars installed as indicated in drawings.

d.2 All Ceiling for entrance canopy eaves/storage spaces/garage shall be 5"x3m perforated UPVC ceiling soffits on ga. 24 galvanized iron 2"x3" metal studs installed as indicated in drawings.

e. **Gutter Works**

e.1 **Colorbonded GI Gutters**

All GI gutters and valleys shall be fabricated from 0.50mm colorbonded flat GI sheets gutters, with jointers and all accessories complete with fasteners, seals and sealant as shown in Drawings

e.2 **Concrete Gutters:**

Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall into wet, newly-painted surfaces Apply 2 coats Boysen Plexibond with a mixture of 2:1 (2 gallons of Plexi bond to one gallon of cement) on all existing concrete gutters and apply silicon sealant on all downspout connections.

f. **Rendering to CHB or Concrete Surfaces**

f.1 All surfaces to be rendered or cement plastered shall be clean from any loose material or contamination to provide strong bond between plaster and the surface.

f.2 Mix proportion shall not be less than 1 part of cement to 4 parts of screened sand Necessary adjustments shall be made to provide a strong and consistent mix, free from cracking due to rapid hydration of plaster mix.

f.3 Tampering of previously mix concrete will not be permitted.

f.4 All surfaces to receive paint finish shall be smooth whilst surfaces to receive tiles shall be rough to provide better adhesion or bond

g. **Doors and Windows**

g.1 Furnish all materials and labor, use of tools for the fabrication, delivery and installation of doors and windows as shown on Drawings and herein specified.

g.2 All Wooden Doors shall be kiln dried and treated Matimco flush doors Panel doors ready for installation with the provisions for locksets, door keys, and hinge completely operational.

g.3 Windows (glass/glazing) shall be as shown on Drawings and herein specified. Glass shall be 6mm thick reflective glass on powder coated aluminum framings.

g.4 UPVC doors shall be heavy duty UPVC brown Wood Grain finish doors with louver/vent slats on the lower part complete with UPVC door Jambes and stainless steel hinges. Sizes as indicated in drawings

- g.4** Deliver all doors and windows free from any damage. Store materials to avoid contamination from soil or unwanted materials.
- g.5** All door jambs for wooden doors shall be pre-fabricated 2"x6" metal jamb finished with epoxy paint.
- g.6** All Fire proof doors shall be from cold rolled steel sheets complete with jambs with a fire proof time of 2 hours electro static powder coated installed complete with panic bars. Sizes as indicated in drawings.

h. Roofing

h.1 Roofing

- h.1.1 Roofing shall be 0.5mm ribbed type colorbonded GI roofing panels Lapping as indicated in the product brochure shall be strictly followed
- h.1.2 Roofing shall be fastened properly to the purlins by a 2-½ inch tex screw.
- h.1.3 Apply silicon sealant at all gutter and downspout joints.
- h.1.4 Flashing and ridge rolls shall be from 0.5mm flat colorbonded GI sheets

10.0 Plumbing Works

10.1 PLUMBING GENERAL REQUIREMENTS

PART 1 – GENERAL

10.1.1 GENERAL DESCRIPTION:

- A.** The work to be done under this Specification consists of the fabrication, furnishing, delivery and installation, complete in all details, testing and commissioning of this contract, at the subject premises and all work materials incidental to the proper completion of the installation, except those portions of the work which are expressly stated to be done by Others. All works shall be in accordance with the governing Codes and Regulations and with this Specification, except those where same shall conflict with such Codes, etc., which the later shall then governs. The requirements with regards to materials and workmanship specify the required standards for the furnishing of all labor, materials, and appliances necessary for complete installation of the work specified herein and indicated on the Drawings. The specification is intended to provide a broad outline of the required equipment, but is not intended to include all details of design and construction.

The term "Contractor" in this specification means "Trade Contractor" unless otherwise specified. The term "Plumbing & Drainage Installation" in this specification has the same meaning as "Sanitary Works" unless otherwise specified.

B. SCOPE OF WORK:

Under this section of the specification, provide all labor, materials and equipment and perform all the work necessary for the complete execution of all the Work as shown on Drawings and specified in this specification. Scope of works shall include but does not be limited to the following major items of work:

1. a) Furnish and install complete water distribution system for the building and ground including incoming supply pipes and connections, pipes, valves, back-flow preventers, hose bibbs, water meters, pressure regulators, insulations, accessories, etc.
b) Storage, delivery, protection before installation and connection of plumbing fixtures (e.g. water closets, shower, sinks, lavatories, faucets in toilets and baths), puttings, trims and accessories.
2. Furnish and install storm drainage system for the building and ground including pipes, valves, drains, cleanouts, storm basins and interceptors.
3. Furnish and install soil, waste and vent systems for the building and ground including pipes, valves, drains, cleanouts, sewer basins and interceptors.
4. Connections to existing water, storm and sewer drainage mains of the building water distribution, storm and sewer collection systems.
5. Supply and installation of pumps and accessories.
6. Complete testing of storm and sewer drainage systems and equipment.
7. Pressure testing of the installed water distribution system.
8. Leakage testing of soil, waste, vent, and storm drainage systems.
9. Disinfections of water distribution system.
10. Test run of pumping system and other equipment.
11. Electrical power and control/wiring system including motor starter, BMS interfacing devices if applicable, interlock and all necessary protection devices from the equipment to disconnect switch. Coordinate work activity with the electrical contractor.
12. Testing, balancing and commissioning of all equipment.
13. Furnish and install all required consumable materials and materials tube installed.

14. Approved hacking on non-structural walls, roofs, floors and partitions to provide openings for pipes. These works shall be properly coordinated and agreed with the architect and structural engineer.
15. Investigation of all conflicts of this work and coordination with other trades.
16. If anything has been omitted on any item of works such as materials usually furnished which are necessary for the completion of the sanitary and plumbing works as outlined herein-before, then such items must be and hereby included in this division of work.
17. Provide anchor bolts, sleeves, templates and other materials incidental to equipment installation on concrete base pad. The contractor shall provide steel shims and non-shrink grouting as necessary to ensure accurate leveling of base plates. Clean and wet the concrete base and/or pad surfaces to assure bond.
18. Painting and labeling of pipes, conduit, metal work, etc.
19. Submittal and certificate of tests on installed equipment and piping system.
20. Securing of all permits and licenses from relevant Authorities as required.
21. Preparation and submittal of reproducible and print as-built plans.
22. Free maintenance for a period of twelve (12) months after completion of the plumbing and equipment installation.

C. BUILDING PROVISION:

Certain provisions have been made in the Building for the accommodation of this installation. These provisions include space allocation, holes through beams and structural slabs, etc. The provisions so made are shown on the Drawings. Before proceeding with the Works, the Trade Contractor has to check and confirm that the provisions are satisfactory for the Works, and where necessary, additional information and requirement is to be furnished. It is the Trade Contractor's responsibility to ensure that the PSHS-SRC PMO is informed of all holes and any other provision requested in the structure. Any subsequent structural openings required due to negligence in providing sleeves beforehand shall be at the expense of the Trade Contractor unless they are covered on a duly authorized variation order issued by the PSHS-SRC PMO. All pipe sleeves shall be supplied and installed by the General Contractor.

The Trade Contractor shall ensure that the fixing is good and the sleeves will not be shifted or moved by concreting or by other trades. It is also the Trade Contractor's responsibility to check and ensure that all holes, openings etc., are provided correctly during construction of the Building.

10.1.2 OTHER APPLICABLE STANDARDS OR CODES FOR THIS SUBCONTRACT:

A. CODES:

1. National Building Code of the Philippines
2. Revised National Plumbing Code of the Philippines, Latest Edition
3. Philippine Code on Sanitation, PD 856
4. Uniform Plumbing Code, Latest Edition by International Association of Plumbing and Mechanical Officials
5. Applicable regulations and local ordinances of City of Koronadal, Province of South Cotabato

B. STANDARDS:

1. Underwriters' Laboratories (UL)
2. American Society for Testing and Materials (ASTM)
3. American National Standards Institute (ANSI)
4. National Electrical Manufacturers' Association (NEMA)
5. American Society of Mechanical Engineers (ASME)
6. Factory Mutual (FM)
7. National Fire Protection Association (NFPA)

Proof of conformance shall be submitted to the PSHS-SRC PMO for approval. Nothing contained in this specification or shown on the Drawings shall be constructed as to conflict with National and Local Ordinances of the City of Koronadal, South Cotabato. All such laws and ordinances shall form part of this specification.

10.2 AS-BUILT DOCUMENTATION:

- A.** Submit five (5) composite bound sets of drawings (including shop drawings) as a record of "as-built" conditions. In addition, one set of As-Built Documents shall be submitted to the Construction Manager in reproducible form and electronic file in CD-ROM, to facilitate printing of future copies.

The drawings shall be supplemented with descriptive specification as appropriate to clearly record the exact form and content of work described in this specification and on the drawings.

10.3 PAINTING:

- A.** All works except steel with chrome plated finish, aluminum, copper or stainless steel shall be primed and painted unless otherwise approved by the PSHS-SRC PMO.

- B. Before painting, the surface of the metal works shall be completely clean and free from rust, scale and grease.
- C. Non-galvanized surfaces other than nuts, bolts and washers that may have to be removed for maintenance purpose shall receive painting comprising the primary coat of rust inhibiting paint and three coats of the finished color. If the PSHS-SRC PMO considers painting not satisfactory, more coating shall be applied without extra cost.
- D. Painting of cased electrical equipment, electrical accessories, and electrical fittings to meet the color requirements stipulated in this specification is not allowed.
- E. All exposed metal parts such as cover plates for any pipe fitting, conduit and accessories, etc. shall be painted with a suitable color to match the interior finish of a particular location as approved by the PSHS-SRC PMO.
- F. Submit color samples and material of the finishing coats to the PSHS-SRC PMO for approval prior to any painting.
- G. Paints of synthetic materials such as PVC or plastic shall be chemically compatible with the material being painted.
- H. Paints of synthetic materials shall be as recommended by the material manufacturers.
- I. Paints for special materials shall be as recommended by the material manufacturers.
- J. Rubber and neoprene products shall not be painted.
- K. Non-galvanized metal work fabricated on site inside false ceiling and pipe duct shall be painted with minimum two coats of primer and rust inhibiting coat. Overcoat finished is not required.

10.4 POTABLE WATER SYSTEM

10.4.1 GENERAL

10.4.1.1 SCOPE:

- A. Provide Potable Water System complete in all respects including submittals, shop drawings, piping, valves, back-flow preventers, bibs, water meters, pressure regulators, insulations, pumps, filters, testing and all accessories required, power wiring and motor starting equipment. Potable water system includes flushing and drinking water supply.

10.4.1.2 QUALIFICATIONS:

- A. All work shall comply with the following:
 1. National Building Code of the Philippines
 2. Revised National Plumbing Code of the Philippines, Latest Edition
 3. Philippine Code on Sanitation, PD 856
 4. Uniform Plumbing Code, Latest Edition by International Association of Plumbing and Mechanical Officials
- B. The Architect's drawings shall serve as bidding drawings for the general layout of the various items of equipment. However, layout of equipment, accessories, specialties, ductwork and piping are diagrammatic, unless specifically dimensioned, and do not necessarily indicate every required valve, fitting, trap, elbow, transition, or similar items required for construction of the work and a complete installation.
- C. No portion of any work requiring a submission to the PSHS-SRC PMO for review shall be commenced until the submission has been reviewed by the PSHS-SRC PMO and returned to the Trade Contractor. All such work shall be in accordance with reviewed documents and samples from documents bearing the Architect's stamp and review comments.
- D. **CROSS-CONNECTIONS:**
No plumbing fixtures, special equipment, device, or piping, shall be installed which will provide cross-connection between a distributing supply for drinking water or domestic water and a polluted supply or waste, such as a drainage system or a soil or waste pipe, so as to make possible the backflow or back-siphonage of sewage or polluted water into the potable water supply system. Where the possibility of back-siphonage exists, water supplied to the fixture shall be introduced through a suitable backflow prevention device.
- E. **FIRE HAZARD CLASSIFICATION:**
All components of the insulation for piping, including coverings, mastics and adhesives; shall have a Flame Spread rating of not over 25, a Fuel Contributed rating of not over 50, and a Smoke Development rating of not over 50. Ratings shall be as established by tests conducted in accordance with UL 723, ASTM E84, or NFPA-225. Trade Contractor shall certify that products meet these criteria prior to construction of any insulation work.

