

c. **Grounding System Test**

The Grounding system shall be tested to ensure continuity and resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to the Engineer and indicate location of rods as well as resistance and soil conditions at the time measurements were made.

INTERIOR LIGHTING

SUBMITTALS

Data, shop drawings showing mounting heights, and reports shall employ the terminology, classifications, and methods prescribed by the IES Lighting Handbook, as applicable, for the lighting system specified.

a. **Manufacturer's Data**

1. Dust Free LED Linear Light (Surface Type)
2. Dust Free LED Linear Light (Recessed Type)
3. 600 mm * 600 mm Troffer Light
4. Strip Light
5. Vertical Downlight Recessed Mounted
6. Vertical Downlight Surface Mounted
7. MR16 7watt LED Cool White

PRODUCT

1. DUST FREE LED LINEAR LIGHT

More and more people have become more accustomed to the use of dust free led linear light. It is started to gain its popularity. Due to their versatility, they can easily be mounted and set up in different areas of a different style. It can use to accentuate a modern-styled room, also can use these to create a different mood and ambiance to a clean-looking area and make it look more dramatic and elegant. These wholesale dust free led linear light come in many varieties, forms, and sizes that allows users to easily mount and set them up to redecorate a room.

These dust free led linear light are often used in warehouse applications and office lighting that can be both used as indirect and parabolic light fixtures. However, because of the versatility of these light fixtures, these can also be seen combined to provide an even brighter and even lighting across vast and open spaces and areas. Common examples of areas where these are mounted include laboratories, workshops, kitchens, hallways, and a gymnasium. Today, the use of led tube lights has been more diverse. It is now used in a huge number of homes, business premises, and even public facilities.

2. LED LINEAR LIGHT

Linear lighting is defined as a linear shape luminaire (opposed to square or round). These luminaires long optics to distribute the light over a more narrow area than with traditional lighting. Linear LED lighting is a highly efficient and effective lighting solution for office environments. It offers a range of benefits including energy efficiency, long lifespan, durability, flexibility, improved productivity, cost-effectiveness, and environmental benefits.

3. TROFFER LIGHT (600mm x 600 mm)

A troffer light is a rectangular or square light fixture that typically fits into a modular dropped ceiling grid, often described as "recessed." Historically, troffer fixtures have been designed to accommodate standard fluorescent lamps like T12 or T8 fixtures.

Troffer lighting (aka recessed troffer lighting) is a term that is often used to describe indoor lighting fixtures that are mounted within a ceiling or ceiling grid, hence the term "recessed." Typical fixture sizes include 1x4 troffers, 2x2 troffers, and 2x4 troffers. This type of interior lighting is located in a range of building types and workplace usage, and is commonly used to provide illumination for commercial lighting, industrial lighting, retail lighting, warehouse lighting, and classroom lighting applications.

4. LED STRIP LIGHT

LED Strip Light often used or connected to an existing landscape lighting system. Great accent lighting for stairs, railings, and overhangs etc.,

The most versatile LED product in the market, ranging from accent lighting, cove lighting, mood lighting, back-lit signage, and other customized lighting requirements.

Applications include classy under cabinet lighting for your kitchen, car undercarriage or motorcycle chassis lights.

Even more, it's no secret the LED has been the "go to" technology for modern lighting because of its unparalleled cost and energy efficiency. Among all LED products the LED strip light may be the most versatile of all. Also, it has many practical and ingenious applications primarily because it can fit into tight spaces.

Different types and different colors, indoor or outdoor LED strip lights; and you can be sure these products will fit your fancy with the reliability and brightness you can expect from LED-based lighting.

5. VERTICAL DOWNLIGHT RECESS MOUNTED TYPE

This fixture with glass cover looks very simple but provides protection to led bulbs. Metal sheet housing gives durability, while mirrored reflection brings additional lighting effect. They equipped with a glass cover that provides a smart overhead illumination solution, very modern and contemporary for decoration. It's best for indoor lightings.

6. VERTICAL DOWNLIGHT SURFACE MOUNTED TYPE

Surface Downlight – the housing or frame of this fixture is made of steel plate and with powder coating under high temperature. It is resistant to abrasion as well as pressure, not easy to be tarnished. As you will notice, it is specialized with light reflector that is made by high quality pure aluminum. Endurable lamp holder for extremely high temperature guarantees the safety and durability of the LED light bulbs. The other parts like springs, elastic slices and other tightening fittings make the down light firmly recessed and easy to install.

7. MR16 LED 7W Cool White

The MR16 LED bulbs offer superior light output and are great for residential and commercial application.

Features:

- Low energy consumption - 7W
- Color Temperature: 4000k - Cool White
- Efficient LED replacement for halogen 75w MR16 lamps
- Very good color rendering
- Flood 40 degree beam angle
- No IR and UV radiation
- Mercury Free
- Suitable for use with totally enclosed luminaires
- Suitable for Damp locations

RECESS AND FLUSH MOUNTED FIXTURES

The Contractor shall provide the type of materials as shown in the plan.

LED BULB

Being the next modern, energy-efficient lighting, it offers brighter lights than both its predecessors improving on lower wattage at the same brilliance and longer life spans. This is definitely a lot of savings in terms of lower electricity bills and maintenance costs.

Powered by light emitting diodes and circuitry, the advantage is that it eliminates the harmful chemicals found in your typical compact bulb. The LED is making it non-hazardous and also Eco-friendly. The very low defect rate of 1% a year and lifetime of over 30,000 hours. Therefore, this product will stand the test of time.

Specifically designed that can easily transition to LEDs without necessarily revamping your current lighting setup. LED bulbs have a wide range of applications from lighting households, schools, and offices, illuminating covered parking lots, warehouses.

This LED Bulb provide each and every household or business in the Philippines access to energy efficient and environmentally friendly lighting alternatives set at reasonably low and affordable prices.

EXECUTION

INSTALLATION

Installing Surface mounted linear light:

- Drill holes on the ceiling at proper position, and fix the mounting clips onto the ceiling.
- Press the linear light into the clips
- Get the LED linear light wired to the supply and ground (If there is).

Installing Recess mounted linear light:

- Cut a hole in the ceiling according to the length of the product.
- Fix the bracket inside the ceiling.
- Fix the screws with the linear light.
- Fit the linear light into the hole and fix with the bracket.
- Get the LED linear light wired to the supply and ground (If there is).

Installing Troffer LED Light:

- First of all turn off the main power of lighting fixture or any other commercial building where you want to install these lights. Then locate the power panel and flip the appropriate switch.
- Now remove the flat panel lens, fluorescent LED tube light, and the cover from there.
- Now unscrew the bolts securing the fixture to the ceiling frame and unscrew the bolts securing the wood frame wires. You have to completely remove the fixture from the ceiling to install advanced LED troffer light over there.
- Now remove the cap and take out the power wire, now add any wire management holes you need on the cap. After that, fix the wire management ring to the cap and screw it tightly to the building's stock wiring.
- Now wire LED troffer to your stock building wires and make sure that you have made safe connections and keep the positive wires together and the negative wires together.

Recessed and semi-recessed fixtures may be supported from suspended ceiling support system ceiling tees if the ceiling system support rods or wires are provided at a minimum of four rods or wires per fixture and located not more than 150 mm from each corner of each fixture. Do not support fixtures by ceiling acoustical panels. Where fixtures of size less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently or with at least two 20mm metal channels spanning, and secured to, the ceiling tees. Provide rods or wires for lighting fixture supports under this section of the specifications. Additionally, for recessed fixtures, provide support clips securely fastened to ceiling grid members, a minimum of one at or near each corner of each fixture.

GROUNDING

Ground non-current-carrying parts of equipment as specified in "Interior Wiring Systems." Where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

FIELD TESTS

The Contractor will provide electric power and apparatus / instruments required and carry out the field tests.

a. Operating Test

Upon completion of the installation, conduct an operating test to show that the equipment operate in accordance with the requirements of this section.

b. Insulation Resistance Test

Perform as specified in "Interior Wiring Systems", both before and after connection of fixtures and equipment.

c. Ground Resistance Tests

Perform as specified in "Interior Wiring System."

ITEM 12 : GROUNDING SYSTEM AND LIGHTNING PROTECTION**GENERAL****REFERENCES**

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

1. American National Standards Institute (ANSI)

ANSI C135.30 (1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

2. Institute of Electrical And Electronics Engineers (IEEE)

IEEE Standard 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Potentials of a Ground System

3. National Fire Protection Association (NFPA)

NFPA 70 (2007) National Electrical Code
NFPA 780 (2007) Lightning Protection Code

4. Underwriters Laboratories (UL)

UL Elec Const Dir (2007) Electrical Construction Materials Directory
UL 96 (2005) Lightning Protection Components
UL 96A (2007) Installation Requirements for Lightning Protection Systems
UL 467 (2007) Grounding and Bonding Equipment

5. Institute of Integrated Electrical Engineer (IIEE)

PEC (2002) Philippine Electrical Code

6. Philippine National Standard (PNS)

BS (2002) Bureau of Standard

RELATED REQUIREMENTS

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

1. System Requirements

Materials shall consist of standard products of a manufacturer regularly engaged in production of lightning protection systems and shall be manufacturer's latest UL approved design. Lightning protection system shall conform to PEC, NFPA 70, NFPA 780, UL 96 and UL 96A.

SUBMITTALS

1. Shop Drawings

Overall lightning protection system each major component

2. Test Reports

Grounding system test

Lightning protection system inspection

3. Certificates

UL listing or label

QUALITY ASSURANCE

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears.

1. Installation Drawings

- a. Submit installation shop drawing for the overall lightning protection system. Drawings shall include physical layout of the equipment, mounting details, relationship to other parts of the work, and wiring diagram.
- b. Submit detail drawings for each major component to include manufacturer's descriptive and technical literature, catalogue cuts, and installation instructions.

2. UL Listing or Label

Submit proof of compliance, label of acceptable evidence. In lieu of label or listing, submit written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that items have been tested and conform to requirements and testing methods of Underwriters Laboratories.

SITE CONDITIONS

Contractor will become familiar with details of the work, verify dimensions in the field, and advise the Engineer of discrepancies before performing work. Deviations from contract drawings will not be made without prior approval of the Engineer.

MATERIAL REQUIREMENTS

MATERIALS

Do not use a combination of materials that forms an electrolytic couple of such nature that corrosion is accelerated in presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, provide conductors with protective coatings or oversize conductors. Where mechanical hazard is involved, increase conductor size to compensate for hazard or protect conductors by covering them with or tubing made of nonmagnetic material.

1. Main and Bonding Conductors

NFPA 780 and UL 96

2. Copper

Provide copper conductors on non-metallic stacks that do not weigh less than 144.83 kg per 300 meters, and provide cable such that the size of any strand in the cable is not less than 2mm².

COMPONENTS

1. Air Terminals

Provide terminals in accordance with UL 96. Support air terminals by suitable brace, with guides, not less than one-half the height of the terminal.

2. Ground Rods

Provide ground rods made of copper-clad steel conforming UL 467. Provide ground rods that are not less than 20mm in diameter and 3000mm in length. Do not mix ground rods of copper-clad steel, stainless steel, galvanized ferrous, or solid copper on the job.

3. Connections and Terminations

Provide connectors for splicing conductors that conform to UL 96, class as applicable. Conductor connections can be made by clamps or welds (including exothermic). Provide style and size connectors required for the installation.

4. Connector Fittings

Provide connector fittings for "end-to-end", "Tee", or "Y" splices that conform to NFPA 780.

