dispersion offset in the direction of radiation. Wall baffle enclosure shall come equipped with a wall mounting bracket designed to assure a rigid mounting to any flat surfaces.

6. Ceiling Speaker Enclosures

Ceiling speaker enclosure shall be constructed of heavy gauge cold steel with interior undercoating and 38 mm thick high density fibreglass 24 kg per cubic meter. The unit shall be round, square and designed for recessed, surface installations which will be accomplished via standard screw torsion spring flange mounting. Recessed models shall have a rust-preventive, textured black coating and the surface mount unit finished in textured white. Enclosure shall include four triple compound conduit knockouts.

SPEAKER SWITCHING PANEL

1. Selector Switches

Zone control shall be provided for the paging function. The speaker switching panel shall contain at least double-pole, 4, 3 position push button selector switches and shall be rack-mounted, desk mounted, selector switches built in microphone to activate priority relays. Selector switches labelling shall be provided to identify the zones.

2. System Power supply

Power supply shall be provided for priority relays and controls, rack mounted and sized for a capacity equal to 200 percent of the as-built control system, and shall operate at 24 Vdc. Input and output shall be protected to permit Class 2 wiring in accordance with NFPA 70.

AM/FM EQUIPMENT (Optional)

1. AM/FM Tuner

AM/FM tuner shall be rack-mounted and shall as a minimum conform to the following characteristics:

Tuning Range:	AM - 540 to 1605 kHz FM - 88 to 108 MHz
Selectivity:	60 dB on FM 40 dB on AM
Sensitivity:	FM - 1.5 micro volts AM - 2.0 micro volts
Capture Ratio:	1.0 dB
Readout/selection:	Digital
Other features:	Phased Lock Loop (PLL)
Power Requirement:	220-240 Vac, 60Hz

2. AM/FM Antenna

The AM/FM antenna shall be roof-mounted, either combined or suitable for both AM and FM reception or separate AM and FM antennas and shall cover all frequency bands specified for radio tuners. The antenna system shall be coordinated with the TV system and other systems

with antenna communication. The system shall be furnished complete with a transformer, insulators, crossover insulator, cable of proper length, lightning arresters, coupling transformer and divider network at the radio tuners.

COMPACT DISC/DVD PLAYER

Player shall have three beam laser pickup, dual Digital-to-Analog converters, random access and random mode programmable playback. [Player shall have capability to play a minimum of 5, 6 discs automatically. Player shall as a minimum conform to the following:

Frequency:	10 - 20,000 Hz Plus or Minus 1 dB
Signal-to-Noise:	Minimum of 100 dB
Dynamic Range:	Minimum of 96 dB
Total Harmonic Distortion:	Maximum of 0.005% at 1 KHZ
Channel Separation:	Minimum 100 dB at 1 KHZ
Quantization:	Minimum of 18 Bits Linear per channel
Conversion Rate:	Minimum 8 x Oversampling
Disc Size:	5 inch
Power Requirement:	220-240 Vac, 60Hz

CASSETTE TAPE EQUIPMENT (Optional)

The [dual] cassette tape play deck shall as a minimum conform to the following specifications:

Frequency Response:	Plus or minus 3 dB, 20 - 20,000 Hz
Wow and Flutter:	Less than 0.09 percent WRMS
Signal-to-Noise:	74 dB
Noise Reduction system:	Dolby [B] [C] [S] [HX PRO]
Play Head:	Hard Parmalloy
Operation:	Automatic Reverse
Power Requirement:	220-240 Vac, 60 Hz

PRIORITY RELAYS AND CONTROLS

Priority relays and controls required to accomplish operations specified shall be provided. Relays shall be completely enclosed with a plastic dust cover for maximum protection against foreign matter, and shall be plug-in type. Relays shall be provided with a diode wired across the relay coil for transient suppression and shall be installed utilizing factory prewired, rack mounted receptacle strips. Coil shall be maximum 24 volts dc.

SWITCHES AND CONTROLS

1. Radio System Control Switch

The loudspeaker in each room, or group of speakers in a room, shall be provided with a flush program channel selector rotating-switch knob. The switch shall be mounted at location and height above the floor and in accordance with Section 7.5 INTERIOR WIRING SYSTEM. A volume control shall be installed with a switch at each station and shall be of the auto transformer type and set so that the maximum volume is sufficient for the area while not disturbing adjacent areas. If music is turned down or off, the paging signal shall override controls except speakers designated for music only. Each device plate shall be satin finished, corrosion-resisting steel permanently marked to indicate the channel selected.

2. Remote Loudspeaker ON/OFF Switches

Remote switches shall be key-operated, toggle switch 2-pole, wall mounted, single gang type with engraved switch plates finished to match the approved finish of electrical wall switches. Low-voltage priority override relays shall be provided as part of the switches with all wiring to the racks to allow override of the ON/OFF switches for priority announcements.

3. Remote Loudspeaker Volume Controls

Remote volume controls shall be an auto transformer type with detected 3 dB steps and an OFF position. The controls shall be wall mounted in single gang outlet boxes and furnished with engraved switching plates finished to match approved finish of electrical wall switches. Insertion loss of the controls shall not exceed 0.6 dB and the power-handling capacities of the control shall be 10, 35, 75 watts. Low voltage priority override relays shall be furnished as part of these controls with all wiring to the racks to allow override of the volume controls for priority announcements.

EQUIPMENT RACKS

Equipment shall be mounted on 482.6 mm racks in accordance with EIA ANSI/EIA-310-D and located as shown on drawings. Ventilated rear panels, solid side panels, and solid top panels shall be provided. Equipment racks shall be provided with lockable front panels that limit access to equipment. The lockable front shall not cover items that require operator access such as AM/FM tuner, CD/DVD player, or tape player. Rack cooling shall be through [perforations or louvers in front panels to ensure adequate ventilation of equipment] [top rack mounted fan. The racks and panels shall be factory finished with uniform baked enamel over rust inhibiting primer.

CABLES

1. Speaker Cable

Cables shall be of the gauge required depending upon the cable run length. In no case shall cable be used which is smaller than 18 AWG. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than 0.2 mm. Cables shall be jacketed with PVC, Fluor polymer compound. The jacket thickness shall be 0.5 mm minimum.

2. Microphone Cable

Cable conductor shall be stranded copper 20 AWG. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than 0.2 mm. Cable shall be shielded 100% of aluminum polyester foil with a bare 22 gauge stranded soft copper drain conductor. Cables shall be jacketed with PVC, Fluor polymer compound. The jacket thickness shall be 0.5 mm minimum.

3. Antenna Cable

Antenna coaxial cable shall have 75 ohm plus or minus 2 ohm. Attenuation of the coaxial cable span between the antenna and amplifier shall not exceed 2.5 dB at 108 MHz

TERMINALS

Terminals shall be solderless, tool-crimped pressure or type.

SURGE PROTECTION

1. Power Line Surge Protection

Major components of the system such as power amplifiers, mixer preamplifiers, and tuners, shall have a device, whether internal or external, which provides protection against voltage spikes and current surges originating from commercial power sources per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line to neutral) and 350 Volt ac (neutral to ground). Surge protection device shall be UL listed and labelled as having been tested in accordance with UL 1449.

2. Signal Surge Protection

Major components of the system shall have internal protection circuits which protect the component from mismatched loads, direct current, and shorted output lines. Communication cables/conductors shall have surge protection installed at each point where it exits or enters a building.

TELEPHONE INTERFACE MODULE (Optional)

Telephone Interface Module shall provide one way all call paging access from telephone to PA system. Paging shall be accomplished by the building telephone system instruments interconnected to the PA system via an interface module to allow telephone dial up access to the paging amplifier. Interface module shall produce an alert tone in the associated speakers on activation. Telephone interface module shall as a minimum conform to the following specifications:

Impedance:	600 ohms
Frequency response:	100Hz to 10Khz
70V Input Impedance:	200K ohms
Output level:	400mV rms
Input Power Requirement:	12-24Vdc (from power supply)
Access requirement:	Electronic (analog) or IA2 line key (line card required) PABX loop or ground-start trunk port, or dedicated single-line phone.

EXECUTION

INSTALLATION

Equipment shall be installed as indicated and specified, and in accordance with the manufacturer's recommendations except where otherwise indicated. Equipment mounted out of doors or subject to

inclement conditions shall be weatherproofed. The antenna shall be supported at least 1.5 m clear above the roof by means of self supported or guyed mast.

1. Equipment Racks

Racks shall be mounted side by side and bolted together. Items of the same function shall be grouped together, either vertically or side by side. Controls shall be symmetrically arranged at a height as shown. CD/DVD, Cassette & Tuner shall be at a height above the floor as shown.

Audio input and interconnections shall be made with approved shielded cable and plug connectors; output connections may be screw terminal type. All connections to power supplies shall utilize standard male plug and female receptacle connectors with the female receptacle being the source side of the connection. Inputs, outputs, interconnections, test points, and relays shall be accessible at the rear of the equipment rack for maintenance and testing. Each item shall be removable from the rack without disturbing other items or connections. Empty space in equipment racks shall be covered by blank panels so that the entire front of the rack is occupied by panels.

2. Wiring

Wiring shall be installed in rigid steel conduit, intermediate metal conduit, cable trays, or electric metallic tubing as specified in Section 7.5 INTERIOR WIRING SYSTEM. Wiring for microphone, grounding, line level, speaker and power cables shall be isolated from each other by physical isolation and metallic shielding. Shielding shall be terminated at only one end.

GROUNDING

All grounding practices shall comply with NFPA 70. The antenna mast shall be separately grounded. Equipment shall be grounded to the serving panel board ground bus through a green grounding conductor. Metallic conduits serving the equipment shall be isolated on the equipment end with an insulating bushing to prevent noise from being transferred to the circuit. Equipment racks shall be grounded to the panel board ground bus utilizing a #8 conductor. Grounding conductor shall be terminated to the rack using connector suitable for that purpose.

ACCEPTANCE TESTS

After installation has been completed, the Contractor shall conduct acceptance tests, utilizing the approved test procedures, to demonstrate that equipment operates in accordance with specification requirements. The Contractor shall notify the Engineer 14 days prior to the performance of tests. In no case shall notice be given until after the Contractor has received written Engineer approval of the test plans as specified. The acceptance tests shall include originating and receiving messages at specified stations, at proper volume levels, without cross talk or noise from other links or non-designated units.

TRAINING

The Contractor shall conduct a training course for members of the operating and maintenance staff as designated by the Engineer. The training course will be given at the installation during normal working hours for a total of hours and shall start after the system is functionally complete but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operating and maintenance manuals, as well as demonstrations of routine maintenance operations. The Engineer shall be notified at least 14 days prior to the start of the training course.

ITEM 19 : MECHANICAL GENERAL REQUIREMENT

GENERAL

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

WORK DESCRIPTION

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

Specifically the work shall involve the following:

a. To supply, haul, install, wire and make operational the split type packaged/window type air conditioning units including exhaust fans for toilets and kitchen areas as shown on the Drawings.

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

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

SUBMITTALS

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

1. Shop Drawings

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

2. Manufacturer's Data

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

3. Standard Compliance

When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), Air Movement and Control Association, Inc. (AMCA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineers for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization which is competent to perform acceptable testing and is approved by the Owner or his authorized representative. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the reference standards listed. The edition or the revised version of such codes and standards current at the date twenty eight (28) days prior to date of bid submission shall apply. During Contract execution, any changes in such codes and standards shall be applied after approval by the Owner.

4. Codes, Inspection, Permits and Fees

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

1) Philippine National Building Code

2) Regulations of the Local Municipality

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

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

OPERATION AND MAINTENANCE MANUAL

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

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

POSTED OPERATING INSTRUCTIONS

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

SAFETY

1. Rotating Equipment Safety

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

INSTRUCTION TO OWNER'S PERSONNEL

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

DELIVERY AND STORAGE

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

STANDARD PRODUCTS/SERVICE AVAILABILITY

1. Materials and Equipment

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

2. Experience Required

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

3. Alternative Service Record

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

4. Service Record

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

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

SAFETY REQUIREMENTS

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

MANUFACTURER'S RECOMMENDATIONS

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

ELECTRICAL REQUIREMENTS

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

ELECTRICAL MOTORS

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

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

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

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

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

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

CHANGES IN WORK DUE TO APPROVAL OF ALTERNATE MATERIALS

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

GUARANTEE

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

AS-BUILT DRAWINGS

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

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

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

QUALITY ASSURANCE

1. Surveys and Measurements:

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

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

2. Drawings and Minor Modification:

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

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

c. Materials and Workmanship

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

ITEM 20 : UNITARY AIR-CONDITIONING SYSTEMS

GENERAL

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

GENERAL REQUIREMENTS

1. Unitary Air-Conditioning System

Air conditioning units in retail stores shall be supplied and installed by the tenant. Capacity of equipment shall not be less than that indicated. In the NFPA standards and SMACNA manuals referred herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. Reference to the "authority having jurisdiction" shall be interpreted to mean the Engineer.