10.4.3 STANDARD SPECIFICATIONS AND CODES:

- A. In addition to the requirements shown or specified in the Contract Documents, comply with the following Standard Specifications and Codes:

1. ANSI Z21.10.3; Gas-Fired Water Heater Certification
2. ASME; Section IV, Low Pressure Fired Water Heater Code
3. ASME; Section VIII, Unfired Heater and Pressure Vessel Code
4. ASME B31.9; Building Services Piping
5. ASHRAE 1984 Systems Handbook; Chapter 34, Service Water Heating
6. ASHRAE 90-A; Section 7, Energy Conservation
7. AWWA C-600; Installation of Iron Water Mains
8. AWWA D-105; Disinfection of Water Storage Facilities
9. WH-201; Plumbing and Drainage Institute Standard
10. OSHA; Occupational Safety and Health Administration
11. IEEE; Institute of Electrical and Electronics Engineers

B. Materials meeting authoritative standards of other rating agencies and organizations which will ensure an equal or higher quality than standards herein specified will also be accepted. Unless otherwise specified in drawings, materials for potable water line shall with the following specifications:

1. All pipes and fittings to be used shall be made of Polypropylene Random Co-polymer (PPr-C)
2. Polypropylene component shall be manufactured using Hostalen PPH5416, a random polypropylene with high molecular weight and shall have a sigma 80 value for allowable stress, in kgf / sq centimetres.
3. All PPR Pipes and Fittings shall be in color blue to conform with international standards for potable water
4. All PPR Pipes and Fittings shall conform with DIN 8077 / 8078
5. All Pipes shall be rated PN 20 and fittings rated PN 25
6. All metal parts for fittings shall be made with Stress Free Brass
7. All metal parts for fittings shall be dove tailed and sidings knurled to ensure high adhesiveness of metal part to plastic components
8. All PPR Pipes and Fittings shall have a working pressure of 300 psi for cold waterline and 150 psi for hot waterline

10.4.4 ELECTRIC MOTORS AND WIRING:

A. GENERAL:

Design and performance of motors shall meet NEMA Standards, and be suitable for service and location shown or required. Provide motors by one manufacturer for all equipment furnished under this Division.

B. RATING:

1. Motors less than 3.7 kW (5.0 hp); Rated at 230V, 1 phase, 60 hertz alternating current.
2. Motors 3.7 kW (5.0 hp) and larger; Rated at 230V, 3 phase, 60 hertz alternating current.
3. Motors shall have proper characteristics to suit specified makes of equipment. Unless directly indicated otherwise, motor kW rating specified is minimum acceptable and specified motor speed is maximum acceptable. Motor speeds 30 rps (1800 rpm) unless otherwise noted. Motors and accessories shall comply in all respects with applicable standards.
4. Provide drip-proof squirrel cage induction motors. Unless otherwise required by duty, location, equipment service, etc., suitable for voltage variations from 90 to 110 percent of rated loads, NEMA Design B having Class B insulation suitable for continuous duty at 50 degrees C ambient and 80 degrees C temperature rise. Oversized motors to comply with this requirement are not acceptable. Motors for external use and located in airstream shall be totally enclosed (TEFC). Motors shall have greasable ball bearings. Fan cool totally enclosed motors. Explosion proof motors Class I Group D.
5. Motors locked-rotor code letter designation shall not exceed code letter "F".
6. Motor Service Factor shall be 1.15 for open drip-proof motors and 1.0 for totally enclosed motors.

C. MISCELLANEOUS:

1. In general, integrally mount motors on mechanical equipment.
2. Installed motors not in compliance with specified requirements, shall be replaced at no cost.
3. Provide enclosed, adequately sized terminal box for each motor regardless of size onto which motor connections have been terminated with provisions for connection of incoming cables. Flying lead connections not acceptable. Size motor terminal boxes to accommodate conduit, wire size and compression type terminal lugs specified in Section 15450.
4. Where parallel feeders are required, motor terminal boxes shall have copper bus bars (size and number as required) for mounting feeder cable lugs to motor terminals. Provide compression type lugs above bus bars as specified in Section 15450.
5. Power capacitors to correct power factors to 90% for each will be provided in Section 15450.

D. STARTERS, CONTROL PANELS AND FACTORY ASSEMBLED PACKAGE UNITS:

1. Motors less than 3.7 kW (5.0 hp) shall have manual thermal motor starting switch specified in Section 15450.
2. Starters for motors rated 3.7 kW (5.0 hp) and larger, except for motors in package units and where otherwise specified, are specified in Section 15450. Starter combination, fused, across-the-line magnetic type with integral control transformers in accordance with Section 15450.
3. Factory assembled package units shall have integral control panel to which motors and associated control devices will be factory wired. Control panel shall contain "Hand-Off-Auto" selector switches in motor control circuit and relays, fused disconnect switches, starters, and other control devices arranged to be accessible for maintenance, testing and inspection.
4. Connect single-phase motors in package units served from three phase circuits to one phase and neutral of supply circuit through separate fuses. Provide motors with integral fused disconnect switches and overload protection.
5. Provide motor starters in factory-assembled package units in accordance with NEMA Standards and Section 15450.
6. Provide three overloads at three-phase starters.

E. CONTROLS AND WIRING:

1. Conform to Section 15450.
2. Provide interconnecting wiring within or on mechanical equipment with equipment unless otherwise indicated. Provide wiring for equipment not completely prewired and provide wiring from this equipment to associated devices required to complete equipment and system operation. This does not include wiring of motors, starters, and controllers specified in Section 15450.

10.4.5 SPECIFIC REQUIREMENTS

10.4.5.1 INSTRUCTIONS TO CONTRACTOR:

- A. Underground piping shall not run under buildings, except that a line connecting to a spigot piece may extend laterally under a building slab not more than 1.5 meters. Provide separate trenches for potable water and other piping. Submit engineer's calculations documenting the design criteria for all reinforced concrete structures and anchor pads, valve pit covers, thrust blocks, vertical & lateral support braces tie rods, and clamps.
- B. Give careful consideration to clearances under beams, around columns, adjacent to doors and walls, over windows, etcetera, to provide maximum headroom and egress in all spaces; and to the locations of equipment devices and piping, and type of fittings, hangers and supports used to obtain these clearances. Ascertain from the drawings the heights of all suspended ceilings and the size of all pipe shafts in which piping is to be concealed, and the location and size of structural members. Coordinate the installation of equipment, devices and piping with ductwork, lighting and the work of other trades. In any location where insufficient spaces is available for the coordination of the work of the trades in rooms, corridors, above suspended ceilings, or in vertical shafts, obtain clarifications from the PSHS-SRC PMO prior to fabricating or constructing any such work.
 1. Make all changes in direction with fittings and changes in main sizes through reducing fittings.
 2. All piping shall include the following:
 - a. Shut-off valves and unions or flanges at each branch, and in supply and return to each item of equipment such as pumps, tanks, automatic valves, etc. Valves and unions or flanges shall be located to isolate each unit, branch circuit, or section of piping to facilitate maintenance and/or removal of all equipment and apparatus.
 - b. Gate valves on capped services for extension to equipment furnished under other sections.
 - c. Drain valves at all low points of each system to enable complete drainage.
 - d. Drain piping from pump glands, relief and safety valves, etcetera, to spill over open sight drains, floor drains, or other acceptable discharge points, terminating drain line with plain end (unthreaded) pipe.
 - e. Pipe sleeves with approved caulking, or packing where piping passes through rated floors, walls and partitions. Furnish trim plates at all visible locations where exposed piping penetrates walls and partitions; prime coated in finished rooms, and polished brass or chrome plated in unfinished spaces.
 - f. Sweat-to-screw insulating adapters at junction of copper pipe to steel pipe, and insulating bushings for flanged connections to steel or cast iron valves and fittings.
 - g. Cast iron clamping flange fitting with caulking ring where piping passes through waterproofing membrane.

- h. Each supply riser shall have a separate bellows type aircushion, sized and located per the Plumbing and Drainage Standard, WH-201.
 - i. Each fixture supply and fixture supply branch shall have a separate job-fabricated air cushion chamber, consisting of a section of pipe not less than 300 mm long, and the same size as the supply to the fixture, but not less than 15 mm diameter tubing, or pipe.
 - j. Pressure gauges where indicated on the drawings, and as follows:
 - 1) At main water meter
 - 2) On discharge at each pump
 - 3) Upstream and downstream, adjacent to each pressure reducing valve
 - k. Strainers where indicated on the drawings and immediately upstream of each automatic valve.
 - l. Threaded plastic-to-metal connections will not be allowed. Provide adaptor fittings, or unions at each junction of PE or PVC with other materials.
 - m. Thermal movement: Make adequate provisions to allow and control thermal movement in the length of pipes and gutters.
 - n. Expansion joints: Provide expansion joints wherever pipings cross building expansion joint to absorb thermal expansion.
 - o. Sealing off: Prevent entry of foreign matter into any system by sealing off openings during construction. Fit access covers and cleanouts as the work proceeds.
 - p. Cutting: Cut ends of pipes and gutters clean and square using equipment appropriate to the material.
 - q. Protection: Use pipe sleeve for total thickness of walls or slabs through which pipes are passed.
 - r. Pipes are to be installed with correct fall for venting and draining and attention must be paid to neatness of installation.
 - s. The Trade Contractor should not use the restricted space available in certain pipe chases and care must be taken to ensure that all pipework is installed in the correct sequence/manner and position such that operation of all valves and maintenance is possible.
 - t. Pipes requiring protection against corrosion to be fixed with 30 mm (minimum clearance between pipe and structure). Avoid fixing such pipes in internal angle.
 - u. The fixing of valves or accessories to pipes shall be installed in such a manner that they can be disconnected and rejoined easily.
 - v. Hot water pipe work shall be capable of standing 80oC.
 - w. Thermometer shall be provided at the inlet and outlet of the water heaters.
 - x. Dielectric connector shall be installed when deem necessary, normal criteria shall be the electric transfer that cause rust.
- C. Where fixture supplies are not sized, the following shall be the minimum nominal pipe sizes:
- | | |
|---------------------------|-------------|
| Supply | |
| Fixture Hot Cold | |
| Lavatories | 13 mm 13 mm |
| Service Sinks | 20 mm 20 mm |
| Sinks | 13 mm 13 mm |
| Showers | 13 mm 13 mm |
| Water Closet (Flush type) | 32 mm |
| Water Closet (Tank Type) | 13 mm |
| Urinal | 25 mm |
- D. All materials and components of the piping, including anchors, hangers, supports and hydrostatic testing, shall comply with the Standard Specifications and Codes. The standard in the table in Clause 4 shall follow if not specified. Expansion and contraction shall be absorbed in bends, swing joints, expansion joints and offsets as indicated on the drawings, or as required by the Standard Specifications and Codes.
1. Piping for service pressures up to 2.0 MPa (300 psi): ASME B31.9.
 2. Support piping at pumps, tanks, and other equipment independently from the structure so that no weight, or expansion and contraction forces will be transmitted to the equipment.
 3. Powder activated, shot type inserts shall not be allowed. Trapeze bars shall be tightly secured to structural members at two points with bolts or other similar mechanical fasteners. Hangers from bar joist and fabricated truss members shall be located at the panel points of the structural members. C-clamp type hangers attached to one side of the angle bottom of steel members will not be allowed. Point loads shall not exceed the lesser of the manufacturer's certified

recommendation for the component parts, except as specifically approved by the PSHS-SRC PMO.

4. Submit hanger loads and locations on shop drawings and include registered engineer's calculations indicating expansion and contraction stress and forces, including point loads for all hangers, and coordinate the combinations of hanger requirements with other trades to maintain these limits. Final location of all hanger anchor points will be subject to review by the PSHS-SRC PMO. Type of pipe brackets and clip as follows:

Hanger/Clamp	Cast Iron/Ductile Iron	Galvanized Malleable	Steel	Copper	Stainless Steel
Holder Bats/Pipe Brackets	X				
Cast Iron	X				
Malleable Iron	X	X	X		
Steel					
Plastics					
Coated hot Dip Galvanized Steel		X	X		
Copper alloy				X	X
Pipe Clips					
Steel Saddle Clips		X	X		
Copper and Copper Alloy				X	X
Plastic Snap in clips					
Lead Tacks					

Bolts, screws and nuts: Hexagonal bolts and nuts shall be applied throughout with chrome-plate finish or approved equivalent. Round head screw is not acceptable. (This table applies to other parts of the specification.)

- E. All valves in main, riser and branch piping, shut off valves to each item of equipment, and drain valves shall be identified by a 25 mm diameter brass tag, secured to valve with brass S-hook or Number 16 jack chain, and numbered consecutively, as identified on the Valve Schedule.
 1. Stamp system identification "key" as follows:
 - System "Code"
 - Cold Water CW
 - Hot Water HW
 2. Provide chain wheel, or other extension operators on all valves and cocks with centerlines located more than 2000 mm above the floor, and which isolate items of equipment as heaters, pumps, and for all riser sectional control valves.
 3. Access panels will be installed where indicated and as required to access valves. Where, in the opinion of the Trade Contractor, access panels are required, but are not shown on the Architectural drawings, the omission shall be noted to the attention of the PSHS-SRC PMO on the shop drawings.