5. Lightning Protection Components

Provide bonding plates, air terminal supports, clips, and fasteners that conform to UL 96 classes as applicable.

EXECUTION

INTEGRAL SYSTEM

Lightning protection system consists of air terminals, down conductors, ground connections, grounding electrodes and ground loop conductor. Electrically interconnect lightning protection system to form the shortest distance to ground. Do not use non-conducting parts of the structure as part of the building's lightning protection system. Conductors are required to be in protective sleeves.

1. Air Terminals

Air terminal design and support conforming to NFPA 780. Rigidly connect terminals to, and make electrically continuous with, down conductors by means of pressure connectors or crimped joints of T-shaped malleable metal. Provide pressure connector or crimped joint

with a dowel or threaded fitting to connect ground rod conductor with air terminal. Set air terminals at ends of structures not more than 610mm from ends of ridges. Where non-metallic spires, is present, mount air terminal to the side. In addition, where spires project more than 3050mm above the building, continue conductor from air terminal to nearest down conductor securely connect thereto.

2. Down Conductors

Make down conductors electrically continuous from air terminals to grounding electrodes. They equally and symmetrically spaced down conductors about the perimeter of the structure. Protect conductors where necessary, to prevent physical damage or displacement to the conductor.

a. Ground Connections

Securely connect conductor forming continuations of down conductors from structure to grounding electrode in a manner to ensure electrical continuity between the two. Provide clamp type connections or welds (including exothermic) for continuation. Attach down conductor to ground rods by welding including exothermic, brazing, or clamping. Provide clamps suitable for direct burial. Protect ground connection from mechanical injury. In making ground connections, take advantage of all permanently moist places where practicable, although avoid such places when area is wet with waste water that contains chemical substances, especially those corrosive to metal.

b. Grounding Electrodes

Provide grounding electrode for down conductor. Extend driven ground rods into the existing undisturbed earth for a distance of not less 3050mm. Set ground rods less than 610mm nor more than 3050mm, from the structure. After the completed installation, measure the total resistance to ground using the fall-of-potential method described in IEEE Standard 81. Maximum resistance of a driven ground rod shall be 10 ohms, under normally dry conditions. Make connections between ground conductors and electrically ground continuous.

FIELD QUALITY CONTROL

1. Grounding System Test

Test the grounding system to ensure continuity and that resistance to ground is not in excess of 10 ohms. Test the ground rod for resistance to ground before making connections to the rod. Tie the grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Include in the written report: locations of ground rods, resistance, and soil conditions at the time that measurements were made. Submit results of each test to the Engineer.

2. Lightning Protection System Inspection

Make visual inspections to verify that there are no loose connections which may result in high resistance joints and that conductor and system components are securely fastened to their mounting surfaces and are protected against accidental mechanical displacement.

ITEM 13 : BACKGROUND MUSIC / PUBLIC ADDRESS SYSTEM**GENERAL**

Electrical General Requirements applies to this Item, with the 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 within 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. Electronic Industries Alliance (EIA) EIA ANSI/EIA-310-D (1992) Racks, Panels, and Associated Equipment

2. Institute of Electrical and Electronics Engineers (IEEE)
IEEE C62.41 (1991; R 1995) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

3. National Fire Protection Association (NFPA)

NFPA 70 (2007) National Electrical Code
NFPA 72 (2002) National Fire Alarm Code

4. Underwriters Laboratories (UL)
UL 1449 (2006) Transient Voltage Surge Suppressors

SUBMITTALS

The following shall be submitted.

1. Shop Drawings**a. Detail Drawings**

Detail drawings as specified.

2. Product Data**a. Spare Parts**

Spare parts data for each different item of material and equipment specified.

3. Test Reports**a. Approved Test Procedures**

Test plan and test procedures for the acceptance tests. The test plan and test procedures shall explain in detail, step by step actions and expected results to demonstrate compliance with the requirements specified. The procedure shall also explain methods for simulating the necessary conditions of operation to demonstrate system performance.

b. Acceptance Tests

Test reports in booklet form showing all field tests performed to adjust each component and to prove compliance with the specified performance criteria, upon completion and testing of the installed system. The reports shall include the manufacturer, model number, and serial number of test equipment used in each test. Each report shall indicate the final position of controls and operating mode of the system.

4. Certificates

a. Components

Copies of current approvals or listings issued by UL, or other nationally recognized testing laboratory for all components.

5. Operation and Maintenance Data

a. Public Address System

SYSTEM DESCRIPTION

The public address system shall consist of an audio distribution network to include amplifiers, mixers, microphones, speakers, cabling, and ancillary components required to meet the required system configuration and operation.

1. Multi-Channel System with Paging

The system shall include microphones, microphone outlet receptacles, microphone inputs with preamplifiers, inputs for film sound, compact disc, magnetic tape, telephone, and program sources, single all channel paging, control for each input, power amplifying equipment, and accessories required to output the public address and paging audio signals through selected portions of the audio distribution network as indicated. The paging signal shall replace by zones channel all channels of the radio system output, when the paging function is activated.

2. Single-Channel System

The system shall control and amplify an audio program for distribution within the areas indicated. Components of the system shall include a mixer-preamplifier, mixer-amplifier, mike input expander, power amplifier, microphone, speaker system, compact disc, cassette/DVD player, AM-FM tuner, cabling and other associated hardware.

3. System Performance

The system shall provide even sound distribution throughout the designated area, plus or minus 3 dB for the 1/1 octave band centered at 4000 Hz. The system shall provide uniform frequency response throughout the designated area, plus or minus 3 dB as measured with 1/3-octave bands of pink noise at locations across the designated area selected by the Engineer. The system shall be capable of delivering 75 dB average program level with additional 10 dB peaking margin sound pressure level (SPL) in the area at an acoustic distortion level below 5 percent total harmonic distortion (THD). Unless otherwise specified the sound pressure reference level is 20 micro Pascal (0.00002 Newton per square meter).

4. Detail Drawings

The Contractor shall submit detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalogue cuts, and installation instructions. Note that the contract drawings show layouts based on typical speakers. The Contractor shall check the layout based on the actual speakers to be installed and make necessary revisions in the detail drawings. Detail drawings shall also contain complete point to point wiring, schematic diagrams and other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

5. Spare Parts

The Contractor shall submit spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

DELIVERY AND STORAGE

Equipment placed in storage until installation shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

VERIFICATION OF DIMENSIONS

The Contractor shall become familiar with the details of the work and working conditions, shall verify dimensions in the field, and shall advise the Engineers of any discrepancies before performing the work.

MATERIAL REQUIREMENTS

STANDARD PRODUCTS

Material and equipment to be provided shall be the standard products of a manufacturer regularly engaged in the manufacture of such products, and shall essentially duplicate material and equipment that have been in satisfactory use at least 2 years. All components used in the system shall be commercial designs that comply with the requirements specified. Equipment shall be supported by a service organization that is within miles of the site.

1. Identical Items

Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

2. Nameplates

Each major component of equipment shall have the manufacturer's name, address, model and catalogue number, and serial number on a plate secured to the equipment.

MIXER-PREAMPLIFIER (Optional)

Mixer-preamplifier shall as a minimum conform to the following specifications:

Rated Output:	18 dB
Frequency Response:	Plus or Minus 1 dB, 20 - 20,000 Hz
Distortion:	Less than 0.5 percent, 20 - 20,000 Hz
Signal to noise:	Microphone - 60 dB
Auxiliary:	70 dB
Inputs:	5-independent balanced low-impedance transformer-isolated
Input Sensitivity:	Microphone - 0.003 volts Auxiliary 0.125 volts Magnetic Cartridge - 0.0005 volts
Input Channel Isolation:	80 dB minimum
Tone Controls:	Plus or Minus 10 dB range at 50 and 15,000 Hz
Power Requirement:	220-240 Vac 60 Hz

POWER AMPLIFIERS

The power amplifier shall be provide with a nameplate indicating power rating to satisfy design, coverage, SPL requirements and reserve capacity requirements. Listed for Protective Signal Service and supervised in accordance with NFPA 72.

Power amplifiers as a minimum conform to the following specifications:

Rated power output:	60, 125, 250 watts RMS
Frequency Response:	Plus or Minus 3 dB, 20-20,000 Hz
Distortion:	Less than 2 percent at RPO, 600-13,000 Hz
Input Impedance:	50 k ohm unbalanced
Output Impedance:	Balanced 4 and 8 ohms
Output voltage:	25 and 70.7 volts
Power Requirement:	220-240 Vac 60 Hz

MIXER AMPLIFIER (Optional)

Mixer amplifier shall as a minimum conform to the following specifications:

Rated Power Output (RPO):	35, 60, 125 watts RMS
Frequency Response:	Plus or Minus 3 dB, 20-20,000 Hz

Distortion:	Less than 1% at RPO, 60 - 13,000 Hz
Inputs:	2 microphones (high impedance or low-impedance unbalanced 2 Aux. (high-impedance))
Output Impedance:	Balanced 4 and 8 ohms
Output Voltage:	25 and 70.7 volts
Power Requirement:	220-240 Vac 60 Hz

MICROPHONE INPUT MODULES

Microphone input modules shall as a minimum conform to the following specifications:

Rated Outputs:	0.25 volts into 10,000 ohms 1.0 volts into 10,000 ohms
Frequency Response:	Plus or Minus 2 dB, 20 - 20,000 Hz
Distortion:	Less than 0.5 percent 20 - 20,000 Hz
Inputs:	4 transformer - coupled balanced 150 ohm
Input Sensitivity:	0.003 volts
Input Channel Isolation:	70 dB minimum

MICROPHONES

1. Desk Microphone

Microphones shall as a minimum conform to the following specifications:

Element:	Dynamic
Pattern:	Cardioid (Unidirectional)
Frequency Response:	50 - 12,000 Hz
Impedance:	Low impedance microphone (150-400 ohms)
Front to back Ratio:	20 dB
Selector switches:	Selector switches for zone shall be integral microphone or Separate console adjacent to microphone

2. Gooseneck Microphone

Gooseneck microphone shall meet the minimum requirements of the desk microphone. Microphone shall have push to talk button. Gooseneck tube length shall be [305] [406] mm.

3. Microphone Jack

Each outlet for microphones shall consist of a standard outlet box, flush-mounted, and fitted with a three-pole, polarized, locking-type, female microphone jack and a corrosion resistant-steel device plate.

LOUDSPEAKERS

1. Cone Speaker

The cone speaker shall as a minimum conform to the following specifications:

Application:	Wall baffle, Ceiling
Frequency range:	60 to 12,000 Hz
Power Rating:	Normal - 7 watts Peak - 10 watts
Voice Coil Impedance:	8 ohms
Line Matching Transformer Type:	25/ 70.7 volt line
Capacity:	4 watts
Magnet:	10 ounces or greater
Primary Taps:	0.5, 1, 2 and 4 watts
Primary Impedance:	25 volts - 1250, 625, and 312 ohms 70.7 volts - 10k, 5k, and 2.5k ohms
Frequency Response:	30 - 20,000 Hz
Insertion Loss:	Less than 1 dB

2. Horn Speaker

The horn speaker shall as a minimum conform to the following specifications:

Application:	Indoor, Outdoor, and Weatherproof
Frequency Response:	400 - 14,000 Hz
Power Taps:	70 volt line - .9, 1.8, 3.8, 7.5, and 15 watts
Impedance:	5000, 2500, 1300, 670, 330, 90, & 45 ohms
Power Rating:	Normal - 7 watts Peak - 15 watts
Dispersion:	110 degrees

3. Dual Horn Speaker (Optional)

The dual horn speaker shall meet the minimum requirements of horn speaker except the dispersion shall be 100 degrees.