2. Refrigerant Piping, Fittings and Accessories

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

a. Piping

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

b. Tubing

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

3. Corrosion Prevention

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

film thickness of the factory coating or paint system applied on the equipment shall be not less than film thickness used on the test specimen.

4. Safety Standards

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

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

MATERIAL REQUIREMENTS

UNITARY AIR-CONDITIONING SYSTEMS - SPLIT TYPES

1. General

The air-conditioning systems shall be designed, constructed, and rating tested in accordance with ARI Standard 210 for unitary air-conditioning equipment of capacities below 135,000 Btu's per hour and ARI Standard 300 for unitary equipment with capacities of 135,000 Btu's per hour and greater. Units shall be ARI certified. Units with capacities below 135,000 Btu's per hour shall be listed in the ARI Directory of Certified Unitary Air-Conditioners.

2. Performance Rating

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

3. Air Conditioners, Ceiling Cassette Type

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

4. Compressors

Provide hermetic, semi-hermetic rotary, or screw type provided with all the minimum standard equipment and accessories listed therein. Compressor speed for compressors above 20 tons shall not exceed 1750 rpm. Provide compressors with automatic capacity reduction of at least 50 percent for units over 10 tons. Compressors shall start unloaded. Provide each compressor with devices to protect the compressor from short-cycling when shut-down by safety controls. Provide a pump-down cycle of the non-recycling start type for each compressor 20 tons and over. Provide compressors with vibration isolators. Compressor motor shall be suitable for electric power characteristics as indicated. Motor shall conform to NEMA NG-1. Motor starters shall conform to NEMA ICS. Motors shall be

constant speed, squirrel-cage induction, open type or hermetically sealed, low starting current, high-torque type, and shall be furnished with reduced voltage or and magnetic across-the-line type motor starter with weather-resistant enclosures

5. Coils

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

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

6. Filter Boxes

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

7. Mixing Boxes

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

8. Controls

   a. Condenser Controls

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

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

9. Refrigerant Circuits

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

10. Corrosion Protection

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

COOLING COILS

1. Direct-Expansion Coils

Direct-expansion coils shall be fin-and-tube type constructed of seamless copper or aluminum tubes and copper or aluminum fins mechanically bonded or soldered or helically wound to tubes. Casing and tube support sheets shall be not lighter than 16-gauge (0.0635-inch nominal thickness) galvanized steel, formed to provide structural strength. Suction header shall be seamless copper tubing or seamless or resistance welded steel tube with copper connection. Supply header shall consist of a distributor to distribute the refrigerant liquid through seamless copper tubing, equally to all the circuit in the coil. Tubes shall be circuited to insure minimum pressure drop and maximum heat transfer. Circulating shall permit refrigerant flew from liquid inlet to suction outlet without causing oil staging or restricting refrigerant flow in coil. Rack coil shall be tested at the factory under water at not less than 300 psi air pressure and shall be suitable for 200 psi working pressure. Each coil shall be completely dehydrated and scaled at the factory upon completion of pressure tests. Coil shall be mounted for counter flow service.

2. Filters

Filter shall be of the sectional or panel cleanable type and be capable of filtering the entire air supply.

3. Manometers

Provide inclined-type manometers for filter stations of 2,000 cfm capacity or larger including filters furnished as integral parts of air handling units and filters installed separately. Manometers shall be of sufficient length to read at least one inch of water column, shall be graduated in 1/10 inches, and equipped with spirit level. Equip each manometer with over-pressure safety traps to prevent loss of oil, and two three-way vent valves for checking zero setting.

CLEANING, PAINTING AND IDENTIFICATION

Cleaning, painting and identification of piping shall be as specified under, "Painting" of "Building Works".

IDENTIFICATION TAGS AND PLATES

Provide equipment, thermometers, valves, and controllers with tags numbered and stamped for their use. Plates and tags shall be of brass or suitable non-ferrous material, securely mounted or attached. Minimum letter and numeral size shall be 1/8 inch.

EXECUTION

INSTALLATION

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

1. General

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

2. Unitary 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 ductwork passes through exterior walls.

FIELD TESTS AND INSPECTIONS

1. Tests

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

2. Leak Testing

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

3. Evacuation, Dehydration, and Charging

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

4. Start-Up and Operation Tests

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

5. Performance Tests

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

6. Sound Tests, 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 21 : EXHAUST EQUIPMENT

EXHAUST EQUIPMENT

GENERAL

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

SCOPE OF WORK

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

PRODUCTS

MATERIAL REQUIREMENTS

1. Bathroom Ceiling Mounted Exhaust Fan

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

2. Wall Mounted Propeller Exhaust Fan

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

EXECUTION

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

ITEM 22 : FIRE DETECTION AND ALARM SYSTEM

GENERAL

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

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition or the revised version of such codes and standards current at the date twenty eight (28) days prior to date of bid submission shall apply. During Contract execution, any changes in such codes and standards shall be applied after approval by the Owner.

1. Factory Mutual Engineering and Research Corporation (FM)
   FM P7825 (2005) Approval Guide Fire Protection

2. National Fire Protection Association (NFPA)
   NFPA 70 (2005) National Electrical Code
   NFPA 72 (2002) National Fire Alarm Code
   NFPA 90A (2002) Installation of Air Conditioning and Ventilating Systems
   NFPA 101 (2002) Life Safety Code

3. ~~Institute of Integrated Electrical Engineers (IIEE) PEC (2000) Philippine Electrical Code~~

4. Underwriters Laboratories Inc. (UL)
   UL 268 (1996; Rev thru Oct 2003) Smoke Detectors for Fire Alarm Signalling Systems
   UL 514A (2004) Metallic Outlet Boxes
   UL 514B (2004) Fittings for Conduit and Outlet Boxes
   UL 864 (2003; Rev Thru Oct 2003) Control Units and Accessories for Fire alarm Systems
   UL 464 (2003; Rev Thru Oct 2003) Audible Signal Appliances
   UL 1242 (2000; Rev thru May 2003) Intermediate Metal Conduit
   UL 1971 (2000; Rev thru May 2004) Safety Signalling Devices for the Hearing Impaired
   UL 521 (1999; Rev thru Oct 2002) Heat Detectors for Fire Protective Signalling Systems

DESCRIPTION OF WORK

The work includes providing new interior fire alarm system including material, tools, equipment, installation, and testing necessary for and incidental to the provision of a complete and usable standard system conforming to the applicable requirements of PEC, NFPA 70, NFPA 72, NFPA 90A, and NFPA 101, and this specification. Materials and equipment to be furnished under this contract shall be essentially the current design products of manufacturers regularly engaged in production of such equipment and shall be listed by the Underwriters' Laboratories, Inc. in the UL FPED, or approved by Factory Mutual System and listed in FM P7825.

SUBMITTALS

Submit the following.

1. Shop Drawings

   a. System layout

b. System wiring diagrams

c. Conductor wire marker schedule

2. Product Data

a. Control panel and modules

b. Batteries

c. Battery charger

d. Manual pull stations

e. Smoke detectors

f. Duct smoke detectors (Optional)

g. Audio/Visual/Alarm horns

h. Graphic annunciator panel

i. Wiring

j. Conduit

k. Outlet boxes

l. Fittings for conduit and outlet boxes

Data which describe more than one type of item shall be clearly marked to indicate which type the Contractor intends to provide.

Submit one original for each item and clear, legible, first generation photocopies for the remainder of the specified copies. Incomplete or illegible photocopies will not be accepted. Partial submittals will not be accepted.

3. Test Reports

4. Preliminary testing

5. Final acceptance testing

Submit for all inspections and tests specified under paragraph entitled "Field Quality Control."

6. Certificates

a. Qualifications of installer

b. Qualifications of system technician

7. Operation and Maintenance Data

a. Fire alarm system

8. Closeout Submittals

a. System as-built drawings

QUALITY ASSURANCE

1. Qualifications of Installer

The Contractor or installer shall have satisfactorily installed fire alarm systems of the same type and design as specified herein. Prior to commencing fire alarm system work, submit data showing that the Contractor or installer has satisfactorily installed three fire alarm systems of the same type and design as specified herein within the past three years. For each system installed, submit the following:

a. A detailed summary of the type and design of the system;

b. The contract name or number, completion date of the project and total cost of the system;

c. The name and telephone number of the facility or installation for which the work was performed;

2. Manufacturer's Representative

Provide the services of a representative or technician from the manufacturer of the system, experienced in the installation and operation of the type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of the system and to provide instruction to Owner representative.

3. Qualifications of System Technician

Installation drawings, shop drawings and as-built drawings shall be prepared by, or under the supervision of, a qualified technician. Qualified technician shall be an individual who is experienced with the types of work specified herein. Contractor shall submit data showing the name and certification of the technician at or prior to submittal of drawings.

4. Drawing Requirements

a. System Layout

Submit shop drawings of the system layout showing locations of initiating devices and alarm horns. Show wire color coding, wire counts, and device wiring order.

b. System Wiring Diagrams

Submit complete wiring diagrams of the system showing points of connection and terminals used for all electrical connections in the system. Show all modules and lamps in the control panel.

c. System As-Built Drawings

Upon completion, and before final acceptance of the work, furnish to the Engineer 4 complete sets of as-built drawings, including complete as-built circuit diagrams, of each the system. The as built drawings shall be as the contract drawings and with title block similar to contract drawings.

MAINTENANCE

1. Spare Parts

Furnish the following spare parts:

a. Five (5) complete sets of system keys
b. One (1) of each type of audible and visual alarm device installed
c. Two (2) of each type of fuse required by the system
d. One (1) spare zone modules for modular type control panels in addition to those installed in the panel
e. Two (2) of each type of heat detector installed
f. Tow (2) of each type of smoke detector base and head installed

2. Manuals

Submit operation and maintenance data manuals. The manual shall include: circuit drawings; wiring and control diagrams; installation instructions; maintenance instructions; safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list.

MATERIAL REQUIREMENTS

SYSTEM DESIGN

1. Operation

Provide a complete, electrically supervised, zoned, annunciated, fire alarm system as described herein, and as shown on the drawings. Provide separate circuits from the control panel to each zone of initiating devices as specified herein.

a. Fire Alarm Signal Initiation

Operation shall be such that actuation of any:

1) Manual station
2) Smoke detector

Shall cause all of the following actions:

a) All building evacuation alarm devices Audio/visual alarm horns to operate continuously;
b) The annunciators to properly register;

All operations shall remain in the alarm mode until the system is manually restored to normal.

b. Monitoring Integrity of Installation Conductors

All system circuits shall be electrically monitored for integrity including the following:

1) Initiating circuits.

