

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

#### b. Monitoring Integrity of Installation Conductors

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

- 1) Initiating circuits.
- 2) Evacuation alarm circuits
- 3) Battery power supply low and no voltage across the standby battery terminals and open battery circuit. Provide Class A initiating device circuits, and Class A notification device circuits as defined by NFPA 72. For Class A circuits, provide separate conduits for outgoing and return (redundant) conductors as required by NFPA 72. A ground fault condition or single break in any other circuit shall cause operation of the system trouble signals. Loss of AC power, abnormal AC voltage, a break in the standby battery power circuit, or low battery voltage shall also cause operation of system trouble signals. The abnormal position of any switch in the control panel shall also cause operation of the system trouble signals. Audible and visual equipment for supervision of the AC power supply shall be energized from the auxiliary DC power supply and vice versa. Trouble signals shall sound continuously until manually silenced or the system has been restored to normal.

#### c. Walk-Test Mode

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

#### d. Alarm Verification Feature

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

## 2. Primary Power

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

### 3. Auxiliary Power

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

#### a. Storage Batteries

Provide sealed lead calcium or sealed lead acid or batteries and charger. Dry cell batteries are not acceptable. House batteries in the control panel. Provide batteries of adequate ampere-hour rating to operate the system, including audible trouble signal devices, and under supervisory conditions for 60 hours, at the end of which time batteries shall be capable of operating the entire system in a full alarm condition for not less than 15 minutes. Provide calculations substantiating the battery capacity. Provide reliable separation between cells to prevent contact between terminals of adjacent cells and between battery terminals and other metal parts.

#### b. Battery Charger

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

## COMPONENT DESIGN

### 1. Control Panel

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

- a. Trouble silencing switch which silences audible trouble signals without extinguishing trouble indicating lamps. For non-self resetting type switch, upon correction of the trouble condition, audible signals will again sound until the switch is returned to its normal position. For silencing switch of the momentary action, self resetting type, the trouble signal circuit shall be automatically restored to normal upon correction of the trouble condition.
- b. Evacuation alarm silencing switch which when activated will silence all alarm notification devices without resetting the panel, and cause operation of system trouble signals. Subsequent alarms from additional zones not originally in alarm shall cause activation of the notification devices even with the alarm silencing switch in the "silenced" position.
- c. Individual zone disconnect switches which when operated will disable only their respective initiating circuit and cause operation of the system and zone trouble signals.

- d. Reset switch which when activated will restore the system to normal standby status after the cause of the alarm has been corrected, and all activated initiating devices reset. Operation of reset switch shall restore activated smoke detectors to normal standby status.
- e. Lamp test switch.
- f. Drill switch which will enable test of notification devices and restoration to normal.

#### 1) Graphic Annunciator Panel (Optional)

Provide panel located as shown. Mount with panel centreline 1.5 m above finished floor elevation. Panel shall be of the interior type, surface-mounted. Panel shall be provided with the building floor plan, drawn to scale, with alarm lamps mounted to represent the location of each initiating device. Panel graphic shall also show the locations of the control panel, and shall have a "you are here" arrow showing its location. Orient building floor plan on graphic to location of person viewing the graphic, i.e. the direction the viewer is facing shall be toward the top of the graphic display. Provide a North arrow. Lamps shall illuminate upon activation of corresponding device and shall remain illuminated until the system is reset. Panel shall have a lamp test switch.

#### 2. Manual Pull Stations

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

#### 3. Smoke Detectors

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

##### a. 4-Wire Smoke Detectors (Optional)

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

##### b. Photoelectric Detectors (Optional)

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

#### c. Detector Spacing and Location

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

### 4. Notification Devices

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

#### a. Alarm Horns

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

#### b. Visible Devices

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

### 5. Conduit

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

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

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

### 8. Wiring

NFPA 70, PEC and NFPA 72. Wire for 240V circuits shall be 3.5 mm<sup>2</sup> minimum copper conductors. Wire for low voltage DC circuits shall be 2.0 mm<sup>2</sup> 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 signaling 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 33: FIRE PROTECTION WORKS****GENERAL-**

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

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

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

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

**DRAWINGS AND SPECIFICATIONS**

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

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

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

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

## **SHOP DRAWINGS**

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

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

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

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

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

## **AS-BUILT DRAWINGS**

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

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

## **CUTTING AND PATCHING**

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

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

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

## **SUB-CONTRACTOR**

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

## **STANDARD OF WORKMANSHIP**

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

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

## **STANDARD OF MATERIALS**

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

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

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

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

## REMOVAL OF DEFECTIVE OR UNAUTHORIZED WORK

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

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

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

## CONFORMITY WITH PLANS AND ALLOWABLE DEVIATIONS

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

## COOPERATION WITH OTHER TRADES

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

Where the work of the contractor will be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so, directed by the Owner, the mechanical contractor shall prepare composite working drawings and sections at a suitable scale not less than 1:50 - M., clearly indicating how his work is to be installed in relation to the work of other trades. If the contractor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make the necessary changes in his work to correct the condition without extra charge.

The mechanical contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

## **INSPECTION AND TESTS**

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

## **INJURY TO PERSONS OR DAMAGE TO PROPERTY**

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

## **TEMPORARY FACILITIES**

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

## **LEAVING THE SITE**

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

## **SUSPENSION OR DELAY**

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

## **CLEANING UP**

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

## **GUARANTEE**

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

## **PERMITS AND DUES**

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

The contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings, in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and/or specified.

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

## **INSPECTIONS AND CERTIFICATES**

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

## **EQUIVALENTS**

When materials or equipment are mentioned by name, they shall form the basis of the Contract, if not the Contractor may recommend, provided that they are equivalent. When approved by the Architect in writing, other materials and equipment may be used in place of those specified, but written application for such substitutions shall be made to the Architect as described in the Bid Documents. The difference cost of substitute materials or equipment and reason for substitution shall be given when making such request. Approval of substitute is contingent on same, meeting specified requirements and being of such design and dimensions as to comply with space requirements.

In case of a difference in price, the Owner shall receive all benefits of the difference in cost involved in any substitution and the Contract may be altered by Change Order to credit the Owner with any savings so obtained.

## **DETAILED BREAKDOWN OF ESTIMATES**

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

## **SCOPE OF WORK OF THE CONTRACTOR**

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

Specifically, the work shall involve the following:

- a. To secure, at his own expense, for all Fire Protection permits certificates and other related permits.
- b. Furnish and install an Automatic Wet Sprinkler System for the entire building, as indicated on the drawing.
- c. Furnish and install of Fire Pump assembly including the jockey pump.
- d. Furnishing of portable fire extinguishers.
- e. Testing of the automatic sprinkler and standpipe system within the facility as required by the laws, ordinances, rules, regulations and orders of governmental authorities having jurisdiction over this work.

**TECHNICAL SPECIFICATIONS**

1. **Quality Assurance** - All materials to be used shall be new and shall conform with the referenced codes and standards. Use of materials shall further be governed by other requirements, imposed on other sections of these specifications. Materials shall be subject to the necessary tests to assure their fitness if so required.
2. **Alternate Materials** - Use of any material, not specified in these specifications may be allowed provided further that a test, if required, shall be done by an approved agency in accordance with generally accepted standards.
3. **Fire Pump**
  - a. The system shall consist of One (1) unit of UL Listed, FM approved Vertical Turbine Fire Pump. The necessary attachments specified herein shall be capable of delivering 150% of rated capacity at no less than 65% of total head. The fire pump shall deliver a capacity as shown on the plans. The motor drive shall be an induction motor of ODP type with an electrical characteristic as shown on the drawings
  - b. **Accessories:**
    1. Check valve in discharge pipe and suction strainer.
    2. OS&Y gate or butterfly valves on system discharge side of check valve and on supply side of pump.
    3. Piping for test and drain to water tank.
    4. Flow measuring device.
    5. Circulation relief valve and discharge cone.
    6. Automatic air release, valve and fittings.
    7. Primary Connect
    8. Capacity Plate.
    9. Pressure Switches.
    10. Water level testing device and piping.
    11. Eccentric Reducer and Concentric Increaser.
    12. Pressure gauges.

## c. Drive:

**Motor:** Motor horsepower rating shall be in accordance with the manufacturer 's requirements. The motor shall be of capacity that 1 15% of the full load ampere rating shall not exceed at any condition of pump load.

**Controller** UL listed, FM Approved Combined Manual and Automatic, reduced voltage, type open transition circuit breaker with interrupting capacity of 100,000 Amps, RMS Symmetrical at 460 volts. Standard features include air unit breaker, running period, timer motor starter, molation switch, pilot lights, pressure switch, manual start, start-push buttons, control relay and other standard accessories in drip-proof enclosure.

Provide Alarm circuit for power failure.