4. High Output Speaker Enclosures (Optional)

High Output speaker enclosures shall be of the tuned-port design for precise balancing and tuning of the speaker. The enclosures shall be constructed throughout of 19.1 mm high density board, with screwed and glued joints, durably braced, and padded with fibreglass where acoustically required. Speaker enclosures shall have a 25, 45 degree vertical dispersion and 90, 120 degrees horizontal dispersion. The effective length of throw shall be a minimum of 15, 40, and 60 m.

5. Wall Baffle Speaker Enclosures (Optional)

The wall baffle speaker shall be of particle board construction covered with walnut laminate and complete with black cloth grille. Baffle shall feature 9.5 degree slope to provide directional sound 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 fiberglass 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 INTERIOR WIRING SYSTEM. Wiring for microphone, grounding, line level, and 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 14 : FIRE DETECTION AND ALARM SYSTEM**GENERAL**

"Electrical General Requirements" applies to this Item 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 Signaling Devices for the Hearing Impaired
UL 521 (1999; Rev thru Oct 2002) Heat Detectors for Fire Protective Signaling 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. Two (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 signaling 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 centerline 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, NEC and NFPA 72. Wire for 240V circuits shall be 3.5 mm² minimum copper conductors. Wire for low voltage DC circuits shall be 2.0 mm² 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 15 : COMMUNITY ANTENNA TELEVISION SYSTEM (CATV)**GENERAL**

Electrical General Requirements applies to this Item, with the 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. American Association of State Highway and Transportation Officials (AASHTO)
AASHTO HB14 (1992) Highway Bridges
2. American National Standards Institute (ANSI)
ANSI C2 (1997) National Electrical Safety Code
3. Code of Federal Regulations (CFR)
29 CFR 1910.27 Fixed Ladders
47 CFR 76 Cable Television Service
47 CFR 76.605 Technical Standards
4. Electronic Industries Association (EIA)
ANSI/EIA/TIA-222-F (1996) Steel Antenna Towers and Antenna Supporting Structures
ANSI/EIA-412-A (1974) Direct View High Resolution Monochrome Closed Circuit Television Monitors
5. Federal Aviation Administration (FAA)
FAA AC-70/7460-1 (Rev. H) Obstruction Marking and Lighting
6. Institute of Electrical And Electronics Engineers, Inc. (IEEE)
IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits
7. National Cable Television Association (NCTA)
NCTA 02 (1989) Measurements on Cable Television Systems
8. National Electrical Manufacturers Association (NEMA)
NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
9. National Fire Protection Association (NFPA)
NFPA 70 (2007) National Electrical Code
NFPA 780 (1995) Lightning Protection Code
10. Institute of Integrated Electrical Engineers of the Philippines (IIEE)
PEC (2000) Philippine Electrical Code
11. Philippine National Standard (PNS)
BS (2002) Bureau of Standard

SYSTEM DESCRIPTION

1. CATV

Community Antenna Television (CATV) System is a network of cables, headend, and electronic components that process and amplify television (TV) and frequency-modulated (FM) radio signals for distribution from one central location equipped with a common system of antennas to TV sets housed in numerous buildings situated in a community or campus-like environment.

a. Headend

Headend contains the antennas necessary to receive desired signals and electronic equipment to filter the signals, multiplex them for transmission, and amplify them to adequate level to feed the distribution system.

b. Distribution System

Distribution system transports and delivers adequate signals to each receiver. Provides distortion-free signal to TV sets by isolating each receiver from the system and by providing proper amount of signal to each set.

c. Local Programming

Cameras, video recorders, and switchers to permit the facility to present pre-recorded or live programs.

2. Cable

Trunk cable is a low-loss cable used to transport the desired signal from the headend equipment into the general area to be served. Feeder cables are connected to the trunk cable through bridging amplifiers and are used to transport signal into close proximity to a number of user locations. Subscriber service cable is used to transport the signal from the feeder cable to the user's building, as stated in this section, interior cable is used within the building to transport signal to user's wall outlet.

3. System Components

System shall provide high quality TV and FM signals to all outlets. Provide any combination of items specified herein to achieve required performance, subject to approvals, limitations, acceptance test, and other requirements specified herein. System shall include antennas; antenna towers; band-pass filters; mixers; preamplifiers; power supplies; converters; TV monitors; cables; wall taps; and all other parts, components, and equipment necessary to provide a complete and usable system.

a. System Input

- a. Very high frequency (VHF) TV channels
- b. Ultra high frequency (UHF) TV channels
- c. FM broadcast band, 88-108 megahertz (MHz).
- d. CATV feed from the commercial CATV system].
- e. Satellite feed channels.
- f. Locally originated program channels

b. System Output

- a. [VHF/[UHF receivers.
- b. FM receivers.

4. System Performance

a. Receiver Termination Signal Level

Each termination for a TV receiver must have a minimum signal level of 3 decibel mill volts (dBmV) (1,400 microvolts).

b. Headend

- 1) Visual carrier to noise ratio of the headend processor: 58 decibels (dB) at 10 dBmV input or 60 dB at maximum rated input.
- 2) Base band signal to noise ratio: 55 dB at optimum signal level.
- 3) Automatic gain control regulation of headend heterodyne processor and demodulator: plus or minus 2 dB.
- 4) Modulation linearity: 10 percent.
- 5) Modulation: 87.5 percent.
- 6) Undesired low frequency disturbance: 0.5 percent.
- 7) Spurious signals: must comply with 47 CFR 76 FCC Rules, 47 CFR 76.605, SUBPART A.
- 8) Differential gain: 1 dB.
- 9) Differential phase: 0.08726 rad.
- 10) Chrominance - luminance delay inequity: 150 nanoseconds.
- 11) Short time waveform distortion (K factor): 4 percent.

c. Distribution System

- 1) Modulation distortion at power frequencies: 4 percent or less hum distortion;
- 2) Composite third order distortion for:
 - a) CW carriers: 53 dB.
 - b) Modulated carriers: 59 dB.
- 3) Subscriber terminal isolation: 18 dB or greater.
- 4) Carrier to second order beat ratio: 60 dB.
- 5) Peak to valley frequency response (6 megahertz (MHz)): 2.3 dB.
- 6) Frequency response across video pass band of any channel: plus or minus 1 dB.

7) Visual, aural carrier level - 24-hour variation: 47 CFR 76 FCC 47 CFR 76.605 Rules 4, 5, and 6.

8) Frequency determination: 47 CFR 76 FCC 47 CFR 76.605.

SUBPART A Rules (1)(2)(3).

d. Extension of Existing System

The new distribution system extension shall not degrade the quality of the signals identified in the paragraph entitled "System Input" by more than those indicated in the paragraph entitled "Distribution System." Measurements shall be made at the far end extremities of the new extension.

e. All New System Tolerance

The system shall not show a serious loss of signal to noise when the system levels are lowered 3 dB below normal or a significant distortion when the levels are increased 3 dB above normal, as observed on a TV set located at the far end extremities of the system.

SUBMITTALS

Submit the following:

1. Shop Drawings

- a. CATV system wiring diagrams and installation details
- b. /CATV system components

2. Product Data

- a. Antennas
- b. Antenna towers
- c. Preamplifiers
- d. Splitters/combiners
- e. Multiplexers
- f. Amplifiers, including headend, trunk, bridging, and distribution
- g. Power supplies
- h. Attenuators
- i. Traps
- j. Band-pass filters
- k. Terminators
- l. Line tap-off
- m. Matching transformers
- n. Wall taps
- o. Set top converters
- p. TV monitors
- q. Cables, including trunk, feeder, subscriber service, and interior
- r. CATV housings/pedestals
- s. Grounding block
- t. Ground rods
- u. Drop wire clamps
- v. Local programming equipment

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

3. Test Reports

- a. Signal survey
- b. Ground rod tests
- c. System pre-test
- d. Acceptance tests
- e. Operational test plan
- f. Operational test procedures
- g. Ground rod test procedure

4. Operation and Maintenance Data

a. CATV system,

Submit operation and maintenance data. Submit a draft copy with the acceptance test procedure for use during the site test, and update with all changes required prior to final acceptance. Update all operation and maintenance data to include modifications made during installation, checkout, and acceptance.

QUALITY ASSURANCE

1. Wiring Diagrams and Installation Details

Illustrate how each item of equipment functions in the system and include an overall system schematic indicating the relationship of MATV/CATV units on one diagram. Drawings shall include wiring diagrams and installation details of equipment indicating proposed locations, layout and arrangements, and other items that must be shown to ensure coordinated installation.

2. Operational Test Plan

Test plan shall define tests required to ensure that the system meets technical, operational, and performance specifications. Test plan shall be based on NCTA 02.

3. Operational Test Procedures

Use test plan and design documents to develop test procedures. Procedures shall consist of detailed instructions for a test setup, execution, and evaluation of test results.

4. Ground Rod Test Procedure

Submit three copies of manufacturer's procedure for using the ground

MAINTENANCE

1. Maintenance Data

Maintenance manual shall contain descriptions of maintenance for the overall MATV/CATV system as well as for the equipment. It shall include inspections, scheduling for and types of periodic preventive maintenance, fault diagnosis, troubleshooting techniques, and repair or replacement of defective components. It shall also include safety precautions for locking out hazardous energy sources.

2. Functional Design Data

Functional design manual shall identify the operational requirements of the system and explain the theory of operation, design philosophy, and specific function of each element of the system.

3. Hardware Data

Submit a hardware manual describing all equipment provided, including:

- a. General description and specifications.
- b. Installation and checkout procedures.
- c. Headend and system schematic diagrams.
- d. Electrical schematics and layout drawings.
- e. Alignment and calibration procedures.
- f. Manufacturer's repair parts list indicating sources of supply include national stock numbers.

4. Operator Data

Operator's manual shall provide procedures and instructions for operation of the system including:

- a. Types of alarms, meaning of alarms, and action to be taken.
- b. Preventive maintenance schedule.
- c. Local programming equipment].

MATERIAL REQUIREMENTS

ELECTRONIC EQUIPMENT

Electronic equipment shall be produced and designed by the same manufacturer with major components of the equipment to have the manufacturer's name, model, and serial number permanently attached. Equipment shall function properly as a complete integrated system.

HEADEND EQUIPMENT

1. Antennas

Heavy duty, professional quality antennas shall be designed to withstand a minimum wind load of [200] km/h. Elements shall have sealed ends [low band element shall be fibre filled. The boom shall not contain open holes. Antennas shall match a 75-ohm transmission line. Front-to-back ratio shall be 15 dB or higher. Matching devices shall be completely encapsulated so as to be weatherproof.

2. Antenna Towers

Towers shall be self supporting and shall be capable of withstanding a minimum wind load of 200 km/h and shall be designed so that tower members form a natural ladder for climbing the full length of the tower.

3. Preamplifiers

When required, preamplifiers shall be antenna- or mast-mounted with power duplexed on the down lead. Preamplifiers shall be weatherproof and shall be capable of operating in temperatures of minus 30 to plus 60 degrees Celsius (C).

4. Modulators

Provide an audio video modulator for each channel of locally originated programming.

5. Channel Converters

Use crystal-controlled oscillators. Single-component failure shall not affect more than one channel in the system.