2) Evacuation alarm circuits

3) Battery power supply low and no voltage across the standby battery terminals and open battery circuit. Provide Class A initiating device circuits, and Class A notification device circuits as defined by NFPA 72. For Class A circuits, provide separate conduits for

outgoing and return (redundant) conductors as required by NFPA 72. A ground fault condition or single break in any other circuit shall cause operation of the system trouble signals. Loss of AC power, abnormal AC voltage, a break in the standby battery power circuit, or low battery voltage shall also cause operation of system trouble signals. The abnormal position of any switch in the control panel shall also cause operation of the system trouble signals. Audible and visual equipment for supervision of the AC power supply shall be energized from the auxiliary DC power supply and vice versa. Trouble signals shall sound continuously until manually silenced or the system has been restored to normal.

c. Walk-Test Mode

Provide system with walk-test mode to allow one person to test alarm and supervisory features of initiating devices. Walk-test mode shall be enabled from the control panel by authorized service personnel. Control panel shall display a unique visual indication when system is in walk-test mode. If testing ceases while in walk-test mode, after a preset delay system shall automatically return to normal standby mode.

d. Alarm Verification Feature

System shall have a smoke detector alarm verification feature. Upon activation of any area smoke detector, system shall institute an alarm verification process prior to enabling of the alarm functions as specified herein. Activation of any initiating device other than an area smoke detector shall cause immediate enabling of system into alarm mode. If an alarm input from a smoke detector on the initial zone in alarm is present at the end of an initial delay period not exceeding 20 seconds, all alarm functions as specified herein shall be immediately enabled. If a smoke detector alarm input is not present at the end of the initial delay period, a second-stage confirmation period of one minute shall be initiated. If a smoke detector alarm input is received during the second-stage confirmation period, all alarm functions shall be immediately enabled. During the verification process, activation of any area smoke detector on any zone other than the initial zone in alarm shall also cause system to go into alarm mode immediately. If no smoke detector alarm input occurs within the second-stage confirmation period, system shall reset to normal. Any alarm input received from an area smoke detector after the second-stage confirmation period has elapsed shall cause system to institute a new verification process.

2. Primary Power

Primary power source shall be 240 volts AC service, transformed through a two winding isolation type transformer and rectified to 24 volts DC for operation of all initiating device, notification device signalling line and trouble signal. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the rated output of the system power supply modules. Obtain AC operating power as shown on contract drawings. Provide an independent enclosed circuit breaker with provisions for locking the cover and operating handle in the "POWER ON" position. Paint the enclosure red and identify it by the lettered designation "FIRE ALARM SYSTEM POWER".

3. Auxiliary Power

Provide secondary DC power supply for operation of system in the event of failure of the AC source. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and shall not cause transmission of a false alarm.

a. Storage Batteries

Provide sealed lead calcium or sealed lead acid or batteries and charger. Dry cell batteries are not acceptable. House batteries in the control panel. Provide batteries of adequate ampere-hour rating to operate the system, including audible trouble signal devices, and under supervisory conditions for 60 hours, at the end of which time batteries shall be capable of operating the entire system in a full

alarm condition for not less than 15 minutes. Provide calculations substantiating the battery capacity. Provide reliable separation between cells to prevent contact between terminals of adjacent cells and between battery terminals and other metal parts.

b. Battery Charger

Provide completely automatic high/low charging rate type capable of recovery of the batteries from full discharge to full charge in 24 hours or less. Provide a trouble light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided. House charger in the control panel.

COMPONENT DESIGN

1. Control Panel

Control Panel shall comply with the applicable requirements of UL 864. Provide modular type panel installed in a surface mounted steel cabinet with hinged door and cylinder lock. Mount with panel centerline 1.5 m above finished floor elevation. Switches and other controls shall not be accessible without the use of a key. The control panel shall be a neat, compact assembly containing all parts and equipment required to provide specified operating and supervisory functions of the system.
Each control panel component shall be UL listed or FM approved and approved by the control panel manufacturer for use in the control panel. Panel cabinet shall be finished on the inside and outside with factory-applied enamel finish. Provide main annunciator located on the exterior of the cabinet door or visible through the cabinet door. Provide audible trouble signal. Provide permanent engraved rigid plastic or metal identification plates, or silk screened labels attached to the rear face of the panel viewing window, for all lamps and switches. Provide panel with the following switches:

a. Trouble silencing switch which silences audible trouble signals without extinguishing trouble indicating lamps. For non-self resetting type switch, upon correction of the trouble condition, audible signals will again sound until the switch is returned to its normal position. For silencing switch of the momentary action, self resetting type, the trouble signal circuit shall be automatically restored to normal upon correction of the trouble condition.

b. Evacuation alarm silencing switch which when activated will silence all alarm notification devices without resetting the panel, and cause operation of system trouble signals. Subsequent alarms from additional zones not originally in alarm shall cause activation of the notification devices even with the alarm silencing switch in the "silenced" position.

c. Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of the system and zone trouble signals.

d. Reset switch which when activated will restore the system to normal standby status after the cause of the alarm has been corrected, and all activated initiating devices reset. Operation of reset switch shall restore activated smoke detectors to normal standby status.

e. Lamp test switch.

f. Drill switch which will enable test of notification devices and restoration to normal.

1) Graphic Annunciator Panel (Optional)

Provide panel located as shown. Mount with panel centreline 1.5 m above finished floor elevation. Panel shall be of the interior type, surface-mounted. Panel shall be provided with the building floor plan, drawn to scale, with alarm lamps mounted to represent the location of each initiating device. Panel graphic shall also show the locations of the control panel, and shall have a "you are here" arrow showing its location. Orient building floor plan on graphic to location of person viewing the

graphic, i.e. the direction the viewer is facing shall be toward the top of the graphic display. Provide a North arrow. Lamps shall illuminate upon activation of corresponding device and shall remain illuminated until the system is reset. Panel shall have a lamp test switch.

2. Manual Pull Stations

Provide noncoded single action type with mechanical reset features. Stations shall be surface semi-flush mounted and interior type as indicated. For surface mounting provide station manufacturer's approved back box. Back box finish shall match station finish. Equip each station with a terminal strip with contacts of proper number and type to perform functions required. Stations shall be a type not subject to operation by jarring or vibration. Break-glass-front stations are not permitted; however, a pull-lever break-rod type is acceptable provided presence of rod is not required to reset station. Station color shall be red. Station shall provide visible indication of operation. Restoration shall require use of a key. Keys shall be identical throughout the system for all stations and control panel. Mount stations with operating lever not more than 1.2 m above finished floor.

3. Smoke Detectors

Provide smoke detector in accordance with NFPA 101, Life Safety Code. Provide detectors designed for detection of abnormal smoke densities by the photoelectric principle. Detectors shall be 4-wire type. Provide necessary control and power modules required for operation integral with the control panel. Detectors and associated modules shall be compatible with the control panel and shall be suitable for use in a supervised circuit. Malfunction of the electrical circuits to the detector or its control or power units shall result in the operation of the system trouble signals. Each detector shall contain a visible indicator lamp that shall flash when the detector is in the normal standby mode and shall glow continuously when the detector is activated. Each detector shall be the plug-in type with tab-lock or twist-lock, quick disconnect head and separate base in which the detector base contains screw terminals for making all wiring connections. Detector head shall be removable from its base without disconnecting any wires. Removal of detector head from its base shall cause activation of system trouble signals. Each detector shall be screened to prevent the entrance of insects into the detection chambers.

a. 4-Wire Smoke Detectors (Optional)

Detector circuits shall be of the 4-wire type whereby the detector operating power is transmitted over conductors separate from the initiating circuit. Provide a separate, fused, power circuit for each smoke detector initiating circuit (zone). Failure of the power circuit shall be indicated as a trouble condition on the corresponding initiating circuit.

b. Photoelectric Detectors (Optional)

Operate on the light scattering principle using a LED light source. Detector shall respond to both flaming and smoldering fires. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268.

c. Detector Spacing and Location

Detector spacing and location shall be in accordance with the manufacturer's recommendations and the requirements of NFPA 72, except provide at least two detectors in all rooms of 54 square meters or larger in area. In no case shall spacing exceed 9 by 9 m per detector, and 9 linear m per detector along corridors. Detectors shall not be placed closer than 0.9 m from any air discharge or return grille, nor closer than 300 mm to any part of any lighting fixture.

4. Notification Devices

Provide in accordance with NFPA 72 and as indicated. Do not exceed 80 percent of the listed rating in amperes of any notification device circuit. Additional circuits above those shown shall be provided if required to meet this requirement. Effective sound levels shall comply with NFPA 72. Provide devices in addition to those shown if required in order to meet NFPA 72 sound level requirements.

a. Alarm Horns

Surface-mounted vibrating type suitable for use in an electrically supervised circuit and shall have a sound output rating of at least 90 decibels at 3 m, when tested in accordance with UL 464 while emitting a slow whoop tone.

b. Visible Devices

Surface-mounted assembly of the stroboscopic type suitable for use in an electrically supervised circuit and powered from the notification device circuits. Devices shall provide a minimum of 75 candela measured in accordance with UL 1971, but in no case less than the effective intensity required by NFPA 72 for the device spacing and location shown. Lamps shall be protected by a thermoplastic lens and labeled "FIRE" in letters at least 12 mm high. Provide visible devices within 300 mm of each audible appliance and as indicated. Visible devices may be part of an audio-visual assembly. Where more than two devices are located in the same room or corridor, provide synchronized operation.

5. Conduit

a. Intermediate Metal Conduit (IMC) UL 1242, zinc-coated steel only.

6. Outlet Boxes UL 514A, zinc-coated steel.

7. Fittings for Conduit and Outlet Boxes UL 514B, zinc-coated steel.

8. Wiring

NFPA 70, PEC and NFPA 72. Wire for 240V circuits shall be 3.5 mm^2 minimum copper conductors. Wire for low voltage DC circuits shall be 2.0 mm^2 minimum copper conductors Insulation shall be 75 degree C minimum with nylon jacket. Color codes all wiring.

EXECUTION

INSTALLATION

Installation shall be in accordance with the requirements of NFPA 70, PEC NFPA 72 and NFPA 90A. Each conductor used for the same specific function shall be distinctively color coded. Each function color code shall remain consistent throughout the system. Use colors as directed by the Engineer. All wiring shall be in steel conduit. All circuit conductors shall be identified within each enclosure where a tap, splice or termination is made. Conductor identification shall be by plastic coated self sticking printed markers. The markers shall be attached in a manner that will not permit accidental detachment. Control circuit terminations shall be properly identified. Wire devices so that their removal will activate system trouble signals. Pigtail or "T" tap connections are prohibited. Wiring for DC circuits shall not be permitted in the same conduit or tubing as wiring for AC circuits. Paint all junction box covers red or provide them with permanent labels reading "FIRE ALARM CIRCUIT." Provide a written schedule of conductor markings identifying each wire marker, the purpose, the origin, and termination point of each conductor. The conductor wire marker schedule shall be turned over to the Engineer at the time of preliminary testing with as built drawings.

1. Additional Installation Requirements

Pull all conductors splice free. Make all conductor connections under screw terminals. Provide insulated barrier type terminal strips at junction points. Use of wire nuts, crimped connectors, or twisting of conductors is prohibited. All control panels shall be dressed out in a professional manner with all wires running in the vertical or horizontal plane, cut to exact length, making all turns at 90 degree angles, and tightly bundled and wire wrapped. Conduit may not enter the top of control panel cabinet.

FIELD QUALITY CONTROL

1. Preliminary Testing

Notify Engineer prior to performing preliminary testing. Contractor shall conduct the following tests during installation of wiring and system components. Any deficiency pertaining to these requirements shall be corrected by the Contractor prior to final acceptance testing of the system. Record results of testing. Submit all test results to the Engineer.

a. Operation of Entire System. Operate all initiating and indicating devices.

b. Operation of Supervisory Systems: Operate all portions to demonstrate correctness of installation.

c. Smoke Detector Test: Clean the smoke detectors in accordance with the manufacturer's recommended procedures. Test smoke detectors using magnet-activated test switch, manufacturer provided test card, or smoke. Use of aerosol sprays to test smoke detectors is prohibited.

2. Final Acceptance Testing

The Contractor shall notify the Engineer when the system is ready for final acceptance testing. Request scheduling for final acceptance testing only after all necessary preliminary tests have been made and all deficiencies found have been corrected to the satisfaction of the equipment manufacturer's technical representative and the Engineer and written certification to this effect has been received by the Fire Protection Engineer. The system shall be in service at least 15 calendar days prior to final acceptance testing. The Contractor shall allow at least 15 calendar days between the dates final testing is requested and the date the final acceptance testing takes place. The Contractor shall furnish all equipment, instruments, devices and personnel for this test. The system shall be tested for approval in the presence of representatives of the manufacturer, the Engineer, and the Fire Protection Engineer. All necessary tests shall be made including the following, and any deficiency found shall be corrected and the system retested.

a. Entire System

Test the entire system by operating all fire alarm initiating, notification, and signalling devices. Perform tests with the system operating on primary power and repeat the test with the system operating on battery power only. Provide necessary equipment to test smoke detectors and heat detectors.

b. Supervisory Systems

All aspects of the supervisory functions of the systems shall be operated. Introduce faults in each circuit at random locations as directed by the Fire Protection Engineer. Verify proper trouble annunciation at the control panel.