Fire Pump Controller shall be METRON or Approved Equal

## d. Controls:

1. **Controller:** Hand-off automatic switch, fire water pressure switch to operate pump drive, fire water pressure switches for alarms.
  2. Local alarm with indicating lights for low fire water pressure and high fire water pressure.
  3. Alarm for low water level and no water at u/G Fire Water Tank.
  4. Contacts for remote circuits to indicate pump operational status and alarm status.
- e. **Acceptable Manufacturers:** Peerless, Fairbanks-Morse, ITT-AC or approved equal.

**JOCKEY PUMP**

- f. Jockey Pump shall consist of 1 unit. Electrically driven Submersible type pump. The jockey pump shall deliver a capacity as shown on the plans, complete controller and accessories.
- g. Provide shut-off v a l v e s, c h e c k v a l v e, and relief valves and Jockey Pump controller, with across the line controller with fusible disconnect switch, motor starter, timer, fuses, pressure switch, selector switch, over-load relays, enclosure to be in NEMA 4 enclosure. Additional feature to have pressure recorder, power on pilot light.
- h. **Acceptable Manufacturers:**
  1. Grundfos
  2. Approved Equal.

## **WATER PIPING**

Sprinkler piping shall be Sch.40 seamless black steel or Iron pipe, ASTM A795 or ASTM A53; Fittings in accordance with ANSI B16 .3 rated for 200 lbs. (1380 kPa) working pressure, in accordance with NFPA.

## **FITTINGS**

Screw joint steel piping up to and including 2inch diameter. Weld piping 2.5inch diameter and larger, including branch connections.

Factory fabricated carbon steel weld fittings shall be 150 lb. or 300 lb., as required, and shall be produced in strict accordance with ANSI Specifications B-1 6.0 and shall conform to details, tolerances and dimensions contained therein.

Malleable iron screwed fittings, 150 lb. or 300 lb., as required, shall be provided in strict accordance with ANSI Specifications B-1 6.9 and shall conform to details, tolerances and dimensions c o n t a i n e d therein.

Should there be a grooved piping inside the building and above the floor, the piping shall be installed in a cut grooved method using ductile iron mechanical pipe couplings of a bolted type with pressure-responsive gasket along with bolted type mechanical pipe ductile iron fittings and flange adapters and shall conform to the details , tolerances and dimensions as required by the system manufacturer.

Fittings shall be designed to withstand the working pressures involved, but not less than 175 psi cold water pressure

## **ACCESSORIES**

- a. Alarm Check Valve: U.L. listed, divided seat ring type alarm check valve with external bypass and retarding chamber. Basic trimmings shall include nipples, fittings, devices for external bypass, alarm test bypass gauge and drain connections, and mounting supports for retarding chamber and drip funnel. Standard alarm trimmings shall be provided for use with, and including water motor alarm and a pressure switch. Alarm check valve shall be "Star", "Viking" or approved equal.

- b. **Flush Fire Department Connection:** For sprinkler system double clapper flush wall connection type, straight body connections, 6" x 2-1/2" x 2-1/2" x 2-1/2" (150 x 65 x 65 x 65) with pinlug plugs and chains, double female snoots, exposed parts with polished brass finish, threads to conform to those used by local fire department with "11 Auto-Sprk" Lettering.
- c. **Check Valve:** Shall be of the swing check type, with iron body, bronze mounted, renewable seat and disc, bolted cap, asbestos gaskets. Steel bolts, 175 lbs. (1225 KPa) water working pressure, flanged ends with drip connections.
- d. **Gate Valves:** Shall be iron body with bronze trim, solid wedge, outside screw and yoke, rising stem, flanged ends, 175 lbs. (1225 KPa) water working pressure. Valves at the discharge side of pumps shall be Class 200.
- e. **Monitor Switch:** U.L. listed, single pole double throw switch with a roller type switch actuator and a spring-loaded plunger mounted in a housing, design to make an electrical contact when O.S.&Y. Control gate valve at sprinkler main riser is closed, "Star", "Viking" or approved equal.
- f. **Hose Valves:** 65 dia. (2.5"), (65mm) polished brass finished, female & male hose threads to match local fire department equipment.
- g. **Roof Manifolds:** Cast brass with female N.P.T, inlet and male N.P.T. outlet, two-way, 150 x 65mm, back inlet.
- h. **Pressure gauges and ball drip valves** 2.5" NPT, bronze and cocks shall be as provided.
- i. **Inspector's test and drain valve** shall conform to the minimum requirements of the latest edition of NFPA No.13

## **SPRINKLER HEADS**

Sprinkler heads shall conform to the minimum requirements of the latest edition of NFPA No. 13, shall be UL and FM listed and shall be as specified hereinafter:

- i. For areas with exposed ceiling, use Quick Response upright, brass, 74 deg. C (165 deg. F) temperature rating and Y2 in. (13mm) standard orifice. (Glass bulb type). "Viking", "Star" or "Reliable" brand
- ii. For all areas with ceiling, use Quick Response pendent type chrome finish, with matching escutcheon, actuating temperature of 165 °F (74°C), listed by UL/FM. Preferably glass bulb type. "Viking", "Star" or "Reliable" brand.
- iii. For high heat areas such as kitchens, use Quick Response pendent type chrome finish, with matching escutcheon, actuating temperature of 212 °F (100 °C), listed by UL/FM. Preferably glass bulb type. "Viking", "Star" or "Reliable" brand.
- iv. Quick Response sidewall type sprinkler heads shall be chrome finish, with matching escutcheon, actuating temperature of 165 °F (74°C), listed by UL/FM. Preferably glass bulb type. "Viking", "Star" or "Reliable" brand.
- v. Sprinkler Cabinet: Shall be fabricated from sheet steel and finished painted with red enamel, to be provided complete with 12 spare sprinkler heads (6 plain brass and 6 chrome plated) and two sprinklers.

## FIRE HOSE CABINETS

Cabinet shall be recessed 16-gauge steel body, annulux finished aluminum door trim with pull handle and friction catch with lock key. Cabinet shall be designed for 100 ft. hose pin rack and fire extinguisher. Door shall be full panel glass. Cabinet finish shall be powder coated white inside with prime coat outside. Cabinet maybe made locally of approved quality. Provide "Break glass in case of Fire" sign.

### Accessories:

1. Pin rack for fire house cabinet shall be semi-automatic type, baked enamel finish designed for 100 ft. of 1.5" hose and furnished with 1.5" chrome plated brass rack nipple.
2. Fire hose for fire hose station shall be 100 ft. of 1.5" cotton double jacket flexible fire hose. Hose coupling shall be 1.5" chrome plated male-female National Standard hose threads. Nozzle shall be approved by UL/FM.
3. Provide one (1) unit 10 lbs. ABC multi-purpose dry powder chemical portable fire extinguisher labeled with UL/FM.

### Hangers

Hangers shall conform to the minimum requirements of the latest edition of NFPA No. 13.

- a. All changes in direction of sprinkler heads shall be provided with hanger.

**PORTABLE FIRE EXTINGUISHERS** - Shall be tri-class dry chemical or multi-purpose (primarily monoammonium phosphate) or equivalent which is non-toxic agent which extinguishes flames in seconds and inhibits reflash. It shall be effective against Class A, B and C fires. Contents shall be 10 lbs. (4.5 kg), the unit shall be mounted inside the fire hose cabinet or thru the fire extinguisher cabinet. Shall be manufactured by UL/FM approved or Approved equal.

**Carbon Dioxide Fire Extinguishing System** - Carbon Dioxide fire extinguishing system will be provided for fire suppression for transformer and electrical rooms, lift motor room, electrical room using portable or wheeled type fire extinguishers. Shall be UL/FM approved or Approved equal.

## **EXECUTION**

### **Workmanship**

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

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

### **Preparation**

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

### **Piping**

- a. Ream pipe and tube ends to full inside diameter.
- b. Remove burrs and bevel plain end ferrous pipe.
- c. Remove scale and foreign materials, inside and outside, before assembly.

### **Coordination**

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

## Installation

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

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

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

### Threaded Pipe and Fittings:

- a. All threaded pipe and fittings shall have threads cut to ANSI Standards B2.1. Care shall be taken that the pipe does not extend into the fitting sufficiently to reduce the waterway.
- b. Pipe shall be reamed after cutting to remove all burrs and fins.
- c. Joint compound or tape shall be applied to the threads of the pipe and not in the fitting.

**Welding Pipe:**

- a. Sections of branch lines, cross mains, feed mains or risers may be shop welded.
- b. Sections of welded piping shall be joined by means of screwed bolt and nut flange or flexible gasketed joints or other approved fittings.
- c. Torch cutting shall not be permitted as a means of modifying or repairing sprinkler systems.
- d. Welding shall be done in accordance with the methods set forth hereinbefore.
- e. Welders shall be certified as specified hereinbefore.
- f. When welded fittings are used to form outlets:
  1. Holes in piping shall be cut to the full diameter of the fitting.
  2. Discs shall be retrieved.
  3. Openings in piping shall be made smooth.
  4. All slag and other welding residue shall be removed.