6. Distribution Amplifiers

Provide [broadband] [single-channel] distribution amplifiers.

7. Traps

Traps shall be designed to reject any transmission interfering with desired signal reception.

8. Attenuators

Provide attenuators to equalize signal levels, when required. Variable attenuators are not permitted.

9. Multiplexers

Use multiplexers to combine signals from multiple antennas. Use at the local program originating location to prevent overloading the local TV receiver.

10. Splitters/Combiners

Use splitters/combiners with characteristics equal to or exceeding the characteristics listed in this paragraph over the entire operating band.

All unused outlets must be terminated with 75 ohm terminators.

- a. Slope: 0.8 dB.
- b. Return loss: 15 dB.

11. TV Monitors

Use TV monitors which comply with ANSI/EIA-412-A.

12. TV Mountings

Use TV flush wall mountings and TV shelf wall mountings.

13. Power Supplies

Power supplies shall contain a current limiter circuit to protect against short circuits on the radio frequency (RF) line. Provide overvoltage protection to protect solid state equipment from line surges and induced voltages, IEEE C62.41.

DISTRIBUTION EQUIPMENT

1. Distribution Amplifiers

Distribution amplifiers shall be equipped for 75 ohms input and output impedance. Electronic equipment exposed to weather shall be equipped with weatherproof housings.

a. Trunk Amplifiers

Trunk amplifiers shall have automatic level and slope features.

b. Bridging Amplifiers

Bridging amplifiers shall be used to connect feeder cables to trunk cables.

2. Cables and Associated Hardware

a. Trunk Cable

For aerial cable construction, coaxial cable shall have the following characteristics:

- (1) Copper-clad aluminum center conductor.
- (2) 2.28mmØ.
- (3) Foam polyethylene dielectric.
- (4) Seamless aluminum tubing shield.
- (5) 75 ohms impedance.
- (6) 1.5 dB 30.48 m of loss at 211 MHz

Cable shall be protected by a black polyethylene jacket with a flooding compound between the jacket and the aluminum shield.] For direct burial construction or for cable in conduit, the same cable shall be used and protected by a black polyethylene jacket with a flooding compound between the jacket and the aluminum shield.

b. Feeder Cable

For aerial cable construction, coaxial cable shall have the following characteristics:

- 1) Copper-clad aluminum center conductor.
- 2) 2.28mmØ
- 3) Foam polyethylene dielectric.
- 4) Seamless aluminum tubing shield.
- 5) 75 ohms impedance.
- 6) 1.5 dB 30.48 m of loss at 211 MHz.

Cable shall be protected by a black polyethylene jacket with a flooding compound between the jacket and the aluminium shield.] For direct burial construction or for cable in conduit, the same cable shall be used and protected by a black polyethylene jacket with a flooding compound between the jacket and the aluminum shield.

c. CATV Housings/Pedestals

CATV housings/pedestals shall be weatherproof, sized as required, and shall comply with NEMA 250.

d. Subscriber Service Cable

Coaxial cable shall have the following characteristics:

- 1) Copper-covered steel center conductor.
- 2) 30 percent conductivity.
- 3) 0.813mmØ

3) Foam polyethylene dielectric.

Shield shall have an inner surface of overlapped tape consisting of polypropylene encased in aluminum and an outer surface of tape consisting of polypropylene encased in aluminum with an overlap approximately 3.14 rad apart from the overlap point of the inner tape. Assembly shall be protected by a polyethylene jacket with a flooding compound between the jacket and the outer shield. Cable shall exhibit 75-ohm impedance and a maximum loss of 4.2 dB 30.48 m at 211 MHz.

e. Interior Cable

RG-6 / RG-59 type cable having the following characteristics:

- 1) Copper-covered steel center conductor.
- 2) 30 percent conductivity.
- 3) 0.813mmØ

4) Foam polyethylene dielectric.

Shield shall consist of a polypropylene braid encased in aluminum with an effective shielding 81 dB down and protected by a polyvinyl chloride jacket. Cable shall exhibit 75-ohm impedance and a maximum loss of 4.2 dB 30.48 m at 211 MHz.

f. Drop wire Clamps

For terminating aerial subscriber service cable without a strength member, use a non-crushing clamp. For terminating cable with a strength-supporting member such as a figure-8 cable, terminate the strength member using a wire vise deadend.

g. Grounding Block

Provide corrosion-resistant grounding block suitable for outdoor installation.

h. Ground Rods

Provide [copper-encased steel] [copper-clad steel], [sectional-type] ground rods at least 19 mm in diameter and at least 3050mm long. Die-stamp each, near the top, with the name or trademark of the manufacturer and the length of the rod in millimeter. Rods shall have a continuous surface that is hard, clean, and smooth throughout the length of the rod.

5. Terminators

Terminators shall be rated for 75 ohms and 1/4 watt and shall be equipped for power blocking.

6. Line Tap offs

Line tap offs shall have 18 dB minimum isolation from each tap to the thru-line. Pressure tap offs are not permitted.

5. Wall taps

Provide flush mounted] [surface mounted, 75-ohm, F-type connector, brown off-white, wall taps. Provide flush-mounted wall taps mounted in standard electrical outlet boxes, surface-mounted wall taps mounted in surface housings.

LOCAL PROGRAMMING EQUIPMENT**1. Cameras**

Two general purpose, color, black and white, cameras for studio classroom locations.

2. Lenses

General purpose lenses, millimeter (mm), f stop (f/) zoom lenses mm to mm, and f/; wide-angle lenses, mm, f/.

3. Digital Video Cassette Tape Recorders

Two front-loading desktop, rack-mounted, digital video cassette tape recorders.

4. Switcher

Input, /output, [desktop rack-mounted, bridging [terminating] switcher.

5. Fader

Input one/output, desktop recessed-in-the-table fader.

SUPPORT EQUIPMENT**1. Matching Transformers**

75-ohm female "F" fitting[s] connected to a 300-ohm spade tip matching transformer.

2. Band Separators

75-ohm female "F" fitting[s] connected to a VHF/UHF spade tip [and FM screw terminals] matching transformer with a band separator.

3. Coaxial Connector Cable

- a. 1830 mm, 75-ohm "F" fitting cable assembly.
- b. 3660 mm, 75-ohm "F" fitting cable assembly.
- c. 760 mm, 75-ohm "F" fitting cable assembly.

4. Coaxial Cable Connecting Kits

- d. 1830 mm, 75-ohm "F" fitting[s] connected to a 300-ohm spade tip matching transformer.
- e. 1830 mm, 75-ohm "F" fitting[s] connected to a 300-ohm VHF/UHF spade tip and FM screw terminals matching transformer with a band separator.

5. Converters

Set top converters equipped for output channel number 2, 3, 4 with 9, 18, 36, 58, 66 input channels.

EXECUTION**INSTALLATION****1. Antenna System****a. Reception**

Provide and orient antennas so that they supply the desired channels with maximum spurious-response rejection and minimal ghost imaging. When necessary to achieve the required input signal characteristics, provide and orient separate antennas for the best reception of each channel.

b. Antenna Mounts

Mount antennas on masts attached to a tower or wall or, antennas shall not be secured to a roof unless special authorization is obtained from the Contracting Officer and appropriate protection of the roof integrity is provided. Antennas shall not be attached to chimneys or vent pipes. Mast shall be securely mounted to adjacent structures with a minimum of three mounting brackets spread at 460 mm minimum intervals. Fasten the mounting brackets with [lag bolts a minimum of 9.525 mm diameter] [or] [expansion anchors sized for bolts a minimum of 9.525 mm diameter]. Mast attachments to mortar or grout joints are not permitted. Securely tighten the mounting hardware, antenna hardware, and the terminals.

c. Corrosion Protection and Wind Loading

All mounting and antenna assembly hardware shall be corrosion resistant. Design antennas and mounting devices to withstand a wind load of 200 km/h.

d. Anchoring

Antenna towers shall be either self supporting or free standing. Base of the tower shall be anchored to concrete legs. Foundations shall be designed for a maximum soil-bearing capacity of MPa and proportioned to provide a safety factor of 2.0 against uplift due to overturning, except that the minimum weight of the concrete footing alone, not considering the weight of the earth cover, shall provide a safety factor of 1.0. Towers shall be designed to resist forces generated by winds of km/h. Steel antenna towers and antenna supporting structures shall be designed, fabricated, and provided in accordance with applicable requirements of ANSI/EIA/TIA-222-F; except that for factory finish, the hot-dipped galvanizing process shall provide a zinc coating of 0.001218 g/mm² of surface.

e. Ladders, Obstruction Lights and Anticlimbing

Provide antenna towers with a system of horizontal members to serve as a ladder. Towers exceeding 6 meters in height shall be provided with a safety ladder device designed, fabricated, and provided in accordance with 29 CFR 1910.27. Provide appropriate anticlimb devices or security fencing around the tower] to prevent unauthorized climbing of the tower. When necessary, towers shall be provided with obstruction lights and markings in accordance with FAA AC-70/7460-1.

f. Lightning Protection and Grounding

Provide antenna system with lightning protection in accordance with NFPA 780. Provide grounding at the base or at the lowest point of the metallic towers. Connect at least two columns by No. 2/0 AWG copper cable to ground in accordance with NFPA 780. Structures adjacent to metallic towers and within their cone of protection do not require primary protection; but all metal frames, ventilators, doors, and window frames shall be bonded together and grounded. Provide antenna lead-ins with spark gap protection connected to ground adjacent to the supporting structure of the antennas.

2. Headend

Provide headend equipment in the location identified on the drawings; mount the equipment in Contractor-provided racks.

3. Distribution System

Distribution system shall conform to cable routing and equipment locations as shown on the facility layout drawing. Installation shall be in accordance with ANSI C2.

a. Exterior Aerial Cable System

(1) Existing pole line plant: Modify and expand the existing pole line, when required, to provide strength and clearance in conformance with ANSI C2. When pole line extension is required, provide in accordance with "Overhead Transmission and Distribution." Provide all new required materials and hardware.]

(2) New pole line plant: Provide in accordance with "Overhead Transmission and Distribution."

(3) Aerial cable: Do not bend the cable more than the minimum radius recommended by the manufacturer, based on the type of sheath used. Attach equipment housings containing the electronic equipment to the strand, and connect the cable shield to the housings. Ground the assembly in accordance with ANSI C2, when possible or to a driven ground rod assembly with a maximum 25 ohms resistance as measured by a ground resistance meter. This measurement must be satisfied before connecting the ground to the equipment housing. For a cable section exceeding 300 meters between equipment mountings, provide intermediate grounds. Provide subscriber service cable from the feeder cable to the building. For distances greater than 30 meters, provide cable with a strength member. Terminate the cable in a grounding block. Connect the grounding block to a grounding system having a maximum 25 ohms resistance.

b. Exterior Conduit Systems

Provide the electronic equipment in weatherproof housings.
Attach the housings to manhole, handhole walls with corrosion resistant hardware.

(1) Existing exterior conduit system: Use only manholes and empty conduits reserved exclusively for telecommunications cables. If it is necessary to provide electronic equipment between existing manholes, Contractor shall provide the necessary conduit and manholes, handholes in accordance with "Underground Electrical Works." The word "TELEPHONE" shall be cast in the top face of all new manholes, handhole covers. All manholes, handholes in streets must be rated AASHTO HB14 Class 20 wheel loading. Attach the weatherproof housings containing the electronic equipment to the manhole, handhole wall with corrosion-resistant hardware.

