the concrete. Level equipment bases, using jacks or steel wedges, and neatly grouted-in with a non-shrinking type of grouting mortar. Locate equipment so that working space is available for all necessary servicing such as shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

2. Air-Conditioning System

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

3. Electrical Work

Electric motor driven equipment specified herein shall be provided complete with motors, motor starters, and controls. Electrical equipment and wiring shall be in accordance with Section 7.1, "Electrical General Requirements" of division 7. Motor starters shall be provided complete with properly sized thermal overload protection and other appurtenances necessary for the motor control wiring required for controls and devices but not indicated.

4. Piping

a) Piping Sleeves

Pipe sleeves shall be as Galvanized Iron, Schedule 20.

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

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

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

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

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

6. Air Filters

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

7. Inspection Plates and Test Holes

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

8. Flashing and Pitch Pockets

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

FIELD TESTS AND INSPECTIONS

1. Tests

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

2. Leak Testing

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

3. Evacuation, Dehydration, and Charging

After system is found to be without leaks, evacuate the system using a reliable gauge and a vacuum pump capable of pulling a vacuum of at least 1 mm lig absolute. Evacuate system in strict compliance with the triple evacuation and blotter method or in strict accordance with equipment manufacturer's printed instructions. System leak testing, evacuation, dehydration, and charging with refrigerant shall comply with the requirement contained in an acceptable industry standard.

4. Start-Up and Operation Tests

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

5. Performance Tests

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

6. Sound Tests, Air-conditioners, Unitary, Split Type

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

ITEM 17 : FIRE PROTECTION SYSTEM

GENERAL

The General Condition and Provision of the Civil works contract not in conflict with these Specification and the Drawings form part of and/or included in this section of these Specification.

The work to be done. under this Division of the specifications consists of the fabrication, complete in all details, of the Fire Protection Works, at the subject premises, and al1 works and materials incidental to the proper completion of the installation, except where same shall be in conflict with such Codes, etc. which, later shall then govern. The requirements with regard to materials and workmanship specify the required standards for t h e furnishing of all labor, materials and appliances necessary for the complete installation of the work specified herein and indicated on the drawings.

The work covered in this contract is to be installed according to the specs. Codes, ordinances and requirements of the followings:

1. Revised Fire Code of the Philippines
2. National Fire Protection Association (NFPA) 10, 13, 14 and 20
3. Ordinances of concerned city or municipality

DRAWINGS AND SPECIFICATIONS

The contract drawing and specifications are complementary to each other and any labor or materials called for by either, whether or not called for by both, if necessary, for the successful operation of any of the particular type of equipment will be furnished and installed without additional cost to the Owner.

All dimensional locations of equipment, fixtures, conduits, and chases shall be verified on site, on the architectural drawings and manufacturer 's catalogue.

INTENT - It is not intended that the drawings shall show every wires, pipes, fitting, and equipment. All such items whether specifically mentioned or not, or indicated on the drawings, shall be furnished and installed if necessary, to complete the system in accordance with the best practice of the Fire Protection trade and to the satisfaction of the Owner through their Construction Manager and the Consultant.

SITE INVESTIGATION - The Contractor is required to visit the site and to ascertain for himself the local conditions and facilities that may affect his work. He will be deemed to have done this before preparing his proposal and any subsequent claims on the ground of inadequate orinaccurate information will not be entertained.

SHOP DRAWINGS

The Contractor shall submit to the Architect and the Engineer, for approval, four (4) copies of all shop drawings of details and connections not shown on the drawings or deviations thereof but required for the work. The Contractor shall certify that the drawings have been checked for dimensions, materials, erection details and that they conform to the intent of the drawings and specifications.

The Shop Drawings shall be bound neatly in three (3) sets and submitted to the Architect with a letter of transmittal. The letter of transmittal shall. contain a list of items indicated above to be submitted along with manufacturer 's name.

The Contractor shall also be able to submit sample products when required by the Owner or Architect.

All materials and equipment installed without prior approval of the Architect shall be at the risk of subsequent rejection.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail. Said approval does not in any way relieve the contractor from his responsibility or necessity of furnishing materials or performing work as required by the contract drawing and specifications.

AS-BUILT DRAWINGS

The contractor, shall during the progress of work, maintain accurate records of all deviations in work as actually installed from work indicated on the Drawings.

Upon completion of work, the Contractor shall submit four (4) copies in Autocad format, one (1) copy shall be reproducible, of the as-built drawings indicating the work as actually and finally installed.

CUTTING AND PATCHING

Contractor shall provide all cutting and patching necessary to install the work specified in this section. The Contractor shall do all drilling required for the installation of his hangers.

No structural members shall be cut without the approval of the Owner or the Architect, and all such cutting shall be done in a manner directed by the Owner or the Architect.

All patching shall be performed in a neat and workmanlike manner acceptable to the Architect. Patching shall match adjacent surfaces.

SUB-CONTRACTOR

Unless otherwise recommended on these Specifications, the Contractor shall not subcontract the whole or any part of the work without the written consent of the Owner. The Contractor shall be responsible for any work carried out by any subcontractor as if he himself were undertaking the work.

STANDARD OF WORKMANSHIP

The Contractor shall execute all work in a neat and workmanlike manner and shall do all necessary work whether it is clearly specified in these Specifications or shown on the Drawings or not. All work shall be done in accordance with the best practices employed in modem sprinkler installations.

The Contractor shall employ only competent and efficient workmen and shall, upon written request of the Architect, discharge or otherwise remove from work any employee who is, in the opinion of the Architect, careless or incompetent, or who obstruct the progress of the work or acts contrary to instructions or conduct himself improperly.

STANDARD OF MATERIALS

All materials shalt be new and shall conform to the technical Specifications. All materials shall be standard products of reputable manufacturer's and shall bear the name of the manufacturer.

All materials shall be subject to the approval of the Architect and Consultant. This approval shall not relieve the Contractor of the responsibility of inspecting such materials for defect of non-conformance with the specifications.

Where the technical specifications or the Drawings give the name of the manufacturer and/or catalogue number of materials, it is given as a guide to the size, strength, quality or class of the materials desired and shall be interpreted to mean that item or another fully equal for the service intended. Substitution shall be subject to prior written approval of the Architect and Consultant.

The apparent silence of the Specification and Drawing as to any detail, or apparent omission from them of a detailed description concerning any material shall be regarded to mean that only material of first-class quality shall be used.

REMOVAL OF DEFECTIVE OR UNAUTHORIZED WORK

Any defective work, whether the result of poor workmanship, defective materials, damage through carelessness or any other cause, found to exist prior to acceptance of, or final payment for the work shall be removed immediately and replaced by work and material which shall conform to these Specifications, or shall be otherwise remedied in an acceptable manner. This clause shall have full effect

regardless of the fact that the work may have been done within the full knowledge of the Architect and Consultant.

All materials not conforming to the requirement of the technical Specifications shall be considered as defective.

No defective materials, the defect of which has been subsequently corrected shall be used unless approval has been given by the Architect and Consultant.

CONFORMITY WITH PLANS AND ALLOWABLE DEVIATIONS

These Specification and Drawing indicate the general layout of the system and the Contractor shall be responsible for the installation of the system without substantial alteration of modifications. Wherever field conditions of exigencies of construction make departures from these Specifications and the Drawings necessary, detail of such departure and reason thereof shall be submitted without delay to the Architect and Consultant and no departure shall be made without written approval of the Architect and Consultant.

COOPERATION WITH OTHER TRADES

The Contractor shall examine and shall familiarize with the Specifications and Drawings of the Civil Works, the Air Conditioning Works, Plumbing/Sanitary Work, and the Electrical Works. He shall arrange his work and dispose his materials so as not to interfere with the work or storage of materials of the other Contractor. Should the Contractor cause damage to any other Contractor on the work, the Contractor shall upon due notice settle with such Contractor by agreement or arbitration. The Contractor shall be liable for any claim by the other contractor against the Owner on account of such damage.

INSPECTION AND TESTS

The Architect and Consultant or his representative shall be allowed access to all part of the work at all times and shall be furnished such information and assistance by the Contractor as may be required to make a complete detailed inspection. Materials and installation shall be subject to such tests as are deemed necessary by the Architect to properly ascertain their fitness both during installation and after installation is completed. All expenses to conduct special test shall be by the contractor.

INJURY TO PERSONS OR DAMAGE TO PROPERTY

The Contractor shall be responsible for all injury to persons and damage to property caused by the work or by workmen and shall be liable for any claim against the Owner on account of such injury and/or damage. The Contractor shall likewise take necessary precautions to protect the property of the Owner against rain or other inclemency of the weather and against theft, where exposure to such inclement

weather or theft is due to the performance of his work. The Contractor shall be liable for any such damage or loss.

TEMPORARY FACILITIES

The Contractor shall make all necessary arrangement and pay for the provisions of the necessary electrical supply required for the work and shall clear away all temporary installation before or upon completion of the work.

LEAVING THE SITE

The Contractor shall not withdraw from the site until the whole Fire Protection system is completed and in operational condition and ready for use by the Owner.

SUSPENSION OR DELAY

The Contractor shall not suspend or fail to make proper progress with the work without justifiable cause. The Owner, in the event of delay or suspension of the work still persisting after written complaint, shall have the right to take over the work and all materials on the site and make arrangements as are necessary to have the work completed by others.

CLEANING UP

During the process of the work on the. completion of the project, the Contractor shall remove from the premises all dirt, rubbish and waste materials caused by him in the performance of his work, he shall remove all tools, scaffolding and surplus materials after completion and acceptance of the work.

GUARANTEE

The Contractor shall guarantee that the Fire Protection system is free from all defective workmanship and materials and will remain so for a period of one (1) year from date of acceptance of the work by the Owner or the Architect. Any defect, appearing within the aforesaid period shall be remedied or replaced by the Contractor at his own expense.

PERMITS AND DUES

The contractor shall give all necessary notices, obtain all permits and pay all government taxes, foes, and other costs, including utility connections or extension, in connection with his work; file all necessary plans, prepare all documents, and obtain all necessary' approvals of all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Construction Manager before request for acceptance and final payment for the work.

The contractor shall include in the work, without extra cost to the Owner, any labor, materials, services: apparatus, drawings, in order to comply with all applicable

laws, ordinances, rules and regulations, whether or not shown on drawings and/or specified.