3. Additional Tests

When deficiencies, defects or malfunctions develop during the tests required, all further testing of the system shall be suspended until proper adjustments, corrections or revisions have been made to assure proper performance of the system. If these revisions require more than a nominal delay, the Engineer shall be notified when the additional work has been completed, to arrange a new inspection and test of the fire alarm system. All tests required shall be repeated prior to final acceptance, unless directed otherwise.

ITEM 23 : PLUMBING AND SANITARY WORKS

SCOPE OF WORK

The work covered for this section shall consist of furnishing all labor, tools, equipment, materials and incidentals necessary for the complete installation, testing and operation of the plumbing and sanitary system within the buildings and premises in accordance with these Specifications and as shown on the drawings or as directed by the Engineer. The septic tank and their effluent and discharge pipelines shall be part of other section of these specifications.

MATERIAL REQUIREMENTS

SUBMITTAL

1. The Contractor shall submit his work method statement with necessary shop drawings to the Engineer for approval twenty eight (28) days before the start of the works.

   Shop drawings shall be dated and shall contain the name of the project and location of the subject item in the shop drawing which h is to be installed.

   The Engineer will review and approve or return for correction all shop drawings with reasonable promptness. The Contractor shall make any corrections required and file with the Engineer three (3) corrected copies of the shop drawings.

2. The drawings shall indicate the general arrangement of all pipings, however, where actual conditions necessitate re-arrangement in opinion of the Contractor and/or the Engineer, the Contractor shall prepare and submit to the Engineer for approval, twenty eight (28) days before placing the order for materials, shop drawings of the proposed re-arrangement. Because of the small scale of the drawings, shop drawings to indicate all offsets, fittings and accessories shall be prepared. The Contractor shall carefully examine the drawings and shall carefully investigate actual structural and finish conditions affecting all his work.

3. The Contractor shall be responsible for the proper fitting of materials, equipment and accessories without substantial alteration and at no cost to the Employer.

4. The Contractor shall be responsible for the proper coordination of the work and shall provide all necessary clearance where necessary.

STANDARDS

Use of materials shall further be governed by other requirement imposed on other sections of these Specifications. Materials shall be subject to tests necessary to ascertain their fitness if the Engineer so requires. All works shall comply with the pertinent provisions of the Plumbing Code of the concerned city or town, the Code on Sanitation of the Philippines, and/or the National Plumbing Code of the Philippines.

MATERIALS

1. Identification of Materials

   Each length of pipe, fittings, traps, fixtures and devices used in the plumbing work shall have cast, stamped or indelibly marked on it, the approved manufacturer's trademark or name, the weight, type and class of product when so required by the standards mentioned above.

2. Alternative Materials

Use of any material not specified in this Specification may be allowed provided such alternate has been approved by the Engineer and provided further that a test, if required, shall be done by an approved agency in accordance with generally accepted standards.

3. Soil, Waste, Drain, Vent Pipes and Fittings

Soil, waste and vent pipes shall be unplasticized Polyvinyl Chloride (uPVC) pipes. Diameter shall be as indicated on the Drawings. It shall conform to ASTM D 1784 or ASTM D 2729.

Drainage pipes shall be reinforced concrete pipes (RCP), diameter shall be as indicated on the Drawings.

4. Jointing Material

The joint material for uPVC pipes shall be PVC solvent cement as recommended by the approved pipe manufacturer.

5. Water Supply Pipes

Water supply pipes shall be polypropylene random-80 (PPR-80) pipes PN 20 conforming to DIN Standards DIN 1988/DIN 8078, German made. Jointing shall be fusion welded.

6. Cleanouts, Plugs and Tee

Cleanouts shall be of the same material as the pipe to be fitted. Cleanouts installed in connection with uPVC hubs and spigot pipes shall consist of a long sweep quarter bend of ¼ as shown on the drawings.

7. Pipe Sleeves

Pipe sleeves shall be installed and properly secured in place at all points where pipes passes through masonry or concrete. Pipe sleeves shall be uPVC pipe, Schedule 40.

8. Downspout

All downspout shall be unplasticized polyvinyl chloride (uPVC) pipe class DWV conforming to ASTM D2729 or ASTM D1784 for sanitary pipes, Series 1000.

9. Splash Block

Provide splash blocks at the outlet of downspout emptying at grade which shall be made of pre-cast concrete, with smooth finished counter sunk dishes sloped to drain away from the building. Dimensions as shown on the Drawings.

10. Roof Strainers

The Contractor shall provide fittings and install 100mm G.I. mesh wire strainers where shown or indicated on the drawings and/or where the Engineer directs. Each strainer shall fit the size of the corresponding downspout which is to be installed.

11. Shower, Floor and Urinal Drain

Shower and floor drains shall be made of stainless steel non-tilting grate, perforated or slotted. Urinal drains shall be cast iron dome type drain.

12. Pipe hangers, Inserts and Support

a. Pipe hangers shall be wrought iron, malleable iron pipe hangers spaced not over 1.5meters apart for uPVC pipes and 3.0meters apart for iron pipes. Chain straps, perforated bars or wire hangers will not be permitted.

Hangers shall have short turnbuckles or other approved means of adjustment. Turnbuckles may be omitted on hangers where space does not permit their use. Trapeze hangers may be used in lieu of separate hangers for pipes running parallel to each other and close together.

b. Inserts shall be of cast iron or cast steel and shall be of a type to receive a machine bolt head or nut after installation.

c. Wrought iron clamps or collars shall be used to support vertical runs of pipes.

13. Unions

Union pipe 50mmØ and smaller shall be malleable iron. Union on water piping 63mmØ and larger shall be flanged pattern and shall be of galvanized (zinc coated) cast iron. Gaskets for flange unions shall be of best quality fiber plastic or leather.

14. Valves

Valves shall be cast bronze of brass body. Chrome plated finish for all fixture taps and faucets and natural finish for all others, like hose bibbs, gate valves and which are not tapped directly to a plumbing fixture. Concrete valve boxes shall be installed where required and will be of sufficient size for operating the valve.

15. Fixtures

a. Water Closets

All water closets for toilets as shown on the drawings shall be TANK TYPE, white with complete fittings and mounting accessories.

b. Lavatories

b. 1. Lavatory (Wall Hung)

Shall be vitreous china, wall hung lavatory with rear overflow holes, fitting ledge suitable for single faucet holes on centers complete with faucet, standard fittings, trap and lavatory brackets and other accessories.

b. 2. Lavatory (Countertop Lavatory)

Shall be vitreous china, oval or round shaped countertop lavatory with front overflow hole, complete with faucet, supply valve and fittings with P-trap. Fitting ledge suitable for single hole on center.

c. Urinals

c. 1. Urinals for all comfort buildings shall be built-in urinal trough as shown on the drawings.

c. 2. Urinals shall be vitreous china, wall-hung washout urinal, flushing rim, integral trap, 19mm top and shall be provided with water saving flush system.

d. Service Sinks

Service sinks where indicated or shown on the Drawings shall be stainless steel, with single bowl and with complete U.S. or Japan imported fittings.

e. Slope Sinks

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

Hose bibb shall be of brass finish.

f. Soap Holder

Soap holder and toilet paper holder shall be vitreous china, wall mounted. All toilet/bath rooms will be provided with soap holder, toilet paper holder and chrome plated towel racks.

g. Faucet for lavatory

Faucet for lavatory shall be in chrome-finish.

h. Bath and shower fitting

Bath and shower fitting shall be chrome-finish.

i. Towel Rail

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

j. Curtain rod

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

k. Grab Bar

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

l. Bidet Spray Combination

Installed in every cubicle near on the water closet, colored white or its equivalent

16. Concrete, Reinforcing Steel, Pipe and Steel Plate

Materials for wash pits, catch basins and manholes shall conform to the requirements as follows:

a. Concrete materials shall conform with the requirements in "Concrete Works" and shall be Class C concrete with a 28-day minimum compressive strength of 21 MPa (3,000 psi).

b. Reinforcing steel shall be as shown on the drawings and shall conform with the requirements of reinforcing steel bars in "Concrete Works."

c. Pipes shall be as shown on the drawings and shall comply with the relevant item of the particular pipe.

d. Steel plates shall be as shown on the Drawings and shall comply with Section "Steel and Metal Works".

17. Non-reinforced Concrete Pipe

Non-reinforced concrete pipe shall be as shown on the Drawings and shall conform with the requirements of non-reinforced concrete pipes AIC latest edition. Concrete shall be with a 28-day minimum compressive strength of 20.7 MPa.

18. Valve for Drinking Fountain

Valve where drinking fountain will be connected shall be polished brass pipe and shall have red enameled handle.

EXECUTION

All installation works shall be in conformity with the National Plumbing Code of the Philippines (NPCP).

EXCAVATION, TRENCHES AND BACKFILLING

1. Trenches for all underground pipelines shall be excavated to the required depth. The bottom of trenches shall be tamped hard and graded to secure the required fill. Bell holes shall be excavated so that pipes will rest on solid ground for their entire length.

Rocks where encountered, shall be excavated to a depth of 150mm below the bottom of the pipe and before the pipe is laid, the space between the bottom of the pipe and the rock shall be filled with sand. Sewer and water pipes shall be laid in separate trenches.

2. After pipelines have been tested, inspected and approved by the Engineer and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris.

Materials for backfilling shall consist of acceptable excavated soil, borrow of sand, gravel or other materials approved by the Engineer and shall be free from trash, lumber or other debris. Backfilling shall be placed in horizontal layers not exceeding 150 mm in thickness and properly moistened to approximate optimum requirements. Each layer shall be compacted by hand or machine tamper or by other suitable equipment to a density that will prevent excessive settlement or shrinkage.

Backfilling shall be brought to a suitable elevation above grade to provide for anticipated settlement and shrinkage thereof.

Water pipes shall have a sand cushion 150mm below and above the pipes.

INSTALLATION OF SOIL, WASTE DRAINS OR VENT PIPES

1. Horizontal Drainage Pipe and Vent Piping

Horizontal waste pipes 75mmØ and smaller shall have a minimum grade of 6.5mm per 0.30m and for 100mmØ and larger, 3.2mm per 0.30m. All main vertical soil and waste stacks shall be extended full size above the roof line as vents, except where otherwise specifically shown.

Where practicable, two (2) or more vent pipes shall be connected together and extended as one pipe through the roof. Vent pipes in roof spaces shall be run as close as possible to the underside of roof with horizontal piping pitched to stacks using fittings as required without forming traps in pipes.

Vertical pipe vents may be connected to a vent line carrying other fixtures. The connection shall be at least 1.20m above the floor on which the fixtures are located to prevent the use of vent lines as waste. Horizontal waste lines receiving the discharge from two (2) or more fixtures shall be provided with vents, unless separate venting of fixtures is noted.

2. Fittings

All changes in pipe sizes on soil waste lines shall be made with reducing fittings or recessed reducers. All changes in direction shall be made by the appropriate use of forty five (45) degree wyes. Long sweep quarter bends or elbows may be used in soil and waste lines where the change in direction of flow is from the horizontal to the vertical and on the discharge from water closets.

Where it becomes necessary to use short radius fittings in any location, the approval of the Engineer shall be obtained before they are installed.

3. Joints

a. PVC Soil Pipe

All joints in uPVC soils, waste and vent pipe shall be accomplished by the use of PVC solvent cement.

b. All joints for uPVC shall be accomplished by applying the manufacturer's recommended solvent before connection to the pipe.

4. Cleanouts

Cleanouts at the bottom of each soil stack, waste stack and where else indicated shall be the same size at the pipe.

Cleanouts on floors shall be by uPVC plug adapter fit into the hub and fitted with uPVC screw plugged flush with the floor.

Cleanout shall be provided at every change in direction greater than 45 degrees.

5. Flashings

All pipes passing through the roof shall be provided with lead flashings. All flashings shall be built to 40 lbs. bituminous felts and shall extend up to the pipe and down-over to top of pipe at least 150mm and along the roof not less than 300mm and shall lap over flashing to make a weatherproof joint.

