

PROPOSED CONSTRUCTION OF SQUASH COURT

TECHNICAL SPECIFICATIONS

OBJECTIVE

The basic objective of the project is the construction of Squash Court located at Rizal Memorial Sports Complex, Malate, Manila.

BASIC INFORMATION

Project Name : Proposed Construction of Squash Court
Location : Pablo Ocampo Sr. St., Malate, Manila

APPROVED BUDGET FOR THE CONTRACT

Sixty Four Million Eight Hundred Sixty Seven Thousand Five Hundred Sixty and 32/100 Pesos
(₱ 64,867,560.32)

QUALIFICATIONS

- The Contractor must have valid PCAB license Category B with principal classification of General Engineering.
- The Contractor must have PCAB ARCC rating of Medium A for Building.
- The Contractor must be ISO 9001 Certified.
- The Contractor must be in sound financial standing with annual turnover/gross billings of at least 50% of the ABC.
- The Contractor must have complete construction of a structure with at least contract value of 50% of the ABC.
- The Contractor must have a licensed Civil Engineer, Electrical Engineer, Mechanical Engineer, Sanitary Engineer, Materials Engineer and Safety Officers.
- All engineers must have an experience in the construction/rehabilitation of structures such as sports facilities and the like.
- The Company must have an experience and specialization in construction of squash courts.

I. GENERAL SPECIFICATIONS

The work shall include the supply of labor, materials, tools, equipment and services necessary to complete the subject project per approved Scope of Work, approved Construction Plans/Drawings and these Technical Specifications, which are part of the Contract of Services, Governing Codes: Republic Act No. 9184 and its Implementing Rules and Regulations, National Building Code of the Philippines (P.D. 1096), Philippine Electrical Code, Philippine Plumbing and Sanitary Code, Philippine Mechanical Code, and all related applicable local ordinances and regulations.

Necessary building permits, clearances or licenses including occupancy permits shall be provided by the Contractor.

The Contractor shall submit, prior to the execution of the specified works, his schedule of work expressed in PERT/CPM Network Diagram, indicating the computation of the contract time, all activities, their duration and projected percentage accomplishments/cash flow, for monitoring purposes.

For all new constructions, the Contractor shall provide new materials, fabricated products, and necessary equipment and services for all works.

For all repair or replacement works, use brand new materials, brands/models, measurements, and finishes. Major materials, products or work items, large volume or quantity items, or other expensive items that are not particularly mentioned in these specifications, shall require submission of samples, product tests, mock-up models, and selection, or approval prior to their installation or application in the project.

Sub-contracting shall only be limited to specialty work items, which require provision of special materials, methods, techniques and equipment and are subject to the approval of the Philippine Sports Commission.

The contractor shall provide full-time supervision of the works.

All materials and equipment shall be delivered to the site at designated locations within the project premises.

The Philippine Sports Commission or its authorized representative reserves the right to reject any materials or workmanship that may be found defective or not in conformity with the approved Construction Plans/Drawings and these Technical Specifications. In case where conflicts between the Construction Plans/Drawings and the Technical Specifications arise, these should be immediately being brought to the attention of the Philippine Sports Commission or its authorized representative for appropriate action.

All billings shall be subject to submission of a Statement of Account by the Contractor, including his percentage accomplishment report and photographs for inspection/evaluation and acceptance by the Philippine Sports Commission. The Contractor shall provide access to the construction areas for the convenience of the inspection team during project inspection.

Change or additional works that are necessary but were not included in the scope of work shall be subject to variation order preparation upon request and notice by the Contractor.

II. GENERAL REQUIREMENTS

a. Regulatory Requirements

- i. National Building Code of the Philippines
- ii. National Plumbing and Sanitary Code of the Philippines
- iii. Philippine Electrical Code
- iv. Philippine Mechanical Code

b. Submittals

- i. Construction Schedules
- ii. Shop Drawings
- iii. Product Data and Samples
- iv. Color Swatches
- v. Construction Photographs
- vi. Permits (when necessary)

III. OUTLINE TECHNICAL SPECIFICATIONS

1.0 SECURING/RENEWAL OF BUILDING PERMITS:

Necessary building permits, clearances, or licenses including occupancy permit shall be provided by the Contractor. The Contractor shall pay all fees and other incidental expenses.

2.0 DISMANTLING OF EXISTING UNWANTED STRUCTURES:

2.1 Demolition, Removal and Dismantling

- a. Before commencing any demolition, removal, and/or dismantling work, all affected electrical lines and water supply lines shall be disconnected, or shut off except such as required for use in connection with the work on site.
- b. Demolish selectively and remove or dismantle carefully all components of structures indicated in the drawings necessary to prepare for renovations. All reusable materials shall be coordinated with the agency architect/engineer for reuse.
- c. Store reusable parts of the structures and materials within the area. All other materials retrieved from the site shall be turned over, supported with an inventory report on quantity and description of materials, to the Philippine Sports Commission, through the agency Property Officer. Only reusable materials shall stay in the construction area. On the other hand, all unused and destroyed materials shall be supported with a Report of Waste Materials.
- d. Protect and maintain structures, materials, fixtures, and utilities that are to remain within the property.

3.0 SITE WORKS

3.1 Site Preparation

3.1.1 General

The Work under this Section shall include complete demolition work timbering, clearing, grubbing, scalping, clean up and disposal of all debris and other objectionable matter and grading work as directed by the Construction Officer.