- F. Pipe Insulation shall be applied in sectional form. Fitting covers shall be firmly packed to ensure a thermal rating at least equal to the adjacent sectional pieces.
 1. Jackets shall run continuously through hangers and shall not be pierced for any reason.
 - a. Provide 25 mm x 150 mm mahogany hardwood blocks at hanger points to prevent compression of insulation. Cut blocks widths equal to thickness of insulation and furnish the following at each hanger. Pipe up to 50 mm: No blocks for 100 kg/m³ density insulation and one block for 50-65 kg/m³ density insulation. Pipe 65 thru 200 mm: Two blocks pipe 250 mm and larger: Three blocks.
 - b. Provide metal saddles at hanger points of insulated piping.
 - c. Stapling of vapor barrier jackets will not be allowed.
 2. Where flanged joints occur, construct the insulation such that the flange bolts can be removed without disturbing the adjacent covering on the remainder of the piping.
 3. Provide sheet metal jackets for all exterior insulation which will be subject to the elements, or where the piping is located within 2100 mm of the finished floor and in Mechanical spaces, where insulated piping is located adjacent to, or protrudes into the egress of the space.
 4. Hot water, branch pipes both concealed and where buried in walls, columns or slab or in direct contact with the concrete inside the bathrooms/pantries from 13 mm diameter to 31 mm diameter shall be covered with plastic thermal insulation sheating, fittings shall be copper and wrapped with Densotherm tape (hot applied).
 5. Insulation for hot water pipes other than the above shall be in rigid and glass fiber section, 50 mm thick with aluminum foil vapour barrier.

10.5 PIPE, FITTINGS AND VALVES:**10.5.1 COLD WATER LINES:**

1. All underground piping, risers and distribution lines shall be Polypropylene (PPR-Random Type 3) and fittings, and rated at PN 20. Basis of design is Vesbo. Joint between PPR and metallic materials shall be made with an approved jointing coupling or flanged connection. Flange gasket and O-ring shall be of EDPM (Ethylene-Propylene-Rubber) quality. Adaptors to threaded connectors for 63 mm diameter and below; and adaptors to flanged for 75 mm diameter and above.
 - a. Cement Mortar Lining: AWWA C-104
 - b. Iron Fittings, 80 thru 1200 mm: AWWA C-110
 - c. Flanged Pipe: ANSI B16.1 and AWWA C-115
 - d. Coal Tar Coatings: AWWA C-203
 - e. Gate Valves, 80 thru 1200 mm: AWWA C-500
 - f. Check Valves, 50 thru 600 mm: AWWA C-508
 - g. Globe Valve: 50 mm thru 150 mm: ASTM B584 200 mm thru 300 mm: ASTM A48; Class 40 350 mm thru 400mm: ASTM A536

10.5.2 VALVES:

Provide all valves specified or shown on the drawings. Water working pressure rating for any valve shall not be less than the hydrostatic test pressure for the system in which it is installed.

1. Bronze Gate Valves: MSS SP-70
2. Bronze Check Valves: MSS SP-71. Non-Slam type
3. Bronze Valves: MSS SP-80
4. Cast Iron Globe Valves: MSS SP-85
5. Cast Iron Backwater Valve: ASTM A-48
6. Butterfly Valves: Flangeless Wafer Body of 500 mm. diameter, suitable for dead end service. Cast iron body, corrosion resistant disc mounted to shaft by two (2) stainless steel screws, field replaceable set with a dovetail or retention groove, complete with gear operator, with two (2) meters extension assembly and floors stands for remote control of valve operator. Connecting flange should be of galvanized steel body.
7. Float Valve: ASTM A-48 Shall be hydraulically operated, pilot controlled, diaphragm actuated, single seated, with resilient disc. Valve shall open wide when float is at low water level and close drip tight when float is at high level. Class 125 and cast iron body with stainless steel trim. Basis of design is Bermad Model 750-60 Series.
8. Pressure Reducing and Pressure Sustaining Valve: Main valve body and cover; conforming to ASTM A-48. The valve shall be a single seated, hydraulically-operated, pilot controlled, diaphragm type globe valve. The valve shall withstand a temperature up to 180oF Maximum. The trim shall be 304 Stainless Steel. Basis of design is Bermad Model 723 Series, Class 250.
9. Anticipating Surge/Pressure Relief Valve Provide an anticipating surge/relief at the main pump discharge riser. Basis of design is Bermad Model 735 Series, Class 250.

10.5.3 JOINTING MATERIALS:

- A. **FLANGE JOINTS:** Gaskets shall be 1.5 mm thick neoprene/natural red rubber. Bolts shall be square-head, ASTM A-307, with heavy stainless steel hex nuts.
- B. **SCREW THREAD JOINTS:** Lubricant shall be non-hardening and non-poisonous. Pipe threads tape to be PTFE of an approved propriety brand.
- C. **SOLDERED JOINTS:** Solder metal shall be 95-5 Tin-Antimony. All metal shall conform to ASTM B32.

10.6 BELLOWS TYPE AIR CUSHIONS:

- A. Provide water hammer arresters where specified and shown on the drawings. Assemblies shall be of all stainless steel construction and include welded, nested bellows precharged with non-combustible gas and an external shell designed to withstand burst pressures of up to 27.5 MPA (4000 psi) and shall comply with the following standards. Basis of design is Wade.
 1. Plumbing and Drainage Standard PDI-WH-201
 2. American Society of Sanitary Engineering Standard ASSE-1010

10.7 PRESSURE GAUGES:

- A. Pressure gauges shall have range such that normal operating pressure is centered in range and be accurate within one percent of the Bourdon tube; spring with 100 mm dials, black finished case, white dial with black figures and graduations, and with recalibrating screws. Each gauge shall be furnished with a shut-off cock and a pressure snubber.

Except for pressure gauges on pump discharge riser which shall have a minimum 150 psi rating, all other pressure gauges shall be rated 100 psi.

10.8 HOSE BIBBS:

- A. Provide brass sill faucet assemblies complete with tee handles, vacuum breakers, 20 - 2.2 mm National Hose Thread on spout. Basis of design is Chicago Faucet.
- B. Rough chromium plated outside sill faucet, with 20 mm female inlet. Chicago Faucet, #998.

10.9 STRAINERS:

- A. Strainers shall be of the same size as the piping in which they are installed. Each strainer shall be equipped with an easily removable cover and stainless steel screen, suitable for the service intended, with a net free area at least that of the entering pipe. Basis of design is Bernad 70F Series, Class 150.
- B. Strainer bodies shall be screwed bronze for 80 mm and smaller; and flanged cast iron, or grooved end ductile iron for sizes 100 mm and larger. Maximum screen perforation size shall be as follows:
 - 1. Upstream of automatic valves: 1 mm
 - 2. Suction side of pumps: 3 mm.

10.10 WATER METER:

- A. Multi jet type for 38 mm and below; and Turbo type for 50 mm diameter and above. Water meter shall be of dry dial, registration in cubic meters, complete with bolts, nuts and gasket with companion flange. Basis of design is ARAD.

10.11 PUMPS:

10.11.1. GENERAL:

- 1. All equipment shall be supplied from reputable firms engaged in the manufacture of each particular item. The entire assembly as installed shall be given a start-up and test to prove that all the specifications have been met, before the acceptance by the Client(s). The test duration shall be 24 hours.
- 2. The specification herein stated is basic guides only. Other items not so indicated but which are obviously necessary for the proper operation of the system as intended shall be supplied and installed in accordance with accepted engineering standards.
- 3. The equipment and installation shall be guaranteed for a period of at least one (1) year of trouble-free operation. The supplier of equipment shall certify to the availability of spare parts locally and service in case system breakdown within a period of at least three (3) years. Manuals of operation and maintenance and list of spare parts shall be supplied together with the equipment.
- 4. The supplier shall submit at least four (4) copies of pumps performance curves showing among others, the pumps rating and pump efficiency, properly marked out.
- 5. Accessories to be supplied for each pump shall include one non-slam type check valve and two gate valves, of sizes equal to the size of the pump discharge and rated 17.5 kg/cm². Also, one pressure gauge of capacity 0-17.5 kg/cm² for each set of pumps and pipe fittings necessary for complete installation. Vibrator isolators and strainers shall also be provided.
- 6. Price quoted shall include cost of delivery of all quoted items to the jobsite, proper installation, and pump and motor installation dimension drawings.
- 7. The brands, names, and place of manufacture of pumps, motors, valves, controls and all accessories where applicable shall be indicated in the quotation. Include also a description of the pump impeller being offered. A metal nameplate indicating in indelible letters the correct specification of the pump and motor shall be properly attached to the assembly at a location such that the information written thereon can be conveniently read by all concerned.
- 8. Electrical:
 - a. Conduit, wiring and electrode shall be provided, supplied and installed by the Trade Contractor who will purchase and install the pump.
 - b. Connection including supply of wire from starter to breaker shall be supplied and installed by the Electrical Trade Contractor.

10.11.2. MOTORS:

Pumps shall be equipped with motors suitable for operation on 3 phase, 60 hertz, 230 volt power. Motors shall be connected to pumps by flexible couplings provided with guards.

10.11.3. CONTROL CENTER:

Shall be manufacturer's published standard assembly including, but not limited to, the following:

- 1. A NEMA 1 designed and constructed control panel, completely prewired by the system manufacturer, having separate physically isolated compartments with a door for each combination magnetic starter and fusible

disconnect switch. Each starter shall have overload protection each of the three phases and manual reset. Each starter shall have hand-off-automatic switch, pilot light and a control circuit transformer with short circuit protection.

2. A relay compartment shall be provided and shall contain the selector switches for pump programming; transformer, relay circuit breaker, all required fuses, time delay and industrial control relays and lights to indicate power on, low system pressure for local and remote indication, system pressure switch, pressure gauge and specialties required for a complete system.
3. The control equipment shall provide the following manual and automatic functions: Level electrode switch shall be provided from underground water reservoir at basement level to the deepwell pump controller at deepwell pump room located outside the building. Pressure gauges to indicate suction and discharge pressures shall be mounted on the pump suction and discharge line.
4. All starters, circuit breakers, reset buttons, lights, switches and gauges shall be labeled clearly with engraved nameplates to indicate their purpose.
5. Terminals shall be provided for extension of alarm signals to the Building Management System.
6. The controls for the pump unit shall be modified as necessary to provide the low suction pressure cut-off control, and to provide automatic restart of the pumps. The controller shall be of the type such that failure of electrical power to the controller or failure of any electro-mechanical component of the controller will shut down the pumps.

10.12 AS-BUILT DRAWINGS:

- A. Maintain a complete and accurate record of all changes or deviations to the Contract Documents and Shop Drawings in the Trade Contractor's field office. Such record copy shall indicate the work as actually constructed and be available for PSHS-SRC PMO and Client's Representative to review.
- B. Incorporate all minor revisions and clarifications noted thru the field modification process which may not necessarily be shown on the Architectural drawings or issued as Addenda, Bulletins, or Change Orders.
- C. Field changes shall be neatly and correctly shown on one set of record prints on a daily basis by the foreman, or superintendent of each trade; and this set will act as a record set at completion of the work and is intended to be of assistance to the Trade Contractor in preparing Record Documents.

10.13 VALVE SCHEDULE:

- A. Furnish a printed schedule, in duplicate, describing each valve by number; giving locations, recommended preventive maintenance service, including cross-reference to data sheets in the Operation and Maintenance Manuals for each valve.
- B. One copy of this schedule shall be mounted under glass in a simple black enamel steel frame and be hung where directed by the Client's Representative. The other copy shall be included in the bound Operation and Maintenance Manuals.

10.14 PRESSURE TESTING:

- A. After portions of the Potable Water System work are completed, the work shall be hydrostatically tested in the presence of the PSHS-SRC PMO's and Client's representatives and other Authorities of jurisdiction. Five days advance notice of the tests shall be given to the PSHS-SRC PMO and client. Furnish all pumps, gauges, instruments, test equipment and personnel required for these tests, and make all provisions for removal of test equipment.
- B. Underground piping shall be tested with the trenches open and all joints, valves and thrust blocks exposed. Sections of the underground piping shall be tested between closed valves to ensure that each valve section of piping is physically able to withstand the pressure alone. Adjacent sections of underground piping shall not be hydrostatically tested together, and pressure gauges located in the adjacent piping sections shall indicate less than 1 atmosphere or 100 kPa internal static pressure during the testing periods.
- C. Systems shall be tested individually with Sectional Control Valves closed. Internal pressure in the zone shall be raised to the stipulated test pressure, and pressures shall be recorded at the beginning and at the end of the holding period for the hydrostatic test.
- D. Testing Requirements - For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, but not less than 150 psi. Hold this pressure for not less than 2 hours. For pump discharge riser pipe, hydrostatic pressure shall not be less than 250 psi. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test maybe performed at the same time and at the same test pressure as the pressure test. During pressure and leakage tests, all isolation valves for plumbing fixtures shall be shut-off to avoid damage of the fixtures.

10.15 STERILIZATION:

- A. Prior to being placed in service, all Potable Water System, including pumps, tanks, piping, devices and equipment shall be thoroughly flushed and sterilized; then re-flushed. The entire system should be hypochlorinated at 100 ppm and after 24 hours the residual chlorine should not be less than 20 ppm, if not, the entire process is done all over again. After the 24-hour period that residual chlorine is 0.20 ppm, and the system is ready for use.

- B. Sterilization shall be in accordance with the AWWA Standard Specifications and applicable Public Health Codes.