The Contractor shall include in his work, without extra cost to the Owner or Architect, Drawing (in addition to Contract/ Drawing and Documents and associated paperwork as required by the approving Authorities.

INSPECTIONS AND CERTIFICATES

Upon completion of the entire installation, the approval of the Architect and Owner shall be secured, covering the installation throughout. The Contractor shall obtain and pay for certificate of inspection and approval form the Public Authorities having jurisdiction. A final inspection certificate shall be submitted to the Architect prior to the final payment. The Contractor shall pay any/ all cost incurred for fees.

DETAILED BREAKDOWN OF ESTIMATES

The Contractor shall submit detailed breakdown of estimate on each listed fire protection system herein along with the provided bid proposal. Detailed breakdown shall consist of the quantity, brand name and costing per item of a system.

SCOPE OF WORK OF THE CONTRACTOR

The work of the Contractor consists of supervision, labor, equipment and materials, and perform all operations in connection with the Fire Protection System shown on the plan, their tests and inspections complete and in accordance with these Specifications and Plans and subject to terms and conditions of the Contract. Any equipment; materials, or works not shown on the Plans but mentioned in the Specifications, or vice-versa, shall be furnished and installed by the Contractor.

Specifically, the work shall involve the following:

a) To secure, at his own expense, for all Fire Protection permits certificates and other related permits. on the drawing.

b) Furnish and install an Automatic Wet Sprinkler System for the entire building, as indicated on the drawing

c) Furnish and install of Fire Pump assembly including the jockey pump.

d) Furnishing of portable fire extinguishers.

e) Testing of the automatic sprinkler and standpipe system within the facility as required by the laws, ordinances, rules, regulations and orders of governmental authorities having jurisdiction over this work.

TECHNICAL SPECIFICATIONS

1. Quality Assurance - All materials to be used shall be new and shall conform with the referenced codes and standards. Use of materials shall further be governed by other requirements, imposed on other sections of these specifications. Materials shall be subject to the necessary tests to assure their fitness if so required.

2. Alternate Materials - Use of any material, not specified in these specifications may be allowed provided further that a test, if required, shall be done by an approved agency in accordance with generally accepted standards.

EXECUTION

Workmanship

The work throughout shall be executed in the best and most thorough manner to the satisfaction of the Architect and the Engineer, who will jointly interpret the meaning of the drawings and specifications and shall have the power to reject any work and materials, which in their judgement, are not in full accordance therewith.

The Contractor shall assume unit responsibility and shall provide the services of a qualified Engineer to supervise the complete installation of equipment and systems and who shall be available for conducting the final acceptance tests.

Preparation

Examine all surfaces which are to support or receive parts place and subsequent construction. Notify General Contractor if any condition exists which will prevent the completion of the Work in this Section in a satisfactory manner. Application or installation of materials constitutes acceptance of the supporting and adjoining construction.

Piping

a) Ream pipe and tube ends to full inside diameter.

b) Remove burrs and bevel plain end ferrous pipe.

c) Remove scale and foreign materials, inside and outside, before assembly.

Coordination

Installation of the wet automatic sprinkler system shall be coordinated, by the Fire Protection Contractor, with the immediate and related mechanical and electrical installations and all other trades involved in other parts of the Work for the proper location and installation of sprinkler heads, piping, outlets and equipment before installation of same.

Installation

Install the wet automatic sprinkler system in strict accordance with the approved drawings and each manufacturer's requirements where required, and as applicable an automatic fire alarm system.

All sprinkler pipe and fittings shall be so installed that the system may be trained. Sprinkler pipes may be installed level and trapped piping shall be drained.

Pipe, tube or fittings shall be joined by the following means:

Threaded Pipe and Fittings:

a) All threaded pipe and fittings shall have threads cut to ANSI Standards B2.1. Care shall be taken that the pipe does not extend into the fitting sufficiently to reduce the waterway.

b) Pipe shall be reamed after cutting to remove all burrs and fins.

c) Joint compound or tape shall be applied to the threads of the pipe and not in the fitting.

Welding Pipe:

a) Sections of branch lines, cross mains, feed mains or risers may be shop welded.

b) Sections of welded piping shall be joined by means of screwed bolt and nut flange or flexible gasketed joints or other approved fittings.

c) Torch cutting shall not be permitted as a means of modifying or repairing sprinkler systems.

d) Welding shall be done in accordance with the methods set forth Here in before.

e) Welders shall be certified as specified here in before.

f) When welded fittings are used to form outlets:

1. Holes in piping shall be cut to the full diameter of the fitting.
2. Discs shall be retrieved.
3. Openings in piping shall be made smooth.
4. All slag and other welding residue shall be removed.

Painting

Paint sprinkler piping as shown on the Drawings and as specified.

1. Care shall be exercised whenever the sprinkler piping is given any kind of coating to ensure that no automatic sprinkler surfaces are coated.

2. Automatic sprinklers shall not be painted and any sprinklers which have been coated, except for factory applied coatings, shall be replaced with new listed sprinklers.

Cleaning

Swab-out lines and/or flush out system with fresh water until they are clean and water runs clear at all outlets.

Acceptance Test

All tests required shall be performed by the installing contractor and witnessed by the Owner or his representative.

The following minimum tests shall be performed. Any additional tests required by the local regulating authority having jurisdiction shall also be performed.

1. Flushing Test.

2. Hydro static Test at a Test Pressure of 250 psi minimum.

3. Leakage Test.

4. Drainage Test.

ITEM 18 : CONCRETE WATERPROOFING

GENERAL

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

SCOPE OF WORK

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

SUBMITTAL

1. Material description and physical properties, application details, and recommendations regarding shelf life, application procedures, and precautions on flammability and toxicity.

2. Samples for each waterproofing type.

DELIVERY AND STORAGE

Deliver manufactured waterproofing materials in manufacturer's original, unopened containers, with labels intact and legible. Containers of materials covered by the referenced specification number shall bear the specification number, type, and class of the contents. Store and protect materials in accordance with the manufacturer's instructions, and use within their indicated shelf life. Promptly remove from the site materials or incomplete work adversely affected by exposure to moisture. Use pallets and canvas tarpaulins to cover stored materials top to bottom.

PRODUCTS

I. DEEP PENETRATING SEALER

Deep Penetrating Sealer (DPS) is an environmentally friendly, non-toxic, odorless, clear, water-soluble liquid compound, which is safe and easy to use.

Deep Penetrating Sealer (DPS) penetrates below the surface and chemically reacts with the alkali and lime found in concrete. This reaction creates a silica gel membrane within the pores and capillaries of the concrete, permanently sealing it against the ingress of moisture yet allowing the concrete to breathe. Over a period of time, the silica gel membrane hydrates and solidifies into a crystalline structure, increasing the hardness and strength of both new and old concrete while reducing moisture vapor emissions and permanently stopping the penetration and flow of

water and water-borne contaminants such as chlorides and acids, both on the positive or negative side forging a waterproofed and preserved concrete structure.

EXECUTION

1. All existing dirt and other surface contaminants adhering on the surface must be thoroughly removed. Apply Concrete Neutralizer using sufficient coats to completely neutralize the surface. Do not wash off. When sufficiently dry, dust lightly to remove crystalline deposits.

2. Mix thoroughly the product mixture as per manufacturer's instruction. Any change from the recommended proportion will affect its quality. Scrape the bottoms, sides and comers of the container to ensure complete and full blending. Prepare only enough quantities that can be used within the pot-life period. Do not delay application. Apply DPS by brush or roller or by using an airless spray.

3. Allow to cure overnight prior to application of topcoat.

II. FLEXIBLE MODIFIED CEMENTITIOUS

Flexible Modified Cementitious (FMC) is a two-component latex-modified cementitious coating. It can be simply achieved by mixing the pre-packed dry-mixing powder with the formulated flexible latex admixture, and subsequent brushing the slurry on various substrates. It protects a wide range of buildings and structural concrete components with excellent resistance to water, aggressive chemicals, long-term weathering, and scratching. It is applicable to those structures subjected to long-term water immersion.

1. Free surfaces from dirt or foreign materials. For the waterproofing to work best, manufacturers recommend the surfaces be sand blasted, bush-hammered or acid-etched.

2. Apply 2 coats of the cementitious waterproofing. The first coat could include the manufacturer's materials only. The second coating will include a cement-sand mixture and also have chemical and metallic elements too. If supplementary waterproofing is required, then a third coat may be required. This typically includes sand and cement for that extra protection.

Methods of Application

Trowel

Application of the coating is done using the handheld trowel, by simply applying and spreading the coating using the trowel.

Spray

This method uses spraying equipment like the ones used in painting vehicles. It is preferred due to its precise finish and efficiency. It is also faster to use the spray than the trowel method.

Brush

Use a typical brush similar to the roll brushes that are used in painting houses. It also has a uniform finish and is faster to use compared to the trowel.

It is good to note that different surfaces will dictate the method of application.

ITEM 19 : FINISHES

SCOPE OF WORK

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

SUBMITTAL

a) Shop drawings for all finishing and painting works for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.

b) The Contractor, before placing order for the finishing materials shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.

c) Samples of all walls finishes, measuring not less than 1000 mm x 1000 mm shall be submitted to the Engineer for approval as to its finish texture and workmanship.

MATERIAL REQUIREMENTS

Wall Finishes and Countertops

a) Plain Cement Plaster Finish
   1. Sand shall be clean and hard material. Sand shall be free from deleterious substances and conforming with the requirements of ASTM C 33.

   2. Cement shall be Portland cement conforming with the requirements of ASTM Designation C 150.

   3. Water shall be clean and potable.

   4. Bonding compound shall conform to ASTM C 631.

   5. Hydrate lime shall conform to ASTM C 206.

b) Textured Cement Plaster Finish
   1. Material Requirements
      a. Portland cement, gray color shall conform to PNS 07, type 1.

b. Portland Masonry Cement, white or colored for textured finish shall be colored masonry cement conforming PNS-53 or to the best commercial standard.

c. Sand shall be clean natural sand or manufactured sand passing a 3 mm screen and retained in a No. 100 mesh sieve for base coat, and a 2 mm screen for textured finish.

d. Water for mixing shall be clean and potable.

e. Lime shall be hydrated lime with the requirement that the unhydrated Calcium Oxide and Magnesium Oxide in the hydrated product shall not exceed 8% by weight, calculated on the "as received" basis.

f. Spraying Equipment for cement texturing shall be of the approved type regularly used by the trade for providing textured finish.