Sprinkler piping shall be substantially supported from the building structure which must support the added load of the water-filled pipe plus a minimum of 250 lbs. (114 kg) applied at the point of hanging.

Types of hangers and installation methods shall be in accordance with and conform to the latest edition of NFPA No.13, unless they are certified by a professional registered engineer for the following:

- a. Designed to support five (5) times the weight of the water-filled pipe plus 250 lbs. (114 kg) at each point of piping support.
- b. These points of support are enough to support the sprinkler system.
- c. Ferrous materials are used for hanger components.

Sprinkler piping shall be supported independently of the ceiling sheathing, except as follows:

- a. Toggle hangers may be used only for the support of branch lines under ceilings of hollow tile or metal lath and plaster.

When sprinkler piping is installed below ductwork, piping shall be substantially supported from the building structure or from steel angles supporting the ductwork provided the angles conform to the requirements of the latest edition of NFPA No.13.

For trapeze hangers, the minimum size of steel angle or pipe span between purlins or joints shall be as specified in the latest edition of NFPA No.13.

- a. All angles shall be used with longer leg vertical.
- b. Any other sizes or shapes giving equal or greater section modulus will be acceptable.
- c. The trapeze bar shall be secured to prevent slip page.

The size of hanger rods and fasteners required to support the steel angle iron or pipe shall be as specified in the latest edition of NFPA No.13.

Screwed unions shall not be used on pipe larger than 2 inches. Couplings and unions of other than screwed type shall be of the types approved specifically for use in wet automatic sprinkler systems. Unions, for fire protection screwed or flexible gasketed couplings or flanges may be used to facilitate installations.

Use one-piece reducing fittings wherever a change is made in the size of the pipe, except hexagonal or face bushings may be used in reducing the size of openings of fittings when standard fittings of the required size are not available.

## **Painting**

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

1. Care shall be exercised whenever the sprinkler piping is given any kind of coating to ensure that no automatic sprinkler surfaces are coated.
2. Automatic sprinklers shall not be painted and any sprinklers which have been coated, except for factory applied coatings, shall be replaced with new listed sprinklers.

## **Cleaning**

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

## **Acceptance Test**

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

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

1. Flushing Test.
2. Hydrostatic Test @ a Test Pressure of 250 psi minimum.
3. Leakage Test.
4. Drainage Test.

**ITEM 34-a : INTERIOR WIRING SYSTEMS****GENERAL**

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

**SUBMITTALS****1. Shop Drawings**

- a. Panel board

**2. Manufacturer's data**

- a. Circuit breakers
- b. Switches
- c. Conduit and fittings (each type)
- d. Ground rods
- e. Device plates
- f. Insulated conductors
- g. Outlet and junction boxes

**3. Test Reports: Submit test results for approval in report form.**

- a. 600Volt - wiring test
- b. grounding system test

**4. 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. Interpret reference in these standards to "authority having jurisdiction," or words of similar meaning, to mean Engineer.

**MATERIALS AND EQUIPMENT REQUIREMENTS**

Materials, equipment, and devices shall, as minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70. All items shall be new.

**CONDUIT AND FITTINGS**

1. Rigid Steel Conduit (RSC): Hot dip galvanized: ANSI C80.1.
2. Flexible Metal Conduit: UL 1.
  - a. Liquid Tight Flexible Metal Conduit (Steel): UL 360.
3. Rigid Plastic Conduit: PVC schedule 40 in accordance with UL 651.

**4. Fittings for Metal Conduit, and Flexible Metal Conduit: UL 514B.**

Ferrous fittings shall be hot dip galvanized in accordance with UL 514.

a. Fittings for RSC: Shall be threaded-type. Split couplings are not acceptable.

b. Fittings for Rigid Non-metallic Conduit: NEMA TC3.

**OUTLET BOXES AND COVERS**

UL 514, hot dip galvanized for ferrous metal.

**CABINETS, JUNCTION BOXES, AND PULL BOXES (WITH VOLUME GREATER THAN 100 CUBIC INCHES) UL 50, hot dip.**

**WIRES AND CABLES**

Wires and cables shall meet applicable requirements of PEC, NFPA 70 and UL for types of insulation, jackets, and conductors specified or indicated. Wires and cables manufactured more than 6 months prior to date of delivery to site shall not be used.

1. Conductors: Conductor 3.5mm<sup>2</sup> and smaller shall be solid, 5.5mm<sup>2</sup> and larger shall be stranded. All conductors indicated shall be copper.

a. Equipment Manufacturer Requirements:

If manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

b. Minimum Conductor Sizes:

Minimum size for branch circuits shall be 3.5 mm<sup>2</sup>

**2. Color Coding**

For 230 volt, 1-phase (1Ø), 3- wire, 60 hertz

**3. Insulation:**

Unless specified for indicated otherwise or required by PEC and NFPA 70, power and lighting wires shall be 600volt, Type THHN / THWN.

**4. Bonding Conductors:**

ASTM B1, solid bare copper wire for sizes 8.0 mm<sup>2</sup> and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes 14 mm<sup>2</sup> and larger diameter.

**DEVICE PLATES**

Provide UL listed, one-piece device plates for outlets and fittings to suit the devices installed. For metal outlets and fittings, plates on unfinished walls and on fittings shall be of zinc-coated sheet steel or cast metal having round or bevelled edges. Plates on finished walls shall be urea or phenolic, minimum 2.5mm wall thickness. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine type with countersunk heads in a color to match the finish of the plate. Use of sectional-type device

plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

## SWITCHES

### 1. Switches

Totally enclosed with bodies of thermosetting plastic and mounting strap. Wiring terminals shall be screw-type, side-wired. Switches shall be rated quiet-type AC only, 250 volts, with current rating and number of poles indicated.

#### WALL SWITCHES AND PLATES

Wall switches in general shall be rated 10 amperes at 230 volts or with ampere and voltage ratings as required. Switches shall be flush mounting and of the rocker type, spring operated. The type of switches shall be tumbler operation and the color, plating and appearance of wall plates shall be as selected by the Engineer. Appropriate samples shall be submitted prior to purchase of wall switches and face plates.

### 2. Receptacles

UL 498 and NEMA WD 1, heavy duty, grounding type. Ratings and configurations shall be as indicated. Wiring terminals shall be screw type, side-wired. Connect grounding pole to mounting strap.

#### WALL RECEPTACLE AND PLATES

- a. Receptacle outlets shall be 15 ampere, 230 volts, 2 pole, 3 wire parallel slot, grounding type. Parallel slot outlet rated 15 amps, 125v grounded type shall be acceptable for use with 230v system. Locking type and other special purpose outlets shall be as indicated in the plans.
- b. Provide weatherproof receptacle plate cover for each convenience receptacle outlet indicated as weatherproof.

#### SPECIAL PURPOSE RECEPTACLES:

Receptacles serving as indicated are special purpose. Provide ratings as indicated. Furnish one matching plug with each receptacle.

## PANEL BOARD

UL 67 and UL 50. Panel board for use as service disconnecting means shall additionally conform to UL 869. Panel board shall be circuit breaker equipped unless indicated. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. Where "space only" is indicated, make provisions for the future installation of a breaker sized as indicated. Panel board locks shall be keyed same. Directories shall be typed to indicate load served by each circuit and mounted in a holder behind transparent protective covering.

### 1. Panel board Buses

All buses shall be copper support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide a separate ground bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

## 2. Circuit Breakers (Bolt-On)

Ambient-compensated thermal magnetic-type solid state-type with interrupting capacity of 10,000 amperes symmetrical minimum. Breaker terminals shall be UL listed as suitable for the type of conductor provided. Plug-in circuit breakers are unacceptable.

### a. Multi-Pole Breakers

Provide common trip-type multi-pole breakers with single operating handle. Breaker design shall be such that an overload in one pole automatically causes all poles to open.

## ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit interrupting rating as indicated. Enclosure type as indicated.

## GROUNDING AND BONDING EQUIPMENT

UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 20mm and minimum length of 3 meters.

## NAMEPLATES

Provide as specified in "Electrical General Requirements."

## EXECUTION

### INSTALLATION

Electrical installation shall conform to requirements of PEC, NFPA 70 and to requirements specified herein.

#### 1. Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

#### 2. Wiring Methods

Provide insulated conductors installed in conduits, except where specifically indicated or specified otherwise or required by PEC and NFPA 70 to be installed otherwise. Provide insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Provide insulated, grounding conductors installed in conduits or raceways.

a. Service Entrance Conduit: Rigid Steel Conduit (RSC), conduit underground: PVC schedule 40. The underground portion shall be encased as indicated.

b. Underground Conduit (other than service entrance) PVC where non-metallic conduit is used, shall be converted to plastic – coated rigid steel conduit before rising through floor slab; plastic coating shall extended at least 152mm above floor.