6. Traps

Each fixture and piece of equipment requiring connections to the drainage system, except fixtures with continuous waste shall be equipped with a trap. Traps shall be specified to be supplied with the fixtures. Each trap shall be placed as near to the fixtures as possible. Traps installed on threaded pipes shall be recessed drainage pattern.

7. Pipe Sleeves, Hangers and Supports

Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through masonry or concrete except unframed floors on earth.

Pipes shall not be permitted to pass through footings or beams unless noted on the drawings.

Pipe sleeves in floors shall extend not less than 25mm and not more than 50mm above the finished floor. After installation of the pipe, the space around the pipe shall be packed with plastic material and made watertight. Flashing shields for sleeves passing through waterproofing membrane shall be thoroughly mopped into the membrane. The space between the pipe and sleeves shall be made watertight by inserting approved sealing and caulking materials.

INSTALLATION OF WATER PIPES, FITTINGS AND CONNECTIONS

1. Gate Valves and Outlets

Gate valves shall be installed close to the point of connection to the existing service line outside the building. The piping shall be extended to all fixture outlets and equipment from the gate valves. Outlets where indicated shall be capped or plugged and left ready for future connections.

2. Mains, Branches and Runouts

All runs of piping shall be installed as shown on the drawings. The piping shall be cut accurately to measurements, and installed at the building site by the Contractor and shall be worked into place without springing or forcing. Care shall be taken not to weaken the structural portions of the buildings.

All pipes above ground shall be run parallel with the lines of the building unless otherwise shown on the drawings. Branch pipes from service lines may be taken off on top of mains, bottom of mains or side of mains, using such cross over fittings as may be required by structural or installation conditions.

All service pipes, valves and fittings shall be kept at sufficient distance from the other work to permit finished covering not less than 6.5mm from such other work and not less than 13mm between finished covering on different services. No water piping shall be buried in floors unless specifically indicated on the drawings or approved. Changes in pipe sizes shall be made with reducing fittings.

The use of long screws and bushings is prohibited.

3. Joints

Joints and connections in the plumbing system shall be gas-tight and watertight for the pressures required by test.

After cutting and before threading all pipes shall be reamed and shall have burrs removed.

All screwed joints shall be applied with an approved graphite compound or TEFLON tape to facilitate connections. Threads shall be full cut and not more than three threads on the pipe shall remain exposed.

Caulking of threaded joints or top to prevent leaks shall not be permitted.

Unions shall be provided where required for disconnection. Threaded swing bolts shall be used for branch connections to risers and mains.

4. Unions

Where required unions shall not be concealed in walls, ceilings or partitions.

5. Tests

The following tests shall be conducted by the Contractor at his expense under the supervision of the Engineer.

a. Tests for Drainage and Venting System

The entire drainage and venting system shall have necessary openings plugged to permit the entire system to be filled with water to the level of the highest vent stack above the roof. The system shall hold the water for 30 minutes with a drop not greater than 100mm.

b. Sterilization

The entire water supply piping system shall be sterilized with a solution containing not less than fifty (50) parts per million of available chlorine, either liquid chlorine or a solution of sodium hypochlorite. The sterilizing solution shall remain in the system for a period of not less than 8 hours during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chloride content is not more than 0.2 parts per million.

c. Pressure Test for Water Lines

1. After the pipe have been installed, the joints completed and with joints exposed for examination, all newly installed pipe or any valve section, thereof, shall be subjected to hydrostatic pressure one and one half (1½) the designed working pressure of the system or as specified by the Engineer.

2. The duration of each pressure test shall be at least 20 minutes unless otherwise specified by the Engineer.

3. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. During the filling of the pipe and before applying the test pressure, all air shall be expelled from the pipeline. To accomplish this, tap shall be made if necessary, at the highest point of the pipe under test and after completion of the test, the taps shall be tightly plugged unless otherwise specified. During the test, all exposed pipes, fittings, valves, joint and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound materials at

his expense. The test shall then be repeated until satisfactory results are obtained.

d. Leakage Test for Water Lines

1. Leakage test shall be conducted after satisfactory completion of the pressure test and shall consist of an examination of all exposed joints for leakage as well as an overall leakage test of the completed pipeline.

2. The pressure to be maintained during the test shall be the designed working pressure of the system.

3. Leakage test shall be made only after a minimum of 24 hours after the pipe to be tested has been filled with water.

4. The duration of each leakage test shall be two hours unless otherwise specified by the Engineer.

5. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation shall be applied by means of a positive displacement type pump and reservoir connected to the pipe in a manner satisfactory to the Engineer.

6. Before starting the leakage test, all air shall be expelled from the pipe. All exposed pipes, fittings, valves and joints shall be examined for leakage during the test.

7. Allowable leakage rate per 100 joints per inch of Pipe Diameter at Pressure Stipulated.

PRESSURE		LEAKAGE RATE	
psi	kg/cm^2	liters/hr.	liters/2 hrs.
50	3.50	1.45	2.90
75	5.30	1.75	3.50
100	7.00	2.05	4.10
125	8.80	2.30	4.60
150	10.50	2.50	5.00
200	14.00	2.90	5.80

e. Defective Work

1. If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated until satisfactory to the Engineer.

2. All repairs to piping shall be made with new materials at the expense of the Contractor.

3. No caulking of screwed joints or holes will be accepted.

ASSEMBLY, INSTALLATION AND CONNECTION OF FIXTURES

Fixtures shall be supported and fastened in a satisfactory manner. Where secured to concrete or masonry work walls, fixtures and equipment shall be fastened with brass bolts or machine screws in lead-sleeve type anchorage units or with brass expansion bolts. Expansion bolts shall enter 7.5 cm into solid concrete or masonry works and shall be fitted with loose tubing or sleeves of proper

length to bring expansion sleeves into the solid concrete masonry walls.

Where wood screws are used, screws shall go into solid pieces set between studs. Where through-bolts are used, bolts shall be provided with plates or washers at back set, so that they will be concealed by plaster. Bolts and nuts shall be hexagonal and exposed nuts, cap nuts, and screw heads shall be provided with chromium plated brass washers.

PROTECTION OF FIXTURES

Pipe openings shall be closed with caps or plugs during installation. Fixtures shall be tightly covered and protected against dirt, water and chemical injury. At the completion of all works, all fixtures shall be thoroughly cleaned and delivered in a condition satisfactory to the Engineer.

FIXTURES AND FASTENING

All fixtures shall be supported and fastened in a satisfactory manner as follows:

1. Where secured to concrete or concrete hollow block walls, they shall be fastened with one quarter inch brass bolts with twenty threads to the inch and of sufficient length to extend at least 7.5 cm into solid concrete or hollow block work, fitted with loose tubing or sleeve insert and shall be securely anchored and installed flush with the finished wall and shall be completely concealed when the fixtures are installed.

2. Where through-bolts are used, they shall be provided with plates or washers back set so that heads, nuts and washers will be concealed by plaster. Bolts and nuts shall be hexagonal. Exposed bolts, nuts, capnuts and screw heads shall be provided with chromium plated brass washers.

GUARANTEE

Upon completion and before final acceptance of the equipment installation, the Contractor shall furnish the Engineer a written guarantee stating that all equipment installed under this Section free from defects. The guarantee shall be for a period of one (1) year from the date of final acceptance of the work. Any part of the equipment that becomes defective during the term of the guarantee shall be replaced, renewed and/or made good by the Contractor, at his own expense and in a manner satisfactory to the Engineer.

Guarantees made by the approved manufacturers or suppliers beyond one year, shall be transferred to PPA without any expense on his part.

CLEANING UP

Upon completion of the work, all parts of the installation shall be thoroughly cleaned of grease, metal cuttings and sludge which may have accumulated during the testing operation.

PLUMBING, FIXTURES AND TOILET ACCESSORIES INSTALLATION

All installation works shall be as shown on the drawings and shall conform to the applicable standards set forth by the National Plumbing Code of the Philippines. All fixtures shall be fastened and/or supported in accordance with the given requirements.

ITEM 24: 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 20 cubic meters per day. Scope of work includes the installation of all components of the system including all pipings (approximately 105 meters), lift pumps, blowers, built-in 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 place the STP equipment underground of at least 100mm compacted gravel and soil below.

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

Total surface area space to be used below ground (STP only) shall be no more than 7m x 2.5m (L x W).

TYPE OF SYSTEM

The STP shall be utilizing biological conventional activated sludge (CAS) plus Membrane Bio-Reactor (MBR) technology in order to fully treat all the sewage water from toilets and kitchen of the Benoni Port facilities. The STP shall treat the sewage water as to meet the new DENR DAO 2016-08 and new DAO 2021-19 effluent standards.

No.	Parameters	unit	Effluent Limits (Class SB Levels)
1	Ammonia as NH_3-N	mg/L	3.0
2	BOD	mg/L	30
3	COD	mg/L	60
4	Color	TCU	100
5	Nitrate as NO_3-N	mg/L	20
6	pH (Range)	-	6.0-9.0
7	Phosphate	mg/L	2
8	Surfactants (MBAS)	mg/L	3
9	Temperature	°C change	3
10	Total Suspended Solids	mg/L	70
11	Oil & Grease	mg/L	5
12	Fecal Coliforms	MPN/100mL	200

SYSTEM OPERATION

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

Wastewater shall convey by gravity from the septic tanks to the sewage treatment facility approximately one hundred One Hundred Five (105) meters in total from three (3) septic tanks. Sanitary PVC pipe shall be use in the sewerage network.

The sewage water will then enter the STP built-in regulating tank. Float switches will indicate when the regulating tank is full and lifting pumps will then pump the sewage water from the regulating tank into initially the anoxic then aerobic tank to start nitrification/denitrification process via the biological treatment components (CAS) using air blowers and an air distribution system. It will then be treated using the membrane bio-reactor tanks (MBR) in the ultra-filtration range to filter out suspended solids, colloidal material, sewage microbes, and bacteria. Circulating reflux pumps within the system will ensure the MLSS levels are in check. MBR shall have automatic backwashing function using oxalic acid or hydrochloric acid.

The sewage water shall be treated at twenty (20) operating hours in day and then be discharged to the designated nearest drainage point approx. fifteen (15) meters away from the unit.

The Contractors scope of work shall include the excavation for the laying of the pipe lines and installation of underground tank. Pipe lines excavations shall be deep enough for a six (6) inches UPVC pipes according to local standards (please see detail at the construction plans).

MATERIAL REQUIREMENTS

CONTAINER STEEL HOUSING

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

REGULATING TANKS

The regulating tanks shall be built-in with the STP in one compact tank. This tank shall be no less than eight (8) cubic meters in volume with measurements of 2m x 2.0m x 2m (L x W x H).

LIFTING PUMPS

Four submersible lifting pumps shall be placed in each septic tanks powerful enough to transport sewage water from the passenger facility to the STP. The minimum power of each pump shall be no less than 0.75kw. Float switches shall also be provided to allow for automatic switching of the lift pumps.

A submersible lifting pump shall be placed also inside the clean water tank of the STP to provide clean water transportation to the discharge point. This pump shall have a minimum of 0.75kW power.

PIPES

Contractor shall supply and install the pipings for the STP system made from UPVC material three (3) inches in diameter with the minimum thickness of 2.3mm. The pipe lines shall be rated at minimum Mpa 1.0 of pressure. Total length of pipelines from the three (3) septic tanks to the STP and to the discharge point is approximately 105 meters.

SEWAGE TREATMENT FACILITY REQUIREMENTS AND MATERIALS

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

AIR BLOWERS

Two steel housed air blowers with at least 1.3kW of power each. One blower shall be operational while the other on standby at any given time. Each air blower shall automatically alternate in operations as to balance the usage.

AIR DISTRUBUTION SYSTEM

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

MEMBRANE CARTRIDGES

The membranes shall be Polyvinylidene Fluoride (PVDF) hollow fiber material in the ultrafiltration range. Cartridges shall be housed in stainless frame with easy access for inspection. Minimum lifetime of membranes shall be four (4) years included in the warranty.

The membrane shall utilize a permeate pump with a minimum of 0.37kW power to transfer the pre-filter water into the clean water tank. There shall also be a 0.55kW backwash pump to provide automatic back wash cleaning of the membranes using oxalic acid.

CIRCULATION PUMPS

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

BIO MEDIA

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

CONTROL ROOM

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

EXECUTION

PRODUCTION

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

INSTALLATION

1. General

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

2. Electrical

Electrical supply shall be provided by the end user using 220v, 1-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 STP container shall be placed underground. A crane with minimum of 10 tons lifting capacity shall be provided by Contractor.