2. Proportioning and Mixing

a. Mixing of Plaster for base coat and textured finish.

Materials shall be accurately measured in a device that will maintain the specified proportions. Mechanical mixers shall be used for the mixing of plaster and textured coating, except where hand mixing of small batches is approved. Plaster shall be thoroughly mixed with the proper amount of water, until uniform in color and consistency. For natural texture color finish, use only one brand of cement. Caked or lumped materials shall not be used. Mechanical mixers, mixing boxes and tools shall be cleaned after mixing of each batch and kept free of plaster from previous mixes. Re-tempering will not be permitted and all plaster that has begun to stiffen shall be discarded.

b. Proportioning of Plaster

Portland cement plaster for base coat shall be a two-coat application. Each coat shall be proportioned as follows: one part Portland cement, three parts sand, and 1/5 part lime putty.

c. Proportioning of Cement Textured Finish

Proportioning of Cement Textured Finish shall be proportioned as follows: one part white or colored masonry cement and one part fine sand.

c) Wall Ceramic Tiles

1. Wall tiles shall be unglazed/glazed ceramic wainscoting Color as per Engineer's approval.

2. Trimmers and moulding shall be lustrous, glazed with size and color corresponding to wall tiles.

3. Portland cement, sand, bonding compound, lime and water shall conform with the requirements

d) Glass Wall

1. Surface burning characteristics as required by ASTM E-84, NFPA 235/UL 723 to be Class A (1), labeled and listed by an independent testing laboratory.

2. Flame spread per ASTM E-84 of 25 or less for the full depth panels and facing; Smoke development, 25 or less; labeled and listed.

3. Panels conform to safety standards ANSI Z97.1 and CPSC Reg.16 CFR 1201, I or II, and labeled and listed as such by an independent laboratory.

4. Available types include smooth and textured glass types as available.

5. Coatings types include solid, pear or metallic coating types as available.

FLOOR FINISHES

1. Vitrified Ceramic Unglazed Tiles

a. Vitrified ceramic unglazed floor tiles shall be white for toilets and as shown on the drawings or to be designated by the Engineer.

b. Portland cement, sand and water shall conform with the requirements.

c. Vitrified ceramic unglazed floor tiles shall be delivered in the manufacturer's original unbroken packages or containers that are labeled plainly with the manufacturer's name and brand. Containers shall be grade scaled. Materials shall be stored in dry weathertight enclosures,

and shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.

2. Plain Cement Floor Finish

    a. Portland cement, sand, bonding compound and water shall conform with the requirements.

    b. Mortar shall be one part of Portland cement to three parts sand.

    c. Hardener shall be non-metallic floor hardener, delivered in cartons, cans or bags to the construction site with the labels installed and seals unbroken.

3. Non-skid ceramic floor tiles

    a. Non-skid ceramic tiles shall be white ceramic tiles to be used for market hall ramp as shown on the Drawings.

4. Granite Slab

    a. Granite Slab shall be pre-polish granite slab and shall comply with ASTM C615.

    b. Shall be sound material with uniform and favorable working qualities and with very limited natural faults.

    c. Color and quality shall be approved by Engineer.

    d. Mixes:
        - ❖ Bond Coat – One (1) part Portland cement, one-half to one (½ to 1) part lime putty, three to four (3-4) parts sand.
        - ❖ Proportion for mortar setting bed – one (1) part Portland cement, three to four (3-4) parts sand.

Homogeneous/ Porcelain Tiles

1. Material
    a. Homogeneous tile is a form of ceramic tiles composed of porcelain clays but fired at much higher temperature than ceramic tiles (exceeding 1,500 degrees centigrade).

b. Homogeneous tiles are denser, harder, less porous and less prone to moisture and stain absorption.

c. Have consistent property the entire section of the tile.

d. Colors of homogeneous ceramic tiles /porcelain tiles run uniformly through its entire thickness will not expose a clay base when chipped.

e. Refer to the drawings for the location of its applications.

2. Leveling mortar bed shall consist of the following:

a. Cement

Ordinary Portland cement shall be used in the preparation of the mortar. Except where shown otherwise on the Drawings, the cement used meet the requirements of ASTM C 150, Type I or AASHTO M 85 Type.

b. Fine Aggregates

The fine aggregate may be naturally occurring sands, manufactured sands or a mixture of both.

- Grading: As shown below, Material retained between any two sieves shall not exceed 45 percent (ASTM C 136).
- Fineness: Not less than 1.50 not more than 3.0. Once approved by the Engineer deviation of over 2 percent shall not be permitted (ASTM C-117).

3. Grouting shall be per manufacturer's standard.

4. Tile adhesive shall be per manufacturer's standard.

EXECUTION

Wall Finishes

1. Plain Cement Plaster Painted Finish
   a. Preparation of Surfaces

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

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

All surfaces shall be thoroughly wetted before plastering.

b. Trial Mix

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

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

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

c. Cement Plaster Finish Application

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

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

Final plaster finishes shall be rubber sponged.

d. Tolerance

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

e. Patching and Cleaning

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

2. Textured Cement Plaster Finish

   a. Workmanship

      Base coats shall be applied with sufficient pressure and the plaster shall be sufficiently plastic to provide good bond on masonry base or uneven concrete surface. Plaster work shall be finished level, plumb, square, and true, within a tolerance of 3 mm in 3 m, without eaves, cracks, blisters, pits, grazing, discoloration, projections, or other imperfections. Plasterwork shall have no visible junction marks. Finished work shall be covered and protected to prevent damage.

   b. Textured Cement Plaster Finish

      Textured Cement Plaster Finish shall be spray-applied to a thickness of not less than 6 mm thick. Application shall be done to provide uniform thickness and texture.

   c. Repair of Defective or Damaged Work (Patching and Pointing)

      Upon completion of the finishing and when directed, all loose, cracked, damaged or defective texturing work shall be cut out and repaired. Exposed textured surfaces shall be left in an unblemished condition, ready to receive paint or other finish. All pointing and patching of textured surfaces shall be done in a neat and workmanlike manner. Plaster droppings shall be removed from all surfaces. Protective coverings shall be removed from floors and other surfaces, and all rubbish and debris removed from the building.

3. Wall Ceramic Tiles

   a. Mortar Preparation

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

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

      The quantity of water shall be controlled accurately and uniformly. The aggregates shall be introduced and mixed in such manner that the materials will be distributed uniformly throughout the mass. A sufficient

amount of water shall be added gradually and the mass further mixed until a mortar of the elasticity necessary for purpose intended is obtained.

Mortar boxes, pans and wall surfaces shall be kept clean and free from debris or dried mortar. The mortar shall be used before the initial set of the cement has occurred. Re-tempering of mortar in which cement has started to set will not be allowed.

b. Application of Wall Tile

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

Scratch coat shall be applied to masonry, as backing for wall tile, not less than 24 hours or more than 48 hours before starting the tile setting. The scratch coat shall not be less than 6 mm from the face of the masonry.

The scratch coat shall be applied with sufficient pressure to ensure a proper bond with the base for the setting bed. While the mortar is still plastic, the scratch coat shall be cut with a trowel at all internal vertical angles for the depth of the coat with the full height of the tile bed and shall be cross-scratched, in 25 mm centers for the extent of the tile bed.

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

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

Intersections and returns shall be formed accurately. Where cutting of tiles is necessary it shall be done at the internal angles of the walls or

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

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

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

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

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

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

c. Cleaning and Curing

All completed tile work shall be thoroughly sponged and washed diagonally across joints, and finally polished with clean, dry cloth. Acid cleaning of unglazed tile, when necessary, shall not be done within ten

days after setting tile. All metal shall be covered with an approved grease and the tile shall be wetted with clean water, before tile is cleaned with 10% muriatic acid solution. After acid cleaning, the tile shall be flushed with clean water, and the grease coating on metal shall be removed. Acid cleaners shall not be used on glazed tile.

d. Protection

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

4. Colored Glass Wall

a. Examination

- ❖ Do not begin installation until substrates have been properly prepared.
- ❖ If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

b. Preparation

- ❖ Clean adjoining and supporting surfaces thoroughly prior to installation. Remove dust from drywall.
- ❖ Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

c. Installation

- ❖ Install in accordance with manufacturer's instructions.
- ❖ Install materials in accordance with manufacturer's printed instructions and submittals. Installation shall start only after all other work on the adjoining walls, base, and floor has been completed. Insure that perimeter details and opening sizes are correct before starting.
- ❖ Panels shall be installed, accurately and in the required locations, as indicated on the drawings. Surfaces shall be plumb, level, aligned and flush, with uniform joints, and with the proper patterns, textures and colors.
- ❖ Manufacturer's protective film on the face of the panels shall not be removed until all work is complete.

d. Wall Installation

- ❖ Adhesive installation: Construction adhesive as recommended by the glass manufacturer with no acetoxic silicone. Adhesive manufacturer's requirements shall be followed. Always wipe dust off walls thoroughly.
- ❖ Frame Installation
  - Wall panel trim shall be installed in a plumb, level and square manner. The face of the trim shall be on a flat and plumb plane. Maximum variation 3 mm in 4572 mm.
  - Exception: When the design intent is for the wall plane to not be plumb and/or not be a continuous flat plane. Joints shall be flush and tight with the maximum tolerance +.0.5 mm.
  - Wall panels shall be flat and on a consistent plane with adjacent panels. Tolerance + 0.8 mm.
  - The plane of the trim face and the plane of the panel face shall have a constant and parallel relationship.
  - Bonding adhesives shall be applied to a sealed and contaminant free bonding surface. No adhesive shall be visible.

Floor Finishes

1. Vitrified Ceramic Tiles

a. Mortar Preparation

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

b. Surface Preparation

Surfaces to receive the tiles shall be clean, free of dust, dirt, oil, grease, and other deleterious substances. Floor tile operations in spaces receiving wall tile shall not be started until wall tile installation has been completed. Before tile is applied with a dry-set mortar bed, the structural floor shall be tested for levelness or uniformity of slope by flooding it with water. Areas where the water ponds shall be filled and leveled with mortar and shall be retested before the setting bed is applied.

c. Placing of Setting Beds and Floor Tile

Mortar setting beds shall have a minimum thickness of 20 mm for floors. The structural concrete slab shall be soaked thoroughly with clean fresh water on the day before the setting bed is to be applied. Immediately preceding the application of the setting bed, the structural slab shall again

be wetted thoroughly, but no free water shall be permitted to remain on the surface.