3.1.2 Requirements

Demolition in work shall consist of complete removal/demolition of all obstructions.

Timbering shall consist of felling and disposal of all trees specifically indicated to be removed. No timbering shall be done until each tree to be removed has been physically marked for removal by the Construction Officer. Trees marked for removal shall be felled in such a manner as not to injure other trees, fences, wires, buildings and facilities which are to remain. All damage to remaining trees, plants or facilities resulting from such timbering shall be repaired by the Contractor at no additional cost to the Government. All resulting stumps shall be left clean and free from sharp protuberances and shall not extend more than 30 cm above ground surface.

Cleaning shall consist of the removal and disposal of all stumps, vines, bush, grass, roots, vegetation, fences, rocks, masonry and debris within the limits and rights-of-way of the project.

Disposal of non-combustible waste shall be accomplished by removal from job-site by the Construction Officer. In no case shall the Construction Officer, prior to commencement of operation, or permission from the property owner, such permission to include the site location, method of disposal and any restrictions or conditions that may form part of the agreement between the Contractor and the Owner. The Contractor shall save the Government from any claim arising or resulting from such disposal operations.

Burning shall be accomplished at site without damage to nearby trees, buildings or other facilities by flames, smoke or ash. All applicable regulations shall be complied with such burning. Permission by the Construction Officer to accomplish burning shall not be construed as to relieve the Contractor of determining and complying with such regulations. All fires shall be kept under constant and adequate attendance and fire control measures and devices shall be sufficient in quantity to control all blazes. In the event that conditions are unsuitable for burning waste, at the option of the Contractor, combustible material may be disposed by other means, provided that prior approval of the Construction Officer is obtained.

The grading work shall be done after clearing the site of stumps, roots, grass, etc. Grading work shall be general smoothening the ground surface of the site such as covering holes left by stumps, etc. and leveling sharp and steep grades.

3.2 Excavating and Grading

3.2.1 General

Work under this section shall be subject to the requirements of applicable paragraphs of the General Conditions of Contract.

3.2.2 Work Included

This work includes labor, materials, and equipment necessary for excavating and grading as required in the Drawings and as specified herein. This, in general, includes cleaning and removal of grass, trees, and loose stones, and excavation for foundations, footings, septic vault, and rough and finish grading.

3.2.3 Materials

Factory fill material shall be of the materials approved by the Construction Officer, and shall be of the type that has obtained its optimum moisture contents.

Unsatisfactory fill materials are Fill Materials that are too wet or too soft, as determined by the Construction Officer, and deficient in providing a stable subgrade or foundation of structures or pavements.

Selected backfill materials shall consist of sand, stone, gravel or screened stoned, uniformly graded and free from soft or unsound particles or other objectionable materials. Sieve analysis shall conform with ASTM C136, and shall conform to the following gradation limits:

Passing 3/8 inch sieve	-	100%
Passing No. 4 sieve	-	85-100%
Passing No. 100 sieve	-	0-10%
Passing No. 200 sieve	-	0-3%

3.2.4 Workmanship

3.2.4.1 Staking Out

The Contractor shall stake cut lines and corners. He shall build batter boards and shall locate first and second floor lines in relation to existing

grades. Lines and levels shall be approved by the Construction Officer or his representative before excavation is started.

The Contractor shall construct two permanent benchmarks of previously known elevations near the site of construction for purpose of determining any settlement that may occur during the construction.

3.2.4.2 Excavation

Excavation shall be executed in a careful manner to proper depths. No excavation shall be carried below elevations indicated on Drawings unless made necessary by existing conditions. Claims for extras will not be allowed for excavations not authorized by the Construction Officer.

Excavated materials shall be transported to and placed in fill areas within work limits. Unsatisfactory materials encountered within established subgrades as shown or 0.30m below grade shall be replaced with satisfactory materials as specified.

Surplus excavated materials not required for fill or embankment shall be disposed of in designated waste or spoil areas. Unsatisfactory excavated materials shall be disposed in designated waste or spoil areas. Excavated materials shall be performed to provide proper drainage at all times. Materials required for fill, in excess of that produced by excavation within the grading limits, shall be excavated from approved borrow areas.

Excavation shall be left clean and clear of loose material.

3.2.4.3 Water and Drainage

Contractor shall do everything necessary for keeping water out of excavations and away from building during construction.

3.2.4.4 Backfill

Backfill shall be installed against foundation walls in not more than 2" or 50mm. Backfill shall be carefully tamped. Debris shall not be used for backfilling.

3.2.4.5 Grading

Finish grading shall include areas with limits shown on plot plan. Grades shall be reformed to easy contours in accordance with Drawings.

3.3 Soil Poisoning

3.3.1 General

Whenever the Scope of Work includes soil poisoning, the work shall include furnishing of labor, materials, and equipment to complete all poisoning works.

3.3.2 Materials

Soil Poisons, Soil poisons shall be water-based emulsions.

Any of the following may be used:

1. Chlordane - 1% Concentration
2. Benzene Hexachloride - 0.8% Gamma Isomer Concentration
3. Dieldrin - 0.5% Concentration
4. Aldrin - 0.5% Concentration
5. Heptachor - 0.5% Concentration

3.3.2.1 Sample and Test

A sample of the concentrated toxicant shall be tested.