#### 3. Conduit Installation:

Unless indicated otherwise, conceal conduit within finished walls, ceilings, and floors. Keep conduit a minimum of 150mm away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits in crawl space under slab as if exposed.

- a. Where conduits rise through floor slabs, curved portion of bends shall not be visible above finish slab.

- b. Conduit Support:

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded studs, or spring tension clamps on steelwork. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceilings shall be vibration resistant and shock resistant. Holes cut to depth of more than 40mm in reinforced concrete beams or to depth of more than 20mm in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations.

- c. Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of all obstructions.
- d. Install pull wires in empty conduits in which wire is to be installed by others. Pull wire shall be plastic having minimum 91 kgs tensile strength. Leave minimum 300mm of slack at each end of pull wire.

- e. Conduit Installed in Concrete Floor Slabs

Locate so as not to adversely affect the structural strength of the slabs. Install conduit within middle one-third of the concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters except at cabinet locations. Curved portions of bends shall not be visible above the finish slab. Increase slab thickness as necessary to provide minimum 25mm cover over conduits. Where embedded conduits cross expansion joints, provide suitable watertight expansion fittings and bonding jumpers. Conduit larger than 25mm trade size shall be parallel with or at right angles to main reinforcement; when at right angles to the reinforcements, the conduit shall be closed to one of the supports of the slab.

- f. Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by PEC and NFPA 70, where insulated bushings are used, and where bushing cannot be brought into firm contact with the box; otherwise, use minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by PEC and NFPA 70.

#### g. Flexible Connection

Provide flexible connection of short length, 1.8 meters maximum for recessed and semi-recessed lighting fixtures.

#### 4. Boxes, Outlets, and Supports:

Provide boxes in wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when installed exposed up to 2.1 meters above interior floors and walkways, or when installed in hazardous areas. Boxes in other locations shall be sheet steel, except that aluminum boxes may be used with aluminum conduit. Each box shall have the volume required by PEC and NFPA 70 for the number of conductors enclosed in the box. Boxes for mounting lighting fixtures shall not be less than 100 mm<sup>2</sup> or octagonal, except that smaller boxes may be installed as required for fixture configurations as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature. Fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports, or make adequate provisions for distributing load over ceiling support members. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved type fastener maximum 600mm from the box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

- a. Boxes for use with raceway systems shall be minimum 40mm deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 100mm<sup>2</sup>, except that 100 by 50mm boxes may be used where only one raceway enters outlet.

#### b. Pull Boxes:

Construct of at least minimum size required by PEC and NFPA 70 of code-gauge aluminum sheet steel except where cast-metal boxes are required in locations specified herein. Furnish boxes with screw-fastened covers. Where several feeders pass through common pull box, tag the feeders to indicate clearly the electrical characteristics, circuit number, and panel designation.

#### 5. Mounting Heights

Mount panelboards, and circuit breakers, so height of operating handle at its highest position is maximum 1.8 meters above floor. Mount lighting switches 1.4 meters above finished floor, receptacles 300mm above finished floor and other devices. Measure mounting heights of wiring devices and outlets to center of device or outlet.

## 6. Conductor Identification

Provide conductor identification within each enclosure where a tap, splice, or termination is made.

## 7. Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Plates shall be installed with an alignment tolerance of 3mm. Use of sectional-type device plates are not permitted. Plates installed in wet locations shall be gasketed.

## 8. Electrical Penetrations

Openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings shall be sealed to maintain fire resistive integrity as tested per ASTM E 814.

## 9. Grounding and Bonding

In accordance with PEC and NFPA 70. Ground all exposed, noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and non-metallic raceways, and conductor of wiring systems. Make ground connection to driven ground rods on exterior of building. Where ground fault protection is employed, ensure that connection of ground does not interfere with correct operation of fault protection.

### a. Grounding Conductor:

Provide insulated, green equipment grounding conductor in feeder and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated, green conductor for grounding conductors installed in conduit or raceways.

### b. Resistance:

Maximum resistance-to-ground of grounding system shall not exceed 25 ohms; contact the Engineer for further instructions.

## FIELD QUALITY CONTROL:

Furnish test equipment and personnel and submit written copies of test results. Give the Engineer five (5) working days notice prior to each test.

### 1. Devices Subject to Manual Operation:

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

### 2. Test on 600-volt Wiring:

Test 600-volt wiring to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 25,000 ohms.

### 3. 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.

**ITEM 34-b : INTERIOR LIGHTING****GENERAL****GENERAL REQUIREMENTS**

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

**DESCRIPTION OF WORK**

The work includes providing lighting fixtures for interior use, including accessories mounted on the exterior surfaces of buildings. Materials not normally furnished by manufacturers of these devices are specified in "Interior Wiring Systems."

**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.

**1. Manufacturer's Data:**

- a. Lighting fixtures, including lamps and ballasts

**MATERIAL REQUIREMENTS****FLUORESCENT LIGHTING FIXTURES**

UL 1570 except lighting fixtures for damp and wet locations shall conform to UL 57.

**1. Fluorescent Lamps:**

Provide the number, type and wattage indicated.

**2. Fluorescent Ballasts:**

UL 935, ANSI C82.1, and shall be labeled Certified Ballast Manufacturers (CBM) certified by Electrical Testing Laboratories (ETL). Ballasts shall be high power factor type and shall be designed to operate on the voltage system to which they are connected. Ballasts shall be Class P and shall have sound rating "A". Fixtures and ballasts shall be designed and constructed to limit the ballast case temperature to 90 degrees Celsius (°C) when installed in an ambient temperature of 40 degrees °C.

**3. Light Emitting Diode (LED)**

LED Bulbs use a semiconductor device that emits visible lights when an electric current passes through it.

**Warm light**

2700k - 3000k

Warm, yellowish light that creates a smooth, personal, intimate and relaxing feel. Very similar light to that of an incandescent light bulb. Warm temperature light is great for homes, libraries, hotels, retail stores, and restaurants.

**Cool light****3500k – 4100k**

Cool light that creates a very friendly, inviting, non-threatening, neat, clean, and efficient feel. It is brighter than the incandescent cool white. Cool temperature light bulbs are great for executive offices, public reception areas, supermarkets, classrooms, and showrooms.

**Daylight****5000k – 6500k**

Daylight is a bluish white light that resembles noon on a cloudless day. This light is great for reading and accent lighting. Bright light bulbs like this a great for jewelry stores, hospitals, beauty salons, galleries, and museums.

**RECESS AND FLUSH-MOUNTED FIXTURES**

Provide types that can be re-lamped from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated.

**EXECUTION****INSTALLATION**

Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturer's directions and approved shop drawings. The installation shall meet with the requirements of PEC and NFPA 70. Mounting heights specified or indicated shall be to bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before installation commence and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed.

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 150mm 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 required for field tests.

**1. 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.

**2. Insulation Resistance Test:**

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

**3. Ground Resistance Tests:**

Perform as specified in "Interior Wiring System."

**ITEM 35 ARCHITECTURAL WORKS AND FINISHES****GENERAL NOTES:**

The contractor should observe special consideration to indent order items that require longer lead time and checking of material availability under specified conditions of sale, the acceptance of which by the supplier constitutes a contract of sale.

The following are listed as the indent items:

*20mm thick Phenolic Toilet Partition and accessories, Roofing, Aluminum Composite Panels (including Honeycomb designed Aluminum panels and Brise soleil), Photoluminescent Signs and markings, Elevator and Escalator, Gang Chairs, Signanges and logos, UPVC Baffle Ceiling and PVC interlocking ceiling panels among others.*

**ITEM 35 a : 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 as indicated on the drawings and as specified herein.

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

**WALLS****Exterior**

- a. Plain cement finished painted with elastomeric base paint.  
Location as shown in the plans and elevations.

**Interior**

- a. Plain cement finished painted with elastomeric paint.
- b. 300mm x 600mm Homogenous ceramic wall tiles.

**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 Covering Basecoat**  
**Reinforcing Membrane: Fiberglass Matting**

**3rd and 4th Coat: Elastomeric Wall Covering Basecoat**

**5th Coat: Elastomeric Wall Covering Topcoat**

#### **Wall Ceramic Tiles**

- a. Wall tiles shall be glazed ceramic tiles color as per Architect's approval.
- b. Trimmers and moulding shall be lustrous, glazed with size and color corresponding to wall tiles.
- c. Portland cement, sand, bonding compound, lime and water shall conform with the requirements.

#### **FLOORS**

**F1 600mm x 600mm Unglazed Floor Tiles (Ivory White Finish)**

- a. Office
- b. Utility Room

Locations are shown in the plan.