A skim coat of neat Portland cement mortar shall then be applied not more than 4 mm thick. The mortar shall be spread until its surface is true and even and thoroughly compacted, either level or sloped uniformly for drainage, as the case requires. A setting bed, as large as can be covered with tile before the mortar has reached its initial set, shall be placed on one operation; but in the event that more setting mortar has been placed than can be covered, the unfinished portion shall be removed and cut back to a clean bevelled edge.

All mounted tiles shall be soaked in clean water a minimum of one hour before they are set. Absorptive mounted tile shall be dampened by placing sheets on a wetted cloth in a shallow pan before setting. No free water shall remain on the tiles at the time of setting. Before the initial set has taken place in the setting bed, a skim coat of neat Portland cement mortar, 0.7 mm to 1.6 mm thick, shall be trowelled or brushed over the setting bed and/or the back of the tile, or a thin layer of Portland cement, 0.79 mm to 2 mm thick, may be hand-dusted uniformly over the setting bed and worked lightly with a trowel or brush until thoroughly damp.

The tiles shall then be pressed firmly upon the setting bed, and beaten into the mortar until true and even with the plane of the finished floor line. Beating and leveling shall be completed within one hour after placing tiles or sheets. Borders and defined lines shall be laid before the field or body of the floor. Where floor drains are provided, the floors shall be sloped to drain properly to the drains. Intersections and returns shall be formed accurately.

Cutting of tile, where necessary, shall be done along the outer edges of the floor. As far as practicable, no tiles of less than half size shall be used. Cutting and drilling of tiles shall be done neatly without marring the tile surfaces. The cut edges of tile against trim, bases, thresholds, pipes, built-in fixtures, and similar surfaces shall be ground and jointed carefully. Tile shall fit closely and neatly at all plumbing fixtures and around electrical outlets, pipes and fittings so that cover plates or escutcheons will overlap the tiles properly. Tiles shall be secured firmly in place and loose tiles or tiles sounding hollow shall be removed and replaced. All lines shall be kept straight, parallel, and true, and all finished surfaces brought to true and even planes. The inner edges of borders shall be kept straight and, where practicable, shall form right angles at all returns. The paper and glue shall be removed from mounted tile, without using excess water, within one hour after installing the tiles.

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

Joint widths shall be uniform and spaced to accommodate the tile in the given spaces with a minimum of cutting. Tiles shall be wetted, if they have become dry, before applying grout. Joints 3.2 mm or less in width shall be grouted with a neat Portland cement grout of the consistency of thick cream. Other joints shall be pointed with mortar consisting of one part Portland cement and two parts pointing sand.

The grout or mortar for joints on floors shall be white Portland cement or as specified by the Engineer. Grout painting mortar shall be forced into joints by using trowel, brush or finger application. Before the grout or mortar sets, the joints of cushion edge tile shall be struck or tooled to the depth of the cushion, filling all skips or gaps, and the joints of square edged tiles shall be filled completely flush with their surface. Dark cement shall not be seen through grouted white joints.

All surplus mortar or grout shall be removed before it has set or hardened.

d. Cleaning and Curing

Floors shall be covered with waterproofed paper with all joints lapped at least 96 mm and allowed to damp cure for at least 72 hours before foot traffic is permitted thereon.

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

Finished tile floors shall be covered with clean building paper before foot traffic is permitted on them. Board walkways shall be placed on floors that are to be continuously used as passage ways by workmen. Thresholds shall be covered with boards. Tiles vertical outside corners (external angles) shall be protected with board corners strips in areas used as passage by workmen.

2. Granite Slab
   a. Before spreading the setting bed, establish lines of borders and center the fieldwork on both directions to permit the pattern to be laid with a minimum of cut slab.

   b. Place mortar onto only as large an area as can be covered with the tile before mortar reaches its initial set. When more setting mortar is spread that can be covered, the unfinished portion shall be cut back to a clean, leveled edge and removed.

   c. Tamp mortar bed to ensure a good bond over the entire area, and screed to provide a smooth level bed at proper height and slope.

   d. Wet slab prior to installation. Lay slab from centerline outward and make adjustments at walls and keep tile joints parallel and straight over the entire area.

   e. Fill in voids with approved joint filler and machine-sand slab using the wet method.

   f. Machine-sand slab to a shiny finish after the application of the wet method three to four (3-4) times.

3. Homogeneous /Porcelain Tiles
   a. Setting

      Set floor tile firmly in setting bed, for a true surface. Joints should be straight, level and of even width not exceeding 15mm.Joint depth is approximately 6mm to 8mm.

   b. Grouting Method

      Grout float method (adaptable to small paving-stone series). Force a maximum amount of grout (1 part cement to 2 parts fine graded sand) into joints.

   c. Cleaning

      Clean homogeneous ceramic tiles /porcelain tiles surface as thoroughly as possible within 10 minutes after completion of grouting with sponge rubber or brush.

ITEM 20 : CEILING

SCOPE OF WORKS

This Item covers the use of aluminum panel as perforated ceiling that consists of furnishing and installing materials, tools, labor and equipment and this also consist furnishing and installing non-load metal partitions such ceiling for the attachment of gypsum board as indicated on the Plans and in accordance with this Specifications.

MATERIAL REQUIREMENTS

Aluminum

The aluminum shall be high strength, heat-treatable alloy which provides good formability and weldability and good corrosion resistance. It shall be suitable for a wide variety of architectural applications and of commercial quality unless specified in the Plans. It shall conform to the applicable requirements of ASTM B 209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

Thickness

Thinner material perforate easier and faster. It shall have a gauge thickness tolerance of + 0.2 mm.

Panel Shape and Size

Panel shape and sizes shall be as indicated in the Plans or as approved by the Engineer.

Aluminum panels shall be equipped with perimeter welded metal frames, return edges, borders mounting holes attachment brackets and clips. It shall be dimensioned as indicated on the Plans and as approved by the Engineer with a width and length tolerances of + 2.0mm and + 4.0 mm respectively.

Perforations

Shape and Size

The shape of perforations shall be as indicated on the Plans using the standard shapes

Size:	1200mm X 600mm
	600mm X 600mm
Hole Diameter:	2.0mm

Weight: 1.94 kg/sq.m.

Powder Coated Finish: Bone White Color with Black tissue felt in-fill to prevent penetration of dust.

In any cases that a custom shape perforations is needed for functional requirement spacing and size of perforation shall be provided.

The hole diameter should not be less than foe thickness of the aluminum panel.

Pattern

Staggered pattern perforations shall have an unfinished end pattern that appears Incomplete at both ends of the sheet.

For staggered perforations both Round and Square the pattern stagger shall be in the short dimension of the sheet. Holes in a straight row pattern shall be parallel to long dimension of sheet.

Slotted Perforation - Slots shall be identified if to be furnished parallel with either the length or width of the sheet.

Margin

The "margin" on a perforated sheet or plate refers to the distance from the edge of the sheet to the first perforation along the same dimension. "No margin" refers to the last row or set of perforations extending off foe sheet or plate.

The long side of a sheet shall be supplied with minimum margins. The short side of a sheet will have either minimum margins or no margins.

CONSTRUCTION REQUIREMENTS

Installation

Install in accordance with manufacturer's installation instructions and approved shop drawings.

1. Level the ceiling height by the use of water level or laser beam.
2. Perimeter trims shall be installed using screw, nails or other applicable fasteners depending on wall type.
3. The ceiling shall be set out from the center to the perimeter wall. The center to center spacing for Triangle Keel shall be 600mm.
4. The maximum distance from the wall to first suspension part shall be 600mm.
5. The Suspension Part Twin Clamps (together with drop -in anchor installed at the concrete slab) shall be spaced 600mm on center.

Note:

The end of the threaded bolt shall be spaced on the drop - in anchor and the other end shall be attached to the suspension Party Twin Clamps using nuts.

6. Triangle Keel shall be attached to the Suspension Part Twin Clamps.
7. When the accessories have been installed, adjustment shall be made to ensure that the whole suspension ceiling is leveled.
8. Slightly push the Aluminum Ceiling Panel upward the ends of the panel until it rest with the triangle keel.

Non-Structural Metal Framing

Material Requirements

Metal framing comes in a variety of gages or thickness. Most interior non-load bearing metal framed walls are either 25 or 20 gage . 25 gage is the lightest or thinnest material available. It is 0.0457 cm thick. Studs and track are C-shaped channels, roll formed from corrosion-resistant, galvanized steel. The minimum thickness and allowable height of Cold-Formed Steel Member are shown in table below.

Minimum Thickness of Cold-Formed Steel Members Non-Load Bearing or Drywall

Designation (mils)	Steel Thickness (cm)	Reference Gage Number
18	0.04	25
27	0.07	22
33	0.08	20

Construction Requirements

Studs shall be used for non-load bearing partition walls and ceilings. Knockouts (pre-punched holes) shall be conveniently placed in the studs to facilitate the installation of electrical wiring, plumbing and bridging.

Studs shall be connected to the floor and ceiling track (runner) with pan head screws, spaced at either 30.48 em, 40.64 cm or 60.96 cm on center-spacing based on wall height. Wallboard or other sheathing shall be then attached with Type "5" (fine-tread) drywall screws.

Metal studs shall be straight, light, non-combustible and not susceptible to termite damage. Matching track is available for each stud size with 3.18 em, 5.08 cm and 7.62 em leg heights.

INSTALLATIONS

Ceiling Assemblies

1. Fix and align accurately all steel angles at the maximum interval of 1.20 meter.

2. Tie the suspension rod securely to the steel angle.

3. Attach the carrying channel to the suspension clip the use the rod joiner to connect the suspension rod to the suspension clip.

4. Attach the metal furring to the carrying channel at right angle to each other using the furring clips. Metal furring can be spaced at 0.40 meter up to 0.60 meter apart

5. Gypsum boards are attached to the metal framing by drywall screw.

Drywall Partition

1. Layout the floor tracks. Secure this using suitable anchoring method.

2. Install the metal studs to the tracks spacing from 0.40 meter up to 0.60 meter, use blind rivets or screws. No horizontal bracing needed if the studs are spaced 0.40m and the height does not exceed 3.0 meters. Thus, making the installation economical and durable.