At least two samples of working solution shall be tested for every 10,000 square feet or 1,000 square meters of treated area.

Samples shall be submitted, analyzed and tested by an approved testing laboratory. Tests shall be paid for by the Contractor. The results shall be submitted to the Construction Officer.

3.3.2.2 Delivery, Storage and Protection

Chemicals shall be delivered to the job site in factory sealed containers with the manufacturer's brand and name clearly marked.

Chemicals shall be stored, handled, and applied in accordance with the directions in the manufacturer's label.

3.3.3 Workmanship

3.3.3.1 Site Inspection

A general survey and thorough examination of the entire premises shall be undertaken in order to fully understand all existing conditions and to determine the location and existence of subterranean termite colonies.

3.3.3.2 Application

Soil poison working solution shall be applied by means of pressure spray, soil injector, or when specified by direct pouring.

Live termite mounds found within the premises shall be exterminated by destroying the mounds and/or introducing soil poison working solution into mounds.

Soil poisoning work shall not begin until all preparations for slab placement have been completed.

Soil poisons shall not be applied when soil of fill is excessively wet or immediately after heavy rains to avoid surface flow of soil poison solution from the application site.

After grading and leveling the soil in the ground, gravel bed shall be set preparatory to the pouring of concrete at every 10.76 sq.ft. (Square Meter) floor footing area shall be flooded or soaked with soil poison working solution.

Every 3.28 linear feet (linear meter) of excavation for footing retaining wall and other foundation work shall be thoroughly drenched and saturated with soil poison working solution before pouring of concrete.

The solution shall be applied to all areas immediately below expansion joints, control joints and all areas where slab will be penetrated by pipe and other construction features.

Masonry wall resting on grades shall have their voids treated with 1 gallon of soil poison working solution per 5 linear feet (1.52 linear meter) of wall. Poison shall be poured directly into below spaces.

Prior to landscaping of lawn, every linear meter of building perimeter and of three-meter width shall be saturated with soil poison working solution.

Earth fill shall be treated thoroughly. As soon as fill is compacted and leveled, every one square meter area shall be drenched with soil poison working solution.

3.3.3.3 Guarantee

Upon completion and acceptance of the work, the Owner shall be furnished with a written guarantee stating that termite control is guaranteed for a period of 10 years and that regular inspections are to be done by the guarantor to ensure the quality of their work. shall be trimmed to give a clear height of 6 m above the roadbed surface. All trimming shall be done by skilled workmen and in accordance with good tree surgery practices. Timber cut inside the area staked for clearing shall be felled within the area to be cleared.

3.4 Concrete Culvert Pipe

3.4.1 General

Whenever Concrete Culvert Pipes are indicated in the Plans, this work shall consist of furnishing reinforced and non-reinforced concrete culvert pipes of the sizes and dimensions indicated on the drawings, conforming to the specifications and the directions of the Construction Officer.

3.4.2 Materials

The fabrication of the pipes shall conform to the specification of ASHO Designation M 170. The Construction Officer reserves the right to inspect and test the pipes delivered for use in the work. Defects that are discovered after acceptance of delivery of the pipes but before installation of the pipe shall be cause for rejection without additional cost to the Government. Mortar for pipe joints shall be composed of one (1) part Portland cement and two (2) parts sand, and shall conform to the requirements of item RC 100: Plain and Reinforced Concrete.

3.4.3 Workmanship

Trenching for concrete culvert pipes shall conform to, and shall be payable under, item EX 100: Excavation. The pipe trench shall be excavated to the depth, grade and width established by the Construction Officer. In material considered satisfactory by the Construction Officer, the pipes may be laid directly on the trench bed shaped to the form of the pipes for at least 10 per centum of their outside diameters. In rock or hardpan and other material considered unsatisfactory by the Construction Officer, the trench bed shall be excavated 30 centimeters deeper and the required selected or granular material shall be laid to bed the pipes. In preparing the pipe bed, recesses for pipe bells shall be provided. Pockets of unsuitable material shall be removed and replaced with approved selected or granular material.

Pipes shall be carefully laid, with hubs up-graded, ends fully and closely joint, true to the lines and grades required. After one length of pipe is laid, the lower portion of the hub shall be primed with mortar on the inside sufficient enough to bring the inner surfaces of the next pipe flushed and even those of the previous one. The remainder of the joint on the inside shall then be filled with mortar and then struck off to a smooth finish. The outside of the joint shall also be filled with mortar, and excess mortar shall be used to form a bead all around the outside of the joint. After the initial set of the outside mortar, it shall be protected from air and sun by thoroughly wetted burlap or earth.

The pipes shall be tested for undue settlement and for watertightness of joints, before backfilling the trench. Unsatisfactorily work shall be corrected without additional cost to the Government.

Filling and Backfilling. The mortar joints shall have set sufficiently prior to backfilling. Backfilling shall be brought up, in uniform 15-centimeter layer on both side and over the line of pipes, to the finished grade. Compaction shall be accompanied by sprinkling with water to obtain at least 95% relative compaction.

3.4.4 Methods of Measurement and Basis of Payment

For purposes of progress payments, concrete pipes installed complete in place in accordance with drawings, these specifications, or as directed by the Engineer shall be paid for the total length in linear meters according to size and kind, measured along the axis of the pipes.