**F2 600mm x 600mm Non- Slip Floor Tiles, Beige Finish**

- a. Male Ecumenical Room
- b. Female Ecumenical Room
- c. PWD Ecumenical Room
- d. Fish Terminal Area

Locations are shown in the plan.

**F3 Non- Skid or Rough Cement Finish**

- a. All Ramps

Locations are shown in the plan.

Waterproof finish for all toilets.

- a. Floor tiles shall be color varies and as shown on the drawings or to be designated by the Architect.
- b. Portland Cement, sand, water and adhesive shall conform with the requirements.
- c. Floor tiles shall be delivered in the manufacturer's original unbroken packages or containers that are labeled plainly with the manufacturer's name and brand. Containers shall be grade scaled. Materials shall be stored in dry weathertight enclosures, and shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.

## EXECUTION

### Floor Tiles

#### a. Mortar Preparation

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

#### b. Surface Preparation

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

#### c. Placing of Setting Beds and Floor Tile

Mortar setting beds shall have a minimum thickness of 20mm for floors. The structural concrete slab shall be soaked thoroughly with clean fresh water on the day before the setting bed is to be applied. Immediately preceding the application of the setting bed, the structural slab shall again be wetted thoroughly, but no free water shall be permitted to remain on the surface.

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

All mounted tiles shall be soaked in clean water a minimum of one hour before they are set. Absorptive mounted tile shall be dampened by placing sheets on a wetted cloth in a shallow pan before setting. No free water shall remain on the tiles at the time of setting. Before the initial set has taken place in the setting bed, a skim coat of neat Portland cement mortar, 0.7mm to 1.6mm thick, shall be 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****1. Interior**

1. C1 - 600mm x 600mm x 0.70mm Aluminum Clipped-In Perforated Ceiling Panel, Bone White or Approved Equivalent
  - a. Office
  - b. Utility Room
  - c. Male Ecumenical Room
  - d. Female Ecumenical Room
  - e. PWD Ecumenical Room

Locations are shown in the plan.

2. C2 - Painted Underside R.C. Slab
  - a. Fish Terminal Area

Locations are shown in the plan.

**SUBMITTAL**

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

### 1. Surface Preparation

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

### DOORS

- D-1 - Marine Plywood Finish Flush Door (0.80m x 2.10m)
- D-2 - Marine Plywood Finish Flush Door with Vent Louver (0.80m x 2.10m)
- D-3 - Marine Plywood Finish Flush Door with Vent Louver (1.00m x 2.10m)

## 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-1 - 1.5mm thk. Aluminum Framed Powder Coated Sliding Type Window with 8mm Thk. Reflective, Tempered Brown Glass  
(1.20m x 1.20m)
- W-2 - 1.5mm thk. Aluminum Framed Powder Coated Framed Awning Type Window with 8mm Thk. Reflective, Tempered Brown Glass  
(0.40m x 0.60m)

**ITEM 35 b: 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 insure proper ventilation and drainage, and shall be supported at least 150 mm above-ground. Lumber shall be protected against dampness before and after delivery, and enough protection under cover in well ventilated enclosure, not exposed to extreme changes of temperature and humidity; and in a manner as to provide air-circulation around all surfaces of each pile to insure thorough air-seasoning. Lumber or millwork in buildings shall not be finished until concrete, masonry work and plaster are dry. Lumber shall be delivered at least thirty (30) days before use.

**d. Grading of Plywood**

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

**MATERIALS****a. Lumber**

Lumber for various uses shall be one of the species listed for the purpose indicated unless otherwise specified in the drawing. For any use not specified, the lumber shall be the best commercial grade normally used for the purpose, subject to the approval of the Engineer.

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

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

**ITEMS 35 c: ALUMINUM PERFORATED CEILING PANEL****GENERAL**

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

**SCOPE OF WORKS**

This Item covers the use of aluminum panel as perforated ceiling panel and shall consist of furnishing and installing materials, tools, labor and equipment necessary for aesthetic purposes as indicated on the Plans and in accordance with this Specifications.

**Material Requirements****Aluminum**

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

**Thickness**

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

**Panel Shape and Size**

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

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

**Perforations****Shape and Size**

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

<b>Size :</b>	600mm X 600mm, T = 0.70mm
<b>Hole Diameter :</b>	2.0mm
<b>Weight :</b>	1.94 kg/ sqm

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

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

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

### **Pattern**

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

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

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

### **Margin**

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

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

### **Construction Requirements**

#### **Installation**

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

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

#### **Note :**

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

6. Tringle Keel shall be attached to the Suspension Part Twin Clamps.
7. When the accessories have been installed, adjustment shall be made to ensure that the whole suspension ceiling is leveled.

8. Slightly push the Aluminum Ceiling Panel upward the ends of the panel until it rest with the triangle keel.

### **Inspection**

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

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

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

**ITEM 35 d : MODULARS, TABLES AND CHAIRS OF VARIOUS TYPE INCLUDING ACCESSORIES****GENERAL**

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

**SCOPE OF WORK**

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

**MODULARS**

<i>Modular System</i>	<i>Unit</i>	<i>Quantity</i>
Office Table (800mm x 1600mm)	pc	1.00

**CHAIRS**

<i>Chairs</i>	<i>Unit</i>	<i>Quantity</i>
Mid back Chair / Clerical Chair	set	1.00

**SUBMITTAL**

1. Shop drawings for all gang chair for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.
2. The Contractor, before placing order for the supply shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.

**EXECUTION**

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

## **ITEM 35 e : HANDRAILS, RAILINGS AND GUARDRAILS**

### **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.

### **SUBMITTAL**

1. Manufacturer's technical data for products and processed used in handrails, railing, guardrails system, including finishes and grout.
2. Shop Drawings showing details of fabrication and installation for each type and of handrail, railing, and guardrails required including plans, elevations, sections, profiles of rails, fittings, connections, and anchors.
3. Prepare samples of each type of metal handrails & railings stainless steel hairline finish. Where finish involves normal color and texture variations, include sample sets composed of two or more units showing limits of such variations expected in completed works.
  - Include 6" long samples of each distinctly different railing member including guardrails, handrails, top rails, posts, and balusters. Include samples of fittings and brackets if requested by Architect.
  - Include sample of typical welded connection.

### **QUALITY ASSURANCE**

#### **Single Source Responsibility**

Obtain handrails, guardrail and railing systems of each type and material from a single manufacturer.

### **STORAGE**

Store handrails, guardrail and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind. Cover with waterproof paper, tarpaulin, or polyethylene sheeting; allow for air circulation inside the covering.

### **FABRICATION**

#### **General**

Fabricate handrails and railing systems to design, dimensions and details shown. Provide handrail and railing members in sizes and profiles indicated, with supporting posts and brackets or size and spacing shown, but not less than required to comply with requirements indicated for structural performance.

#### **Shop Assembly**

Pre-assembled items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

### **Welded Connections**

Fabricate handrails, guardrail and railing systems of materials for interconnections of members of welding. Use welding method, which is appropriate for metal and finish, indicated and develops strength required to comply with structural performance criteria. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

Form changes in direction of railing members by bending members by metering, or as indicated on the drawing, as approved by the Architect.

Furnish inserts and other anchorage devices for connecting handrails, guardrail and railing systems to concrete or masonry work. Fabricate anchorage devices, which are capable of withstanding loading imposed by handrails, guardrails and railing systems.

Coordinate anchorage devices with supporting structure.

a. For railing, and guardrail posts set in concrete provide pre-chiseled openings and insert posts as indicated on drawings. Fill opening with non-shrink, non-metallic grout.

### **MATERIALS**

#### **General**

Comply with standards indicated for forms and types of metals indicated or required for handrail and railing system components.

#### **a. Stair Railings:**

As indicated on plans.

#### **b. Stair Handrail:**

As indicated on plans.

#### **c. Guardrail**

As indicated on plans.

#### **d. Glass Railings**

As indicated on plans.

Refer to plans for the required dimension of various types of stainless steel railings and location.

Fastenings: commercial types, except where special types are shown or required.

Fastenings for all exterior work shall be non-ferrous, unless otherwise shown. Fastenings for steel and aluminum and for all other interior work, where exposed, shall match the fastened metal.

Miscellaneous materials or accessories not listed above shall be provided

as specified hereinafter the various items of work and/or indicated on the drawings, or in accordance with manufacturer's specifications.

## **GLASS FINISHES**

All glass materials shall be delivered at jobsite with labels affixed indicating quality, make, type and thickness.

### **Material**

Use 10mm (13/32") thick tempered glass of clear quality

### **Execution**

#### **PREPARATION**

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

#### **INSTALLATION**

- a. Safety precaution and procedure shall be observed in determining the sizes and in providing the required clearances by measuring the actual opening to receive the glass.
- b. Secure glass with stainless steel brackets.

## **METAL FINISHES**

Comply with NAAMM "Metal Finishes Manual" for recommendations and designations of finishes, except as otherwise indicated.