3. Install the gypsum board using drywall screw.

INSPECTION

When Items not meeting specification requirements are discovered, their existence shall be called to the attention of the manufacturer prior to installation. Possible use of such items may be adjudicated among the responsible parties involved, based on the nature of the deficiency and the effect on the performance of the ceiling.

When rejection occurs, the manufacturer shall have the right to examine the rejected material. After removal of the portion not conforming to the specification, re-submission of the lot shall be permitted.

The inspection of specific ceiling areas for acceptability shall be made with lighting conditions corresponding to that of final building occupancy. If temporary lighting must be used, care shall be taken to position lights such that temporary conditions will approximate the final lighting condition.

ITEM 21 : LOW-E GLASS AND GLASS WALL

SCOPE OF WORK

This item shall consist of furnishing all low-e glass and glass wall materials, labor, tools and equipment required in undertaking the proper Installation as shown on the Plans and in accordance with these specifications.

MATERIAL REQUIREMENTS

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

2. Glass and Glazing
   (a) All glass and glazing materials shall be delivered at Jobsite with labels affixed indicating quality, make, type and thickness. Each glass in glazed position shall resist a design pressure of 244 kilograms per square meter.
   (b) Glazing materials for glass installation may be:
      1. Bulk compound such as mastic that are elastic and non-skinning compound.
      2. Putties - wood sash putty or metal sash quality.
      3. Sealant - shall be chemically compatible with setting blocks, edge blocks and sealing tapes.

3. Setting and Edge Blocks shall be made of lead or neo-prene, chemically compatible with sealant.

4. Accessories like glazing dips, shims, spacer strips etc. shall be made from non-corroding metal accessories.

CONSTRUCTION REQUIREMENTS

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

WORKMANSHIP

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

CLEANING

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

ITEM 22 : ALUMINUM TRELLIS

INTRODUCTION

Trellis is an architectural structure, usually made from an open framework or lattice of interwoven or intersecting pieces of wood, bamboo or metal that is normally made to support and display climbing plants or simply for aesthetic purposes.

SCOPE OF WORK

This item shall consist of furnishing all aluminum trellis materials, labor, tools and equipment required in undertaking the proper installation as shown on the Plans and in accordance with this specification.

MATERIAL REQUIREMENTS

1. Aluminum Trellis shall be fabricated from extruded aluminum sections true to details with clean, straight, sharply defined profiles and free from defects impairing strength, durability and appearance.

2. Extruded aluminum sections shall conform to the specification requirements of ASTM B-211.

3. Brackets, Anchor, Screws, nuts, washers, bolts, rivets, and other miscellaneous fastening devices shall be made of non-corrosive materials such as aluminum and stainless steel.

CONSTRUCTION REQUIREMENTS

1. For all fabrication works, the cut ends shall be true to line, free of burrs and rough edges.

2. Protections

   a) All aluminum parts shall be protected adequately to ensure against damage during transit and construction operations.

   b) Aluminum parts in contract with steel members shall be properly insulated by a coat of zinc chromate primer applied to the steel or by application of bituminous paint.

3. Cleaning

   a) The contractor shall protect all entrance units during construction and shall be responsible for removal of protective materials and cleaning all aluminum surfaces.

   b) Aluminum shall be thoroughly cleaned with plain water with kerosene or gasoline and then wipe surfaces using clean cotton fabrics. No abrasive cleaning agents shall be permitted.

ITEM 23 : DOORS AND WINDOWS

SCOPE OF WORK

The work shall cover the fabrication, delivery and complete installation of doors and windows including glazing for the buildings.

The works shall consist of furnishing all labor, materials, tools, equipment and other incidentals necessary for the complete installation of the above mentioned doors and windows, including glazing, as shown on the drawings and in accordance with this specifications or as directed by the Engineer.

SUBMITTAL

The Contractor shall submit the shop drawings for the fabrication of the doors and windows to the Engineer for approval, twenty eight days before the start of works.

The shop drawings shall indicate the following:

a) Elevations for each type;
b) Details for each type;
c) Location in the building for each item;
d) Typical and special details of construction; and
e) Location and installation requirements for hardware.

HANDLING AND STORAGE

All doors and windows and door frames shall be delivered, stored and handled so as not to be damaged or deformed. All doors and windows and door frames stored at the site before installation shall be stocked vertically on non-absorptive strips or wood platforms and covered with suitable covering to provide weather tight protection and proper air circulation.

MATERIAL REQUIREMENTS

Wood Doors

a) Wood doors shall be of the following types where indicated on the drawings with complete locksets, hinges and accessories, duco painted finish.

    1) Flush-type marine plywood finish door

    2) Flush type marine plywood finish with fixed louver door

    3) Panel type wood tanguile doors

b) Frame wood block insets shall be kiln-dried tanguile, as shown on the drawings.

c) Facings shall be raised wood panels, ordinary plywood, marine plywood where shown on the drawings. Plywood shall be first quality, grain and color suitable for natural finish and of the thickness indicated on the drawings.

d) Local plywood used for fabrication of wood doors shall conform to PTS 631-02, Class 1, preservative treated, and the adhesive used for plywood manufacture shall be water-proofing grade. The Contractor shall submit compliance certificates for plywood and adhesive for approval prior to fabrication of doors.

e) Local lumber used for fabrication of wood doors shall conform to PTS 20. Lumber used shall be of premium select grade and in no case contain any defects or damage. Lumber shall be Tanguile or a higher class hardwood specie. Wood blocking for specified hardware shall be provided in all hollow core doors.

f) Adhesive and bonds shall be in accordance with NWMA Standard I.S.I. using requirements for interior doors. Adhesives shall be waterproof type.

g) Door jambs and headers shall be well-seasoned yakal.

h) Nails shall be of the smooth shank, zinc-coated, common wire nails of the types and sizes suited for the purpose and as directed by the Engineer.

i) Wood screws shall be brass or cadmium plated of the best available commercial quality of the types and size suited for the purpose.

Aluminum Doors

a) General Material Requirement

All frames for aluminum door shall consist of aluminum shapes and materials extruded from alloy 6063-T5 to ASTM B 221. Frames shall be coated with polyester powder and with shade as shown on the Drawing or as directed by the Engineer. Powder coating shall satisfy the following requirements:

Pre-treatment : zinc chromating and acid rinsing

Powder application : one operation using electrostatic gun

Oven curing temp : 200°C for 20 min,

Coating thickness : min. 60 microns

Impact resistance : min. 20 in/lb

(ASTM D 2794)

b) Door panels shall either be clear or smoked glass with panel thickness as shown on the Drawings.

c) Screws, nuts, washers, bolts, rivets and other miscellaneous fastening devices shall be non-corrosive materials such aluminum, stainless steel, etc.

d) Hardware for fixing and locking devices shall be closely matched to the extruded aluminum section and adaptable to the type and method of opening.

e) Vinyl weatherstrip shall be first class quality flexible vinyl forming an effective seal and without adverse deformation when installed.

f) Pile weatherstrip shall be silicon treated and free from residual wetting agents and made of soft line hair as on wool, fur, etc.

g) Glazing shall conform to the requirement.

Emergency Exit Doors

The provisions herein shall apply to every exit door serving an area having an occupant load more than 10, or serving hazardous rooms or areas.

a) Swing. Exit doors shall swing in the direction of exit travel when serving any hazardous areas or when serving an occupant load of 50 or more. Double acting doors shall not be used as a part of fire assembly, nor equipped with panic hardware. A double acting door shall be provided with a view panel of not less than 1300 square centimeters (200 square inches).

b) Type of Lock or Latch. Exit door shall be openable from the inside without the use of a key or any special knowledge or effort: Except, That this requirement shall not apply to exterior exit doors in a Group E or F Occupancy if there is a conspicuous, readily visible and durable sign on or adjacent to the door, stating that the door is to remain unlocked during business hours. The locking device must be of a type that will be readily distinguishable as locked. Flush bolts or surface bolts are prohibited.

c) Width and Height. Every required exit doorway shall be of a size as to permit the installation of a door not less than 90 centimeters (3 feet) in width and not less than 2.00 meters (6 feet, 7 inches) in height. When installed in exit doorways, exits doors shall be capable of opening at least 90 degrees

and shall be so mounted that the clear width of the exitway is not less than 70 centimeters (2 feet, 4 inches). In computing the required exit width, the net dimension of the exitway shall be used.

d) Door Leaf Width. No leaf an exit door shall exceed 1.20 meters (4 feet) in width.

e) Special Doors. Revolving, sliding, and overhead doors shall not be used as required exits.

f) Egress from Door. Every required exit door shall give immediate access to an approved means of egress from the building.

g) Door Identification. Glass doors shall conform to the requirements specified in Section 10.05.05 of the National Building Code of the Philippines. Other exit doors shall be so marked that they are readily distinguishable from the adjacent construction.

Aluminum Windows

a) General Material Requirements

Aluminum windows shall conform to the requirements of ANSI/AAMA 302.9,

ANSI/AAMA A 134.1 and the specifications listed below. Provide windows of combinations, types and sizes indicated or specified. Each window shall consist of a unit including frame, sash, mullions, trim, and anchors, complete. All frame and sash extruded members shall be constructed from 6063-T5 aluminum alloy with a nominal depth of 38 mm (1-1/2") and wall thickness of 3 mm (1/8 inch) for principal members of all solid and tubular shapes. Window unit shall be prime windows of the types specified. Dimensions shown are minimum.

Fixed Glass Aluminum Windows

1) Window frames shall aluminum powder coated finish as shown on the Drawings.

2) Fixed glass shall bereflective tempered glass 10.0 mm thick.

Awning Aluminum Windows

1) Window frames shall be aluminum powder coated finish as shown on the Drawings.

2) Glass shall be reflective tempered glass 10.0 mm thick.

3) Provide each side hinged ventilator with one pair of non-friction-type extension hinges, one sash operator designed to hold ventilator open firmly at any angle up to 90° and one locking handle. Hinges shall have the strength necessary to permanently support the glazed ventilator without twist or sag.

Casement Aluminum Windows

1) Window frames shall aluminum powder coated finish as shown on the Drawings.