(2) **New Exterior conduit system:** Provide a new conduit system constructed in accordance with "Underground Electrical Works." The word "TELEPHONE" shall be cast in the top face of all new manholes, handhole covers. Attach the weatherproof housings containing the electronic equipment in new, Contractor-provided manholes, handholes. New manholes, handholes for such housings and equipment are not indicated on the drawings, but shall be provided. All manholes, handholes in the streets must be rated AASHTO HB Class 20 wheel loading.

(3) **Exterior cable in exterior conduit:** Do not bend cable more than the minimum radius recommended by the manufacturer, based on the type of sheath used. Connect cable conductors to the electronic equipment, and connect the shield to the housing. Provide subscriber service cable to the building, and terminate in a grounding block. Provide and connect grounding block to a grounding system, having a maximum 25 ohms resistance.

c. Direct Buried Cable

Provide buried cable in accordance with "Underground Electrical Works." Provide CATV weatherproof housings/pedestals, handholes. The new housing/pedestals, handholes for the electronic equipment are not indicated on the drawings but shall be provided. Attach electronic equipment with corrosion-resistant fasteners in these housings/pedestals, handholes. Connect cable conductors to the electronic equipment, and connect the shield to the equipment housing. Provide and connect the equipment housing to a grounding system, having a maximum 25 ohms resistance. Provide subscriber service cable to the building, and terminate in a grounding block. Provide and connect the grounding block to a grounding system, having a maximum 25 ohms resistance.

d. Grounding Block

Provide the grounding block [inside] [outside]. Ground this device [according to the requirements of ANSI C2] [to a continuous length of metal cold water pipe without insulating joints and to a ground rod assembly driven a minimum of 150 mm below the surface of the surrounding earth]. Resistance, as measured by a ground resistance meter, shall be a maximum of 25 ohms.

e. Interior Cable

Provide interior cable in conduit in compliance with NFPA 70 and in accordance with "Interior Wiring System." Provide cable to grounding blocks, to line tap-off's, and to wall taps.

4. TV [and FM] Receivers

Provide required coaxial connector cable or kits to connect one existing TV receiver located within 1825 mm from the wall tap.

SIGNAL SURVEY

Conduct a signal survey to determine the best antenna location and orientation and the type of antennas required for receiving desired signal levels and rejection of undesired signals.

FIELD TESTING

1. Ground Rod Tests

Test ground rods for ground resistance value before the wire is connected. Use a portable ground testing meg-ohmmeter to test each ground or group of grounds. Instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the value of the ground electrode under test.

2. System Pre-test

Upon completing installation of the CATV system, the Contractor shall align and balance the system and shall perform complete pretesting. During the system pre-test, Contractor utilizing the approved spectrum analyzer or signal level meter shall verify that the system is fully operational and meets all the system performance requirements of the specification. Contractor shall measure and record the video and audio carrier levels of each channel at each of the following points in the system:

- a. Antenna outputs.
- b. Preamplifier outputs.
- c. Headend output.
- d. Distribution amplifier inputs and outputs.
- e. Last outlet of each section of cable.
- f. A random sampling of 25 percent of the outlets.

3. Acceptance Tests

Contractor shall notify the Contracting Officer of system readiness 10 days prior to the date of acceptance testing. CATV system shall be tested in accordance with the approved test plan in the presence of the Contracting Officer's representative to certify acceptable performance. System test shall verify that the total system meets all the requirements of the specification and complies with the specified standards. Deficiencies revealed by the testing shall be corrected and revalidated by follow-up testing.

INSTRUCTIONS AND TRAINING

1. Instructions to Government Personnel

Supply the services of competent instructors to give complete instructions to designated personnel in the operation, adjustment, and maintenance of the CATV system and related equipment. Instructions shall include alarm indications, required corrective action, and pertinent safety requirements. Supply operational training for the local programming equipment. Orient the training specifically to the system provided. Number of training days (8-hour days) of instruction shall be for the CATV system and for the local programming equipment].

2. Training Documentation

Supply training manuals for each trainee and one additional copy for the library. Manuals shall describe in detail the information included in each training program. Lesson plans and list of reference material shall also be supplied.

ITEM 16 : WIRE COMMUNICATION AND SIGNAL SYSTEM**TELEPHONE SYSTEM****GENERAL**

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

DESCRIPTION OF WORK

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

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

PRODUCTS**CONDUIT AND FITTINGS**

- a. Conduit shall be polyvinyl-chloride conduit (PVC) where specified, shall be heavy wall, high impact resistant Schedule 40, with factory made bends, couplings and fittings. PVC cement for joints shall be of the same brand as for the PVC pipe.
- b. No conduits shall be used in any system smaller than 20mm (1/2") diameter electric trade size, nor shall have more than four (4) 90 degree bends in any one run and where necessary, pull boxes shall be provided as directed.
- c. No wire shall be pulled into any conduit until the conduit system is completed in all details, in the case of concealed work until all rough plastering masonry has been completed, and in the case of exposed work until the conduit work has been completed in every detail.
- d. The ends of all conduits shall have tightly plugged to exclude plaster, dust and moisture while the construction of the building is in progress. All conduits shall be reamed to remove all burrs.

OUTLETS, BOXES AND FITTINGS

- a. At all outlets whatever kind, for all system, there shall be provided a suitable fitting, which shall be either a box or other device especially designed to receive the type of fitting to be mounted thereon.
- b. The Contractor shall consult with the Engineer as to the nature of the various fittings to be used before installing his outlet fittings, and shall conform strictly in the use of fittings, to the nature of the appliance to be mounted on them, so that the work, when the completed will be a finished design.
- c. All outlets on concealed conduit work provide galvanized pressed steel outlet boxes on standard make. These boxes shall be in all cases standard and where such boxes are not available on the market, special boxes shall be secured by the Contractor at his own expense. In general outlet boxes shall be at least 100mm diameter, 53mm deep and No. 16 minimum gauge.

JUNCTION AND PULL BOXES

- a. Junction and pull boxes, of code gauge steel, galvanized shall be provided as indicated or as required for facilitating the pulling of wires and cables. Pull boxes as finished places shall be located and installed with the permission and to the satisfaction of the Engineer.
- b. All junction and pull boxes on exposed conduit work shall be provided with hubs for threaded pipe entry and covers provided with neoprene gaskets.

LOCAL TELEPHONE COMPANY PROVIDER / INTERCONNECTION OF PABX SYSTEM

- a. All components, connections of Telephone Company shall conform to EIA/TIA standards.
- b. Cable terminals shall be the type acceptable to the Telephone Company. Terminals shall be Cat- 6 as required on the plans.

TELEPHONE INSTALLATION

The telephone installation shall be mounted and as indicated on the plans.

HORIZONTAL CABLE

All horizontal cabling shall be Category 6 network cables.

TELEPHONE / DATA OUTLETS

All modular jacks shall be data grade Cat- 6.

SHOP DRAWINGS

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

ITEM 17 : MECHANICAL GENERAL REQUIREMENTS**GENERAL**

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

WORK DESCRIPTION

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

Specifically the work shall involve the following:

- a. To supply, deliver, install, wires/cables, conduit, circuit breaker and make operational the split type and ceiling cassette type inverter air conditioning units including bathroom exhaust fans for toilets as shown on the Drawings.
- b. To supply and install the refrigerant piping system and condensate drain lines including necessary insulation and hangers.
- c. To supply and install the electrical wiring connections from the AC supply provided by the Electrical Contractor which is located close to the point of installation. This shall include power and control wirings and interlocks with the thermostat control.

SUBMITTALS

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

1. Shop Drawings

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

2. Manufacturer's Data

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

3. Standard Compliance

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

4. Codes, Inspection, Permits and Fees

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

- 1) Philippine National Building Code
- 2) Regulations of the Local Municipality

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

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

OPERATION AND MAINTENANCE MANUAL

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

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

POSTED OPERATING INSTRUCTIONS

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

SAFETY

1. Rotating Equipment Safety

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

INSTRUCTION TO OWNER'S PERSONNEL

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

DELIVERY AND STORAGE

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

STANDARD PRODUCTS/SERVICE AVAILABILITY

1. Materials and Equipment

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

2. Experience Required

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

3. Alternative Service Record

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

4. Service Record

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

5. Manufacturer's Nameplate

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

SAFETY REQUIREMENTS

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

MANUFACTURER'S RECOMMENDATIONS

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

ELECTRICAL REQUIREMENTS

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

ELECTRICAL MOTORS

1. All electrical motors of sizes and types as specified for driving air conditioning and ventilating equipment shall be furnished and erected under this section. All motors shall be of proper power and speed to suit the specified makes of equipment. If other makes of equipment are accepted in any case, the proper adjustment of motor speed and power including affected changes in electrical system circuit breakers and wiring must be included without additional cost to the Owner. Technical data shall be submitted for approval before the equipment is purchased.
2. All motor ratings shall be as specified on the drawings.
3. Generally, all motors shall be constant speed, squirrel-cage type motors and energy efficient except as otherwise listed on plans. Single phase motors shall be capacitor start induction-run or split phase type as approved for the service.
4. All belt-connected motors shall have adjustable bases and set screws to maintain proper belt tension, and shall be provided with proper belt guards.
5. All motors and accessories shall comply in all respect with NEMA Standards. Types shall be as required by Local Code.
6. All motors shall be furnished with type "B" insulation and tropical fungus proofing according to NEMA standards.

CHANGES IN WORK DUE TO APPROVAL OF ALTERNATE MATERIALS

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

GUARANTEE

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

AS-BUILT DRAWINGS

1. The Contractor shall, during the progress of work, keep record of all deviations of the actual installation from that shown on the Contract Drawings.
2. Upon completion of work, the Contractor shall submit two (2) copies of the as-built drawings, signed by the Contractor's Registered Professional Mechanical Engineer and Owner Project Inspector, indicating the work as actually and finally installed, including new information not originally shown in Contract Drawings.

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

QUALITY ASSURANCE

1. Surveys and Measurements:

- a. The Contractor shall base measurements, both horizontal and vertical, from established benchmarks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.
- b. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or intent of the drawings and specifications, he shall notify the Owner's representative and shall not proceed with his work until he has received instructions from the Owner's representative upon referring the matter to the Engineer.

2. Drawings and Minor Modification:

- a. Drawings are diagrammatic and indicate the general arrangement of the system and work included in the contract. Drawings are not to be scaled. The drawing and details shall be examined for exact location of fixtures and equipment by verifying actual site conditions.
- b. The Contractor shall follow drawings in laying out work and check drawing of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Owner's representative shall be notified before proceeding with installation, if directed by the Owner's representative, the Contractor shall, without extra charge, make reasonable modifications and the layout as needed to prevent conflict with work of other trades or for proper execution of the work.
- c. **Materials and Workmanship**

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

ITEM 18 : UNITARY AIR-CONDITIONING SYSTEMS**GENERAL**

"Mechanical General Requirements" applies to this item 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 TYPE INVERTER

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 Inverter

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

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

5. 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

6. 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.

7. Filter Boxes

Provide filter boxes with either hinged 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".

8. 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.

9. 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.

10. 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.

11. 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 flow 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 "Electrical General Requirements". Motor starters shall be provided complete with properly sized thermal overload protection and other appurtenances necessary for the motor control wiring required for controls and devices but not indicated.

4. Piping

a. Piping Sleeves

Pipe sleeves shall be as Galvanized Iron, Schedule 20.