### **EXECUTION**

#### **PREPARATION**

a. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete and masonry construction. Coordinate delivery of such items to project site.

#### **b. Field Measurements**

Take field measurements prior to fabrication.

#### **INSTALLATION**

##### **GENERAL**

- a. Fit exposed connections accurately together to form tight, hairline joints.
- b. Perform cutting, drilling, and fitting required for installation of handrails, guardrail and railing systems. Set work accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels.
- c. Field Welding

Comply with applicable AWS specification for procedures of manual shielded metal-arc welding, for appearance and quality of welds made, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent rail surfaces.

d. Prior to anchoring, adjust handrails and railing systems to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loading.

#### **ANCHORING POSTS**

a. **Concrete-Anchored Posts:** Provide chiseled opening on concrete base as indicated on the drawings to receive railing posts and required anchoring system, holes of all loose material, insert posts, and fill annular space between post and concrete with non-shrink, non-metallic epoxy grout, mixed and placed to comply with grout manufacturer's directions.

#### **RAILING CONNECTIONS**

a. **Welded Connections:** Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use manufacturer's standard fittings designed for this purpose.

#### **ANCHORING RAILING ENDS**

a. Anchor railing ends to metal surfaces with manufacturer's standard fittings using concealed fasteners, unless otherwise indicated.

b. Anchor Railing Ends to Concrete or Masonry, use drilled-in expansion shields and concealed hanger bolts, unless otherwise indicated.

#### **PROTECTION**

a. Protect finishes of railing, handrails and guardrails system from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion.

b. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

## ITEM 35 f: CONCRETE WATERPROOFING

### GENERAL

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

### SCOPE OF WORK

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

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

### SUBMITTAL

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

### DELIVERY AND STORAGE

Deliver manufactured waterproofing materials in manufacturer's original, unopened containers, with labels intact and legible. Containers of materials covered by 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 35 g : PAINTING****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**

This Section covers the surface preparation, coating materials and application of coatings systems required for the Works.

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

The term paint as hereinafter used includes emulsion paints, varnishes, oils, pigments, thinner and dryers.

All exposed metal surfaces, except metal surfaces embedded in concrete, shall be painted unless otherwise specified.

**STANDARD**

The following publications listed below, but referred to thereafter by basic designation only, forms a part of these Specifications to the extent indicated by the reference thereto:

Steel Structures Painting Council (SSPC) U.S. Specification JIS K 5628 Red-lead Zinc Chromate Anti-Corrosive Paint.

**SUBMITTAL**

1. The Contractor shall submit work method statements with lists of materials to the Engineer for approval twenty eight days before the starting of works. This statement shall include following items:
  - a. Type of paint and manufacturer
  - b. Manufacturer's specifications
  - c. Storage and delivery of materials
  - d. Surface preparation
  - e. Finish painting and drying
  - f. Touch-up painting, if any
  - g. Equipment
2. The Contractor, before placing order for the painting materials, shall submit to the Engineer for approval samples of materials. No placing of orders for material shall be made without his approval.

**STORAGE AND DELIVERY**

1. The Contractor shall deliver all material to the site in the original labeled sealed cans and containers, with labels intact and seal unbroken.
  - a. Seals shall remain unbroken until after inspection and acceptance of material by the Engineer.

- b. The Contractor shall deliver materials in ample quantities sufficiently in advance of the need to avoid any delay or interruptions in the works.
2. Paint in thinner shall be stored in accordance with the approved manufacturer's instructions.
    - a. All regulations required for storage of paint shall be observed and all necessary safety signs required by governing codes shall be posted.
    - b. Any damage caused by failure to exercise proper precautions in paint storage shall be repaired.

## MATERIAL REQUIREMENTS

### PAINT

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

Paints for exterior finish must be with tile like durability and elegance, fast drying, solvent based acrylic, highly suitable for coastal or polluted areas with excellent anti-fungus properties and alkali resistance.

100% Acrylic, water based, quick-drying, easy to clean-up and environmentally friendly, resist dirt, stains, alkali, water, humidity, algae, mold and mildew growth and highly durable paint for interior finish.

An all-purpose synthetic quick dry paint for all types of wood and metal surfaces. It has high gloss, good color retention and outstanding durability.

For pipes, valves and equipment, galvanized and ungalvanized ferrous metal, use a 100% acrylic gloss paint, has excellent resistance to ultraviolet rays and resists chalking, cracking and color fading, dries fast and environmentally friendly.

### SCHEDULE OF PAINTING

Architectural Items	
a. Exterior Finishes	
1. On Concrete Walls	
Three Coats, Concrete Masonry Paint	Elastomeric Paint or approved equal
2. Unprimed Ferrous Metal	
First Coat	Red Oxide Primer, #310 or approved equal
Second & Third Coat	Quick Dry Enamel or approved equal
3. On Concrete Block Wall	
Masonry Neutralizer	Masonry Neutralizer #44 or approved equal

Three Coats Concrete Masonry Paint	Elastomeric Paint or approved equal
4. On Wood	
First Coat Exterior Wood Primer	Flatwall Enamel or approved equal
Second & Third Coat Exterior enamel	Quick Drying Enamel or approved equal
b. Interior Finishes Location of the various finishes are listed in the Finish Schedule on the drawings or else will be confirmed by PPA	
1. On primer and coated metal two coats of interior semi-gloss enamel or as indicated in the Schedule finish	Red Oxide Primer #310, Quick Dry Enamel or approved equal
2. On Plaster	
First Coat	Masonry Neutralizer #44 or approved equal
Three Coats	Elastomeric Paint or approved equal
3. On Wood	
First Coat Enamel undercoater	Flatwall Enamel or approved equal
Second & Third Coat Exterior enamel	Quick Drying Enamel or approved equal
4. Wood Stain Finish	
First Coat Second & Third Coats Fourth & Fifth Coats	Oil Wood Stain , Lacquer Sanding Seale r#1254 Clear Gloss Lacquer #1250 or approved equal
c. Non – Architectural Items (Piping, valves, equipment, etc.)	
1. Piping, valves, equipment etc. in rooms are to be painted	
2. Galvanized pipes and ducts	
Primer – one coat	Red Oxide Primer, #310 or approved equal
Finish – one coat	Quick Dry Enamel or approved equal
3. Black steel pipes	
Primer – one coat	Red Oxide Primer, #310 or approved equal
Finish – one coat	Quick Dry Enamel or approved equal
4. Mechanical Items	
a. Ungalvanized ferrous metal Primer – one coat	Red Oxide Primer, #310 or approved equal

Finish – one coat	Quick Dry Enamel or approved equal or approved equal
b. Galvanized ferrous metal Primer – one coat  Finish – one coat	Red Oxide Primer, #310 or approved equal Quick Dry Enamel or approved equal or approved equal
c. Submerged galvanized ferrous metal Primer – one coat	Red Oxide Primer, #310 or approved equal
d. Buried miscellaneous ferrous surface valves, & flanged joints (excl. pipe) Primer – one coat	Red Oxide Primer, #310 or approved equal

## EXECUTION

### SURFACE PREPARATION OF STEEL

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

### SURFACE PREPARATION OF WOOD

1. Wood surfaces shall be sanded to a fresh surface. Surface mould where present, shall

be removed by washing, rubbing down and burning off as necessary. Resinous exudation and large knots shall be removed and replaced with filler or other materials approved by the Engineer.

2. Parts of timber to be enclosed in walls shall always be primed unless already impregnated. Priming shall be brushed on and a minimum of two coats applied to end grain. When the priming paint is hard, all cracks, holds, open joints, etc. shall be made good with hard stopping and rubbed down with fine abrasive paper. Priming of joinery shall be applied only on site after the Engineer has approved such joinery and before it is fixed. For internal surfaces primer coats shall be carefully flattened.

## **SURFACE PREPARATION OF CONCRETE AND PLASTER**

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

## **SURFACE PREPARATION FOR FIBER CEMENT SURFACES**

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

## **ALUMINUM FRAMES FOR DOORS AND WINDOWS**

All metal surfaces shall undergo pre-treatment process which includes: desmutting, water-rinsing, degreasing/etching, water rinsing, zinc phosphating, water rinsing and acid rinsing.

Powder coating application, shall be factory applied and shall be done in one operation using an electro-static powder gun. The materials to be coated should be well connected to earth. Coating thickness should be kept to a minimum of 60 microns for exposed areas. On details which are to be treated mechanically after coating (drilling, sawing, etc.), the coating film must not exceed 100 microns.

The powder coating shall be oven cured in the range of 20 minutes at 220° C (metal temperature measured on the area with greatest metal thickness). The temperature variation in the oven should not exceed +/- 10° C.

### **Handling**

Coated items should be cooled to no less than 40° Centigrade before handling. Precautions should be taken to avoid damages on the finished coating during stacking, storing and transportation.