10.16 FLOW TESTS:

- A. After the Potable Water System have been Pressure Tested, and the Fixtures have been set and trim piped, but prior to practical completion, each fixture supply shall be flowed to observe proper dynamic action of the set, including flushing actions, lavatory drains and splash patterns from facets, spigots and the like.
- B. These Flow Tests shall typically be performed as a part of the preliminary punchlist observations for the Work. Trade Contractor shall notify the PSHS-SRC PMO in writing at such time as the Potable Water System, Sanitary, Waste and Vent Piping, and Plumbing Fixtures are complete and ready to be Flow Tested on an acceptable basis.
- C. After the Trade Contractor has adjusted and repaired all items noted in the preliminary punchlist observations, he shall notify the PSHS-SRC PMO in writing that all adjustments, corrections and repairs have been completed, and that the Final punchlist observations for this work may be generated.

10.17 PAINTING:

A. PRIMING:

All shop-fabricated and factory-built equipment, devices and apparatus not galvanized, or protected by plating, or a baked enamel finish, shall be cleaned and given one shop coat of paint primer. Any portions of shop coat damaged in delivery, during construction, or prior to Finish Painting, shall be recorded.

B. FINISH PAINTING:

Refer to Section, PAINTING. Do not paint name plates, labels, placards, tags, stainless steel or plated items as valve stems, motor shafts, levers, handles, trim strips, etcetera. Exposed and visible piping, equipment, devices and apparatus in Potable Water System shall be ANSI Standard Color, Bright Blue; except as directed otherwise by the Architect.

C. IDENTIFICATION:

Stencil 40 mm high white enamel block type characters of all items of equipment for identification purposes. Also, stencil a complete system of pipe identification purposes. Also, stencil a complete system of pipe identification adjacent to each valve and branch take-off, and at not over 15 meters intervals along runs of pipe, with flow arrows at each marking. Pipe identification shall be a contrasting color, either white or blue, to the finish coating of the piping.

10.18 DRAIN, WASTE, AND VENT SYSTEM

10.18.1 GENERAL

- A. Provide Drainage, Waste and Vent Systems complete in all respects including submittals, shop drawings, pipes, valves, cleanouts, drains, basins, and testing and all accessories required.

10.18.2 QUALIFICATIONS:

- A. All work shall comply with the following.
 - 1. National Building Code of the Philippines
 - 2. Revised National Plumbing Code of the Philippines, (Latest Edition)
 - 3. Philippine Code on Sanitation, PD 856
 - 4. Uniform Building Code
- B. The Architect's drawings shall serve as bidding drawings for the general layout of the various items of equipment. However, layout of equipment, accessories, specialties, ductwork and piping are diagrammatic, unless specifically dimensioned, and do not necessarily indicate every required fitting, trap, elbow, transition, or similar items required for construction of the work and a complete installation.
- C. No portion of any work requiring a submission to the PSHS-SRC PMO for review shall be commenced until the submission has been reviewed by the PSHS-SRC PMO and returned to the Trade Contractor. All such work shall be in accordance with reviewed documents and samples, and be constructed by tradesmen working from documents bearing the Engineer's stamp and review comments.

10.19 STANDARD SPECIFICATIONS AND CODES:

- A. In addition to the requirements shown or specified in the Contract Documents, comply with the following Standard Specifications and Codes:
 - 1. ASME B 31.9; Building Services Piping
 - 2. ASTM D-2321; Installation of Underground Plastic Sewer Pipe
 - 3. OSHA; Occupational Safety and Health Administration
 - 4. IEEE; Institute of Electrical and Electronics Engineers
- B. Materials meeting authoritative standards of other agencies and organizations which will ensure an equal or higher quality than standards herein specified will also be accepted.

- C. Comply with such standards and codes in accordance with the Contract Documents. Where quantities, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specification and/or drawings shall govern.

10.20 UNDERGROUND PIPING

10.20.1 INSTRUCTIONS TO TRADE CONTRACTOR:

- A. Provide all piping and accessories, as scheduled and shown on the drawings.
- B. Underground piping shall be laid on solid earth at a pitch of not less than 1% slope. Where it is necessary to lay piping on fill, each joint connection shall rest on a concrete anchor pad. Provide separate trenches for potable water and other piping. Submit Registered Engineers calculations documenting the design criteria for all reinforced concrete structures and anchor pads, manhole covers, thrust blocks, vertical and lateral support braces tie rods and clamp.
- C. Give careful consideration to clearances under beams, around columns, adjacent to doors and walls, over windows, to provide maximum headroom and egress in all spaces; and to the locations of piping, and type of fittings, hangers and supports used to obtain these clearances. Ascertain from the drawings the heights of all suspended ceilings and the size of all pipe shafts in which piping is to be concealed, and the location and size of structural members. Coordinate the installation of piping with ductwork, lighting and the work of other trades. In any location where insufficient space is available for the coordination of the work of the trades in rooms, corridors, above suspended ceilings, or in vertical shafts, obtain clarification from the PSHS-SRC PMO prior to fabricating or constructing any such work.
- D. Provide pipe sleeves with approved caulking, or packing where piping passes through rated floors, walls and partitions. Furnish trim plates at all visible locations where exposed piping penetrates walls and partitions; prime coated in finished rooms and polished brass or chrome plated in unfinished spaces.
- E. Provide sweat-to-screw insulating adapters at junction of copper pipe to steel pipe, and insulating bushings for flanged connections to steel or cast iron valves and fittings.
- F. Provide cast iron clamping flange fitting with caulking ring where piping passes through any water-proofing membrane.
- G. Threaded plastic-to-metal connections will not be allowed. Provide adaptor fittings, or unions at each junction with other materials.
- H. Where fixture drains are not sized, the following shall be the minimum nominal pipe size:
 Drain Fixture Waste Vent
 Lavatories 50 mm 50 mm
 Service Sinks (Slop Sinks) 75 mm 50 mm
 Kitchen Sinks 50 mm 50 mm
 Showers 50 mm 50 mm
 Electric Water Coolers 50 mm 50 mm
 Water Closets 100 mm 50 mm
 Urinals 50 mm 50 mm
 All materials and components of the piping anchors, hangers and supports shall comply with ASME B 31.9. Expansion and contraction shall be absorbed in bends, swing joints, expansion joints and offsets.
1. Provide each segment of hub and screwed pipe with an anchor, hanger or support adjacent to the hub or fitting. Provide each segment of no-hub pipe with two anchors, hangers or supports so that no weight of the piping shall be carried by the couplings.
 2. Support piping at pumps, tanks, and other equipment independently from the structure so that no weight, or expansion or contraction will be transmitted to the equipment.
 3. Powder activated, shot type inserts shall not be allowed. Trapeze bars shall be tightly secured to structural members at two points with bolts or other similar mechanical fasteners. Hangers from bar joist and fabricated truss members shall be located at the panel points of the structural members. "C" clamp type hangers attached to one side of the angle bottom of steel members will not be allowed. Point loads shall not exceed the lesser of; the manufacturer's certified recommendation for the component parts, except as specifically approved by the PSHS-SRC PMO. Submit hanger loads and locations on shop drawings and include Registered Engineer calculations indicating point loads for all hangers, and coordinate the combinations of hanger requirements with other trades to maintain these limits. Final location of all hanger anchor points will be subject to review by the PSHS-SRC PMO.
- J. Access panels will be installed where indicated and as required to access cleanouts. Where, in the opinion of the Contractor, access panels are required, but are not shown on the Architect's drawings, the omission shall be noted to the attention of the PSHS-SRC PMO on the shop drawings.
- K. Layout the subsoil pipe work.
- 1). Lay sub soil drain in straight line with sleeve coupling joint.
 - 2). Lay sub-soil pipe with filter matt.
 - 3). Joint branch pipes to main pipes with tee or y-joint.
 - 4). Cover central part of pipe and joints with gravel (13mm to 20mm) to prevent them from moving.

- 5). Backfill with gravel (13mm to 20mm) to cover up the pipes and tamp both sides of pipes with a log.
 - 6). Further backfill with hardcore to the required thickness.
 - 7). Cover up with a filter matt, overlap filter paper and joint with a torch.
 - 8). Backfill with sand and top soil as per landscaping detail.
- L. All pipework shall be completed and arranged with cleaning eyes for cleaning and easy access to all traps.

10.20.2 PIPE, FITTINGS AND VALVES:

A. UNDERGROUND SANITARY, SEWER PIPES:

PVC pipes and fittings, Series 1000, conforming to ASTM D-2729 and/or 180/D154435 and or 180/D153633, and push on joints with rubber ring gasket conforming to ASTM FH77. Basis of design is Emerald Supra Series, Neltex Series 8050.

B. STORM WATER DRAINAGE SYSTEM:

1. Downspouts inside the building: PVC pipes and fittings, Series 1000, conforming to ASTM D-2729 and/or 180/D154435 and or 180/D153633, and push on joints with rubber ring gasket conforming to ASTM FH77. Basis of design is Emerald Supra Series, Neltex Series 8050.
2. Downspouts outside the building: Galvanized steel pipe, Schedule 40, conforming to ASTM A-53, and with corrosion protection when buried underground, petrolatum tapes with outer wraps, densyl mastic and denso tape. Basis of design is Super. Joints shall be malleable iron, 63mm and below, screwed, and 75mm and above, flanged. Basis of design is BIS.
3. Underground storm drainage pipe inside the building: Bell and spigot, extra heavy, conform to ASTM A-74. Basis of ASA. Joints between galvanized iron and cast iron shall be cast iron.
4. For outside the building: Reinforced Concrete Drainage Pipes: ASTM C76, Class II, Wall B, for 300 mm diameter and larger storm drains.

C. VENT SYSTEM:

For all sizes

1. PVC pipes and fittings, Series 1000, conforming to ASTM D-2729 and/or 180/D154435 and or 180/D153633, and PVC socket joints with PVC solvent. Basis of design is Emerald Supra Series or Neltex 8050.

D. INTERIOR SUSPENDED SANITARY:

PVC pipes and fittings, Series 1000, conforming to ASTM D-2729 and/or 180/D154435 and or 180/D153633, and push on joints with rubber ring gasket conforming to ASTM FH77. Basis of design is Emerald Supra Series, Neltex 8050.

10.20.3 CLEANOUTS:

- A. Provide cast bronze, taper thread, counter sunk type cleanout plugs where shown on the drawings and as required by the Local Codes. Furnish access body all cleanouts located behind finished walls. Manufacturer's numbers are basis of design and establish quality level as well as aesthetic features. Basis of design is Jay R. Smith.
- B. CLOSURE PLUGS: Jay R. Smith Mfg. Co. Figure 4470.
- C. FLOOR ACCESS BODY ASSEMBLIES:
Cast iron body and frame, flashing flange, lead-seal or thread-seal bronze plug, round adjustable top with vandal-proof screws.
 1. Finished Concrete Floors: Scoriated nickel-bronze cover. Jay R. Smith Mfg. Co. Figures 4021-S-F-U and 4023-S-F-U.
 2. Unfinished Concrete Floors: Scoriated cast iron cover. Jay R. Smith Mfg. Co. Figures 4221-U and 4223-U.
- D. FACE OF WALL ASSEMBLIES:
Cast iron ferrule and vandal proof screws. Jay R. Smith Mfg. Co. Figures 4402- U, 4422-U, and 4472-U.
Note: Use of closure plugs, access bodies and assemblies as manufactured by JPI is acceptable.
- E. DRAIN COLLECTOR ASSEMBLIES:
 1. Provide Drain Collector Assemblies with cast iron bodies complete with flashing collar or device and hub or screwed bottom outlet, unless otherwise specified. Basis of design is Jay R. Smith.
 2. AREA DRAIN:
305 mm diameter cast iron tractor grate seepage flange and 140 mm deep slotted sediment bucket with lift bar with polished bronze top. Jay R. Smith Mfg. Co. Figure 2233
 3. FLOOR DRAINS:
 - a. Heavy Duty at Trenches: 100 mm diameter cast iron tractor grate, seepage flange and 140 mm deep slotted sediment bucket with lift bar. Jay R. Smith Mfg. Co. Figure 2233.

- b. Medium Duty at Toilets and Baths: Cast Iron Body and flashing collar with 127 mm (5") diameter strainer head with solid hinged cover Jay R. Smith Mfg. Co. Figure 2005 Y.
 - c. Kitchen Areas: Cast Iron Body and flashing collar with 127 mm (5") diameter strainer head with solid hinged cover. Jay R. Smith Mfg. Co. Figure 2005-A.
 - d. Heavy Duty at Parking: 75 mm diameter cast iron grate, seepage flange and clotted sediment basket. Jay R. Smith Mfg. Co. Figure 2425 C.
- F. ROOF DRAINS:
- 1. Built-up Felt Roof: 100 mm diameter with cast iron dome grate, seepage flange, under deck clamp and 115 mm high perforated stainless steel gravel stop extension. Jay R. Smith Mfg. Co. Figure 1330 for deck with gutter and 1470 for RD flushed in roof deck
- G. Balloon mesh on top of open vent pipes: #20 copper or stainless steel.
- H. Floor sink, by WADE Model 9100
- I. CHECK VALVES (Pump Discharge):
- 1. IBBM, 0.9 MPa WSP, bolted cap renewable and regrindable disc and seat ring, swing, flanged. Check valves on sewage ejector discharge shall be complete with outside arm operator. Check ball valve shall be non-slam type.
- J. DRAIN VALVES:
- 1. 20 mm brass, 1.0 MPa WSP, angle valves, fitted with 20 mm brass hose nipple.