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

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

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

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

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

6. Air Filters

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

7. Inspection Plates and Test Holes

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

8. Flashing and Pitch Pockets

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

FIELD TESTS AND INSPECTIONS

1. Tests

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

2. Leak Testing

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

3. Evacuation, Dehydration, and Charging

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

4. Start-Up and Operation Tests

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

5. Performance Tests

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

6. Sound Tests, 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 19 : EXHAUST EQUIPMENT**EXHAUST EQUIPMENT****GENERAL**

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

SCOPE OF WORK

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

PRODUCTS**MATERIAL REQUIREMENTS****1. Bathroom Ceiling Mounted Exhaust Fan**

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

2. Industrial Propeller Exhaust Fan and Jet Fan Type

The propeller exhaust fan shall be indicated 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. The capacity of the industrial exhaust fan and Jet fan shall be shown on the plan.

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 20 : DISTRIBUTION TRANSFORMER

SCOPE OF WORK

The work to be done shall consist of supply and delivering and upgrading distribution line and metering devices completed in accordance with all the materials submitted by Manila Electric Company (MERALCO), including labor, tools and equipment and all incidentals works as found necessary.

GENERAL REQUIREMENTS

a) All works shall be done in accordance with the requirements of the publications and agencies having jurisdiction, as well as the requirements of the approved standards.

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

b) Materials Requirements (If needed)

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

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

c) **Standard Test Reports:**

1. Routine Tests

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

2. Type of Test

- Impulse test
- Temperature Rise Test

PRODUCTS (DISTRIBUTION TRANSFORMER)

External Features

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

Internal Features

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

PRODUCTS (GENERAL DESCRIPTION)

- 1. High Voltage Bushing**, the cover mounted and tank - wall high voltage bushing are made of wet process porcelain suitable for both copper and aluminum conductors.
- 2. Low Voltage Bushing**, single or double eyebolt or spade terminal made of wet process porcelain.
- 3. Tank and Cover**, manufactured from hot-rolled steel sheets and pressure tested to ensure a leak free enclosure. Grit blasted or chemically treated to remove every trace of scale, rust or oil, for better paint adhesion. Outer and inner surfaces are primed with epoxy primer for rust prevention and the outer surface is coated with polyurethane.
- 4. Pressure Relief Valve**, gradually releases excess pressure and designed for outdoor condition.
- 5. Tank and Low Voltage Grounding Provisions**, provided to help prevent damage to the transformer during electrical surges.
- 6. Externally Operated No-Load Tap Changer**, provides up to five (5) primary voltage for convenient changing of high voltage tap connection at no-load.
- 7. Radiators**, made of hot-rolled steel sheets these are provided for higher KVA units for added cooling surface.

8. **Core Coil Assembly**, uses a superior transformer insulation system and is permanently centered in the tank using a close fitted steel frame. Materials used for our coils, are wither silicon-iron for our Blue and Silver series or Amorphous metal for our gold line.
9. **Winding Material**, distribution transformer uses a combination of standard copper-aluminum or copper-copper winding materials.
10. **Insulating –Di- Electric Fluid**, used are either mineral oil or an environment friendly high fire point fluid.
11. **Coil Support**, used compatible materials to hold the coil in place and restraint it during short circuit-circuit conditions. Core clamps and clamp angles are also used to ensure that the core and windings are effectively secured even during mechanical stresses.

EXECUTION

INSTALLATION

They shall be in accordance with the code and requirements specified herein.

GROUNDING

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

WORKMANSHIP

The work throughout shall be executed in the best and most thorough manner under the direction of and at the satisfaction of the Registered Electrical Engineer or Master Electrician, who will interpret the intent meaning of the drawings and specification and shall have the power to reject any work and materials which in his judgment, are not in full accordance therewith.

TESTING OPERATIONS

When the electrical installation is completed, the Contractor shall test the installed electrical materials and equipment in the presence of Registered Electrical Engineer or Master Electrician. The system shall be free from any defects, shorts or grounds. The Contractor at no extra cost shall furnish all necessary instruments and personnel required for the testing.

GUARANTEE

Upon completion and before final acceptance of the work, the Contractor shall furnish the Engineer a written guarantee stating that all works executed are free from defects on materials and workmanship. The guarantee shall be for a period of one year from the date of the final acceptance. Any work that becomes defective during the said period shall be corrected / replaced by the Contractor at his own expense in a manner satisfactory to the Authority.

ITEM 21 : CAR LIFTER (4 TONS CLEAR FOOT)**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 handrails, railings and guardrails as indicated on the drawings and as specified herein.

SPECIFICATION

Lifting Capacity: 4 Tons
Lifting Height: 1800mm
Lifting Time: 50s
Minimum Height: 120mm
Motor Power: 2.2kw / 60hz
Overall Height: 3340mm
Width Between Columns: 2850mm
Power Supply: 220v
Packing Size: 3350mm x 450mm x 670mm
Overall Weight: 320kg

The 2 Post Car Lifter shall be installed at location(s) as indicated in plans.

ITEM 22 : 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 its effluent and discharge pipelines shall be part of other sections 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 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 piping, however, where actual conditions necessitate re-arrangement in the opinion of the Contractor and/or the Engineer, the Contractor shall prepare and submit to the Engineer for approval, within 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. 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 $\frac{1}{4}$ as shown on the drawings.

7. Pipe Sleeves

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

8. Downspout

All downspouts 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 1.5 meters apart for uPVC pipes and 3.0 meters apart for iron pipes. Chain straps, perforated bars or wire hangers will not be permitted.

Hangers shall have short tumbuckles or other approved means of adjustment. Tumbuckles 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 a flanged pattern and shall be of galvanized (zinc-coated) cast iron. Gaskets for flange unions shall be of the best quality fiber plastic or leather.

14. Valves

Valves shall be cast bronze or 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 FLUSH 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 as 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 the 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 a 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 the 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 has been installed, the joints are 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 the 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 Philippine National Plumbing Code. All fixtures shall be fastened and/or supported in accordance with the given requirements.

ITEM 23 : 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 consists of furnishing all labor, materials, equipment, tools, and incidentals necessary to undertake, a complete supply of water pump, and pressure tank for the building as indicated on the drawings and as specified herein.

Pressure Tank/ Water Pump**a. PRESSURE TANK**

1. Location: Pump House
Tank Volume: 850 liters
Diameter: 80 cm.
Height: 195 cm.
Connectors: 50 mm
Pressure: 150 psi

b. WATER PUMP

1. Location: Pump Room
Description: Constant Pressure Booster Pump
Function: Booster pump
Power: 3.0 hp.
Flowrate: 90-130 gpm @ 30-100 feet tdh
Specs: 230 volts, 60 HZ

EXECUTION

All materials will be delivered and installed on-site.

ITEM 24a : 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 consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete all finishing works and painting for the buildings 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

1. Interior
 - a. Plain cement finished painted with elastomeric paint.
 - b. 300mm x 600mm Vitrified Glazed Tiles
 - c. 12mm thick Fiber cement board on metal studs framing.
Locations are shown in the plans and elevations.

Stud: 76 mm (3 inches)
3.00 meter length

Track: 76 mm (3 inches)
3.00 meter length

Board: 1.20 x 2.40 x 6mm 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

- a. 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 not 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.
- b. Portland cement, sand, bonding compound, lime and water shall conform with the requirements.

FLOORS

Port Operational Building

1. (FF-02) - 600mm x 600mm Unglazed Ceramic Tile Finish (Design 1)

Ground Floor

- a. Transport
- b. Pantry
- c. Waiting Room
- d. PPA-TI Lobby
- e. Storage
- f. Control Room
- g. Vacant
- h. PCS-LAI
- i. Pantry
- j. Hallway
- k. PPAEDCO
- l. Pantry
- m. Pantalan
- n. File Room
- o. Security Office

2. (FF-03) – 600mm X 600mm Unglazed Ceramic Tile Finish (Design 2)

Ground Floor

- a. Transport Toilet
- b. Vacant Toilet
- c. PCS-LAI Toilet
- d. Department Manager Toilet

Mezzanine 1

- a. Male CR
- b. Female CR

Mezzanine 2

- a. Male Dorm Toilet and Bath
- b. Female Dorm Toilet and Bath

3. (FF-04) - Checkered Steel Plate

Mezzanine 1

- a. Stairs @ PPA-TI Office

Mezzanine 2

- b. Stairs @ Dormitory
- c. Balcony @ Dormitory

4. (FF-05) - 300mm X 300mm Vinyl Tile Finish

Mezzanine 1

- a. Department Manager
- b. Division Manager 1
- c. Division Manager 2
- d. PPA-TI Office
- e. Conference Area
- f. File Room
- g. Pantry

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 dryset 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 trowelled 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 pointing mortar shall be forced into joints by using trowel, brush or finger application. Before the grout or mortar sets, the joints of cushion edge 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**Port Operational Building****1. (CF-01) – Exposed Slab/Ceiling****Ground Floor**

- a. Transport
- b. Waiting Room
- c. Vacant
- d. PCS-LAI
- e. Hallway
- f. PPAEDCO
- g. Pantalan
- h. Security Office
- i. Office Pantry

Mezzanine 1

- a. Department Manager
- b. Division Manager 1
- c. Division Manager 2
- d. PPATI Office
- e. Conference Room
- f. File Room
- g. Pantry at PPATI Office

2. (CF-02) - 600mm x 600mm Non-sag Acoustic Board on Aluminum T-Runners**Ground Floor**

- a. Transport
- b. Waiting Room
- c. Vacant
- d. PCS-LAI
- e. Hallway
- f. PPAEDCO
- g. Pantalan
- h. Security Office
- i. Office Pantry

Mezzanine 1

- a. Department Manager
- h. Division Manager 1
- i. Division Manager 2
- j. PPATI Office
- k. Conference Room
- l. File Room
- m. Pantry at PPATI Office

3. (CF-03) – 12mm Thk. Gypsum Board Painted on 0.40mm Thk. Galvanized Steel Ceiling Suspension System @ 0.40 m O.C. (Furring) 0.60 m O.C. (Carrying Channel) and 1.20m O.C. Bothways (Suspension Rod)

Ground Floor

- a. Transport Toilet
- b. PPA-TI Lobby
- c. PPA-TI Lobby Storage
- d. Control Room
- e. Vacant Toilet
- f. PCS-LAI Toilet
- g. Pantalan Toilet
- h. Pantalan Storage
- i. Pantalan File Room
- j. Storage
- k. Pump Room (For Cistem)
- l. Pump Room (For Tank)
- m. Electrical Room
- n. Control Room

Mezzanine 1

- a. Department Manager Toilet
- b. Male CR
- c. Female CR

Mezzanine 2

- a. Dining Area
- b. Male Dorm
- c. Toilet and Bath
- d. Female Dorm
- e. Toilet and Bath
- f. Exterior Hallway

4. (CF-04) – Painted Finish Under Slab

Ground Floor

- a. Storage

5. CF-05 – Fire Rated, 12mm Thk. Gypsum Board Painted on 0.40mm Thk. Galvanized Steel Ceiling Suspension System @ 0.40 m O.C. (Furring) 0.60 m O.C. (Carrying Channel) and 1.20m O.C. Bothways (Suspension Rod)

Mezzanine 1

- a. Fire Exit @ PPATI Office

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 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 walls 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. Selected 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.