2) Glass shall be reflective tempered glass 10.0 mm thick.

3) Provide each side hinged ventilator with one pair of non-friction-type extension hinges, one sash operator designed to hold ventilator open firmly at any angle up to 90° and one locking handle. Hinges shall have the strength necessary to permanently support the glazed ventilator without twist or sag.

Curtain Walls

1) Glass shall be low-e glass 12mm thick.

2) Curtain walls shall have spider clips satin finish to used to secure glass panels to a supporting structure in a curtain wall as shown on the Drawings.

EXECUTION

Wood Doors

a) Wood panel doors shall be of the designs, sizes and thickness as shown on the drawings. Frames shall be set plumbed and true and braced to prevent distortion. Frames in concrete and masonry walls shall be secured by anchor bolts or as shown on the drawings or as directed by the Engineer.

b) Wood panel doors shall be of the types, sizes and thicknesses as shown on the drawings. Top and bottom edges of all interior and exterior doors shall be given a coat of lead and oil priming paint or a coat of water-resistant spar varnish after cutting, fitting and prior to installation in the work. Doors shall be glazed as indicated. Doors shall be primed before glazing.

c) Flush wood doors shall be fabricated such that the entire core and frame assembly shall be bonded to the face veneers with approved type of water resistant adhesives, and cured under controlled heat and pressure. Facing shall be waterproofed plywood or ordinary plywood as shown on the

drawings. Items of finishing hardware specified in other sections of the specifications shall be fitted carefully and attached securely. Care shall be exercised so as not to mar or injure the work.

d) Hinged doors shall be plumbed and fitted accurately allowing 1.5 mm clearance at the jambs and heads and 3.0 mm over thresholds. Clearance at the bottom of the door having no thresholds shall be 9.5 mm. Lock stiles of door 44.5 mm thick and thicker shall be beveled 3 mm. Knob locks and latches shall be installed 1.75 mm from the finished floor to the center of the locks.

Aluminum Doors and Windows and Curtain Walls

a) Fabrication

All frames shall be factory prefabricated in accordance to the designs and dimensions indicated in the Drawings. Minimum metal wall thickness shall be 3mm except glazing beads, moldings, and trim which shall not be less than 1.5mm. Frames that are to receive fixed glass shall have removable glass stops and glazing beads.

Cut, join and fit rails and stiles to hairline joints securely reinforced and joined by means of concealed fastening wherever possible.

Protective Coating: Clean all surfaces and apply a protective coating of clear, water-white methacrylate-type lacquer, resistant to alkaline mortar and plaster immediately after fabrication. Covering shall not chip, peel or flake due to temperature or weather, and shall protect against discoloration and surface damage from transportation, storage, and construction activities. Covering shall be readily removable without affecting the finish. Covering shall either be adhesive paper, waterproof tape, or strippable plastic and may not be removed even after completion of installation.

b) Installation

Set and anchor frames as shown in details and in approved shop drawings.

Set frames plumb and square and brace where necessary to prevent distortion.

Set frames without springing, forcing or distorting the product.

Secure frames in accordance with the manufacturer's instructions.

Wedge clear of masonry all frames set in prepared openings 4.76 mm (3/16") to 6.35 mm (1/4") to allow for caulking. Aluminum louvers can be installed flush-mounted to fit masonry or as free standing barriers or screens.

Protection of aluminum from dissimilar materials:

Aluminum to dissimilar metals: where aluminum surfaces come in contact with metals other than stainless steel, zinc or white bronze of small area, keep aluminum surfaces from direct contact with incompatible metals by the following methods:

1) Painting the dissimilar metal with one coat of heavy-bodied bituminous paint.

2) Applying good quality caulking materials between the aluminum and the dissimilar metal.

3) Drainage from dissimilar metals: Paint dissimilar metals used in location where drainage from them passes over aluminum as specified above, to prevent staining of aluminum.

4) Aluminum to masonry and concrete: Give aluminum surfaces in contact with mortar, concrete, or other masonry materials one coat of heavy-bodied bituminous paint.

5) Adjust all frames and attach hardware before glazing. Secure all windows and doors to be watertight and all hardware operating free and easy.

6) Upon completion and installation, thoroughly clean surfaces of doors and frames in accordance with the recommended procedure of the manufacturer. Do not use abrasive, caustic or acid cleaning agents.

c) Special Installation Procedure for Aluminum Glass Louver Windows

1) Examination

Examine the areas and conditions under which windows are to be installed. Do not begin installation should any condition be found unsuitable until the unsatisfactory conditions have been corrected and are acceptable to the Installer. Proceeding with work will imply acceptance of the conditions by the Installer.

2) Installation

a) Aluminum louver windows in accordance with the manufacturer's instructions and recommendations.

b) Cut frames to dimension, smooth, square, even and neat.

c) Shim window frames about 1/8 inch away from concrete or masonry walls. Coat aluminum surfaces in contact with concrete, masonry or dissimilar metals with bituminous paint or a factory recommended separator to prevent galvanic action. Take care in the application of bituminous paint or separators so that coating is not visible when installation is complete.

d) Cut slats and vanes to exact lengths per manufacturer recommendation. Predrill holes at the ends of vinyl slats for securement to the pivot clips perpendicular to the slat. Clean prior to insertion into the pivot clips. Do not use self drilling screws.

e) Drill holes accurately into the push bar for connection of connecting bar accurately.

f) Miter screen frame corners neatly and assemble using corner reinforcement. Frames shall be square and plumb within the jalousie window.

i. Cut screen fabric to size and install neatly within the frame smooth and taut, without bulges or waves, held snugly in place with the splines. Trim excess fabric.

ii. Roll splines neatly and uniformly rolled into the screen frame. Do not stretch vinyl splines during installation to avoid "shortening" of the spline upon relaxing.
- Securely fasten screen retaining fasteners to the base frame to hold screen frames firmly in place.
- Notch window frames and screen frames as required to provide drainage for entrapped moisture.

Adjustments

a) Adjust all frames and attach hardware before glazing.

b) Secure all windows and doors to be watertight and all hardware operating free and easy.

Cleaning

Upon completion and installation, thoroughly clean surfaces of doors and frames in accordance with the recommended procedure of the manufacturer. Do not use abrasive, caustic or acid cleaning agents.

ITEM 24 : PAINTING

SCOPE OF WORK

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

SUBMITTAL

(a) The Contractor shall submit work method statements with lists of materials to the Engineer for approval twenty eight days before the starting of works. This statement shall include following items:
   (i) Type of paint and manufacturer
   (ii) Manufacturer's specifications
   (iii) Storage and delivery of materials
   (iv) Surface preparation
   (v) Finish painting and drying
   (vi) Touch-up painting, if any
   (vii) Equipment

(b) The Contractor, before placing order for the painting materials, shall submit to the Engineer for approval samples of materials. No placing of orders for material shall be made without his approval.

STORAGE OF MATERIALS

The Contractor shall deliver all material to the site in the original labeled sealed cans and containers, with labels intact and seal unbroken. Paint in thinner shall be stored in accordance with the approved manufacturer's instructions.

MATERIAL REQUIREMENTS

(a) Paint

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

All paint materials shall meet the requirements of the standard specifications of the Standardization Committee on supplies and shall be in accordance with the latest Classification Class "A" of the Institute of Science, Manila, Philippines, and shall be delivered on the work in the original containers, with labels intact and seals unbroken.

Boysen Paint or Davies Paint or equivalent shall be used on all surfaces and certificate of origin and quality shall be submitted to the Owner for inspection and approval before using any of the paint materials.

The use of ready mixed paint may be allowed in this project, provided, however, that such paint is in accordance with the standard Specification No. 13 of the Philippine
Government and that ready mixed plants shall be those listed under "Good Substitutes" only.
Tinting colors for latex shall be the highest grade obtainable. Tinting colors for oil paint shall be color in oil ground in pure linseed oil. Color shall be non-fading. Color pigments shall be used to produce the exact shades of paint which shall conform to the approved color scheme of the building. Except as otherwise noted, color of priming coat shall be white.
All materials to be used in the work shall be stored in a place to be designated by the Owner, and such place shall be kept neat and clean at all times. Any damage on this place and its surroundings shall be rectified. All precautions to avoid danger of fire must be observed by removing oil rags, wastes, etc. from the building at the end of daily work.

EXECUTION

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

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

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

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

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

5. Additional Requirements for Preparation of Surfaces with Existing Coatings
   (a) Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:
   (b) Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D 235. Allow surface to dry. Wiping shall immediately precede the application of the first coat of any coating, unless specified otherwise.

(c) Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.
(d) The requirements specified are minima. Comply also with the application instructions of the paint manufacturer.
(e) Previously painted surfaces, specified to be repainted or damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter.
(f) Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed.
(g) Chalk shall be removed so that when tested in accordance with ASTM D 4214, the chalk resistance rating is no less than 8.

6. Existing Coated Surfaces with Minor Defects
Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings. Remove chalking by sanding so that when tested in accordance with ASTM D 4214.

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

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

All painting shall be done by thoroughly experienced workmen.

Safety regulations shall be adhered to at all times, including the wearing of respirators by persons engaged on assisting in spray painting. Adjacent areas and installation shall be protected by the use of cloths or other approved precautionary measures.
Plain enamel and varnish shall be applied carefully with good clean brushes or approved spraying equipment, except that the initial coat on any surface shall be applied with brush. Sufficient time shall be allowed between coats to assure thorough drying and each coat shall be in proper condition before receiving the next coat.

Sanding and dusting as required shall be performed between coats in varnishing work. Finish coat shall be smooth and free from runs, sags, and other defects. Exterior paint shall not be applied during rainy days. All paint when applied shall provide a satisfactory film and smooth, even surface. Paint shall be thoroughly stirred and kept at a uniform consistency during application. Powdered metallic pigments added at the time of use shall be mixed by adding the powder in small increments to about one-third of the base paint or vehicle, with thorough mixing to obtain a smooth paste. The remainder of the base paint shall then be thoroughly stirred in.

9. Drying
    a. No primer or paint shall be forced to be dried under conditions which will cause cracking, wrinkling, blistering, formation of pores which would detrimentally affect the condition of the paint.
    b. No drier shall be added to the paint unless specified in the approved manufacturer's instructions.
    c. Painted surfaces shall be protected from dust, dirt, and the elements of the weather until dry to the fullest extent practicable.