The quantities measured as provided above and accepted for payment shall be paid for the purposes of progress payments only at the unit price per linear meter of the kind and size of concrete pipes, in which price and payments shall constitute full compensation for furnishing or manufacturing of the pipes, for hauling and installing, for bedding and jointing, and for all other headwalls and other structures are excluded from the payment prescribed herein. Final payment shall not exceed the total amount for this work item shown in the Proposal Schedule.

When the Proposal Schedule does not provide separate payment for work herein specified, full compensation therefore shall be considered as included in the lump sum contract price for Exterior Drainage System within the purview of items PS 100.

3.5 Roadways and Paving

3.5.1 General

Whenever Roadways and Paving are called for in the Plans, the Contractor shall furnish all labor, materials, equipment and incidentals for the construction of new pavement, sidewalks, gutters and curbs, and for the restoration of existing pavement, sidewalks, gutters and curbs, as shown on the Drawings and as specified herein. The Construction Officer may direct the Contractor to excavate and repave additional areas to those indicated.

3.5.2 Standard Specification Reference

Except as otherwise specified herein, materials and construction shall be in accordance with the “Republic of the Philippines, Department of Public Highways, General Specifications for Roads and Bridges, 1976.”

ASTM D1559 Resistance to Plastic Flow of Bituminous Mixture Using Marshall Apparatus.

3.5.3 Materials

Granular subbase and base course materials shall be as specified under Items 300, 301, and 302 of the General Specifications. Grading requirements shall be as follows:

Sub-base	Standard Sieve Size	Percent Passing
75.00 mm		100
37.50 mm	80	100
9.50 mm	45	100

4.75 mm	30	85
2.00 mm	15	65
0.425 mm	5	35
0.075 mm	0	15
Base	Standard Sieve Size	Percent Passing
25.00 mm		100
19.0 mm	75	100
7.75 mm	40	60
2.00 mm	25	45
0.425 mm	12	25
0.075 mm	5	12

Concrete shall meet the requirements for structural concrete.

For asphalt concrete, under Item 401 of General Specifications, aggregate grading shall be Class B. Test specimens of the job-mix formula shall be prepared and tested in accordance with the design procedures given for the Marshall Method of Mix design, and shall meet the requirements given below when tested in accordance with ASTM D1559.

Marshall Stability N	3300 min
Flow, 0.25 mm	8 - 46
Percent voids in total mix	3 - 5
Use 75-blows/end compaction	

The job-mix formula shall be submitted for the Construction Officer’s approval that may change the aggregate grading and bitumen content to improve the quality of the mix.

For Gravel surfacing material, under Item0 407 of General Specifications 1 grading requirements shall be as follows:

Standard Sieve Size	Percent Passing
25.00 mm	100
19.00 mm	85 - 100
9.50 mm	60 - 100
4.75 mm	50 - 85
2.00 mm	40 - 70
0.425 mm	25 - 45
0.075 mm	10 - 25

3.5.4 Workmanship

3.5.4.1 Subgrade

Following clearing, grubbing and preparation stripping of topsoil the subgrade shall be prepared by sprinkling and rolling with a steel roller until the subgrade is completed to 90 percent of optimum. Subgrade in cut areas shall be scarified to a depth of 0.15 m and recompacted at a moisture content slightly above the optimum.

Areas that require common fill to raise to sub-grade elevations shown on the Drawings shall be filled except that no lift shall be thicker than 150 mm. Where existing sub-grade materials have been disturbed, or are in the opinion of the Construction Officer unsuitable for subgrade, the materials shall be removed as directed and shall be replaced with common fill and shall be compacted.

No subbase material for new restored pavement shall be placed until the Construction Officer has inspected and approved the subgrade.

3.5.4.2 Subbase and Base Course Materials

Aggregate Base Course shall be placed and compacted as shown on the Drawings, and as required in - Aggregate Base Course.

The finish base course shall not vary more than 1.5 centimeters above or below the set grade at any point. Any area that does not conform to the grading requirements shall be reworked and recompacted.

3.5.4.3 Portland Cement Concrete Pavement

See - Portland Cement Concrete Pavement.

3.5.4.4 Sidewalks

All sidewalks disturbed during the course of the work shall be restored to their original condition. New sidewalks shall be 21 Map concrete.

New concrete pavement shall be in accordance with - Concrete of the General Specifications.

Concrete pavement to be removed shall be up to vent lines cut by an abrasion saw. Where existing reinforcing steel is removed it shall be replaced with equivalent steel bars.

Concrete curbs and gutters shall be constructed as indicated on plans. All exposed concrete edges shall be finished with an edging tool having a 1-cm radius.

3.6 Concrete Curb and Gutter

3.6.1 General

Whenever indicated in the plans, this work shall consist of concrete curb or combined curb and gutter, constructed at the locations and to the dimensions, shape shown on the drawings and specified herein or as directed by the Construction Officer.