10.20.4 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS:

- A. SCOPE OF WORK: The work includes the furnishing and installation of plumbing fixtures and fittings, complete and operational.
- B. GENERAL REQUIREMENTS:
- 1. The Trade Contractor shall furnish and install plumbing fixtures and fittings as indicated on the Drawings complete with trimmings and accessories unless otherwise specified under this item.
 - 2. Fittings and trimmings for fixtures shall be chromium plated polished brass, unless otherwise specified. Where corrosion resisting metal is mentioned, same shall be chromium plated and shall contain not less than 13% chromium and less than 8% nickel alloy.
 - 3. Generally, fixtures except water closets shall have the water supply discharge below the rim, equipped with back-flow preventors, angle stops, or stops. Stops integral with the faucets shall be furnished and installed with fixture. Exposed traps and supply pipes for all fixtures and equipment shall be connected to the rough piping system at the wall unless otherwise specified.
- C. INSTALLATION
- 1. All installation work shall conform to the applicable standard set forth by the Philippine Plumbing Code.
 - 2. Fixtures shall be fastened and/or supported in accordance with the requirements of this section.

10.21 AS-BUILT DRAWINGS:

- A. Maintain a complete and accurate record of all changes or deviations to the Contract Documents and Shop Drawings in the Trade Contractor's field office. Such record copy shall indicate the work as actually constructed and be available for PSHS-SRC PMO and Owners' review.
- B. Incorporate all minor revisions and clarifications noted thru the field modification process which may not necessarily be shown on the Engineers' drawings or issued as Addenda, Bulletins, or Change Orders.
- C. Field changes shall be neatly and correctly shown on one set of record prints on a daily basis by the foreman, or superintendent of each trade; and this set will act as a record set at completion of the work and is intended to be of assistance to the Trade Contractor in preparing Record Documents.

10.21.1 PRESSURE TESTING:

- A. After portions of the Drainage, Waste and Vent Systems work are completed, but before fixture are set, the work shall be tested with water or air in the presence of the PSHS-SRC PMO's and Owners' representatives and other Authorities of jurisdiction. Five (5) days advance notice of the tests shall be given to the PSHS-SRC PMO and Owner. Furnish all pumps, compressors, gauges, instruments, test equipment and personnel required for these tests, and make all provisions for removal of test equipment. Provide all test plugs, temporarily cup fittings for the tests.
- B. WATER TEST: A water test shall be applied to the piping; in it's entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged, except the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 3 meter head of water. In testing successive sections, at least the upper 3 meters of the next preceding section shall be tested, so that no joint or pipe in the building(except the uppermost 3 meters of the system) shall have been submitted to a test of less than a 3 meter head of water. The water shall be kept in the system or in the portion under test, for at least 30 minutes before inspection starts; then the system shall then be tight at all points during which time there shall be no drop greater than 100 millimeter.

- C. AIR TEST: An air test shall be made by attaching an air compressor or testing apparatus to any suitable opening and, after closing all other inlets and outlets of the system, forcing air into the system until there is a uniform gauge pressure of 35 kPa or sufficient to balance a column of mercury 250 mm in height. This pressure shall be held, without introduction of additional air, for a period of at least 15 minutes.

10.21.2 FLOW TESTS:

- A. After the piping has been Pressure Tested, and the Fixtures have been set and trim piped, but prior to practical completion, each fixture supply and system, tank or equipment drain and relief valve shall be flowed to observe proper dynamic action of the set.
- B. These Flow Tests shall typically be performed as a part of the preliminary punchlist observations for the Work. Trade Contractor shall notify the PSHS-SRC PMO in writing at such time as the Potable Water System, Drainage Waste and Vent Systems, and Plumbing Fixtures are complete and ready to be Flow Tested on an acceptance basis.
- C. After the Trade Contractor has adjusted and repaired all items noted in the preliminary punch list observations, he shall notify the PSHS-SRC PMO in writing that all adjustments, corrections and repairs have been completed and that the Final punch list observations for this Work may be generated.

10.21.3 PAINTING:

- A. PRIMING: All shop fabricated and factory built equipment, devices and apparatus not galvanized, or protected by plating, or a baked enamel finish, shall be cleaned and given one shop coat of paint primer. Any portions of shop coat damaged in delivery, during construction, or prior to Finish Painting, shall be recoated.
- B. FINISH PAINTING: Exposed and visible components in Drainage, Waste and Vent Systems shall be ANSI Standard Color, International Orange, and Storm piping shall be ANSI Standard Color, Safety Green; except as directed otherwise by the PSHS-SRC PMO.
- C. IDENTIFICATION: Stencil 40 mm high white enamel block type characters on all items of equipment for identification purposes. Also, stencil a complete system of pipe identification adjacent to each branch take-off, and at not over 15 meter intervals along runs of pipe, with flow arrows at each marking. Pipe identification shall be a contrasting color, either white, orange, or green, to the finish coating of the piping.

10.21.4 INSTALLATION:

- A. Taps: Fix in accordance with manufacturer's recommendations making a watertight seal with the appliance. Place cold tap at right and hot tap at left as viewed by user of appliance.
- B. Wastes: Bed in Waterproof, joining compound and fix with resilient washer between appliance and back nut.
- C. Waste outlets to floor drains to be bedded in red lead cement.
- D. Water Closet: Connect to soil pipe spigots with coupling and connector in accordance with manufacturer's recommendations.

10.21.5 INSTALLATION OF PLUMBING FIXTURE AND PUMPS:

- A. Plumbing Fixtures:
 - 1. The Trade Contractor shall:
 - a. supply all red lead cement, motor, lead plugs and other necessary materials.
 - b. cut and pin or raw plug brackets.
 - c. make all connections to water supply pipes, overflow pipes, and waste pipes.
 - 2. Water Closet shall be:
 - a. securely bedded on concrete floors or finished floors with red lead cement.
 - b. fixed by floor screws with bolt caps and washers.
 - c. connected to cast iron pipes, caulked with yarn, filled solidly with 1:1 cement sand mortar and pointed with white cement mortar to a neat finish.
 - 3. Waste outlets to lavatory sinks, bath tubs, shower bases and floor drains shall be bedded solidly in red lead cement Taps, basins, sinks, bath tabs, water closet, shower head and those items in the schedule of sanitary fixture and fittings supply list shall be supplied by Trade Contractors. The Trade Contractor is responsible for safe custody after hand-over to them, delivery from storage space to the working location and installation. All hangers, support, connection to pipes, traps, accessories not mentioned in the supply list of plumbing fixture shall be supplied by this Trade-Contractor. Caulking and protection after installation shall be by Trade Contractor.
- B. Pump Installation:
 - 1. Mounting: pump and motor on an integral base plate of welded steel supported on an approved type of anti-vibration rubber pads on static block equal to twice the pump set weights with 50mm machine hard cork. Sample of hard cork to be submitted to the PSHS-SRC PMO for approval. Motor are to be accurately aligned with pumps. Plastic drain piping for gland leakage is to be provided for each pump And carried to drain. Appropriate coupling guard shall be provided for shaft coupling between motor and pump.
 - 2. Pipe Fittings at Pumps, provide:

- a. Flexible connectors at the suction and discharge sides of each pump. The connectors to be constructed of materials suitable for the conveying medium and capable of withstanding the required working pressure.
 - b. 100mm diameter pressure gauges at the pump suction and discharge sides. All reading for pressure gauge shall be in kPa and psi.
 - c. To provide air cock and drain plug for each pump.
3. DRAIN PIPING: Provide drain piping for gland leakage for each pump. Such drain pipes to be carried to a proper drain inside the pump room.

10.21.6 The Trade Contractor shall supply and install platform with M.S. frame and 45 aluminum checker plate of approved width (without handrail) of over any group of pipes extending a width of over 600mm on floor or pipes installed at 600mm to 1500mm above finished floor level.

10.21.7 Waste and sewage pipes running over or passing through laundry shall be clad with galvabond cladding.

11.0 ELECTRICAL WORKS

11.1 INTERIOR WIRING SYSTEM

11.1.1 SUBMITTALS

- A. Sampling shall be conducted by the Contractor in the presence of the Engineer, cost incidentals to materials sampling shall be at the contractor's expense.
- B. Materials such as wire and cables, 300mm long each size and conduits, 1 meter long each size, shall be sampled for testing and/or approved by the Engineer prior to use in the work.
- C. Catalog cuts in three copies of conduit and fittings, wires and cables, circuit breakers, safety devices, panel boards and lighting fixtures shall be furnished by the contractor before any work is started.
- D. Certificates in triplicate from the manufacturer attesting that the materials meet the requirements specified herein shall be submitted by the contractor for approval by the Engineer before delivery of materials to the site. Certification shall be made by approved nationally recognized independent testing organization and shall be submitted only in the absence of label or listing. Three copies of all manuals, instructions or documents furnished with procured equipment shall be submitted.
- E. Three copies shall be submitted of all shop drawings and data for lighting fixtures and A/C control units. Drawings shall show types, sizes, accessories, installation details and other details of construction. Data accompanying and construction details with complete dimensions and coordinates with reference to the layout drawings.
- F. Manufacturer's Data shall be submitted in triplicate for all fixtures with photometric or illumination data and indicating mechanical and electrical construction. Three copies shall be submitted of all manuals, instructions or documents furnished with procured equipment.

11.2 QUALITY ASSURANCE

- A. Installer shall have or at least three years experience in electrical work of similar nature.
- B. After the electrical wiring system installation is completed (without any electrical load connected) and when directed, the Contractor shall conduct an insulation resistance test (megger tests with 500 volts d.c.) and an equivalent operation test, in that order, to demonstrate compliance of installation with the specification.
- C. Tests shall be performed in the presence of the Engineer or his representative.
- D. The Contractor shall submit in writing in appropriate tabulated form each branch circuit and feeders. All defective materials and workmanship disclosed as a result of the tests shall be corrected or replaced at the contractor's expense.

11.3 MATERIALS DELIVERY, STORAGE AND HANDLING

- A. Materials delivered to the site shall be inspected for damage, unloaded and stored to provide protection from the weather and accidental damage.
- B. Electrical conduits shall be stored to provide protection from the weather and accidental damage.
- C. Cables shall be scaled, stored and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather.

11.4 MATERIALS AND EQUIPMENT

- A. Materials, equipment and devices shall, as a minimum, meet the requirements of UL, where UL Standards are established for those items and the requirements of the Philippine Electrical Code NFPA 70. Further, each item shall meet the requirements of these specifications and publications referenced herein. All items shall be new unless specified or indicated otherwise.
- B. Conduits shall be rigid (IMC) steel, zinc-coated and fittings for rigid (MIC) conduits shall be threaded type, Matsushita and/or Maruichi of Japan or UL approved rigid steel conduit.
- C. Wires and cables shall meet all the applicable requirements of the PEC and UL for the type of insulation, jacket and conductor specified or indicated. Unless indicated or specified otherwise, conductor sizes are based on copper.
1. Color coding is required for all services feeder, branch, control and signaling circuit conductors. The color of the insulation shall be white for neutrals and green for grounding conductors. Insulation color of the ungrounded conductors in different voltage systems shall be as follows:
 - a) 240V, 3-phase; red, black and blue
 - b) 120/240V, 1-phase; red and blackAll undergrounded conductors of the same color shall be connected top the same ungrounded feeder conductor.
 2. Conductor sizes for branch circuits shall be not less than 3.5mm² diameter rigid steel conduit.
 3. Unless specified or indicated otherwise, all power and lighting conductors shall be insulated for 600 volts, type TW solid for 5.5mm² and smaller type THW stranded for sizes larger than 5.5mm².
- D. Tapes shall be plastic and rubber conforming to UL Standard No. 510.
- E. Device plates shall be UL approved or equivalent of the one piece type and shall be provided for all outlets and fittings to suit the devices installed. Plates on finished walls shall be of metallic material with finish as indicated on the drawings. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster filings will not be permitted. Plates shall be installed with an alignment tolerance of 1.5mm. The use of sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed.
- F. Toggle switches UL Standard No. 20 shall be totally enclosed with bodies of thermosetting plastic and a mounting strap. Wiring terminals shall be of the screw type, back of side wired. Switches shall be rated quiet-matic with the ratings and number of poles indicated. Color of switches and switch cover shall be white.
- G. Receptacle shall be grounding type. Bodies shall be thermosetting plastic supported on a metal mounting strap. Wiring terminal shall be of the screw type, back of side wired.
- H. Panelboards and cabinets: Panelboards for use as service disconnecting means shall have the rating, class and number of poles indicated. Breakers shall be the thermal magnetic type. Single-pole breakers shall be full module size; two poles shall not be installed in a single module. Multi-pole breakers shall be of the common-trip type having a single operating handle, and for 50-ampere or less, may consist of single-pole breakers permanently assembled at the factory into a multi-pole unit. Breakers shall be the bolt-in type (that is bolted to the current-carrying bus); plug-in units are subjects to approval. Ground fault protection shall be provided where indicated and where required by the PEC and NEC. Panel board assembly shall be so designed that any individual breaker can be removed without disturbing adjacent units or loosening or removing supplemental insulation supplied as a means of obtaining clearance and other requirements of UL. Three keys shall be furnished for each cabinet lock. All panel board locks included in the project shall be keyed alike. Directories shall be type to indicate load service by each circuit and counted in a holder behind transparent protective coating.