D-01 – Motor Operated (3/4HP) Roll-up Door, Shutter: Using Galvalumed GA#18, Cover using GA#26, Cover using Angle Bar, Sidepost: Galvalumed Unpainted. (4.52m X 7.00m)

D-02 - Motor Operated (3/4HP) Roll-up Door, Shutter: Using Galvalumed GA#18, Cover using GA#26, Cover using Angle Bar, Sidepost: Galvalumed Unpainted. (4.17m X 4.12m)

D-03 – Double Leaf Metal Door using 2x2 Wire Mesh on 2x4 Steel Tubular Frame in Automobile Paint Finish. (2.50m X 2.45m)

D-04 - Marine plywood finish double leaf flush door in quick drying enamel finish (Wall = 200mm thk). (1.00m X 2.45m)

D-05 - Marine plywood finish double leaf flush door in quick drying enamel finish (Wall = 150mm thk). (1.70m X 2.45m)

D-06 - Marine plywood finish single leaf flush door in quick drying enamel finish (Wall = 150mm thk). (1.30m X 2.45m)

D-07 - Marine plywood finish single leaf flush door in quick drying enamel finish (Wall = 150mm thk). (0.80m X 2.45m)

D-08 – Metal Flush Door in Quick Drying Enamel Finish (Wall = 100mm thk). (1.00m X 2.45m)

D-09 - Marine plywood finish single leaf flush door in quick drying enamel finish (Wall = 100mm thk). (0.90m X 2.45m)

D-10 - Marine plywood finish single leaf flush door in quick drying enamel finish (Wall = 100mm thk). (0.80m X 2.45m)

D-11 - Marine plywood finish single leaf flush door in quick drying enamel finish with louver at the bottom portion (Wall = 150mm thk). (0.80m X 2.45m)

D-12 - Marine plywood finish single leaf flush door in quick drying enamel finish with louver at the bottom portion (Wall = 100mm thk). (0.80m X 2.45m)

D-13 – Fire Rated Cold Rolled Steel Emergency Exit Door in Quick Drying Enamel Finish with Panic Push Bar Lock. (1.00m X 2.45m)

D-14 - Fire Rated Cold Rolled Steel Emergency Exit Door in Quick Drying Enamel Finish with Panic Push Bar Lock. (1.10m X 2.45m)

D-15 – 12mm Thk Tempered Glass Door Frameless with Stainless Steel Handle with Swivel accessories and Frosted Sticker on Glass. (0.80m X 2.40m)

D-16 – Double Leaf Wood Panel Door in Wood Jamb Wall (Wall = 200mm Thk). (1.70m X 2.45m)

D-17 – Marine plywood finish single leaf flush door in quick drying enamel finish (Wall = 100mm thk). (0.90m X 2.45m)

D-18 – Marine plywood finish single leaf flush door in quick drying enamel finish (Wall = 100mm thk). (0.80m X 2.15m)

D-19 – Marine plywood finish single leaf flush door in quick drying enamel finish with louver at the bottom portion (Wall = 100mm thk). (0.80m X 2.15m)

D-20 – 12mm Thk Tempered Glass Door Frameless with Stainless Steel Handle with Swivel accessories and Frosted Sticker on Glass. (0.80m X 2.10m)

D-21 – Fire Rated Cold Rolled Steel Emergency Exit Door in Quick Drying Enamel Finish with Panic Push Bar Lock. (1.00m 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-01 - 1.5mm Thk. aluminum framed powder coated casement type window w/ 6mm thk. reflective, tempered glass. (3.00m X 1.50m)

W-02 - 1.5mm Thk. aluminum framed powder coated casement type window w/ 6mm thk. reflective, tempered glass. (2.00m X 1.50m)

W-03 - 1.5mm Thk. aluminum framed powder coated casement type window w/ 6mm thk. reflective, tempered glass. (1.00m X 1.50m)

W-04 - 1.5mm Thk. aluminum framed powder coated casement type window w/ 6mm thk. reflective, tempered glass. (4.00m X 1.50m)

W-05 - 1.5mm Thk. aluminum framed powder coated casement type window w/ 6mm thk. reflective, tempered glass. (3.20m X 1.50m)

W-06 - 1.5mm Thk. aluminum framed powder coated casement type window w/ 6mm thk. reflective, tempered glass. (2.40m X 1.50m)

W-07 - 1.5mm Thk. aluminum framed powder coated casement type window w/ 6mm thk. reflective, tempered glass. (1.60m X 1.50m)

W-08 - 1.5mm Thk. aluminum framed powder coated awning type window w/ 6mm thk. reflective, tempered glass. (1.80m X 0.60m)

W-09 - 1.5mm Thk. aluminum framed powder coated fixed type window w/ 10mm thk. reflective, tempered glass. (3.60m X 2.10m)

W-10 - 1.5mm Thk. aluminum framed powder coated fixed type window w/ 10mm thk. reflective, tempered glass. (1.80m X 2.10m)

W-11 - 1.5mm Thk. aluminum framed powder coated awning type window w/ 10mm thk. reflective, tempered glass. (9.00m X 0.70m)

W-12 - 1.5mm Thk. aluminum framed powder coated awning type window w/ 8mm thk. reflective, tempered glass. (8.00m X 0.70m)

W-13 - 1.5mm Thk. aluminum framed powder coated awning type window w/ 8mm thk. reflective, tempered glass. (5.00m X 0.70m)

W-14 - 1.5mm Thk. aluminum framed powder coated awning type window w/ 8mm thk. reflective, tempered glass. (4.00m X 0.70m)

W-15 - 1.5mm Thk. aluminum framed powder coated awning type window w/ 8mm thk. reflective, tempered glass. (3.00m X 0.70m)

W-16 - 1.5mm Thk. aluminum framed powder coated awning type window w/ 8mm thk. reflective, tempered glass. (2.00m X 0.70m)

W-17 - 1.5mm Thk. aluminum framed powder coated awning type window w/ 8mm thk. reflective, tempered glass. (1.00m X 0.70m)

W-17A - 1.5mm Thk. aluminum framed powder coated awning type window w/ 8mm thk. reflective, tempered glass. (1.00m X 0.70m)

W-18 - 1.5mm Thk. aluminum framed powder coated fixed type window w/ 8mm thk. reflective, tempered glass. (7.20m X 2.10m)

W-19 - 1.5mm Thk. aluminum framed powder coated fixed type window w/ 8mm thk. reflective, tempered glass. (2.70m X 2.40m)

ITEM 27b : TERMITE PROOFING, BUKBOK PROOFING

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 Contractor shall hire the services of an approved or accredited pesticide company to furnish all labor, materials, equipment, tools, plant, and services to complete the termite and "bukbok" proofing work hereinafter described.

EXAMINATION OF SITE

Inspect the site of work and examine the premises to fully understand existing conditions with respect to the work involved. Prior to soil stripping, excavation or filling all termite mounds within the area should be demolished, removed and treated.

MATERIAL REQUIREMENTS

CHEMICALS AND EQUIPMENT

For termite proofing, use Termiticide Concentrate acceptable to the PPA and should have license from Fertilizer and Pesticide Authority.

For "bukbok" proofing of kiln dried wood and for untreated wood, use chemical name accredited name/or acceptable to the PPA and should have valid license from Fertilizer and Pesticide Authority (FPA).

The pest control Contractor shall submit the specified chemicals in their original manufacturer sealed containers to the Project Inspector of inspection, sampling and safekeeping. Containers with broken seal shall not be accepted.

Dilution ratings (for Termiticide Concentrate):

1 part Termiticide Concentrate TC to 50 parts water

Pesticides - 1 : 100 concentration

Dilutions shall be done only at the jobsite in the presence of the Project Inspector. The strength of the mixture or solutions shall be made uniform by thorough stirring. All solutions prepared for termite proofing shall be used within 24 hours.

EXECUTION

CONTRACTOR LICENSE AND CERTIFICATION REQUIREMENT

The pesticide company should have a valid license from Fertilizer and Pesticide Authority of the Department of Agriculture.

All pesticide shall be applied by or under the direct supervision of a certified pesticide applicator.

ENVIRONMENTAL AND SAFETY CONDITIONS

Formulation, treatment, storage and disposal of pesticide shall be in accordance with label directions. Water for formulation shall be drawn only from site(s) designated by the Project Inspector, and the filling hose shall be fitted with a backflow preventor meeting local plumbing codes/standards. The filling operation shall be under the direct and continuous observation of the Project Inspector to prevent overflow.

APPLICATION

1. Termite Control

Application of solution shall be done by means of power sprayers fitted with flow meters for accurate monitoring of actual quantity used. At the time of soil treatment application, the soil shall be preferably in a friable condition with low moisture content to allow uniform distribution of the treatment solution throughout the soil. Do not apply pesticide during or immediately following heavy rains, or when conditions will cause runoff and create an environmental hazard. Cover treated area with waterproof sheeting if concrete is not poured on the same day as the soil treatment. Take precautions to prevent disturbance of the pesticide barrier. Before the placement of structural components, re-treatment where soil or fill is disturbed after treatment. Apply pesticide prior to placement of gravel base, vapor barrier or waterproof membrane.

a. Slab on Grade Construction

Establish a horizontal pesticide barrier over areas intended for covering by floors, porches, attached entryways, garages, carports and terraces. Apply treatment solution with a low pressure coarse spray at the rate of four (4) liters solution per square meter. Apply at the rate of seven (7) liters solution per square meter if the fill is washed gravel or other coarse material. Establish a continuous chemical barrier in the voids of hollow block foundation or voids of masonry. Apply treatment at the rate of seven (7) liters per 3 linear meter. Make pesticide band at least 15 cm wide the pesticide evenly distributed throughout. Treat buildings constructed with basement slabs in the same manner.

b. Crawl Space Construction

Establish a vertical pesticide barrier inside of foundation walls, both sides of interior partition walls, around piers, plumbing, and rodding and utility conduits. Apply treatment solution by rodding or rodding and trenching the fill at the rate of 15 liters solution per 3 linear meter, and 30 cm deep from grade to bottom of foundation. Treat both sides of foundation and around all piers and pipes. Make treated barrier of fill at least 15 cm wide with the pesticide evenly distributed throughout.

c. Dry Pipes and Conduits

Establish pesticide barrier on various dry pipes and conduits such as electrical service entrance, raceways, pipe chase, vents. Use powder type termiticide by injecting it inside the pipe.

d. Termite Mounds

Demolish and treat all termite mounds within the property found after the construction.

2. **"Bukbok" Proofing**

Kiln-dried wood, plywood, tanguile, apitong, cabinets, dividers, and paneling shall be brushed generously with Pesticides before painting or varnishing.

3. **Sun-Dried Wood Treatment**

Sun-dried lumber to be used for ceiling joint runners, nailer, etc. shall be brushed with Pesticides before installation of plywood or ceiling panels.

ENGINEERS

The Contractor shall submit to the Engineer for approval, a copy of the pest control company's proposal and chemical application, method/procedure including the description of the equipment to be used before start of work.

INSPECTION AND TEST

Sampling shall be done only in the presence of the Project Inspector.

Amount of sample to be taken: 50 cc each.

CONTRACTOR'S GUARANTEE

Upon completion of work, and on a condition for final acceptance, the Contractor shall submit to PPA a written guarantee from the pesticide company which shall provide that:

1. The soil poisoning treatment shall prevent subterranean termites from attacking the building on its contents for a period of not less than five (5) years.
2. The Contractor shall thereby warrant all works in pest control that all materials and workmanship applied under the contract are of good quality in every respect and will remain as such for not less that five (5) years.