### **Storage and Delivery**

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water and easily accessible for inspection and handling. Store materials neatly on the floor, properly stacked on non-absorptive strips or wood platforms. Protect finished surfaces during shipping and handling using manufacturer's standard method.

## WOOD REPAIR

Badly decayed areas shall be removed and repaired. Areas and pieces decayed beyond repair shall be replaced with new pieces that match originals in all respects. Moderately decayed areas, weathered, or gouged wood shall be patched with approved patching compounds, and shall be sanded smooth. The source or cause of wood decay shall be identified and corrected prior to application of patching materials. Wet wood shall be completely dried to a moisture content not exceeding 12 percent, as measured by a moisture meter, to its full depth before patching, unless otherwise authorized. Wood that is to be patched shall be clean of dust, grease, and loose paint.

### 1. Epoxy Wood Repair

Epoxy wood repair materials shall be applied in accordance with manufacturer's written instructions. Health and safety instructions shall be followed in accordance with the manufacturer's instructions. Clean mixing equipment shall be used to avoid contamination. Mix and proportions shall be as directed by the manufacturer. Batches shall be only large enough to complete the specific job intended. Patching materials shall be completely cured before painting or reinstallation of patched pieces.

### 2. Epoxy Consolidant and Epoxy Paste

Epoxy liquid wood consolidant shall be used:

1. To penetrate and impregnate deteriorated wood sections in order to reinforce wood fibers that have become softened or absorbent.
2. As a primer for areas that are to receive epoxy paste filler. Epoxy paste shall be used to fill areas where portions of wood are missing such as holes, cracks, gaps, gouges, and other voids.

## MIXING AND THINNING

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

## WEATHER CONDITION

The paint shall not be applied when the relative humidity is above 85 percent. The paint shall not be applied in rain, wind, fog, dust or mist.

## APPLICATION

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

All painting shall be done by thoroughly experienced workmen.

Safety regulations shall be adhered to at all times, including the wearing of respirators by persons engaged on assisting in spray painting. Adjacent areas and installation shall be protected by the use of cloths or other approved precautionary measures.

Plain enamel and varnish shall be applied carefully with good clean brushes or approved spraying equipment, except that the initial coat on any surface shall be applied with brush. Sufficient time shall be allowed between coats to assure thorough drying and each coat shall be in proper condition before receiving the next coat.

Sanding and dusting as required shall be performed between coats in varnishing work. Finish coat shall be smooth and free from runs, sags, and other defects. Exterior paint shall not be applied during rainy days.

All paint when applied shall provide a satisfactory film and smooth, even surface. Paint shall be thoroughly stirred and kept at a uniform consistency during application. Powdered metallic pigments added at the time of use shall be mixed by adding the powder in small increments to about one-third of the base paint or vehicle, with thorough mixing to obtain a smooth paste. The remainder of the base paint shall then be thoroughly stirred in.

Different brands of emulsion paints shall not be mixed prior to application of the materials.

Where necessary to suit conditions of surface temperature, weather and method of application, the package paint may be thinned immediately prior to application in accordance with the approved manufacturer's directions, but not in excess of 125 cc of suitable thinner per liter (one pint per gallon). Before using, the paint shall be mixed to a uniform consistency and shall be stirred frequently during application.

Paints other than water-thinned paints shall be applied only to surfaces which are completely free of moisture as determined by sight or touch and only such combinations of humidity to be painted as will cause evaporation rather than condensation.

Surfaces which have been cleaned, pretreated and/or otherwise been prepared for painting shall be primed or painted with one coat of finish paint as soon as practicable after such preparation has been completed, but in any event prior to any deterioration of the prepared surfaces.

The first coat of paint on all exterior surfaces shall be applied by brush. Interior prime coats and all other subsequent coats on either exterior or interior surfaces may be applied by brush or spray. Whenever spraying is permitted all areas inaccessible to spray painting shall be coated by brushing or other suitable means. Brushes to be used for application of water-emulsions shall be soaked in water for a period of 2 hours prior to use.

All cloths and cotton waste which might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day.

Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site or destroyed in a manner approved by the Engineer. Paint spots, or stains upon adjacent surfaces shall be removed and the entire job left clean and acceptable to the Engineer.

No smoking shall be permitted in the vicinity where painting is going on.

#### TOUCH-UP PAINTING

Touch-up painting shall be done with the same paint as used for the original coat. The resulting minimum dry film shall be the same as for the original coat.

Touch-up painting shall include cleaning and painting of field connections, welds and all damaged or defective paint and rusted areas.

During touch-up painting, only loose, cracked, brittle or non-adherent paint shall be removed during cleaning. All exposed edges shall be feathered. Touch-up painting shall be performed in a manner which will minimize damage to sound paint. Rust spots shall be thoroughly cleaned and edges of the existing paint shall be scraped back to sound material.

#### DRYING

1. No primer or paint shall be forced to be dried under conditions which will cause cracking, wrinkling, blistering, formation of pores which would detrimentally affect the condition of the paint.
2. No drier shall be added to the paint unless specified in the approved manufacturer's instructions.
3. Painted surfaces shall be protected from dust, dirt, and the elements of the weather until dry to the fullest extent practicable.
4. After drying, any areas of paint damaged from any cause shall be removed, the surface again prepared and then touched-up with the same paint and to the same thickness as the undamaged areas as specified in sub-section 4.14.3.7 above.

#### HANDLING

1. Precautions shall be taken to minimize damage to paint films resulting from stacking for drying.
2. Paint which is damaged in handling shall be scraped off and touched-up with the same paint and in the same thickness as was previously applied to the damaged area at Contractor's expense.

#### INSPECTION

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

**ITEM 35 h: FACILITIES AND DEVICE FOR PERSONS WITH DISABILITY****SCOPE OF WORK**

The work shall consist 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**

Grabrail shall be manufactured from gauge 18 tubular stainless steel 25mmØ and provided with safety grip finish.

**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 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 on the drawings and with a nonskid surface and tactile strips.

## **ITEM 35 i: 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 than 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 35 j : 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 20mm thk 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.

**ITEMS 35 k : SUPPLY AND INSTALL OF PHOTOLUMINESCENT SIGNS AND MARKINGS****GENERAL**

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

**SCOPE OF WORK**

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

**PHOTOLUMINESCENT SIGNS AND PATH MARKERS**

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

**SUBMITTAL**

1. Shop drawings shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.
2. The Contractor, before placing order for the finishing materials shall submit to the Project-In - Charged for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without approval.

**MATERIALS**

Pictogram (290mm X 162mm) /(420mm X 230mm)

Bracket: Ceiling Mount (420mm X 230mm)

Bracket: Flag Mount (230mm X 133mm)

Double Sided Pictogram Directional (420mm X 230mm)

Pictogram W/ Protective Clear coat(420mm X 230mm)

Evacuation Map

Path Marker

Guidance Strip

Handrail Strip

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

## **EXECUTION**

### **INSTALLATION**

For versatility the signs and markers can be installed using fixers (screws) or adhesive tape.

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

**ITEM 35 I: SIGNAGES AND LOGO****SCOPE OF WORK**

Furnish materials and perform labor to include miscellaneous works required for the installation of room identification for the toilets and port office.

**SAMPLE AND SHOP DRAWINGS**

The Contractor shall submit samples for approval by the Architect. Notify the Architect for any changes, clarifications and discrepancies.

For the room I.D. full size lettering layout and installation method shall be submitted to the Architect for approval before start of work.

**MATERIAL REQUIREMENTS****1. FISH TERMINAL NAME**

- Hot dipped cut out 4.5 mm thick Metal sheet screwed at the back.

**2. ROOM MARKERS**

Black acrylic letters, 38mm (1-1/2") high on white acrylic background, 63mm (2-1/2") high, with clear acrylic cover. Lengths shall be as required by the full notation therein.

**EXECUTION****WORKMANSHIP**

Workmanship shall be executed in high quality comparable with artworks.

**MOUNTING**

For all mounted assemblies, appropriate mounting hardware and connectors which are concealed shall be sufficiently used.

Assemblies shall be mounted plumb, straight, level, and at prescribed heights.

**INSTALLATION**

Installation shall be done in a secure and permanent manner at prescribed heights and/or layout. The backwall shall not be mutilated. After the dowels are positioned, fill with expanding grout, or other approved fillers, and retouch, flashed to the backwall surface.

## ITEM 35 m: ROOFING AND TINSMITHRY

### SCOPE OF WORK

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

### MATERIAL REQUIREMENTS

#### POLYCARBONATE SOLID SHEET

Standard Polycarbonate roof panel system, made of thermoplastic materials capable of handling both extremely low and high temperatures.