Panelboards for light and power shall conform to the indications on the drawings with respect to supply characteristics, ratings of main lugs or main circuit breakers, number and sizing of branch circuit breakers.

Each panelboard shall consist of a factory completed dead front assembly of back pan, main busses, over-current and switching units, sheet metal cabinet and trim. Cabinets shall be fabricated from code gauge galvanized sheet metal with corners lapped and fastened by approved methods. Cabinets shall permit suitable wiring gutter space all around at least 100mm or wider.

Panelboard cabinets and trims shall be suitable for the type of mounting shown on the drawings. The inside and outside of panelboard cabinets and trims shall be factory painted with one rustproofing primer coat and two finish shop coats of pearl gray enamel paint.

Power and distribution panelboards shall have inside wiring gutters for branch circuit wiring connections not less than 125mm in width when the largest device does not exceed 225 amperes, nor less than 200mm in width where the largest device exceeds 225 amperes.

Provide panelboards in the light and power system where shown conforming to the indications on the drawings with respect to the following:

1. Supply characteristics;
2. Requirements for "device mains" or "lugs only means";
3. Sizing of mains; and
4. Number and sizing of branch devices.

Air circuit breakers for overcurrent protection and switching in the various panelboards shall have an interrupting rating as follows:

For Lighting Panels	Minimum acceptable Symmetrical interrupting Rating in RMS amperes
<u>Frame Size</u>	<u>For 200-250V/100-125V</u>
50 AF	5,000 Amps.
100 AF	5,000 Amps.
225 AF	18,000 Amps.
400 AF	25,000 Amps.
500 AF	30,000 Amps.
For Power and Distribution Panel	Minimum acceptable Symmetrical interrupting Rating in RMS amperes
<u>Frame Size</u>	<u>For 200-250V/100-125V</u>
100 AF	30,000 Amps.
225 AF	80,000 Amps.
400 AF	80,000 Amps.
600 AF	80,000 Amps.
800 AF	80,000 Amps.
600 AF	80,000 Amps.
1000 AF	100,000 Amps.
1200 AF	100,000 Amps.

Panelboards shall be complete with cabinets of the dead-front type, with rating, size and number of automatic circuit breakers, and type of mounting as specified and indicated on the drawings. Circuit breakers shall be molded case bolt-in type and circuit breakers shall be numbered serially from top to bottom with bold numbers. Front of cabinets shall be finished to resist corrosion with not less than one priming coat and two pearl gray finishing coat. Three keys shall be furnished, each of which shall operate all panelboard cabinet locks. Panelboards and air circuit breakers shall be manufactured by Fuji, Mitsubishi or equivalent as approved by the Engineer.

Supporting methods for all electrical equipment and circuitry shall conform to the best practice and shall be in accordance with the standards published by the United States National Electrical Contractors Association and the Philippine Electrical Code.

- I. T-5 Fluorescent Fixture: each open tube of fluorescent fixture shall be provided with spring-loaded, telescoping sockets on lamp retainers (two per lamp). Where indicated, fluorescent fixtures shall have line filters integral to the fixture assembly. Filters shall have radio frequency attenuation characteristics.
- J. Emergency Lighting Units: each unit shall have an automatic power failure device, test switch, pilot light, fully-automatic high/low trickle charger and grown-out sensitive circuit to activate battery when AC input falls to 75% of normal voltage and shall provided with a rack for wall mounting. Battery shall be sealed wet-cell type, shall operate un-attended and shall be maintenance free for a period of not less than 10 years under normal operating conditions.
- K. Motor controllers shall conform to NEMA Standard No. ICS. All controllers shall have thermal overload protection in each phase and short circuit protection. Magnetic type motor controllers shall have under voltage protection when used with momentary-contract push button stations or switches and shall have under voltage release when used with maintained-contract push button stations or switches. Control circuits connections to any hand-off automatic selector switch or more than one automatic regulatory control device shall be made in accordance with a manufacturer's means for locking in any position. For each motor, not in sight of the controller, the controller disconnecting means shall be capable of being locked in the open position or a manually operated, non-focused switch which will disconnect the motor from the source of supply shall be placed within sight of the motor location. Overload protective devices which give adequate protection to the motor windings shall be of the thermal inverse-time limit type and shall include a manual-reset type push button on the outside of the motor controller case. The cover of a combination motor controller and manual switch on circuit breakers shall be interlocked with the operating handle of the switch or circuit breakers so that the cover cannot be opened unless the handle of the switch or circuit breaker is in the "OFF" position. All motors 10Hp and smaller shall be provided with starters of full voltage magnetic type and those larger than 10Hp shall be of the reduced voltage star-delta type.
- L. Ground Rods shall be rolled to a commercially round shape from a welded copper-encased steel manufactured by the molten-welding process or by the electro-formed process (molecularly bonded). They shall have an ultimate tensile strength of 516 MPa and an elastic limit of 345 MPA. The rods shall have a hard, clean, smooth and continuous copper surface, and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.38mm at any point of the rod.

11.5 INSTALLATION

- A. General Requirements: All electrical installations shall, as a minimum, meet the requirements of the PEC and the requirements specified herein.
- B. Wiring Methods: Wiring shall be insulated conductors installed in conduit, except where specifically indicated or specified otherwise, or required by the PEC to be installed otherwise. Conduit shall be rigid metal conduit.
- C. Conduit Installation: Unless indicated otherwise, conduit shall be concealed within finished walls, ceilings and floors where practicable. Conduit shall be kept at least 150mm away from parallel runs of flues and steam or hot-water pipes. Conduits that will be visible after completion of project shall be installed parallel with or right angles to ceilings, wall and structural members.
- 1. Conduits shall be supported by pipe straps, wall brackets, hangers or ceiling trapeze. Fastening shall be by wood screws or screw type nails to wood, by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete brick; by machine screws, welded threaded studs, or spring-tension clamps on steel work.

Threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine or wood screws. Threaded C-clamps may be used on rigid steel conduit only.

Conduits or pipe straps shall not be welded to steel structures. The load applied to fasteners shall not exceed one fourth of the proof test load. Holes cut to a depth of more than 38mm in reinforced concrete beams or to depth of more than 19mm in concrete joints shall not cut the main reinforcing bars. Holes not used shall be filled. In suspended ceiling construction, conduit shall be run above the ceiling and only lighting system branch circuit conduits may be fastened to the ceiling supports. Spring steel fasteners may be used for lighting branch circuit conduit supports in suspended ceiling in dry locations.

2. Changes in direction of runs shall be made with symmetrical bends or cast metal fittings. Field-made bends and offsets shall be made with a hickey or conduit bending machine. Crushed or deformed conduits shall not be installed. Trapped conduits shall be avoided. Plaster, dirt or trash shall be prevented from lodging in conduits, boxes, fitting and equipment during construction. Clogged conduits shall be freed of all obstructions.
3. Empty conduits in which wire is to be installed by others, shall have pull wires installed. The pull wires shall be 3.5.mm² (gauge 12) zinc-coated steel or of plastic having not less than 890-Newton tensile strength. Not less than 300mm of slack shall be left at each end of the pull wire.
4. Conduit installed in concrete floor slabs shall be located so as not to adversely affect the structural strength of the slabs. Conduits shall be installed within one-third of the concrete slab. Conduits shall be spaced horizontally not closer than three diameters except at cabinet locations. (Curved portions of bends shall not be visible above the finished slab. Slab thickness shall be increased as necessary to provide a minimum 25mm cover over the conduit. Where embedded conduits cross expansion joints, suitable watertight expansion fittings and bondings shall be provided. Conduit larger than 25mm trade size shall be parallel with or at right angles to the main reinforcement; when right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.
5. Conduits shall be fastened to all sheet metal boxes and cabinets with two locknuts where required by NEC, where insulated bushing are used and where bushings cannot be brought into firm contact with the box; otherwise, at least a single locknut and bushing shall be used. Locknuts shall be the type with sharp edges for digging into the wall of metal enclosures. Bushings shall be installed on the ends of all conduits and shall be of the insulating type where required by the PEC.
6. Conduit stubbed up through concrete floors for connections to free-standing equipment shall be provided with a short elbow and an adjustable brass top or coupling of brass or bronze threaded inside for plugs set flush with the finished floor. Screw driver-operated, recessed-square socket type or threaded flush plugs shall be installed in conduits from which no equipment connections are made.
7. Flexible connections of short lengths shall be provided for equipment subjects to vibration, noise transmission or movement and for all motors. Liquid-tight flexible conduit shall be used in wet locations. A separate ground conductor shall be provided across all flexible connections.

11.6 BOXES, OUTLETS AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems wherever required for pulling of wires, making connections and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal hub type when located in normally wet locations; when surface-mounted on outside of exterior surfaces in hazardous areas; and when installation is exposed up to 2.13 meters above interior floors and walkways. Boxes in other locations shall be sheet steel. Each box shall have the volume specified by the PEC for the number of conductors enclosed in the box. Boxes for mounting fixtures shall be not less than 100mm octagonal except that smaller boxes may be installed as required by the fixture configuration as approved. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers as required. Boxes and supports shall be fastened to wood screws or screw type nails of equal holding strength.

Boxes for use with raceway systems shall not be less than 38mm deep except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be not less than 100mm square except that 100mm x 50mm boxes may be used where one raceway enters the outlet. Telephone outlets shall be, as a minimum, 100mm square by 38mm deep.

Pull boxes of not less than the minimum size required by the NEC shall be constructed of code gauged galvanized sheet steel except where cast metal boxes are required in locations specified above. Boxes shall be furnished with screw-fastened covers. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number and panel designation.

11.7 CONDUCTOR IDENTIFICATION

Conductor identification shall be provided within each enclosure where a tap splice or termination is made. Identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, or heat shrink type sleeves. Control circuit terminations shall be properly identified.

11.8 SPLICES

All splices shall be in accessible locations. Splices shall be in wires 5.5mm², and larger shall be made with an insulated pressure type connection splices for 8mm² and larger shall be covered with an insulation material equivalent to the conductor insulation.

11.9 GROUNDING AND BONDING

Grounding and bonding shall, as a minimum, be in accordance with the PEC requirements. All exposed non-current carrying metallic parts of electrical equipment, metallic raceway systems and neutral conductor of wiring systems shall be grounded. The grounding electrode system shall include made-ground rods driven externally to the building. All grounding conductors shall be of copper.

11.10 FIELD TESTS AND INSPECTION

- A. General: The Contractor shall show by demonstration in service that all circuits and devices are in operating condition. Tests shall be such that each item of control equipment will function not less than five times.
- B. Test on wiring: all 600-volt wiring shall be tested to verify that no short circuit or accidental grounds exist. Tests shall be made with the use of a megger with 500volts d.c. to provide a direct reading of resistance.
- C. Grounding System Tests: The grounding system shall be tested to assure continuity and that the resistance to ground is not excessive. Each ground rod shall be tested for resistance to ground. Resistance measurements shall be made in normally dry weather not less than 48 hours after rainfall and with the ground rod under test isolated from other grounds. Written results of each test shall be submitted to the Engineer and shall indicate the location of the rod as well as the resistance and soil conditions at the time the measurements are made.
- D. Tests and Inspection: The contractor shall perform all field tests and inspections in accordance with the General Requirements. The contractor shall give the engineer ample notice time schedules and locations of the tests and inspections.

11.12 TESTS AND GUARANTEE:

The Contractor shall furnish if the apparatus for making tests after the electrical work is complete. All wiring shall be tested thoroughly for shorts and grounds using electrical insulation testers. The Contractor shall guarantee all works installed under this contract to be free all defects for a period of one (1) year after acceptance of the project and shall agree to repair and make good at his own expense any and all defects which may develop in his work during the time, if said defects arise due to poor workmanship and materials furnished by the Contractor.

11.14 UNDERGROUND ELECTRICAL WORK DESCRIPTION

This section covers the underground work and miscellaneous associated equipment and materials for a complete system.

APPLICABLE PUBLICATIONS

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

G. Underwriter’s Laboratories, Inc. (UL)

- 6 – 1976 Rigid Metallic Conduit
- 83 – 1975 Thermoplastic Insulated Wires
- 510 – 1976 Insulating Tape
- 514 – 1977 Outlet Boxes and Fittings
- 543 – 1972 Fiber Electrical Conduit

H. National Electrical Manufacturers Associations (NEMA)

- WC7 – 1971 Standard for Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable for Transmission and Distribution of Electrical Energy (IPCEA S-66-52A)
- TC3 – 1976 PVC Fittings for use with Rigid PVC (R 1973) Conduit and Tubing
- TC6 – 1974 ABS and PVC Plastic Utilities Duct for Underground Installation.