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

ITEM 25 : ALUMINUM COMPOSITE PANEL

MATERIAL COMPOSITION

Aluminum Composite Panel (ACP) is a lightweight durable panel made of laminated aluminum and polyethylene core compound, coated with an advanced fluorocarbon paint Polyvinylidine Flouride (PVDF) to ensure the excellent durability of the surface finish. It is an excellent material for exterior and interior cladding of new building construction as well as retro fit applications. It also has a high degree of levelness top reserve the fine architectural design and can be roller bended to suit various design shapes. The laminated structure of ACP ensures exceptional strength of the panel.

THICKNESSES: 3mm (Polyester)4 to 6mmPVDF/+Nano

Characteristics

1. Flatness - as the composite material is rigid, the flat surface can be preserved. This is considered a major advantage of ACP.

2. Fire Resistance - ACP are laminated at temperature from 250 to 250 to bond aluminum cover sheets protect the plastic core.

3. Light Weight - as the weight is less than 1/2 to 1/3 of the weight of porcelain enamel, iron, copper stainless and other metal panels consequently it can reduce weight of the building.

4. Durability - ACP is highly resistant to chemical corrosion due to the PVDF coating. The composite material is rigid, resistant to blows, breakage, and pressure and has high bending and breaking strength.

Specifications

I. Aluminum Composite Panel (ACP) must be composed of density polyethylene core sandwiched between two sheets of aluminum.

II. It must be strong, lightweight approximately 5.5 kg/sqm. but must be exceptionally flat.

III. The ACP composition

-Two shees of aluminum
-Front side aluminum roll coated with polyvinylidine fluoride PVDF according to AAMA606.2 requirements

IV. PVDF coating finish adhere to the following standards.

V. Total thickness must be 4.0mm minimum (standard)

VI. Framing must also be made of aluminum to prevent corrosion of the panels.

VII. Aluminum Composite panel supplier must be the same company that will install the framing and will fabricate and install all panels. This is to ensure optimum workmanship. All labor and installation must have a warranty of not less than one year.

Pattern/Finish/Color

A. Panel Color. Black Galaxy or any approved equivalent by the designing Architect.

B. Solid Aluminum Composite Panel: Honeycomb / Circle holes design or any approved equivalent by the designing Architect.

C. Wooden Finish or any approved equivalent by the designing Architect.

SUBMITTAL

A. Product Data

Manufacturer's printed product literature, specifications and data sheets.

B. Shop Drawings

1. Indicate project layout and elevations; dimensions and thickness of panels; connections; details and locations of joints and sealant; methods of anchorage; number of anchors; supports reinforcement; flashings; accessories; materials; and finishes.

2. Indicate proposed joints details providing watertight and structural sound panel system that allows no uncontrolled water penetration on inside face of panel system as determined by ASTME331.

Samples

1. Sample of panel system materials for selection and verification of finishes, colors and sealant colors.

2. Sample of panel assembly.

Test Reports

Certified test reports for ACP from approved independent testing laboratories indicating compliance with specifications for specified performance, characteristics and physical properties.

QUALITY ASSURANCE

A. Fabricator/Installer to be accepted by the manufacturer.

B. Fabricator/Installer to have work similar in scope and size to this project.

C. Take field measurements prior to completion of shop fabrication schedule with construction progress to avoid delay of work. Field fabrication should be allowed to ensure proper fit and keep it to minimum with majority of fabrication being done under controlled shop conditions.

D. Maximum deviation from vertical and horizontal alignment of erected panels should be made.

E. Assume responsibility for components of exterior panel system including but not limited to attachment to sub-construction, panel to panel joinery, panel to dissmilar material joinery and joint seal associated with panel system.

Delivery, Storage and Handling

A. Cover exposed surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to the job site.

B. Leave protective covering in place until final cleaning of building.

C. Deliver materials in (manufacturer's) original sealed packaging.

D. Store panels and accessories in a dry, secure location and protect from weather.

E. Protect finish and edges of panel.

Loading and Unloading

A. Panels must be handled carefully to prevent damage.

B. Panels may buckle if they are not properly supported.

C. A forklift may be used for panels up to 10 feet (3meters) long. However, some means of supporting the panel load over a longer distance form the forks may be used.

PREPARATION

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

Accessories

A. Extrusions, formed members, sheet and plate are in accordance with ASTMB209 and recommendations of Manufacturer's

B. Panel stiffeners are structurally fastened or restrained at ends and secured to rear face of ACP with double-sided tape of sufficient size and strength to maintain panel flatness.

C. Sealant within panel system to conform with Manufacturer's standards to meet performance requirements.

D. Fasteners are not exposed except where unavoidable.

ITEM 26 : PHOTOLUMINISCENT SIGNS AND MARKINGS

SCOPE OF WORK

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

PHOTOLUMINESCENT SIGNS AND PATH MARKERS

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

SUBMITTAL

1. Shop drawings shall be submitted in advance to allow twenty-eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.

2. The Contractor, before placing order for the finishing materials shall submit to the Project In - Charged for approval representative samples of finishing materials. No placing of orders

for material for finishing works shall be made without approval.

MATERIALS

Step Nosing - 75.2mm x 33.2mm - 3060mm, loose insert for hidden fixers.

Handrail Strip - 16mm - 3060mm with foam tape

Path Marker- 3060mm

Guidance Strip -16mm - 3060mm full length with foam tape

Pictogram - 420mm x 230mm /290mm x 162mm sign size

Running Man - 228mm x 102mm sign size

Flag Mount Bracket-162mm sign size

Evacuation Map -210mm x 297mm sign size

Fire Extinguisher Sign -228mm x 102mm sign size

Exit Down Stairs Sign -228mm x 102mm sign size

EXECUTION

INSTALLATION

For versatility the signs and markers can be installed using fixers (screws or rivets), polyurethane adhesive and/or adhesive tapes.

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

ITEM 27 : GANG CHAIRS AND OFFICE FURNITURES

GANG CHAIRS

GANG CHAIRS	UNIT	QUANTITY
1- SEATER GANG CHAIR	set	2
5 - SEATER GANG CHAIR	set	99

SUBMITTAL

Shop drawings for all gang chair for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.

The Contractor, before placing order for the supply shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.

EXECUTION

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

ITEM 28 : HYBRID SOLAR POWER SYSTEM

SCOPE OF WORK

The work shall include the furnishing of all labor, materials and equipment necessary to complete the hybrid solar power system works as shown on the drawings and/or as directed by the PPA Engineer.

The contractor shall submit for approval of the PPA Engineer, brochures/manuals of the following materials listed below to be installed which shall be reviewed by the PPA Engineer. If found satisfactory and in accordance with the standard requirements of PPA, approval shall be given, subject however, to the standard tests as deemed necessary which the proposed hybrid solar power system should pass prior to their delivery at site.

MATERIAL REQUIREMENTS

Hybrid Solar Power System to be used shall be brand new and shall conformed to the following requirements:

2 Size the PV Panel

Total Wp of PV panel capacity needed $= \frac{1957883.20}{3.43} = 570,811.43$

Number of PV panels needed $= \frac{570811.43}{110} = 5,189.19$

say: **5,190.00 modules**

3 Inverter Size

	Factor	W
188258.00	1.25	235322.5

Inverter size should be 235,322.50 W

4 Battery Sizing

Nominal battery voltage 12

Days of autonomy 3

Battery capacity $= \frac{Wh/day \times 3}{0.85 \times 0.6 \times 12} = 959,746.67$ Ah

5 Solar Charge controller sizing

PV module specification

Pm	110 Wp
Vm	16.7 Vdc
Im	6.6 A
Voc	20.7 A
Isc	7.5 A

Solar charge controller rating (4 strings x 7.5 A) x 1.3 = 39 A

So the solar charge controller should be rated 40 A at 12 V or greater

All Electrical accessories shall be inspected by the PPA Engineer to determine their physical conformance with PPA requirements as to dimensions, type, make, markings and acceptance tolerances. Electrical Fixtures not conforming to PPA requirements shall be rejected and replaced.

The Contractor shall guarantee all Electrical accessories against any defects that are attributable to faulty design and manufacture and shall also guarantee their performance under normal working conditions. The guarantee shall be for a minimum period of 12 months from the date of the issuance of the Taking-Over Certificate of the Works. During the period of guarantee, repairs and replacement of defective fixtures and/or material shall be carried by the Contractor at his own expense.

TESTING AND COMMISSION

All Hybrid Solar Power System shall be tested for circuit continuity and shall be tested to assure that it is free from short circuits, accidental grounding of other defects prior to energizing at normal system operating voltage.

The contractor shall then energize the system from their normal power source and confirm that all system are operational as required by the contract documents, prior to final inspection.

At a specific time which shall be determined by the Electrical Engineer, the contractor shall demonstrate that the entire electrical system is operational and will function as required prior to final project acceptance.

GUARANTEE AND CERTIFICATES

Upon completion and before final acceptance of the work, the contractor shall furnish the Engineer a written guarantee stating that all works executed are free from defects on all materials, equipment, fixtures devices and workmanship for a period of one year from the date of written acceptance of the project. Any works of major materials that becomes defective during the period shall be replaced by the contractor at its own expense in manner satisfactory to the Engineer.

The work shall consist of testing and commissioning of electrical works.