3.6.2 Materials

Concrete shall be of the class of strength shown on the drawings and shall conform to the requirements of Plain and Reinforced Concrete. Pre-molded filler for expansion joints shall conform to the specifications of AASHTO M-33 and poured filler for intermediate construction joints shall be of mixed asphalt and mineral filler or mixed asphalt and rubber filler conforming to the specifications of AASHTO M-89,

with asphalt having a penetration (77oF, 100gr., 5 specs.) within the range of 30 to 50 and a softening point of not less than the range of 30 to 50 and a softening point of not less than 90oC (200oF). Steel reinforcement, if any, shall conform to the specifications of ASTM Designation: A615, Grade 40.

3.6.3 Workmanship

Formwork for concrete placing shall be constructed upon the prepared base previously completed in accordance with the requirements of Aggregate Base Course. Forms shall be smooth on the side placed next to the concrete and shall have a true smooth upper edge. The depth of forms for back of curbs shall be equal to the full depth of the curb, and the depths of the face of the forms for curbs shall be equal to the full-face height of the curb. Forms shall be rigid enough to withstand the pressure of fresh concrete without distortion, and shall be thoroughly cleaned and coated with form oil to prevent adherence of concrete. Setting of forms shall conform to the required dimensions and to the alignment and grade shown on the drawings. Stakes shall be positioned to hold the form rigidly in place and clamps, spreaders, and braces shall be additionally placed where necessary to enhance rigidity in the forms. Benders or thin plank forms cleaned together may be used on curves, grade changes, or for curb returns. In constructing curbs, entrances shall be provided for driveways, with dimensions shown on the drawings or designated by the Construction Officer. Dowels and reinforcements shall be of the size, shape and spacing shown on the drawings.

The curb and gutter shall be constructed in uniform segments not more than 5 meters in length, except where shorter segments are required to coincide with the location of weakened plane or contraction joints in the adjacent concrete pavement, or for closure, but no segment shall be less than 2 meters long. The poured joint shall be formed by sheet templates that will give the required joint thickness and that are cut to the cross-section of the curb or the combined curb or gutter. The templates are set carefully normal to the line of curb and to plane of gutter and held firmly in place until the concrete has set sufficiently to hold its shape. They are removed shortly after the curb face form is removed, but before all the other forms are removed. Expansion joints shall be formed with pre-molded joint material, likewise placed normal to line or curb and to plane of gutter, cut and shaped to the cross-section of the curb and gutter, and positioned at locations shown on the drawings.

Concrete shall be placed and consolidated in the forms without segregation. Prior to the removal of the forms, the surface of concrete shall be shaped true to grade by means of a straight edge float preferably 3 meters long, operated longitudinally over the surface of the concrete. For clamps and braces shall have been so positioned as not to interfere with the operation of this float. Immediately after the removal of the front curb forms, the face of the curb shall be floated and trowelled smooth. No plastering will be permitted and the finishing shall be accomplished by simply floating the green concrete, accompanied by careful wetting. Minor defects shall be repaired with mortar containing one part Portland cement and two parts of fine aggregate. Corners and edges shall be rounded to the radii shown on the drawings. Surface irregularities in excess of 6 millimeters in 3 meters shall be considered as cause for rejection of segment, which shall be removed and replaced without additional cost to the government.

Removal of the rest of the forms may be done after 24 hours that the concrete is placed, but proper protection shall be made by the Contractor to prevent injury or damage to the finished concrete. After finishing and sufficient hardening to the concrete curb or the combined concrete curb and gutter, curing shall be

immediately done by any method specified under Plain and Reinforced Concrete. Backfilling next to the curb shall be performed and paid for under the provisions of Filling and Backfilling.

3.6.4 Methods of Measurement and Basis of Payment

For purposes of progress payments, the quantity to be paid for shall be the total length in linear meters of concrete curb and gutter, completed and measured in place. Measurement shall be made along the face of the curb, whether the portion being measured is straight or curved. No deductions shall be made for flattening of curbs at entrances.

The quantity of curb or combined curb and gutter as measured above shall be paid for purposes of progress payments only at the unit price bid per linear meter, in which price and payment shall constitute full compensation for all materials, labor, plant, equipment, tools and incidentals necessary to complete the work. Inclusive of form work, concrete placing, finishing, shaping, curing, joining, etc. Final payment shall not exceed the total amount for this work item as shown in the Proposal Schedule.

4.0 TEMPORARY FACILITIES

4.1 Temporary Facilities

4.1.1 Scope of Work

This section shall include the mobilization and demobilization of Contractor's plant, equipment, materials and employee to the site; construction/ rental and maintenance of Engineer's staff house, and service vehicle in compliance with the contract requirements during the entire project duration.

This section shall include the furnishing of labor, materials, transportation, tools, supplies, plant, equipment and appurtenances to complete satisfactorily the construction of the proposed project.

4.1.2 Mobilization and Demobilization

The Contractor upon receipt of the Notice-to-Proceed shall immediately mobilize and transport his plant, equipment, materials and labor forces to the site and demobilize or remove the same at the completion of project and level/ clear the site acceptable to the Engineer and the Owner. Mobilization and Demobilization are incidental to other items of work and will not be measured for payment.

4.1.3 Field Office for the Engineer

During the performance of the contract, the Contractor shall provide and maintain field office for the Engineer and Engineer's representative within the site of the work at designated location indicated on the Drawings while the work is in progress.

The Contractor shall also maintain the existing staff house of the Engineer and shall also provide and maintain a separate office on rental basis for the Engineer's Representative at location approved by the Engineer during the entire duration of the contract.