Base Solid Sheet thickness	:	2 mm, 3mm, 4.5mm, 6mm, 8mm, 10mm
Length	:	1.22 m x 2.44m , 1.22m x 4.88m, 1.22m x 30.48m (roll)
Color	:	Blue
Material Finish	:	hard coating applied to give a harder finish and improve resistant to impact and fracture that demand high reliability and performance. The polymer has density 1.2 – 1.22 g/cm <sup>3</sup> ), maintains toughness up to 140°C and down to -20°C.

### EXECUTION

#### POLYCARBONATE SOLID SHEET

1. Standard Polycarbonate Roofing panel

Spacing of purlins safe at 1.0m to 1.2m.

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

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

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

## HANDLING AND STORAGE

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

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

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

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

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

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

Bundles shall not be left expose to the weather.

## FLAT STEEL BAR

Flat bar is a type of steel product displaying rectangle section. Flat bar has uses in many industries and is often an ideal choice due to its non-corrosive properties and structural strength. Flat bar is considerably less expensive than wood, is lighter in weight, insect resistant, and resists warping and cracking from water damage.

Flat bar

Grade 43A

Thickness: 3- 12mm

Minimum length : 8 ft (2400mm)

Maximum length : 20 ft(6100mm)

**ITEM 36 ARCHITECTURAL WORKS AND FINISHES****GENERAL NOTES:**

The contractor should observe special consideration to indent order items that require longer lead time and checking of material availability under specified conditions of sale, the acceptance of which by the supplier constitutes a contract of sale.

The following are listed as the indent items:

*20mm thick Phenolic Toilet Partition and accessories, Roofing, Aluminum Composite Panels (including Honeycomb designed Aluminum panels and Brise soleil), Photoluminescent Signs and markings, Elevator and Escalator, Gang Chairs, Signages and logos, UPVC Baffle Ceiling and PVC interlocking ceiling panels among others.*

**ITEM 36 a : 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 as indicated on the drawings and as specified herein.

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

**WALLS****Exterior**

- a. Plain cement finished painted with acrylic solvent base paint.  
Location as shown in the plans and elevations.

**Interior**

- a. Plain cement finished painted with elastomeric paint.
- b. 300mm x 600mm Homogenous ceramic wall tiles.

**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: Acrylic solvent Base Wall Covering Sealer

2nd and 3rd Coat: Acrylic solvent Base Wall Covering Basecoat

4th Coat: Acrylic solvent Base Wall Covering Topcoat

**With mesh:**

1st Coat: Acrylic solvent Base Wall Covering Sealer

2nd Coat: Acrylic solvent Base Wall Covering Basecoat  
Reinforcing Membrane: Fiberglass Matting

3rd and 4th Coat: Acrylic solvent Base Wall Covering Basecoat

5th Coat: Acrylic solvent Base Wall Covering Topcoat

#### **Wall Ceramic Tiles**

- a. Wall tiles shall be glazed ceramic tiles color as per Architect's approval.
- b. Trimmers and moulding shall be lustrous, glazed with size and color corresponding to wall tiles.
- c. Portland cement, sand, bonding compound, lime and water shall conform with the requirements.

#### **FLOORS**

**F1 600mm x 600mm Floor Tiles (Ivory White Finish)**

- a. Security Inspection/ XRay Area
- b. Pre Departure/ Waiting Area
- c. Terminal Fee Room
- d. Office
- e. Janitor's Room/ Storage
- f. Diaper / Changing Nursing Mother Room
- g. Control Room
- h. Electrical Room

Locations are shown in the plan.

**F2 600mm x 600mm Floor Tiles, Beige Finish**

- a. Male Ecumenical Room
- b. Female Ecumenical Room
- c. PWD Ecumenical Room
- d. Landing
- e. Steps (Front and Rear)
- f. Stairs (Leading to Roof Deck)

A skim coat of neat Portland cement mortar shall then be applied not more than

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.

c. Placing of Setting Beds and Floor Tile

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.

b. Surface Preparation

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

a. Mortar Preparation

Floor Tiles

EXECUTION

Floor tiles shall be delivered in the manufacturer's original unbroken packages or containers that are labeled plainly with the manufacturer's name and brand. Containers shall be grade sealed. Materials shall be stored in dry weather-tight enclosures, and shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.

requirements.

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

designated by the Architect.

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

Waterproof finish for all toilets.

Locations are shown in the plan.

a. All Ramps

F3 Non-Skid or Rough Cement Finish

Locations are shown in the plan.

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

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

d. **Cleaning and Curing**

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

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

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

## Ceiling

1. **Interior**

1. C1 - 1200mm x 600mm x 0.70mm Aluminum Clipped-In Perforated Ceiling Panel, Bone White or Approved Equivalent
  - a. Security Inspection/ XRay Area
  - b. Pre Departure/ Waiting Area

Locations are shown in the plan.

2. C2 - 600mm x 600mm x 0.70mm Aluminum Clipped-In Perforated Ceiling Panel, Bone White or Approved Equivalent
  - a. Terminal Fee Room
  - b. Office
  - c. Janitor's Room/ Storage
  - d. Diaper / Changing Nursing Mother Room
  - e. Control Room
  - f. Electrical Room
  - g. Male Ecumenical Room
  - h. Female Ecumenical Room
  - i. PWD Ecumenical Room

Locations are shown in the plan.

3. C3 - Painted Underside of R.C. Slab
  - a. Entrance/ Exit Porch

#### 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

**1. Surface Preparation**

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

**DOORS**

- D-1 - 1.5mm thk. Aluminum Framed Powder Coated Finish with 8 mm thk. Reflective Tempered Brown Glass Double Swing Door w/ Fixed Transom Window (1.70m x 2.73m)
- D-2 - 1.5mm thk. Aluminum Framed Powder Coated Finish with 8 mm thk. Reflective Tempered Brown Glass Double Swing Door w/ Fixed Transom Window (1.50m x 2.73m)
- D-3 - Marine Plywood Finish Flush Door (0.80m x 2.10m)
- D-4 - Marine Plywood Finish Flush Door w/ Vent Louver (0.80m x 2.10m)
- D-5 - Marine Plywood Finish Flush Door w/ Vent Louver (1.00m x 2.10m)

**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-1 - 1.5mm thk. Aluminum Framed Powder Coated Framed Combination of Fixed and Sliding Type Window with 8mm Thk. Reflective, Tempered Brown Glass (3.60m x 1.20m)
- W-2 - 1.5mm thk. Aluminum Framed Powder Coated Framed Combination of Fixed and Sliding Type Window with 8mm Thk. Reflective, Tempered Brown Glass (2.40m x 1.20m)
- W-3 - 1.5mm thk. Aluminum Framed Powder Coated Framed Combination of Fixed and Sliding Type Window with 8mm Thk. Reflective, Tempered Brown Glass (1.80m x 1.20m)
- W-4 - 1.5mm thk. Aluminum Framed Powder Coated Awning Type Window with 8mm Thk. Reflective, Tempered Brown Glass (1.20m x 1.70m)
- W-5 - 1.5mm thk. Aluminum Framed Powder Coated Sliding Type with 8mm Thk. Reflective, Tempered Glass (1.20m x 1.20m)
- W-6 - 1.5mm thk. Aluminum Framed Powder Coated Fixed Type Window with 8mm Thk. Reflective, Tempered Glass (0.60m x 0.90m)
- W-7 - 1.5mm thk. Aluminum Framed Powder Coated Awning Type Cum Fixed Type Window with 8mm Thk. Reflective, Tempered Glass

(3.60m x 1.70m)

**W-8 - 1.5mm thk. Aluminum Framed Powder Coated Awning Type Cum  
Fixed Type Window with 8mm Thk. Reflective, Tempered Glass  
(1.46m x 1.20m)**

**ITEM 36 b: 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 insure proper ventilation and drainage, and shall be supported at least 150 mm above-ground. Lumber shall be protected against dampness before and after delivery, and enough protection under cover in well ventilated enclosure, not exposed to extreme changes of temperature and humidity; and in a manner as to provide air-circulation around all surfaces of each pile to insure thorough air-seasoning. Lumber or millwork in buildings shall not be finished until concrete, masonry work and plaster are dry. Lumber shall be delivered at least thirty (30) days before use.

**d. Grading of Plywood**

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

**MATERIALS****a. Lumber**

Lumber for various uses shall be one of the species listed for the purpose indicated unless otherwise specified in the drawing. For any use not specified, the lumber shall be the best commercial grade normally used for the purpose, subject to the approval of the Engineer.

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

All doors, windows, transoms, or other opening where so indicated on plans, shall have frames and sills of the dimensions shown or as hereafter detailed, and all frames coming in contact with concrete shall be anchored by means of 20-d nails, spaced not more than 0.20m, apart, all around the 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. | Bofiden Salts | - | 45.5 kg. dry chemical per cubic foot of wood |
| b. | Wolman Salts  | - | 0.31 kg. dry chemical per cubic foot of wood |