ITEM 29 : OVERHEAD DISTRIBUTION SYSTEM

REFERENCES

1) ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
2) ASTM A123/A123M	(2013) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3) ASTM A153/A153M Hardware	(2009) Zinc Coating (Hot-Dip) on Iron and Steel
4) ASTM A36/A36M	(2014) Carbon Structural Steel
5) ASTM A475	(2014) Zinc-Coated Steel Wire Strand
6) ASTM A53/A53M Welded and Seamless	(2012) Pipe, Steel, Black and Hot-Dip, Zinc-Coated,
7) ASTM B232/B232M	(2011) Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR)
8) ASTM B3	(2013) Soft or Annealed Copper Wire
9) ASTM D1654	(2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
10)ASTM D709	(2013) Laminated Thermosetting Materials
11)IEEE 100	(2000) The Authoritative Dictionary of IEEE Standards Terms
12)IEEE C135.22	1988) Zinc-Coated Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction
13)IEEE C2	(2014) National Electrical Safety Code
14)NETA ATS	(2013) Acceptance Testing Specifications for Electrical Power Equipment and Systems
15)ANSI C29.2	(2012) Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type
16)ANSI C29.5	(2002) Wet-Process Porcelain Insulators (Low and Medium Voltage Pin Type)
17)NEMA WC 74/ICEA S-93-639	(2012) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy
18)NEMA/ANSI C29.7	(2002) Wet Process Porcelain Insulators - High-Voltage Line Post Type
19)NFPA 70	(2014) National Electrical Code
20)PEC	(2009) Philippine Electrical Code
21)PNS	(2002) Philippine National Standard
22)RUS 202-1	(2004) List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers
23)UL 467	(2007) Grounding and Bonding Equipment
24)UL 486A-486B	(2014) Wire Connectors
25)UL 510	(2013) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
26)UL 6	(2014) Electrical Rigid Metal Conduit-Steel

DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

SUBMITTALS

1) Product Data
   a) Conductors
   b) Insulators
   c) Concrete poles
   d) Steel poles
   e) Surge arresters
   f) Guy strand
   g) Anchors
2) Design Data
   a) Concrete poles
   b) Steel poles
   c) Power-Installed Screw Foundations
3) Test Reports
   a) Field Test Plan
   b) Field Quality Control
   c) Ground resistance test reports

QUALITY ASSURANCE

1. Regulatory Requirements
   In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Engineer.
   Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70, PEC and IEEE C2 unless more stringent requirements are specified or indicated.
2. Standard Products
   Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2- year period. Where two or more items of the same

class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

3. Alternative Qualifications
   Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.
4. Material and Equipment Manufacturing Date
   Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.
5. Ground Resistance Test Reports
   Submit the measured ground resistance of grounding system. When testing grounding electrodes and grounding systems, identify each grounding electrode and each grounding system for testing. Include the test method and test setup (i.e. pin location) used to determine ground resistance and soil conditions at the time the measurements were made.
   a. Field Test Plan
      Provide a proposed field test plan 15 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

MAINTENANCE

1. Additions to Operations and Maintenance Data
   In addition to requirements of Data Package 5, include the following in the operation and maintenance manuals provided:

   a. Assembly and installation drawings
   b. Prices for spare parts and supply list
   c. Date of purchase

DELIVERY, STORAGE AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

MATERIAL AND EQUIPMENT

Consider materials specified herein or shown on contract drawings which are identical to materials listed in RUS 202-1 as conforming to requirements. Equipment and component items, not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes

which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1.6 mm (1/16 inch) from the test mark. The described test mark and test evaluation shall be in accordance with ASTM D1654 with a rating of not less than 7 in accordance with

POLES

Poles shall be of lengths and strengths indicated.

1. Steel Poles

   Steel poles shall be designed to withstand the loads specified in IEEE C2 multiplied by the appropriate overload capacity factors, shall be hot-dip galvanized in accordance with ASTM A123/A123M and shall not be painted. Poles shall have tapered tubular members, either round in cross-section or polygonal, and comply with strength calculations performed by a registered professional engineer. Calculations shall be submitted in accordance with the design data portion of paragraph entitled "SUBMITTALS." Provide certification, from the manufacturer, that the technical requirements of this specification shall be met. Pole shafts shall be one piece. Poles shall be welded construction with no bolts, rivets, or other means of fastening except as specifically approved. Pole markings shall be approximately 900 to 1200 mm above grade and shall include manufacturer, year of manufacture, top and bottom diameters, length, and a loading tree. Attachment requirements shall be provided as indicated, including grounding provisions. Climbing facilities are not required. Bases shall be of the anchor-bolt-mounted type.

2. Concrete Poles

   Concrete poles shall be designed to withstand the loads specified in IEEE C2 multiplied by the appropriate overload capacity factors. Poles shall be reinforced or prestressed, either cast or spun. Spun poles shall be manufactured by a centrifugal spinning process with concrete pumped into a polished round tapered metal mold. Concrete for spun poles shall have a compressive strength of at least 34.5 MPa at 28 days; steel wire shall have an ultimate tensile strength of at least 827 MPa; and reinforcing bars shall have an ultimate tensile strength of at least 276 MPa. After the high speed spinning action is completed, a spun pole shall be cured by a suitable wet steam process. Spun poles shall have a water absorption of not greater than three percent to eliminate cracking and to prevent erosion. Concrete poles shall have hollow shafts. Poles shall have a hard, smooth, nonporous surface that is resistant to soil acids, road salts, and attacks of water. Poles shall not be installed for at least 15 days after manufacture. Fittings and brackets that conform to the concrete pole design shall be provided. Poles shall conform to strength calculations performed by a registered professional engineer and submitted in accordance with design data portion of paragraph entitled

"SUBMITTALS." Provide certification, from the manufacturer, that the technical requirements of this specification shall be met.

BRACKETS

a) Armless Construction

Pole mounting brackets for line-post or pin insulators and eye bolts for suspension insulators shall be as shown. Brackets shall be attached to poles with a minimum of two bolts. Brackets may be either provided integrally as part of an insulator or attached to an insulator with a suitable stud. Bracket mounting surface shall be suitable for the shape of the pole. Horizontal offset brackets shall have a 5-degree uplift angle. Pole top brackets shall conform to
IEEE C135.22, except for modifications necessary to provide support for linepost insulator. Brackets shall provide a strength exceeding that of the required insulator strength, but in no case less than a 12.5 kN cantilever strength.

HARDWARE

Hardware shall be hot-dip galvanized in accordance with ASTM A153/A153M and ASTM A123/A123M.

INSULATORS

Provide wet-process porcelain insulators which are radio interference free.

a) Line post type insulators: NEMA/ANSI C29.7, 13.2 kV - Class 57-1
b) Suspension insulators: ANSI C29.2 13.2kV-Class 52-1; Quantity per phase, 2 Pin insulators: ANSI C29.5, 13.2kV-Class 55-3.

OVERHEAD CONDUCTORS, CONNECTORS AND SPLICES

Conductors of bare aluminum conductor steel reinforced (ACSR) of sizes and type indicated. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486A-486B shall be used.

a) Aluminum Conductor Steel Reinforced (ACSR) ASTM B232/B232M aluminium
b) Connectors and Splices

Connectors and splices shall be of aluminum alloys for aluminum-composition conductors, and a type designed to minimize galvanic corrosion for copper to aluminum-composition conductors. Aluminum-composition, and aluminumcomposition to copper shall comply with UL 486A-486B.

GUY STRAND

ASTM A475, extra high-strength, Class A or B, galvanized strand steel cable. Guy strand shall be 9.5 mm in diameter with a minimum breaking strength of 68,50 Newton. Provide guy terminations designed for use with the particular strand an developing at least the ultimate breaking strength of the strand.

ROUND GUY MARKERS

Vinyl or PVC material, yellow colored, 2400 mm long and shatter resistant at subzero temperatures.

a) Guy Attachment
Thimble eye guy attachment.

ANCHORS AND ANCHOR RODS

Anchors shall present holding area indicated on drawings as a minimum. Anchor rods shall be triple thimble-eye, 20 mm diameter by 2400 mm long. Anchors and anchor rods shall be hot dip galvanized.

(a) Screw Anchors
Screw type anchors having a manufacturer's rating of not less than100,000 Newton in loose to medium sand/clay soil, Class 6 and extra heavy pipe rod conforming to ASTM A53/A53M, Schedule 80, and couplings conforming to ASME B16.11.

(b) Plate Anchors
Minimum area of 90,000 square mm and rated by manufacturer for 100,000 Newton or more in soils classified as medium dense coarse sand and sandy gravels; firm to stiff clays and silts.

(c) Rock Anchors
Rock anchors having a manufacturer's rating of 100,000 Newton.

GROUNDING AND BONDING

(a) Driven Ground Rods
Provide copper-clad steel ground rods conforming to UL 467 not less than 20 mm in diameter by 3 m in length.

(b) Grounding Conductors
ASTM B3. Provide soft drawn copper wire ground conductors a minimum 22 mm2. Ground wire protectors shall be PVC.

(c) Grounding Connections
UL 467. Exothermic weld or compression connector.

CONDUIT RISERS AND CONDUCTORS

The riser shield shall be PVC containing a PVC back plate and PVC extension shield or a rigid galvanized steel conduit, as indicated, and conforming to UL 6.

INSTALLATION

Provide overhead pole line installation conforming to requirements of IEEE C2 for Grade B construction of overhead lines in light loading districts, NFPA 70 and PE for overhead services. Provide material required to make connections into existing system and perform excavating, backfilling, and other incidental labor. Conside street, alleys, roads and drives "public." Pole configuration shall be as indicated.

ITEM 30 : SEWAGE WASTEWATER TREATMENT FACILITY

GENERAL

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

SCOPE OF WORK

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

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

Aside from equipment supply and commissioning, Contractor shall also provide a full monthly maintenance service plan to clean, maintain, and offer full warranties (parts and effluent quality) to the service equipment for three (3) months

TYPE OF SYSTEM

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

SYSTEM OPERATION

Sewage treatment facility shall be modular and made from compact carbon steel containers package modules with separate steel regulating tanks. The system shall be a complete sewage treatment plant which includes anaerobic, aerobic, membrane bioreactor (MBR) ultra-filtration, sludge, and clean water tanks, as well as circulation pipings and a control room.

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

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

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

EXECUTION

PRODUCTION

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

INSTALLATION

1. General

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

2. Electrical

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

3. Plumbing

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

4. Mechanical Installation

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

FIELD TEST

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

2. Acceptance Test

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

3. Sludge Seeding

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

4. Normal Operations

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

WARRANTY

1. All equipment and installation shall have a one-year warranty from the delivery date for the mechanical parts based on correct installation and maintenance.

2. Within one-year guarantee period, if there is any default of the mechanical parts, Contractor shall deliver the parts for free. If due to incorrect operation caused the mechanical damage, Contractor will replace the parts based on the parts price list.

MONTHLY AFTER SALES SERVICE PLAN

Contractor shall provide a minimum three (3) months free after sales service after installation of STP. The contract is for the full operation and warranty of the sewage wastewater treatment facility.

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

High Effluent Standards

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

Unlimited Warranty While Under Service

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

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

Bi-monthly Technician Visit and Routine Maintenance

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

Monthly Effluent Parameters Report

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

Accumulated Solids Removal and Disposal

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