Construction shanties, sheds and temporary facilities provided as required for the Contractor's convenience shall be maintained in good condition and neat appearance including finishes as required by the Engineer.

The field office for the Engineer/Engineer's representative shall be constructed all in accordance with the Standard Specification and design shown on the approved Drawings.

The building shall have the floor area prescribed on the Plans and shall have a 24-hour security services and shall strictly comply with the provisions of Batas Pambansa 344 (Accessibility Law) and the Building National Code.

All facilities to be provided by the Contractor shall conform to the best standard for the required types. The facilities provided by the Contractor including utilities and communication facilities shall revert to the Government including office equipment, furniture, etc. upon completion of the Project.

The Contractor shall be responsible for raising the ground (if necessary), the grading and provision of drainage facilities in the vicinity of the facility with suitable access walkways, seeding and sodding of the ground as directed and approved by the Engineer. Also, the Contractor shall provide a parking area at the compound near the building and a satisfactory access road to the parking area. The Contractor shall be responsible for the maintenance and protection of all facilities to be provided during the entire duration of the Contract including provision of adequate stock of all expendable items, such as light bulbs, light tubes, laboratory equipment and supplies, etc., at all times to ensure proper and continuous functioning of all the Engineer's facilities.

The buildings shall be provided with air-conditioning system, complete with all standard accessories which will operate on a 220 volt, 60 cycle current at the location and quantity/capacity reflected per approved Plans which can cool and dehumidify the air.

It shall be understood that if the Contractor cannot provide the articles as described or intends to supply equivalent substitutes, the Engineer may execute their availability and the Contractor shall pay therefore as certified by the Engineer or the Engineer shall have the right to deduct the sums from any money which is due or which will become due to the Contractor.

4.1.4 Temporary Light and Power

The Contractor shall provide and maintain temporary electrical service including installation of temporary power and lighting within the construction site and facilities constructed thereat.

The electrical services shall be adequate in capacity to supply power to construction tools and equipment without over-loading the temporary facilities and shall be made available to supply power, lighting and construction operations of all trades. All temporary equipment and wiring for power and lighting shall be in accordance with the applicable provisions of the local governing codes. At the completion of the construction work, all temporary wiring, lighting, equipment and devices shall be removed.

4.1.5 Temporary Toilets

The Contractor shall provide and maintain in sanitary condition enclosed toilets for the use of all construction personnel located within the contract limits, complete with fixtures, water and sewer connections and all appurtenances. Installation shall be in accordance with all applicable codes and regulations of the local authorities having jurisdiction thereof. Upon completion of the work, temporary toilet and their appurtenances shall be removed.

4.1.6 Temporary Water Service

The Contractor shall provide and maintain temporary water supply service, complete with necessary connections and appurtenances. Installed water supply lines shall be used as a source of water for construction purposes subject to the approval of the Engineer. The Contractor shall pay the cost of operation, maintenance and restoration of the water system.

All temporary water service including equipment and piping shall be removed upon completion of the work and all worn out and damaged parts of the permanent system shall be replaced and restored in first class condition equal to new.

4.1.7 Security

The Contractor shall provide sufficient security in the construction site to prevent illegal entry or work damaged during nights; holidays and other period when work is not executed; and during working hours. The Contractor shall take ample precautions against fire by keeping away flammable materials, and ensure that such materials are properly handled and stored. Fires shall not be allowed within the area of construction, except when permitted by the Engineer.

4.1.8 Disposal Area

The proposed location of disposal area shall be at the site designated by the Engineer. It is the responsibility of the Contractor to disposed off-site all construction debris and be considered in the preparation of his proposal.

4.1.9 Maintenance of Field Office for the Engineer

The maintenance of staff house for the Engineer shall include provision of water and electricity 24 hours daily and shall be paid for from the date the Engineer's representative's occupancy reckoned from the commencement of the Works until completion of the contract. Unit of measurement and payment is "Month".

5.0 CLEARING AND GRUBBING

5.1 Construction Requirements

This item shall consist of clearing, grubbing, removing and disposing all vegetation and debris as designated in the Contract, except those objects that are designated to remain in place or are to be removed in consonance with other provisions of this Specification. The work shall also include the preservation from injury or defacement of all objects designated to remain.

5.2 Clearing and Grubbing

All surface objects and all trees, stumps, roots and other protruding obstructions, not designated to remain, shall be cleared and/or grubbed, including mowed as required, except as provided below:

- (1) Removal of undisturbed stumps and roots and nonperishable solid objects with a minimum depth of one (1) meter below subgrade or slope of embankment will not be required.
- (2) In areas outside of the grading limits of cut and embankment areas, stumps and nonperishable solid objects shall be cut off not more than 150 mm above the ground line or low water level.
- (3) In areas to be rounded at the top of cut slopes, stumps shall be cut off flush with or below the surface of the final slope line.

(4) Grubbing of pits, channel changes and ditches will be required only to the depth necessitated by the proposed excavation within such areas.

(5) In areas covered by cogon/talahib, wild grass and other vegetations, top soil shall be cut to a maximum depth of 150 mm below the original ground surface or as designated by the Engineer, and disposed outside the clearing and grubbing limits

(6) Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted to the required density.