FIELD TEST

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

2. Acceptance Test

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

3. Sludge Seeding

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

4. Normal Operations

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

WARRANTY

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

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

3) Warranty repairs or replacements does not include travel and accommodation of technician or engineer and shall be charged to the client.

MONTHLY AFTER SALES SERVICE PLAN

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

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

High Effluent Standards

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

Unlimited Warranty While Under Service

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

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

Bi-monthly Technician Visit and Routine Maintenance

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

Monthly Effluent Parameters Report

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

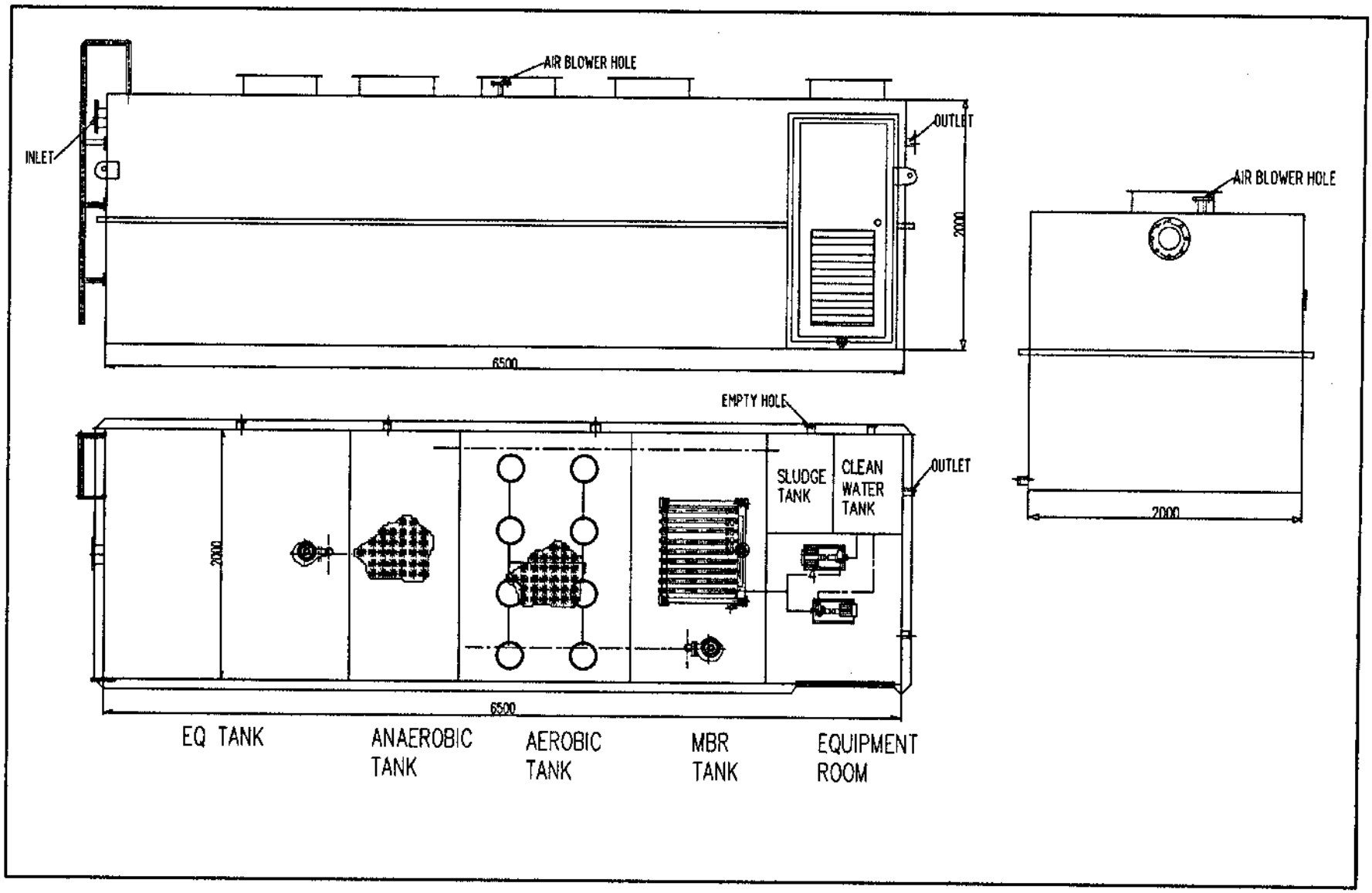
Accumulated Solids Removal and Disposal

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

EFFLUENT STANDARDS

The entire sewage treatment facility shall pass the DENR DAO 2016-08 and new DAO 2021-19 Class SB level effluent standards in accordance with the Clean Water Act 2004.

See attached drawings for details of the wastewater treatment plant.


AIR BLOWER HOLE
INLET
OUTLET
2000
6500
AIR BLOWER HOLE
2000
EMPTY HOLE
SLUDGE TANK
CLEAN WATER TANK
OUTLET
2000
6500
EQ TANK
ANAEROBIC TANK
AEROBIC TANK
MBR TANK
EQUIPMENT ROOM

ITEM 25 : WATER PUMPS AND PRESSURE TANK

GENERAL

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete supply of water pump and pressured tank for the building as indicated on the drawings and as specified herein.

Pressure Tank/ Water Pump

PRESSURE TANK

1. Tank Volume: 119 gallons/ 450 liters
   Diameter: 66 cm.
   Height: 153 cm.
   Connectors: 1 ¼ inches
   Pressure: 125 psi

WATER PUMP

1. Location: Ground Floor (Pump House)
   Description: Constant pressure booster pump
   Function: Booster pump
   Power: 2.0 hp.
   Flowrate: 80 gpm @ 115 ft. tdh
   Specs: 220 / 230 volts, 60 HZ, 3500 RPM

EXECUTION

All materials will be delivered and installed on site.

ITEM 26 : FINISHES

GENERAL

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

SCOPE OF WORK

The work covered by this section consists of furnishing all labor, materials, equipment, tools, and incidentals necessary to undertake, complete all finishing works as indicated on the drawings and as specified herein.

Wall, floor, ceiling and other finishing works shall include but are not limited to the following:

WALLS

Exterior

a. Plain cement finished painted with elastomeric paint.

Location as shown in the plans and elevations.

Interior

a. Plain cement finished painted with elastomeric paint.

b. 300mm x 600mm Ceramic Wall Tiles

c. 12mm thick Fiber cement board on light steel frame. (For drywall works)

Locations are shown in the plans and elevations.

Stud: 75 mm (3 inches)
3.00 meter length

Track: 75 mm (3 inches)
3.00 meter length

Board: 1.20 x 2.40 x 12mm fiber cement

Fiber Cement Surfaces

SUBMITTALS

a. Manufacturer's product data for each type of product specified.

b. Samples

(1) 300 mm x 300 mm 2 sets of required mock up.

(2) Miscellaneous product samples such as joint tapes and compounds.

Application and Finishing

1. Apply and finish fiber cement panels as per specifications by manufacturer for flush-jointed.

b. Install fiber cement panels in manner which minimizes the number of end-butt joints or to avoid where possible.

c. Install exposed fiber cement panel with face side out. Do not install imperfect, damages or damp boards. Bat boards together for slight contact at edges and ends with not more than 1.5 mm open space between boards. Do not force into place.

d. Locate either edge or end joints over supports, except in horizontal applications where intermediate support is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered ends. Do no place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

e. Attach fiber cement panel for supplementary framing and blocking provided for additional support at openings and cutouts.

f. Space fasteners in fiber cement boards in accordance with referenced application and finishing standard and manufacturer specifications

Methods Panel Application

a. Follow specifications by manufacturer.

~~b. Install fiber cement panel as follows, and as indicated on the drawings.~~

c. Apply fiber cement panels to supports as follows:

Fasten to steel framing with adhesive and supplementary screws as per recommendation by manufacturer.

Finishing of Fiber Cement Boards

a. Apply to joint treatment at fiber cement panels joints (both ~~directions);penetrations; fasteners head, surface defects and~~ elsewhere as required to prepare works for decoration.

b. Finish fiber cement panels as per recommendation by manufacturer.

Protection

a. Provide final protection and maintain conditions, in a manner suitable to installer that ensures, fiber cement panel construction being without damage or deterioration at time of substantial completion.

Plain Cement Finish

a. Surface Preparation

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 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 3mm 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 re-plastered in a satisfactory and approved manner.

Painting Works

a. Surface Preparation

Allow new masonry to dry for 14 days (for exterior surfaces) to 28 days (for interior surfaces) under normal conditions before painting. Surface to be painted should be clean and dry, free from oil, grease, dirt, dust, contaminants, and all loose grit and mortar.

Without mesh:

1st Coat: Elastomeric Wall Covering Sealer

2nd and 3rd Coat: Elastomeric Wall Covering Basecoat

4th Coat: Elastomeric Wall Covering Topcoat

With mesh:

1st Coat: Elastomeric Wall Covering Sealer

2nd Coat: Elastomeric Wall Covering Basecoat
Reinforcing Membrane: Fiberglass Matting

3rd and 4th Coat: Elastomeric Wall Covering Basecoat

5th Coat: Elastomeric Wall Covering Topcoat

Wall Ceramic Tiles

a. Wall tiles shall be glazed ceramic tiles color as per Architect's approval.

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

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

FLOORS

F1 600mm x 600mm Floor Tiles ; Unglazed Ceramic Finish
Ground Floor:

a. Pre-departure Area
b. Security Inspection Area
c. Rentable Spaces Area
d. Ballistic Room
e. PPA Cashier Booth
f. Terminal fee Booth
g. Ecumenical Rooms (He/ She)
h. Play Lot
i. Electrical Room
j. Clinic
k. Nursing/Diaper Changing Area
l. Port Police Office
m. Right Side Stairwell Lobby
n. Ticket Booths

Second Floor:

a. Lounge
b. Administration and Finance Office
c. Conference Room
d. Audio Visual Room
e. Terminal Manager's office
f. Terminal Manager's Quarters
g. Female Dormitory
h. Male Dormitory
i. Guest Rooms 1 and 2
j. Common Area / Recreational Room
k. Mess Hall and Kitchen
l. Supply Room
m. Pantry
n. Storage/Janitor Room
o. Electrical Room
p. Hallway

Roof Deck / Third Floor:

a. Viewing Room
b. Storage Room
c. Electrical Room

Locations are shown in the plan.

F2 600mm x 600mm Floor Tile; Non – Slip Ceramic Tile Finish
Ground Floor:

a. Entrance Porch
b. Out Going Passenger Exit Platform

c. Right Stairwell
d. Left Stairwell
e. Fire Exit

Second Floor :
a. Right Stairwell
b. Left Stairwell
c. Fire Exit

Roof Deck / Third Floor:
a. Viewing Room
b. Storage Room

Locations are shown in the plan.

F3 600mm x 600mm Floor Tile; Unglazed Ceramic Tile Finish
Ground Floor:
a. Male Toilet
b. Female Toilet
c. PWD Toilet
d. All – Gender Toilet
e. Public Toilet
f. Port Police Toilet

Second Floor :
a. Male Toilet
b. Female Toilet
c. Office Toilet
d. Terminal Manager's Toilet and Bath
e. Female Dormitory Toilet and Bath
f. Male Dormitory Toilet and Bath
g. Guest Room 1 Toilet and Bath
h. Guest Room 2 toilet and Bath

Roof Deck / Third Floor:
a. Male Toilet
b. Female Toilet

Locations are shown in the plan.

F4 Non Skid/ Rough Cement Floor Finish Embedded with Aluminum Flat Bar

a. All Ramps
Locations are shown in the plan.

F5 Waterproof Coating Cement Based

a. Roof Deck Area

Waterproof finish for all toilets.

Locations are shown in the plan.

F6 Rough Cement Floor Finish

a. Perimeter Sidewalk

Locations are shown in the plan.

a. Floor tiles shall be color varies and as shown on the drawings or to be designated by the Architect.

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

c. 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.

EXECUTION

Floor 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 20mm 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 4mm 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 beveled 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, 0.7mm to 1.6mm thick, shall be troweled or brushed over the setting bed and/or the back of the tile, or a thin layer of Portland cement, 0.79mm to 2mm 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.