Should there be termite and "Bukbok" infestation within the one (1) year period the Contractor thereby agrees to do all necessary repairs on the damaged portions of the buildings caused by termite infestation to the satisfaction of PPA, at the Contractor's expense. Retreatment shall also be done by the Contractor after completion of the repairs and at his expense. Such repairs and corrective works shall be done within five days after a written notice from the Owner has been received by the Contractor.

Should there be infestation after the one (1) year period up until the five (5) year guarantee, the pesticide company agrees to do all the necessary repairs at their expense. The pesticide company shall conduct annual inspection of the building and surrounding to check any infestation during the guarantee period. Notice shall be given by the pesticide company to PPA in case there is presence of termites in the surroundings.

ITEM 24c : FLOOR 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 consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete all finishing works and painting for the buildings 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:

SELF LEVELING EPOXY**Product Description**

Self-Leveling Epoxy is a three component heavy duty floor coating that provides a high gloss, seamless, hygienic surface that is extremely hard wearing and durable. The coating can also be applied to provide a nonslip texture in combination with non slip aggregates. This product may be top coated if required.

Characteristics

Color:	As per color card
Finish:	Gloss
Solid Contents:	99 ± 1%
Specific Gravity:	1.5 – 1.6 (mixed)
Recommended dry Film Thickness:	1mm to 5mm
Theoretical Coverage:	1.0m ² /ltr @ 5mm DFT
Flash Point:	68°C
Mixing Ratio by volume:	Comp A 7.5 ltr Comp B 2.85 ltr Comp C 20kgs (7.7ltrs)
Viscosity:	ASTM D 4287
Specific Gravity:	ASTM D 1475
Gloss:	ASTM D 523

Storage and Handling

Product must be stored in accordance to national regulations. The product should be kept in well ventilated place protected from heat and direct sunlight. The containers must be kept tightly closed.

Safety Precautions

Material health and safety data sheet is available upon request. Please observe the precautionary notice displayed on the container. Ensure proper ventilation during application and drying of paint. Avoid inhalation of paint mist and vapors and skin contact. Spillage of paint on skin should immediately be removed with suitable cleanser soap and water. Eyes should be well flushed with water and immediate medical attention should be sought.

Application Procedures

Surface Preparations:

Concrete should be minimum 28 days old to allow for curing. Prior to the application of any coating the maximum moisture content allowed is 4%. Concrete Substrates must be cured, sound, clean, dry and free from laitance, loose particles and contaminants such as oil, grease, curing compounds, shuttering oils, chemicals, etc. This is achieved by using the adequate combination of mechanical means such as abrasive blast cleaning, grinding, high-pressure water jetting (150 bars/ 2200 psi) and detergent cleaning.

Unsound concrete, surface defects, blowholes, honeycombs, aggregate pop-offs, and the like should be repaired using an approved repair medium (Epoxy Putty)

Application Conditions:

Minimum temperature at 15° C and relative humidity 20 - 85%. The vicinity must be free from dust to avoid any contaminations before the paint is dry.

LOCATION:

Ground Floor

- a. Parking Area
- b. Service Bay
- c. Body Repair
- d. Electrical Room
- e. Control Room
- f. Pump Room (For Cistem)
- g. Pump Room (For Fire Tank)
- h. Storage

RUBBERIZED FLOOR COATING**Product Description**

A rubberized coating product that is one step, self-priming for use on concrete, metal and all general surfaces. It is fast drying and has excellent resistance to water, weather, oil, acid and other chemicals. It is formatted using a modified non-chlorinated formula that is nontoxic and ozone safe.

Application:

Method of Application:	Brush, Roller or Spray
Reducer / Cleaner:	Floor Coat Reducer
% Reduction:	Brush / Roller: 0 – 10 % Spray: 10 – 20%
Dry Time	
Touch:	20 mins
Hard:	2 – 4 Hrs
Recoat:	4 – 6 Hrs, Minimum
Full Cure:	3 Days

Surface Preparation

Preferred surface profile is semi-rough plaster finish and leveled. When concrete floor finish is smooth, mechanical grinding is recommended. Dust off with broom or best use vacuum cleaner to rid sand dust. Surface should be adequate dry, free from dirt and other contaminants prior to paint application.

LOCATION:**Ground Floor**

- i. Parking Area
- j. Service Bay
- k. Body Repair
- l. Electrical Room
- m. Control Room
- n. Pump Room (For Cistem)
- o. Pump Room (For Fire Tank)
- p. Storage

Mezzanine 2

- a. Male Dorm
- b. Female Dorm

ITEM 24d : CONCRETE WATER PROOFING**GENERAL**

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

SCOPE OF WORK

The work shall cover the waterproofing requirements for building as shown on the drawings.

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

SUBMITTAL

1. Material description and physical properties, application details, and recommendations regarding shelf life, application procedures, and precautions on flammability and toxicity.
2. Samples for each waterproofing type.

DELIVERY AND STORAGE

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

PRODUCTS**I. DEEP PENETRATING SEALER**

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

Deep Penetrating Sealer (DPS) penetrates below the surface and chemically reacts with the alkali and lime found in concrete. This reaction creates a silica gel membrane within the pores and capillaries of the concrete, permanently sealing it against the ingress of moisture yet allowing the concrete to breathe. Over a period of time, the silica gel membrane hydrates and solidifies into a crystalline structure, increasing the hardness and strength of both new and old concrete while reducing moisture vapor emissions and permanently stopping the penetration and flow of water and water-borne contaminants such as chlorides and acids, both on the positive or negative side forging a waterproofed and preserved concrete structure.

EXECUTION

- All existing dirt and other surface contaminants adhering on the surface must be thoroughly removed. Apply Concrete Neutralizer using sufficient coats to completely neutralize the surface. Do not wash off. When sufficiently dry, dust lightly to remove crystalline deposits.
- Mix thoroughly the product mixture as per manufacturer's instruction. Any change from the recommended proportion will affect its quality. Scrape the bottoms, sides and corners of the container to ensure complete and full blending. Prepare only enough quantities that can be used within the pot-life period. Do not delay application. Apply DPS by brush or roller or by using an airless spray.
- Allow to cure overnight prior to application of topcoat.

II. FLEXIBLE MODIFIED CEMENTITIOUS

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

1. Free surfaces from dirt or foreign materials. For the waterproofing to work best, manufacturers recommend the surfaces be sand blasted, bush-hammered or acid-etched.
2. Apply 2 coats of the cementitious waterproofing. The first coat could include the manufacturer's materials only. The second coating will include a cement-sand mixture and also have chemical and metallic elements too. If supplementary waterproofing is required, then a third coat may be required. This typically includes sand and cement for that extra protection.

Methods of Application

Trowel

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

Spray

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

Brush

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

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

ITEM 24e : CARPENTRY AND 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 ensure 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 contact surfaces. All frames shall be rabbeted, molded and cut with saw and cut under for water drips.

SPECIE	USE
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 Laminate

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

- a. Wood Laminates:** 6mm THK substrate laminated on HPL Accent Matte Finish for Interior Cladding or any approved equivalent by the designing Architect.
- b. 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.

ITEM 24f : TOILET PARTITION

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

Furnish and install toilet partitions as shown on drawings and as specified herein.

SUBMITTALS

1. Submit shop drawings indicating elevations of partitions, full scale sections, thickness and gauges of metal, fastenings, proposed method of anchoring, the size and spacing of anchors, details of construction, hardware, fittings, mountings, and other related items and installation details.

2. Submit sample one of each item of hardware, fittings, fastening, and each type of panel. The panel sample shall be cross-sectioned not less than 150 mm by 150 mm in size and shall show finish on base material and core of the panel.

3. Submit manufacturer's data literature for each item of hardware, fitting, fastening and each type of panel, complete with description of materials, finishes, and anchoring devices, and appurtenances.

4. Submit one sample of each color of partition for verification that products match the color indicated. Where colors are not indicated, submit the manufacturer's standard color samples for selection by the Architect.

DELIVERY AND STORAGE

Deliver materials to the site in original sealed containers or packages, bearing the manufacturer's name, brand designation, specification number, type, style and finish as applicable. Store and handle materials in a manner to protect them from damage.

MATERIALS

Toilet compartments/cubicles - comprising 12mm thick intermediate panels, doors, and partitions/compartments (compact laminated phenolic board) including door frame system urinal divider, cubicle divider, hardware and accessories in stainless finish and all other incidentals to complete.

Sizes, dimensions of doors, cubicles and dividers as shown on plans. Color shall be as selected by Architect.

All the accessories shall be of heat chemical and bacteria resistant.

All edges of doors and pilasters are chamfered and finish without any metal trimming.

EXECUTION**INSTALLATION**

Installation of toilet partitions and urinal screens shall be in accordance with approved shop drawings and manufacturer's installation and directions.

ITEM 24g : SUPPLY AND INSTALL OF STAIR NOSING**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 supply and install of stair nosing for the buildings as indicated on the drawings and as specified herein.

STAIR NOSING

1. Supply and installation of 50mm x 30mm Step Nosing with Photoluminescent guide

SUBMITTAL

1. Shop drawings for all stair nosing 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 the 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.

ITEM 24h : FACILITIES AND DEVICE FOR PERSONS WITH DISABILITY**SCOPE OF WORK**

The work shall consists of furnishing materials, tools, labor and incidentals necessary for the construction/installation of facilities and device for disabled persons as shown on the Drawings and in accordance with the Implementing Rules and Regulations of Batas Pambansa Bilang 344 and this Specification.

MATERIAL REQUIREMENTS**GRAPHIC SIGNS**

Graphic signs like the International Symbol of Access shall be fabricated from plastic materials, white color with either dark blue background. Letters and symbols shall be laminated and raised from the background.

HANDRAILS

Handrail for ramp shall be 50mmØ tubular stainless steel buff finished. It shall be provided with a small hole as of a Braille system.

GRABRAIL

Grab rail shall be manufactured from gauge 18 tubular stainless steel 50mmØ and provided with safety grip finish.

Flip up bar shall be 38mmØ tubular stainless steel buff finished.

CONCRETE MATERIALS FOR RAMPS

1. Portland cement shall conform with the requirement of "Reinforced Concrete".
2. Aggregates shall conform with the requirements of "Reinforced Concrete".
3. Temperature bars shall have diameter of 10mm conforming with the requirements of "Concrete Works".

EXECUTION**GRAPHIC SIGNS**

1. Directional and information signs, indicating the location of the ramp for physically handicapped persons, shall be installed / placed at the front of the main entrance of the Terminal Building. The signed board size and dimensions shall be based on DOTr approved Standard Design, schedule 40, sign post and the text and arrow shall be in accordance with the International Symbol of Access "B". Manual (See attached drawings and tabulation).
2. Signs shall be placed at the entrance and exits of the ramps and toilets, installed at conspicuous locations. The signboards shall be based on DOTr approved Standard Design Manual (See attached drawings and tabulation).

RAMP

The ramp shall be constructed as shown in plans and with a nonskid surface and tactile strips.

ITEM 24i : DOUBLE BUBBLE DOUBLE FOIL INSULATION

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 handrails, railings and guardrails as indicated on the drawings and as specified herein.

SPECIFICATION

Product Thickness: ¼ inch nominal
Fire Rating: Class A
Flame Spread: 0 ASTM E84-08
Insulation Thickness: ¼ inch nominal
Smoke Developed: 40 ASTM E84-08
Temperature Range: -60°F TO 180°F
Water Vapor Permeance: .02 perms

The Double bubble double foil insulation shall be installed at location(s) as indicated in plans.