If perishable material is burned, it shall be burned under the constant care of component watchmen at such times and in such a manner that the surrounding vegetation, other adjacent property, or anything designated to remain on the right of way will not be jeopardized. If permitted, burning shall be done in accordance with applicable laws, ordinances, and regulation.

The Contractor shall use high intensity burning procedures, (i.e., incinerators, high stacking or pit and ditch burning with forced air supplements) that produce intense burning with little or no visible smoke emission during the burning process. At the conclusion of each burning session, the fire shall be completely extinguished so that no smoldering debris remains.

In the event that the Contractor is directed by the Engineer not to start burning operations or to suspend such operations because of hazardous weather conditions, material to be burned which interferes with subsequent construction operations shall be moved by the Contractor to temporary locations clear of construction operations and later, if directed by the Engineer, shall be placed on a designated spot and burned.

Materials and debris which cannot be burned and perishable materials may be disposed off by methods and at locations approved by the Engineer, on or off the project. If disposal is by burying, the debris shall be placed in layers with the material so disturbed to avoid nesting. Each layer shall be covered or mixed with earth material by the land-fill method to fill all voids. The top layer of material buried shall be covered with at least 300 mm of earth or other approved material and shall be graded, shaped and compacted to present a pleasing appearance. If the disposal location is off the project, the Contractor shall make all necessary arrangements with property owners in writing for obtaining suitable disposal locations which are outside the limits of view from the project. The cost involved shall be included in the unit bid price. A copy of such agreement shall be furnished to the Engineer.

The disposal areas shall be seeded, fertilized and mulched at the Contractor's expense. Woody material may be disposed off by chipping. The wood chips may be used for mulch, slope erosion control or may be uniformly spread over selected areas as directed by the Engineer. Wood chips used as mulch for slope erosion control shall have a maximum thickness of 12 mm and faces not exceeding 3900 mm² on any individual surface area. Wood chips not designated for use under other sections shall be spread over the designated areas in layers not to exceed 75 mm loose thickness. Diseased trees shall be buried or disposed off as directed by the Engineer.

All merchantable timber in the clearing area which has not been removed from the right of way prior to the beginning of construction, shall become the property of the Contractor, unless otherwise provided.

Low hanging branches and unsound or unsightly branches on trees or shrubs designated to remain shall be trimmed as directed. Branches of trees extending over the roadbed

5.3 Individual Removal of Trees or Stumps

Individual trees or stumps designated by the Engineer for removal and located in areas other than those established for clearing, grubbing and roadside cleanup shall be removed and disposed of as specified under Subsection 100.2.2 except trees removed shall be cut as nearly flush with the ground as practicable without removing stumps.

6.0 CONCRETE WORKS

6.1 Concrete

6.1.1 General

The Contractor shall furnish all labor, materials, equipment and incidentals necessary for the construction / rectification of all concrete work including reinforcing steel, forms, water stops and miscellaneous related items such as wall sleeves, anchor bolts and embedded items specified under other sections.

6.1.2 Repair of Defective Concrete

Defective or honeycombed areas, as determined by the Construction Officer, shall be chipped down to at least 25mm deep into sound concrete by means of chisels or chipping hammers. If honeycombs around reinforcement steel, a clear space at least 10mm wide shall be chipped all around the steel.

For areas than 40mm deep, the patch may be made for filling form tie holes, etc.

Thicker repairs will required build-up in successive 40mm deep layers on successive days, and each layer shall be applied with neat cement paste as described in paragraph 2 above.

For very deep patches the Construction Officer may order the use of a non-shrink grout, with or without the addition of pea gravel. The materials shall be composed of 1 to 1½ cement/sand mortar without non-shrink grout components to prevent rust staining of the surface. After hardening, the patch shall be rubbed as for filling form-tie voids.

All exposed concrete surfaces and adjoining work stained by spilling or leakage of concrete shall be cleaned to the satisfaction of the Construction Officer.

All cracks that appear in the concrete prior to acceptance of the work shall be "veed" and filled with sealant.

6.1.3 Repair of Pre-Cast Architectural Ornamentation

Walls and concrete surfaces should be cleaned of biological growth, black depositions, soil deposits, cuprous or ferrous staining, using materials or chemicals and methods as recommended by the Lead Architect. Extermination of woody plants and other biological growth should also be done following prescribed chemicals and method. In the process of removing biological growth in crevices or cracks in the concrete building fabric, the affected concrete portions should be so restored, or patched, or stabilized with compatible material fill.

Mechanical Cleaning shall be done using soft nylon brush for delicate interior/exterior wall surfaces. Hand-axe or saws shall be used for removing woody plants prior to chemical application/injection to destroy the growth.

Chemical Cleaning through solutions or poultices shall be done on hard to clean surfaces that may include cuprous or ferrous staining, or black deposits. Pre-cast decor wall decorative ornaments, e.g. art deco ornamentations on concrete walls, shall be applied with poultices.

Cracks and fissures found in the walls, ceilings, slabs and architectural ornamentations of the historic building should be addressed by structural assessment and appropriate stabilization, patching up and grouting measures, e.g. compatible injection fill (CIF), structural stitching, (if seriously fissured and affecting the physical/mechanical properties of the member and building) etc. CIFs should be properly tested prior to final penetration into the cracks or fissures. CIF composition and calibration shall be determined under the supervision of the Lead Architect.