Ceiling

1. Interior

1. C1 - 600mm x 1200mm x 0.70mm Aluminum Clipped-in Perforated Panels, Bone White or of Equivalent

Ground Floor:
a. Pre Departure Area
b. Security Inspection Area
c. Ecumenical
d. Rentable Spaces Area

Second Floor:
a. Administration and Finance Office
b. Mess Hall and Kitchen

Roof Deck/ Third Floor:
a. Right Stairwell

b. Left Stairwell
c. Lounge

Locations are shown in the plan.

2. C2 - 600mm x 600mm x 0.70mm Aluminum Clipped-In Perforated Panel, Bone White or Approved Equivalent

Ground Floor :
a. Play Lot
b. Nursing / Diaper Changing Area
c. Clinic
d. Terminal Fee Booth
e. PPA Cashier
f. Port Police Office

Second Floor :
a. Recreational Area
b. Audio Visual Room

Locations are shown in the plan.

3. C3 - 12mm thk. Gypsum Board Painted on 0.40 mm thk. Galvanized Steel Ceiling Suspension System @ 0.40 m o.c. (Furring), 0.60 m o.c. (Carrying Channel) and 1.20 m o.c. Bothways (Suspension Rod)

Ground Floor :
a. Electrical Room
b. PWD Toilet
c. All Gender Toilet
d. Male Toilet
e. Female Toilet
f. Ballistic Room
g. Foot Bath Washing Area
h. Port Police Toilet
i. Right Stairwell Lobby
j. Ticketing Booths

Second Floor :
a. Lounge
b. Male Toilet
c. Female Toilet
d. Supply Room
e. Conference Room
f. Office Toilet
g. Terminal Manager's Quarter
h. Terminal Manager's Toilet
i. Male Dormitory
j. Female Dormitory
k. Male Dormitory Toilet and Bath

l. Female Dormitory Toilet and Bath
m. Guest Rooms 1 and 2
n. Guest Rooms Toilet and Bath
o. Hallway
p. Storage/Janitor Room
q. Electrical Room

Roof Deck/ Third Floor:
a. Viewing Room
b. Pantry
c. Storage Room
d. Electrical Room
e. Male Toilet
f. Female Toilet

Locations are shown in the plan.

4. C4 – Exposed Steel Trusses
   a. Covered Driveway

Locations are shown in the plan.

5. C5 - 600mm x 1200mm x 0.40mm Aluminum Composite Panel

Ground Floor Area:
a. Entrance Canopy
b. Out Going Passenger Exit Porch
c. Underside of Left Stairwell Roofing
d. Underside of Right Stairwell Roofing

Locations are shown in the plan.

6. C6 – Painted Underside of RC Slab

Ground Floor:
a. Drop Off Area
b. Left Fire Exit Porch

Second Floor:
a. Spiral Stair Underside
b. Left Fire Exit Porch
c. Canopies

Locations are shown in the plan.

7. C7 – 0.4mm thk. Pre-Painted Ribbed type Spandrel Metal Ceiling

Third Floor:
a. Roof Canopy

Locations are shown in the plan.

SUBMITTAL

1. 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.

2. The Contractor, before placing an 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.

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

GRANITE TILES

a. Black granite slabs for toilet countertops, fascia, and splashboard. Dimensions as shown on the drawings.

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

c. Color, veining and quality shall be approved by Engineer.

d. Veining shall run vertically on all vertical surfaces and direction of veining shall continue in same directions over horizontal surfaces except as directed by the Engineer.

e. Sealer

e. 1. Shall be a commercial penetrating type free from harmful alkali or acid content specially prepared for marble work
e. 2. Shall have a Ph factor between 7 and 9
e. 3. Shall not discolor
e. 4. Shall produce a slip resistant surface
e. 5. Shall have a flash point not less than 35 °C

f. Cleaning fluid

f. 1. Shall be commercial neutral liquid type especially prepared for marble work
f. 2. Shall have a Ph factor between 7 and 9
f. 3. Shall be free from crystallizing salts or water-soluble alkaline salts
f. 4. Shall be biodegradable and phosphate free

INSTALLATION OF DOORS / GLASS PANELS

1. Surface Preparation

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

DOORS

D-1 - 1.5mm thk. Aluminum Framed Powder Coated Finish W/ 10mm thk. Reflective Tempered Glass Double Swing Door (1.70m x 2.15m)

D-2 - 1.5mm thk. Aluminum Framed Powder Coated Finish W/ 10mm thk. Reflective Tempered Glass Sliding Door w/ Fixed Type Window And Fixed Type Transom Window (4.115m x 2.65m)

D-3 - 1.5mm thk. Aluminum Framed Powder Coated Finish W/ 10mm thk. Reflective Tempered Glass Double Swing Door with Fixed Type Transom Window (1.60m x 2.60m)

D-4 - 6.3mm Thk. Wire Glass on GA. 18 Metal Door with Mineral Core (1.0m x 2.15m)

D-5 - 6 mm Thk. Marine Plywood Flush Type Door In Quick Drying Enamel Finish With Stainless Sheet Kick Plate (As Per Bp 344) (1.0m x 2.15 m)

D-6 - Marine Plywood Finish Door in Quick Drying Enamel Finish w/ 8mm thk Clear Glass (0.90m x 2.15m)

D-7 - Frameless 12 Mm thk. Clear Glass Door (0.90m X 2.15m)

D-8 - 6 mm Thk. Marine Plywood Flush Type Door in Quick Drying Enamel Finish (0.80m X 2.15m)

D-9 - 6 mm Thk. Marine Plywood Flush Type Door in Quick Drying Enamel Finish (0.90m X 2.15m)

D-10 - Marine Plywood Finish Flush Door in Quick Drying Enamel Finish With Louver At The Bottom Portion (0.80m x 2.15m)

GLASS PANEL
(Including Door Schedules In Dimension)

GP – 1 - 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (5.675m x 2.15m)

GP – 2 - 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (3.825m x 2.15m)

GP – 3 - 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (3.260m x 2.15m)

GP – 4 - 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (± 3.125m x 2.15m)

GP – 5 - 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (2.625m x 2.15m)

GP – 6 - 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (± 2.140m x 2.15m)

GP – 7 - 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (± 1.88m x 2.15m)

GP – 8 - 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (1.36m x 2.15m)

GP – 9 - 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (1.20m x 2.15m)

GP – 10- 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (0.82m x 2.15m)

GP – 11- 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (0.775m x 2.15m)

GP – 12- 12 mm thk. Clear Tempered Glass Partition Curtain Wall Framed at the Back Wood Grain Finish on Aluminum (± 0.53m x 2.15m)

INSTALLATION OF WINDOWS

1. Surface Preparation

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

W-7 - 1.5 Mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (4.10m x 1.75m)

W-8 - 1.5 Mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (3.30m x 1.75m)

W-9 - 1.5 Mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (3.20m x 1.75m)

W-10 - 1.5 Mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (2.40m x 1.75m)

W-11 - 1.5 Mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (1.75m x 1.75m)

W-12 - 1.5 Mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (1.65m x 1.75m)

W-13 - 1.5 Mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (1.40m x 1.75m)

W-14 - 1.5 Mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (1.20m x 1.75m)

W-15 - 1.5 mm thk. Aluminum Framed Powder Coated Fixed With 10mm thk. Reflective, Tempered Glass (0.70m x 1.75m)

W-16 - 1.5 mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (1.10m x 1.75m)

W-17 - 1.5 mm thk. Aluminum Framed Powder Coated Fixed Type and Awning Type Window With 10mm Thk. Reflective, Tempered Glass (0.80m x 1.75m)

W-18 - 1.5 mm thk. Aluminum Framed Powder Coated Awning Type Window With 10mm Thk. Reflective, Tempered Glass (2.35m x 0.60m)

W-19 - 1.5 mm thk. Aluminum Framed Powder Coated Awning Type Window With 10mm Thk. Reflective, Tempered Glass (1.775m x 0.60m)

W-20 - 1.5 mm thk. Aluminum Framed Powder Coated Awning Type Window With 10mm Thk. Reflective, Tempered Glass (1.20m x 0.60m)

W-21 - 1.5 mm thk. Aluminum Framed Powder Coated Awning Type Window With 10mm Thk. Reflective, Tempered Glass (0.70m x 0.60m)

W-22 - 1.5 mm thk. Aluminum Framed Powder Coated Fixed Type Window With 10mm Thk. Reflective, Tempered Glass (0.70m x 0.60m)

W-23 - 12 mm thk. Low E Glass Curtain Wall Framed at the Back in Wood Grain On Aluminum (5.675m x 2.95m)

W-24 - 1.5 mm thk. Aluminum Framed Powder Coated Fixed Type Window With 10mm thk. Reflective, Tempered Glass (5.575m x 2.65m)

W-25 – 12mm thk. Low-E Glass Curtain Wall Framed at The Back in wood Grain Finish on Aluminum (3.65m x 2.65m)

W-26 – 12mm thk. Low-E Glass Curtain Wall Framed at The Back in wood Grain

Finish on Aluminum (5.375m x 1.40m)

GLAZING MATERIAL

All glazing materials shall be delivered at job site with labels affixed indicating quality, make, type and thickness.

MATERIAL

Use 6.3mm plate glass mirror on 6mm marine plywood backing with aluminum frame.

Refer to plans for the required dimension of various glass mirror and location.

INSTALLATION

1. All comfort rooms whether shown or not, the Contractor shall provide and fit securely in place at the most convenient height above each lavatory.

2. Setting and edge blocks shall be made of neoprene, chemically compatible with sealant.

3. All glass mirror shall be bedded, back puttied, secured in place and face puttied. Secure glass in aluminum frame with non-corrosive clips.

CARPENTRY, JOINERY WORKS

SCOPE OF WORK

The work shall consist of furnishing all tools, labor, equipment and materials, unless otherwise specified to complete all carpentry and joinery works shown on the Drawings and specified herein.

GENERAL REQUIREMENTS

a. Lumber Grades

Lumber shall be of the best grade available, of the respective kinds required for the various parts of work; well seasoned, thoroughly dry and free from loose or unsound knots, sap, shakes or other imperfections impairing its strengths, durability and appearance. All exposed woodwork shall be smooth by dressed and sandpapered unless otherwise indicated or specified. Framing lumber shall be of the rough dimensions unless otherwise shown on the drawings.

b. Substitution of Lumber

Any lumber equally good for the purpose intended maybe substituted for the kind specified, subject to prior written approval of the Engineer. Provided, however, that in the substitution of the cheaper kind of lumber than that specified, a reduction in the contract price equal to the difference in the costs of the two kinds of lumber shall be made.

c. Delivery and Storage

The Contractor shall deliver lumber to the site in undamaged condition. Lumber shall be stacked in such a manner as to insure proper ventilation and drainage, and shall be supported at least 150 mm above-ground. Lumber shall be protected against dampness before and after delivery, and enough protection under cover in well ventilated enclosure, not exposed to extreme changes of temperature and humidity; and in a manner as to provide air-circulation around all surfaces of each pile to insure thorough air-seasoning. Lumber or millwork in buildings shall not be finished until concrete, masonry work and plaster are dry. Lumber shall be delivered at least thirty (30) days before use.

d. Grading of Plywood

Each sheet of plywood shall bear the mark identifying the plywood as to wood species, glue type and grade.

MATERIALS

a. Lumber

Lumber for various uses shall be one of the species listed for the purpose indicated unless otherwise specified in the drawing. For any use not specified, the lumber shall

be the best commercial grade normally used for the purpose, subject to the approval of the Engineer.

All framings shall be done as far as possible with carefully fitted mortise and tenon joints.

All doors, windows, transoms, or other opening where so indicated on plans, shall have frames and sills of the dimensions shown or as hereafter detailed, and all frames coming in contact with concrete shall be anchored by means of 20-d nails, spaced not more than 0.20m, apart, all around the contract surfaces. All frames shall be rabetted , molded and cut with saw and cut under for water drips.

SPECIE	U S E
Yakal	All door jambs, headers and transom bars, wood plates and all other woodwork in contact with concrete or masonry and where indicated.
Apitong (pressure treated)	All truss members and rafters and where indicated; all wood framings and carpentry, except when in contact with concrete.
Tanguile (Kiln dried)	All exterior and interior mill work, siding, finish and trim, frame work and all other wood works not specifically mentioned; except when in contact with concrete.

b. Plywood

Plywood shall conform to Commercial Standard PSI and shall be of local manufacture.