I. Institute of Electrical and Electronic Engineers (IEEE)

- 48 – 1975 Standard Test Procedures and Requirements

for High Voltage Alternating Current Cable
Transmission

- J. American National Standards Institute (ANSI)**
C2 – 1981 Philippine Electrical Code, Vol 2. (exterior Electrical Installation)
- K. National Fire Protection Association (NFPA)**
70 – 1981 Philippine Electrical Code, Vol 1. (Interior Electrical Installation)
- L. American Society for Testing and Materials (ASTM)**
 - D1556 – 64 Density of soil in Place by the
 - (R – 1974) Sand Cone Method
 - D1557 – 70 Moisture Density Relations of Soils using a
4.5 kg Rammer and 457mm Drop

11.15 GENERAL REQUIREMENTS

The general requirements for all underground electrical work shall be in accordance with the sub-sections entitled GENERAL REQUIREMENTS with the following additions and modifications.

A. Factory Test:

1. Soil-density relationships for compaction of backfill materials shall be determined in accordance with ASTM-D1557 Method D.
2. Soil – density relationships shall be determined as specified for soil tests in the section entitled EARTHWORK, etc.

B. Arc – Proofing Test For Cable Fireproofing Materials: Test one sample assembly consisting of a 75mm diameter lead tube with a 6mm thickness, fire proofed as specified. Test shall be made at three different points. At each point, the testing shall consist of an arc magnetically blown against the test assembly until melting occurs at the point of arc contact. The arc shall be struck between two 22mm electrodes located 25mm from the sample assembly. Electrodes must be squared off after each test run. Arc current shall be between 195 and 210 amperes at 40 vdc. For each test, the lead for at least 25 seconds at any point and an average time of no less than 30 second for the three tests.

In lieu of the above test, the contractor may submit copies of the report of such test previously made for the manufacturer, with his certification that the materials supplied for this project is the same as that used in the test. Test elements and requirements shall be essentially as specified in the above test.

11.16 SUBMITTALS:

The following information shall be submitted for approval:

A. Catalog Information: (3 copies Each)

- | | |
|-------------------------------|--------------------------|
| Conduit | Manhole Frame and Cover |
| Insulation Tape | Handhole Frame and Cover |
| High Voltage Cables | Cable Lubricants |
| High Voltage Splice kits | Terminator |
| High Voltage Terminating Kits | Potheads |

B. Manufacturer’s Instructions: (3 copies each)

- a. Manufacturer’s direction for use of ground megger with proposed method indicated.
- b. Terminator manufacturer’s installation instructions.

C. Certificates:

- a. Material and Equipment: Manufacturer's statement that the product supplied meet or exceed contract requirements shall be furnished in triplicate.
 - a. Manhole and hand hole frame and cover
 - b. High voltage cable
 - c. High Voltage terminator
- b. Workmen's Competency's: Cable splicer's certificate of competency shall be submitted for approval.

D. Materials and Equipment

Materials and equipment listed by UL or approved by Factory Mutual (FM) System shall be furnished when such equipment is listed or approved.

1. Conduit shall conform to the following:

- a. Rigid galvanized steel conduit and fittings shall conform to the requirements of UL 1242, respectively, for use with low voltage secondary and signal circuits.
- b. Fiber conduit shall be homogeneous fiber impregnated with a bituminous compound and shall conform to the requirements of UL 543, type 1 for HV distribution circuits.
- c. Outlet boxes for use with steel conduits rigid or flexible shall be cast-metal with gasketed closures conforming to UL 514

E. Plastic insulating tape shall conform to the requirements of UL 510.

F. POWER, WIRE and CABLE:

- a. Wire and cable conductor sizes are designated in square millimeters. Conductors shall be copper. Insulated conductors shall bear the date of manufacture imprinted on the wire insulation with other identification. Wire and cable manufactured more than 12 months before delivery to the job site shall not be used.
- b. Wires and cables rated for 5KV and above 100 percent insulation level, grounded shall be shielded. Insulation shall be cross linked polyethylene, either, unfilled or non-carbon filled and shall be PVC jacketed or equal, all conforming to NEMAWC7. Insulation and jacket thickness shall be required by IPCEA.
- c. Wires conforming to UL83. THW and TW shall be provided as required. Only wires with "W" in the type designation shall be used in wet or damp locations.
- d. High Voltage Cable Terminations: Potheads shall be provided for termination of single and multi conductor cables when indicated. Pot heads shall conform to the requirements of IEEE 48, class 1 termination. The manufacturer shall provided all components and insulating compound for filling two copies of complete directions for assembly, filling and putting the unit into service, one of which shall be submitted for record. Installation shall include stress relief cones.

Aluminum and copper or copper bearing parts shall not be used in contact with each other in construction or installation of class 1 terminations. Terminators shall be designed for use with specific cable indicated.

- G. Grounding Rods shall be copper clad steel with diameter adequate to permit driving to full length of the rod, but not less than 19mm in diameter and 3 meters long, unless otherwise indicated.

H. INSTALLATION:

Underground cable installation shall conform to ANSI C₂ and NFPA70, except as otherwise specified or indicated.

- A. Contractor Damage:** The Contractor shall promptly repair any indicated lines or systems not indicated which are caused by his operations shall be treated as "CHANGES" under the terms of the General Requirements of this contract. If the contractor is advised in writing of the location of a non-indicated line or system such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In any event, the contractor shall immediate notify the Engineer of any such damage.

B. Direct Burial Ground Grid System: The bare copper cables that under sidewalks paved areas and roadways, the cables shall be installed in conduit encased in concrete. The conduits shall be sloped to drain. Trenches in which the cables are placed shall be excavated by hand or with mechanical trenching equipment, and a minimum cable cover of 600mm below finished grade shall be provided and shall be not less than 150mm wide, shall be in straight lines between ground rods. Bends in trenches shall have a radius of not less than 900mm. Where two or more cables are laid in the same trench, they shall be spaced laterally at least 75mm apart. When rock is encountered, it shall be removed to depth of at least 75mm below the cable and the space filled with sand or clean earth free from particles larger than 6mm. Cables shall not be unreeled and pulled into the trench from one end. However, the cable may be unreeled one grade and lifted into position on a 75mm sand bedding with 75mm more sand placed on top of the cable.

- 1.) Grounding grid cables shall be in one piece without splices between connections except where the distance exceeds the length in which the cable is furnished.
- 2.) Bends in cables shall have an inner radius not less than 12 times the cable diameter.
- 3.) Horizontal slack of approximately 900mm shall be and at all points where connections are brought above ground. Where cable is brought above ground additional slack shall be left to make necessary connections.
- 4.) **Identification Slabs:** A concrete slab marks shall be provided at each change of direction of cable over the ends of ducts or conduits which are installed under paved areas and roadways and over each splice. The concrete slab shall be 500mm x 500mm square, 150mm thick and shall be set flat in the ground so that the surface projection not less than 19mm nor more than 32mm above ground. The concrete shall have a compressive strength of 21Mpa and have a smooth troweled finish on exposed surface. An identifying legend such as "cable" "duct" "splice", or other applicable designations shall be inscribed on the top surface before the concrete hardened. Circuit identification symbols shall also be inscribed on slabs as directed. The letters and/or figures shall be 50mm high and the grooves shall be approximately 6mm in width and depth. The slabs shall be installed so that the side nearest the inscription on the top shall include an arrow indicating the side nearest the cable.
- 5.) Soil treatment for grounding cable trenches shall be accomplished using one of the following insecticides in uniform concentration by weight as follows:
 - a.) Chlordane – 1.0 percent
 - b.) Dieldrin – 0.5 percent
 - c.) Alfrin – 0.5 percent

Diluent shall contain no pesticide rinsate or residue. Containers shall be delivered in manufacturers sealed containers complete with application instructions and bearing current Environmental Protection Agency registration.

C. Underground Duct with Concrete Encasement:

Underground ductlines shall be constructed of individual conduits encased in concrete. The kind of conduit used shall not be mixed in anyone duct bank. Ducts shall not be smaller than 50mm in diameter unless otherwise indicated. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 75mm of cover for ducts.

- a. The top of the concrete envelop shall not be less than 450mm below grade, except that under roads and pavement, it shall be not less than 600mm below grade.
- b. Duct lines shall have a continuous slope downward manholes and away from building with a pitch of not less than 75mm in 30 meters. Except at conduit risers, changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal shall be accomplished by long sweep bends having a minimum radius of curvature of 7.5 meters, sweep bends may be made up of one or more curved or straight section or combinations thereof. Manufactured bends shall have a minimum radius of 450mm for use with conduits of less than 75mm in diameter and a minimum radius of 90mm for ducts of 75mm in diameter and larger.
- c. Conduits shall terminate in end-bells or grounding bushing where duct lines enter manholes and handholes. Separators shall be of pre-cast concrete high impact polystyrene, steel or any

combination of these. The joints of the conduits shall be staggered by rows and layers so as to provide a duct line having a maximum strength.

During construction, partially completed duct lines shall be protected from the entrance of debris such as mud, sand and dirt by means of suitable conduit plugs. As each section of a ductline is completed from manhole/handhole to manhole/handhole, a testing mandrel not less than 300mm long with a diameter of 6mm less than the size of the conduit, shall be drawn through each conduit after which a brush having the diameter of the duct and having stiff bristles shall be drawn through until the conduit is clear of all particle of earth, sand, and/or gravel; conduit plugs shall then be immediately installed. A plastic pull rope having 900mm of spare of each end shall be provided in telephone ducts.

- D. Underground conduit** for service feeders into buildings shall be rigid steel from the service equipment to a point 1.5 meters beyond the building. The end of the conduit shall be protected by thread metal caps or bushings; the threads shall be coated with graphite grease or other suitable coating. Conduit shall be cleaned and plugged until conductors are installed.
- E. Concrete for electrical requirements** shall be at least 21 MPa concrete with 2.5mm maximum aggregate conforming to the requirements of sections 3- CPNCRETE.
- F. Backfilling** a plastic warning tape about 300mm below the top of the trench shall be provided in layers not more than 150mm thick and each layer shall be compacted. Backfilling shall progress as rapidly as the construction, testing and acceptance of the work permits. Backfill shall be free from roots, wood scrap materials and other vegetable matter and refuse. Compaction of backfill shall be to 90 percent of maximum density.
- G. Reconditioning of Surface:**
1. Unpaved surface disturbed during the installation of duct or direct burial cable shall be restored to their original condition. Sod or topsoil shall be preserved carefully and replaced after the backfilling is completed sod that is damaged shall be replaced by sod of quality equal to that removed. Where the surface is disturbed in a newly seeded area, the restored surface shall be reseeded with the same quantity and formula of seed as that used in the original seeding.
 2. The contractor shall patch pavement, sidewalks, curbs and gutters where existing surfaces are removed for construction. Cut pavement edges shall be sawn. Graded aggregate base course shall have a maximum aggregate size of 38mm. Base course shall be primed as required prior to paving. Thickness of base course shall match existing but shall be at least 150mm. Asphalt concrete shall be hot plant mixed and hot laid. Maximum aggregate size shall be 13mm and match existing, but shall be at least 50mm thick. Portland cement concrete pavements, sidewalk curbs and gutters shall be repaired using 21 MPa concrete. Pavement thickness shall be at least 150mm. Side walks thickness and curb and gutter cross-sections.
- H. Cable Pulling:** Duct lines shall be tested with a mandrel and thoroughly swabbed out to remove foreign materials before the pulling of cables. Cables shall be pulled down grade with the feed-in point at the manholes or buildings of the highest elevation. Flexible cable feeds shall be used to convey cables through the manhole opening and into the duct runs. Cable lubricants shall be petroleum grease for lead covered cables and soapstone, graphite or talc for rubber or plastic jacketed cables.
- 1.) Lubricants for assisting in the pulling of HV jacketed cables shall be those specifically recommended by the cable manufacturer.
 - 2.) Cable pulling tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.
 - 3.) **Installation of cables in Manhole and Handholes:** Cables shall not be installed utilizing the shortest route, but shall be routed along and the maximum spare cable lengths. All cables shall be formed to closely parallel walls, not to interfere with duct entrances, and shall be supported on brackets and cable insulators at a maximum of 1.20 meters.

In existing manhole and handhole where new ducts are to be terminated, or where new cables are to be installed, the existing installation of cables, cable supports and grounding shall be modified as required for a neat and workman like installation with all cables properly arranged and supported.

I. Fire proofing (Arc Proofing) of cables in Manholes and Handholes: All wire and cables which will carry current at 220 volts or more in manholes and handholes shall be fire proofed

1. Strips of fire proofing tape approximately 1.6mm thick x 75mm wide shall be wrapped tightly around each cable spirally in half lapped wrapping, or in two butt-joined wrappings with the second wrapping covering the joints of the first. The toward the cable and shall extend 25mm into the ducts.

To prevent unraveling, the fire proofing tape shall be random wrapped the entire length of the fire proofing with pressure sensitive glass cloth tape. The fire proofing shall consist of a flexible, conformable fabric having one side coated with flame retardant, flexible polymeric coating and/or a chlorinated elastomer not less than 1.27mm thick and shall weigh not less than 1.5 kilograms per square meter. The tape shall be non- corrosive to cable sheath, shall be self-extinguishing, and shall not support combustion. The tape shall not deteriorate when subjected to oil, water, gases, saltwater, sewage and fungus.