Plywood to be varnished shall be tanguile or kalantas veneers (as indicated), ribbon grained, water resistant, Class B and of the thickness indicated.

Plywood to be painted shall be tanguile veneer ordinary rotary-cut, water resistant, Class C and of thickness indicated.

Plywood exposed to the outside elements or where indicated shall be waterproof or marine plywood and of the thickness indicated.

c. Fastenings

Fastenings shall be common nails, glue or specified, flat-head wood screws (F.H.W.S.), rough-head wood screws (R.H.W.S.), bolts or lag screws where specified or called for shall be used. Conceal fastenings as much as possible; where not possible, locate them in inconspicuous places, where nailing is permitted through woodwork smooth-finished face, conceal nail heads.

1. Nails

Shall be of the smooth shank, zinc coated, common wire nails of local manufacture, and of types and sizes best suited for the purpose.

2. Wood Screws

Shall be brass or cadmium plated of the best available commercial quality, and of types and sizes suited for the purpose.

PRESSURE-TREATED LUMBER

a. Preservative Treatment

All lumber indicated to be pressure treated, shall contain any of the following net retention of solid preservative.

a. Boliden Salts - 45.5 kg. dry chemical per cubic foot of wood
b. Wolman Salts - 0.31 kg. dry chemical per cubic foot of wood
c. Tenalith Salts - 0.34 kg. dry chemical per cubic foot of wood

The Contractor shall submit an affidavit signed by an official of the preservative treatment company to the Engineer. This affidavit shall indicate the net retention of solid preservatives obtained and shall certify that pressure treated lumbers have a moisture content that does not exceed 17 percent upon shipment from the treatment plant.

Where it is necessary to cut or bore pressure-treated lumber on the job, two coats of prepared concentrated preservatives solution shall be applied to the end-cut or bored surfaces.

ROUGH CARPENTRY

All work shall be well fitted, accurately set, and rigidly secured in place. Anchors and bolts (with nuts and washers) straps and tie rods shall be provided as required.

a. Cutting and Fitting

Cutting and fitting to accommodate other work shall be done in the required manner, and cut or damaged work shall be patched and made good.

b. Framing and Structural

Framing and structural lumber shall be well-seasoned, straight, square-edge stacks, and free from loose or unsound knots, bark edges or other defects that will impair its strength.

c. Plates for Walls and Partitions

Plates for walls and partitions shall be of the same width as the studs and shall form continuous horizontal ties.

Structural members shall not be cut, bored or notched for the passage of pipes or conduits without prior approval of the Engineer. All members damaged by such cutting or boring shall be reinforced by means of specially formed and approved sheet metal or steel shapes or remove or replaced with new member as directed.

Anchors, connectors and fastenings not indicated or specified otherwise shall be of the size and types necessary to suit the conditions encountered. Size, type and spacing of nails, screws or bolts for installation of manufactured building materials shall be as recommended by the product manufacturer unless indicated or specified otherwise.

Rough hardware, exposed to weather or in contact with exterior walls or masonry or slabs shall be zinc-coated except as specified otherwise.

All lumber surfaces in contact with concrete or masonry shall be given a brush coat of bituminous paint before installation.

JOINERY WORK

All lumber used for the joinery work shall be of the kinds and grades specified and shall be of the contours, patterns and profiles indicated.

All joints shall be made, installed tight and securely fastened in a manner approved by the Engineer. Exterior joints shall be mitered and interior angles coped. Panels shall be fitted to allow for shrinkage, avoid swelling, and insure that the work remain in place without warping, splitting and opening of joints.

Interior trims shall be approved standard stock moldings, except where special patterns or profiles are indicated.

Joints for cabinet work shall be glued in addition to nails or other fastening device required. Nailing shall be concealed where practicable. Where face nailing is used, nails shall be set for putty stopping.

All exposed surfaces shall be machined or hand sanded finished to an even smooth surface. No hammer marks or other unsightly marks shall be allowed on any wood panel or veneer.

WOOD LAMINATES AND WOOD PLASTIC COMPOSITE PANELS

INTRODUCTION

A. WOOD LAMINATES

A wood laminate is a thin sheet of material used to cover the core of a wood project in order to change the appearance of the material. Laminates may be any material, but typically they are made veneers, which are thin sheets of wood.

High-pressure decorative laminates are characterized by their qualities, durability, and functional performance. High-pressure laminate sheets are available in a wide variety of colours, patterns and surface finishes. They are resistant to wear, scratching, impact, moisture, heat, and staining; and possess good hygienic and anti-static properties, being easy to clean and maintain.

B. WOOD-PLASTIC COMPOSITE

Wood-Plastic Composite architectural products are a sustainable timber alternative with added benefits such as durability and strength.

SCOPE OF WORK

This item shall consist of furnishing all wood laminates and wood composite panels materials, labor, tools and equipment required in undertaking the proper installation as shown on the Plans and in accordance with this specifications.

SPECIFICATIONS

- Wood Laminates: 6mm THK substrate laminated on HPL Accent Matte Finish for Interior Cladding or any approved equivalent by the designing Architect.
- Wood Composite Panels: Supply and Installation of Wood-Plastic Composite panels in sizes: 500mm X 45mm X 50mm including angle bracket support or any approved equivalent by the designing Architect.

SUBMITTALS

A. PRODUCT DATA

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

B. SHOP DRAWINGS

Indicate project layout; 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.

C. SAMPLES

1. Sample materials for selection and verification of finishes, colors, and textures.

2. Sample of panel assembly.

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 manufacture or fabrication. Coordinate fabrication schedule with construction progress to avoid delay of work. Field fabrication should be allowed to ensure proper fit and keep it to minimum with majority of fabrication being done under controlled shop conditions.

PREPARATION

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

ACCESSORIES

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

ROOFING AND TINSMITHRY

SCOPE OF WORK

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

MATERIAL REQUIREMENTS

ROOFING SHEETS

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

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

EXECUTION

ROOFING SHEETS

1. Roof, Long span

Spacing of purlins safe at 1.0m to 1.2m.

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

Laying shall start from the end opposite the side from where the prevailing monsoon is coming from. The first sheet shall be laid and installed with the turned-down edge towards the outside of the area to be covered. The next sheet shall be overlapped to the previous sheet in such a manner that the exposed edge is turned down and the covered edge is turned up. The overlapped edge in the side shall be with the rib having the anti-capillary groove. End and side laps including flashing shall be as approved by the Project-In-Charged.

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

CONCRETE EAVES AND CANOPY

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

Waterproofing shall be in accordance with "Concrete Waterproofing".

HANDLING AND STORAGE

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

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

Tool shall be handled carefully to prevent them from sliding over the coated surface.

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

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

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

Bundles shall not be left expose to the weather.

CONCRETE EAVES AND CANOPY MATERIALS

Concrete materials shall comply with the requirements in Concrete Works.

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

C CHANNEL

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

C-sections
Height: 100, 120, 150, 200, 250, 300 mm
Thickness: 1.0–3.0 mm
Minimum length 1600 mm
Maximum length 18000 mm

ALUMINUM COMPOSITE PANEL

INTRODUCTION

A. 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

B. 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
Temperatures from 200° to 250° to bond aluminum sheets to the polyethylene core. The non-flammable aluminum cover sheets protect the plastic core.

3. Light Weight–as the weight is less than ½ to ⅓
Of the weight of porcelain enamel, iron, copper, stainless and other metal panels, consequently it can reduce the 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.

SPECIFICATION

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

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

III. The ACP composition

- Two sheets of aluminum
- Front side aluminum roll coated with polyvinylidene fluoride PVDF according to AAMA605.2 requirements.

IV. PVDF coating finish adheres to the following standards.

Testing Item	Standard	Result
Finished coat thickness	ISO 2360 (CNS 8406)	27.6m
Gloss	ASTM D532-89	20 ~ 45 %
Pencil hardness	ASTM D3363-00	2H
Toughness	ASTM D4145-83	2T no rift
Adhesive force	ASTM 3359-97	4B
Impact resistance	ASTM D2794-93	>100 kg. cm.
Abrasion resistance	ASTM D968-93	64.6 L/mil
Mortar resistance	ASTM 605.2-90	24 Hrs. pat test exceed
Himidity resistance	ASTM D714-97	3000 hr no blister
	ASTM D2247-02	
Boiling- water resistance	ASTM D3359-B	Passed
Salt-spray resistance	ASTM D117-03	3000 hr no blister
Acid resistance	ASTM D1308-87	No effect
	AAMA 605.2-91, TEST #7, 7.31	
Alkali resistance	ASTM D1308-87	Passed
Solvent resistance	ASTM D2248-73	Passed
	ECCAT T5 & NCCA No. 11-18	
Color retention	ASTM D2244-93	ΔE = 0.34
Chalk resistance	ASTM D4214-98	No chalking
Gloss retantion	ASTM D2244-93	84.2 %

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 insure optimum workmanship. All labor and installation must have a warranty of not less than one year.

PATTERN / FINISH / COLOR

A. Panel Color:

- Mouse Gray or any approved equivalent by the designing Architect.
- Postal Blue or any approved equivalent by the designing Architect.

Locations are shown in the Elevation drawings.

SUBMITTALS

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 structurally sound panel system that allows no uncontrolled water penetration on inside face of panel system as determined by ASTME331.

C. SAMPLES

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

2. Sample of panel assembly.

D. TEST REPORTS (as requested)

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

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-dissimilar-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 (3 meters) long. However, some means of supporting the panel load over a longer distance from the forks may be used.

PREPARATION

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

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.

STEEL DECKS

GENERAL

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete the installation of steel deck as indicated on the drawings and as specified herein.

PRODUCTS

- Materials Provide products of a manufacturer that is regularly engaged in production of steel deck units and accessories.
  - Steel Decks:

Base Metal Type :	ASTM A466 cold – rolled 550 mpa (80,000 psi)
Thickness :	0.80mm X 0.90 m
Coating :	Imported Coil – Zinc – 275 gms/ m^2 Local Coil - Zinc – 120 to 150 gms/ m^2
Length :	Transportable

SUBMITTALS

1. Manufacturer's catalog data for steel deck and accessories. Include decking design calculations, or applicable published literature covering the specific type of construction required by this project.

2. Manufacturer's certification that design of steel decks meets the requirements of the local standards.

3. Shop drawing large-scale, cross-sectional detail of decking, various connections, and bearing on supports, methods of welding, attachment of accessories, adjusting plate details, floor layouts, placement directions, structural properties including composite section properties, and other pertinent details.

4. Samples:

- Approximately one-square foot of steel deck
- Accessories, one of each type
- End closures, one of each type
- Adjusting plates, one of each type
- Mechanical deck fastener (if used), one of each type

4. Welder Certification:

Including a report of welder qualification procedure. Provide qualification of welders and duration of qualification period in accordance with AWS

5. Delivery and Storage

Do not damage or overload decking and accessories during delivery, storage, or handling. Do not use decking for storage or as a working platform until units have been welded into position. Stack decking on platforms or pallets and cover with weather-tight ventilated covering. Elevate one end during storage to provide for drainage.

EXECUTION

1. Inspection prior to installation of decking units and accessories, inspect work-site to verify that the as-built structure will permit the indicated field installation of decking system without modification.

2. Installation

Install steel deck units in accordance with approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports. Report inaccuracies in alignment or leveling to the Project- In- Charged and make necessary corrections before deck units are permanently anchored. Locate end laps over supports only, with minimum lap of 50 mm. Do not use unanchored deck units as a work or storage platform. Permanently anchor all units placed by the end of each working day.

3. Anchorage Methods

After placement and alignment, and after inaccuracies have been corrected, permanently fasten steel deck units in place by welding, or with self-drilling screws or powder-actuated fasteners. Use methods as recommended by the Steel Deck Institute, subject to approval. Length of side and end laps of deck and intervals of fastening shall be as recommended by the steel deck manufacturer. Clamp or weight deck units to provide firm contact between deck units and structural supports while welding of fastening is being performed.

- Welding

Perform welding in accordance with AWS D1.3 using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Only operators previously qualified by test prescribed in AWS