J. Cast-In-Place Manholes and Handholes:

Cast-in place reinforced concrete manholes and handholes shall be provided as indicated. Concrete used shall provided 21 MPa compressive breaking strength at 28 days maturity. Floor manholes and handholes shall be rated for wheel loadings indicated for traffic areas.

- 1.) Drainage pipe and fittings shall be cast-iron, extra strength. Drains shall be cast-iron, coated or uncoated, plain pattern, bottom outlet with perforated or slotted hinged cover.
- 2.) Metal frames, covers and gratings where required, shall be made of cast-iron. Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Steel covers shall be rolled steel floor plate having an approved anti slip surface.
- 3.) Pulling-in irons shall, be steel bars bent in the form indicated and cast in the walls and floors. In the floor, they shall be centered under the manhole, and in the wall, above or below, and opposite the conduits entering the manhole. Pulling – in irons shall be projected into the manhole approximately 100mm.
- 4.) Cable racks including hooks and insulators shall be spaced not more than 450mm horizontally. The wall bracket shall be T-section steel. the hooks shall be of steel or malleable iron and shall be of the removable type. Insulators shall be dry process glazed porcelain.
- 5.) **Field Painting:** Cast-iron frames and covers if any not buried in masonry shall be cleaned of mortar, rust, greases, dirt and other deleterious materials and given a coat of bituminous paint. Steel frames if any, hot buried masonry and steel covers shall be cleaned of mortar, dirt and grease by an approved blasting process. Surfaces that cannot be cleaned satisfactory by blasting shall be cleaned to bare metal by wire brushing or other mechanical means. Surfaces contaminated with rust, dirt, or grease or other contaminants shall be washed with solvents until thoroughly cleaned. Immediately after cleaning surfaces coating or be given a crystalline phosphate coating. As soon as practicable after the pretreatment, zinc chromate primer and one coat of synthetic exterior class enamel be applied.
- 6.) **Connection To Manhole:** Concrete encased duct lines connecting to manholes and handholes shall be constructed to have a tapered section adjacent to the manholes and handholes shall be constructed to provide keying the concrete envelope of the duct line into the wall of the manhole. Vibrators shall be used when this is poured to assure a seal between the envelope and the wall of the manhole. For duct line connections to existing manholes, the manhole wall shall be broken out to the dimensions required to preserve the steel in the manhole wall. The steel shall be cut appropriately and bent out for lying into the reinforcing of the duct line envelop.
- 7.) **Connections To Existing Ducts:** Where connections to existing duct lines are indicated the lines shall be excavated to the maximum depth necessary. The lines shall be cutoff and loose concrete removed from the conduits before new concrete encased ducts are installed. A reinforced concrete collar, poured monolithically with the new duct line shall be provide to take the shear at the joint of the duct lines.

- 8.) **Removal of Cuts:** Where duct lines are removed from existing manholes, the opening shall be closed to water proof the manhole the wall opening shall be chipped out to provide 1 keys for the new section of wall.
- 9.) **Cable and Duct Shields:** Shields shall be provided where cables enter and leave manholes and other duct entrances and shall be of a suitable type manufactured for the purpose.

K. Earthwork: Earthwork shall be in accordance with the section entitled earthwork.

1. Excavated materials not required or suitable for backfill shall be removed from the site as directed, sheeting and shoring shall be provided as necessary for protections of works and safety of personnel. Water shall be removed from excavation by pumping or other approved method.
2. Backfilling around structures shall consist of earth, loam, sand-clay, or sand and gravel free from large clods of earth or stones over 25mm in size. Backfill materials shall be placed symmetrically or all sides in loose layers not more than 225mm deep. Each layer shall be moistened, it necessary and compacted with mechanical or hand tampers to 90 percent compaction. Surfaces disturbed during the installation of manholes and hand hole shall be replaced as described under the paragraph entitled "Reconditioning of surface" of this section.

L. Cable Terminations:

Terminations of insulated power and lighting cables shall be protected from accidental contact, deterioration of covering and moisture by the use of terminate on devices and materials. Terminations shall be made by using materials and methods indicated or specified herein or as designed by the written instruction of the cable manufactures and termination kit manufacture Termination for high voltages shall be rated and capable of with standing test voltages in accordance with IEEE 48.

M. Splices For 600 Volt Class Cables:

Splices in underground systems shall be made only in accessible locations such as manholes and handholes, using a compression connector on the conductor and by insulating and water proofing by one of the following methods suitable for continuous submersion in water.

1. Cast-type splice insulation shall be provided by means of a molded casting process employing a thermosetting epoxy resin insulating material which shall be applied by a gravity poured method or by a pressure injected method. The component materials of the resin insulation shall be in a packaged form and shall not be removed from the package. The cables shall not be allowed to be moved until after the splicing materials have been complete set.
2. Gravity poured method shall employ materials and equipment contained in an approved commercial splicing kit which include a mold suitable for the cables to be spliced. When the mold is in place around the joined conductors. The cables shall not be allowed to be moved until after the splicing materials have completely set.

N. Splices in High Voltage Cables: Splice shall be made only in accessible locations in manholes and handholds and shall be suitable for continuous submersion in water.

1. High voltage cable splicer/terminator certification of competency and experience shall be submitted 30 days before splices or terminations are made in high voltage cables. Splicer terminator experiences during the immediate past three years shall include performance in splicing terminating cables of the type and classification being provided under the contract.
2. High voltage splice shall be made using "KIT" which shall be the product and shall have the approval in writing of the cable manufacturer. The contractor shall provide the engineer with a copy manufacturers instructions before splicing is started. Splices in shielded cables shall include covering the spliced area with metallic tapes like material to the original cable shield and connecting it to the cable shield on each side of the splice. A 14MM² bare copper ground connection brought out in a water tight manner and grounded to a 20mmx 3 meters ground rod shall be provided as part of the splice installation, wire shall be trained to the side of the enclosure in a manner to avoid interference with the working area.

O. Grounding: Non-current carrying metallic parts associated with electrical equipment shall have a maximum resistance to solid "EARTH" ground not exceeding the following Values:

Generating and Control Equipment –1,000 Volts and over 1ohm
Main Distribution Substations – 500KVA to 1000KVA – 5 ohms
Pad Mounted Substations without protected Fences – 5 ohms
Ground in manholes and handholes – 10 ohms

Grounding other metal enclosures of primary voltages, electrical and electrically operated equipment – 10 ohms grounded secondary distribution system neutral and non-current carrying metal parts associated with distribution systems and grounds not otherwise covered – 25 ohms. When work in addition to that indicated or specified, is directed in order to obtain the specified ground resistance, the provision of the contract covering “CHANGES” shall apply.

1. Grounding electrodes shall be cone pointed driven ground rods, driven ground rods full depth plus 150mm, installed where indicated to provide an earth ground of the value here in before stated for the particular equipment being grounded.
2. Grounding connections which are buried or otherwise normally in accessible and expecting specifically those connection for which access for periodic testing is required shall be made by exothermic weld. Exothermic welds shall be made strictly in accordance with the weld manufacturer's recommendations. Welds which have “Puffed Up” or which show convex surfaces, indicating improper cleaning are not acceptable. No mechanical connector is required at exothermic weldments.
3. Grounding conductors shall be bare soft-draw copper wire 22mm² minimum unless otherwise indicated or specified.

Field Test:

As an exception to requirements that maybe stated elsewhere in the contract, the engineer shall be give five working days notice prior to each test.

A. Distribution Conductor 600 volt class:

All 600 volt class conductors shall be tested to verify that no short circuit or accidental ground exist. Tests shall be made using an instrument which applies a voltage of approximately 500 volts to provide a direct reading of resistance.

B. High Voltage Cables: The high voltage cables shall be tested after installation in accordance with the requirements of the appropriate IPCEA – NEMA “Voltage test after installation” Paragraph in the part specification for the cable involved. The contractor shall furnish the engineer with three copies of the result of the tests. Ground rods shall be tested for ground Resistance value before any wire is connects. A portable ground testing megger shall be used to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fraction there-of to indicate the ground value of the ground electrode under test. One copy of the megger manufacturer's direction use of the ground megger indicating the method to be used shall be provided.

C. Compaction: backfill shall be tested in accordance ASTM D1556.

D. Test Report:

1. 600 volt cables (identify each cable and test result.)
2. High voltage cables (identify each cable and test result.)
3. Grounding electrodes and systems (identifying electrodes and systems each test).

12.0 MECHANICAL WORKS

12.1 FIRE SPRINKLER SYSTEM:

12.1.1.Pipes and Fittings:

All pipes for Fire Sprinkler system shall be unused BI pipes ASTM Schedule 40 without any defects, size as indicated in drawings. Fittings shall be welded type.

12.1.2 Valves:

Valves shall be Buttefly valve 100mm with supervisory switch UL

12.1.3 Pumps:

Pumps specifications as follows: 25 Hp fire pump, 2Hp jockey pump with valve and accessories

12.1.4 Sprinkler heads:

Sprinkler heads shall be new and unused pendant type or sidewall type with mounting plate as indicated in drawing.

13.0 ELECTRONIC AND COMMUNICATION

13.1 SAFETY SYSTEM EQUIPMENT AND MONITORING DEVICES

13.1.1 CCTV System

- a. DVR (8 inputs High Definition, USB compatible Network)
- b. Indoor Camera shall be with IP 800TVL or higher IP66, minimum illumination 0.04lx, true day and night, real color picture thru ATW, signal to noise ratio: more than 46dB; automatic black light compensation and fixed and DC type vari focal lens support.
- c. Provide 4 terabyte Hard disk
- d. Color LCD monitor 19"
- e. Provide Centralized power supply 12v/25amp.

13.2. PAGING SYSTEM

13.2.1 Paging System shall have a power amplifier of not less than 300watts, with pre-amplifier mixer capable of 4 mic inputs. Mic to be provided with tone chime. Speaker shall be wall horn type 100 watts.

14.0 SPECIALTIES

14.1 General

Furnish all materials (unless noted otherwise), labor, equipment and use of tools for the satisfactory installation of these items as indicated on drawings and as described in the Bill of Quantities.

14.2 Toilet Partitions

- 13.2.1 PANELS: Shall be 18mm thk. Moisture Resistant laminated melamine boards
- 13.2.2 ACCESSORIES: Shall be black nylon coated or stainless steel accessories and fittings.
- 13.2.3 TOP FRAME: Shall be 2mm thk. Aluminum header in black powder coated finish.
- 13.2.4 U-CHANNEL: Shall be 2mm thk. aluminum in black powder coated finish. FINISHES: Laminate shall be from Smooth Cherry wood grain laminated sheets.
- 13.2.5 LOCKS-provide appropriate locksets with external indicators for all cubicles.

14.3 Locksets and Hinges

- 13.3.1 Provide YALE stainless door locksets or equivalent for all wooden doors complete with keys.
- 13.3.2 Loose Pin Hinges for all wooden doors shall be HAFELE BRAND stainless steel loose pin hinges or equivalent.

14.4 Cabinetry

- 1. All Cabinet Accessories shall be HAFELE brand stainless steel handles, hinges, and accessories.

14.5 Lavatory Counters:

- 1. Lavatory counters shall be from 1" x60cm solid natural granite slab natural grey code 63-586899.

14.6 Signages

- 1. Interior Signage's (Room designation Signage's) shall be 8" high and 24" wide with ACP Background and sticker cut out text.

15.0 Other Fire Protection

- a. The design, installation and maintenance of standpipe systems shall be in accordance with NFPA 14, standard for the installation of standpipe, private hydrant and hose system.
- b. Fire Hose box shall ALUMINUM FRAMED RED FIRE HOSE BOX with glass cover with 38mm (1-1/2")brass nipple and 1-1/2" BFP approved nozzle with at least 100 feet of 1-1/2" fire hose for first aid fire fighting installed at each floor level as indicated in the drawings.
- c. Provide a 64 mm inlet pipe as indicated in drawings.
- a. Exit Signs shall be Illuminated L.E.D Exit signs Model SKRE 705 230V/60Hz with rechargeable 1.2V/06AH Battery installed at all exit doors as indicated in drawings.

- b. Smoke Detectors shall be First Alert SA340CN Smoke Alarm with Lithium Battery installed at locations as indicated in drawings.
- c. Emergency Lights shall be True light dual Emergency Lamps Model ST8051 installed at locations as indicated in drawings.
- d. Fire Alarm bell shall be Hallux Italy Red Round Bell 6" 220V/60Hz with Red Diamond Fire Plus Push Fire Alarm Switch installed at locations as indicated in drawings
- h. Siamese Connections shall be 2-1/2"x2-1/2"x2-1/2" Brass BFP approved female inlet installed as indicated in drawings.

16.0 SOLAR PANELS

16.1 Seraphim Solar Panel shall be Polycrystalline solar cells 1.56mm x1.56mm in dimension (60 pcs per panel) covered with in anodized electrophoretic aluminum alloy with MCA compatible connector with 3.2mm tempered front glass cover rated 250w maximum power voltage of 30V and maximum system voltage 1000 TUV. 600 UL roof tilt mounted with hopergy mounting hardwares. With single phase string inverters