Missing parts, losses or lacunae, especially in ornamental or decorative elements, should be filled in or replaced following: a) testing the material composition of the elements; b) basing the replacement or reproduction on historical references; c) should there be no historical references available, especially if the loss or lacuna is significant, the replacement or in-fill for the loss can be designed following the perceived thematic pattern of existing or surviving extant portions, and should be decided after consultation with the owner/custodian of the property and the members of the architectural team.

6.1.4 Evaluation and Acceptance

After the removal of the forms any concrete, judged by the Construction Officer as defective and beyond repair, shall be rejected, demolished and replaced with new concrete in a manner acceptable to the CO. The evaluation and acceptance of concrete shall be in accordance with Chapter 17 of ACI Standard 301.

6.1.5 Inspection

Installation of reinforcing steel, pipes, sleeves, anchors and other embedded items, batching, mixing, transportation, placing, curing and finishing of concrete shall at all times be subject to the inspection of the Construction Officer.

No concrete shall be placed without prior notice to and approval of the Construction Officer.

7.0 MASONRY WORKS

7.1 Scope of Work

The work includes furnishing all labor, materials and services, equipment, plant and other facilities and the satisfactory performance of all work necessary to complete all cement and masonry work shown in the plans and specified herein.

The work under this section shall include but not be limited to the following:

- 7.1.1 Concrete Hollow Block Walls
- 7.1.2 Masonry Reinforcing Bars for Concrete Blocks
- 7.1.3 Grouting
- 7.1.4 Connecting Wall Anchors, Ties, Bolts and Related Embedded Items.
- 7. 1.5 Installation only of Frames For Doors, Windows, Louvers, Steel Lintels and Recessed Fixtures.

7.2 Standard Specification References

The following Standards are referred to:

ASTM C32	Concrete Aggregates
ASTM C90	Hollow Load-Bearing Concrete Masonry Units
ASTM C144	Aggregate for Masonry Mortar
ASTM C150	Portland Cement
SAO No.15-2	Standardization of Concrete Hollow Blocks

7.3 Protection of Materials

All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials, such as cement, shall be delivered and stored in their original containers, plainly marked with identification of material and maker. Materials in broken containers, or in packages showing watermarks or other evidence of damage, shall not be used and shall be removed from the site.

7.4 Samples

The contractor shall submit to the CO for approval samples of concrete blocks, and also information on the cement and sand such as chemical analysis of cement and the sieve analysis of sand.

7.5 Materials

7.5.1 Cement

Cement shall be normal Portland cement conforming to ASTM Specifications C150, Type I. Masonry cements shall not be used. One color of cement shall be used throughout the Work.

7.5.2 Sand for Mortar

Sand shall be clean, durable particles, free from injurious amounts of organic matter. The sand shall conform to ASTM Specifications C144 or C33 as required. Sand for grout shall conform to ASTM Specifications C144 or C33 as required.

7.5.3 Water

Water shall be free from injurious amounts of oils, acids, alkalis, organic matter, and shall be clean and fresh.

7.5.4 Concrete Hollow Blocks (CHB)

7.5.4.1 Classification

Concrete block shall conform to ASTM C90, Grade N, and/or to the Philippine Bureau of Standards SAO No. 15-2. The load bearing concrete blocks, Type I, shall be divided into the following two classification:

- 7.5.4.1.1 Class A, for use in exterior walls below grade and for exterior walls above grade that may be exposed to the weather.
- 7.5.4.1.2 Class B, for general use in walls above grade not exposed to the weather.

7.5.4.2 Manufacturing Requirements

Concrete hollow blocks shall be manufactured to the requirements as shown in Table I.

Minimum Face Shell Thickness	Compressive Strength Minimum (Average Gross Area MPa)		Water Absorption Maximum (KN/cu.m)	Moisture Content Percentage of Total Absorption
Sample	Average of 5 Samples	Individual Sample	Average of 5 Samples	Average of 5 Samples
A	6-9	5.5	240	40
B	4-8	4.1	240	40

Aggregate for concrete blocks shall consist of sand and evenly graded pea gravel conforming to ASTM C33.

All concrete hollow blocks shall be even textured with straight and true edges, wet steam cured for at least 18 hours and then air cured in covered storage for not less than 28 days before delivery to the job site.

Units when received at the construction site shall be stacked so as to provide air circulation and shall be protected from the weather. The moisture content of hollow blocks when laid shall not exceed 35 percent of total absorption.

7.5.4.3 Dimensions

The actual dimensions of the concrete hollow blocks shall be as shown in Table II below.

NOMINAL DIMENIONS (mm)			ACTUAL DIMENSIONS (mm)		
Width	Height	Length	Width	Height	Length
100	200	400	92	194	397
150	200	400	143	194	
200	200	400		194	

No overall dimension shall differ from the specified actual dimensions by more than 3mm.

7.5.4.4 Minimum Face Shell and Web Thickness

The following dimensions shown in Table III below shall apply for minimum face and web thickness:

NOMINAL WIDTH (mm)	MINIMUM FACE SHELL THICKNESS (mm)	MINIMUM WEB THICKNESS (mm)
100	19	19
150	25	25
200	32	25

7.6 Mortar Mixes

Masonry mortar for setting blocks shall be in the proportion of 1 part cement to 3 parts sand or as otherwise approved by CO. Mortars shall be mixed with water in an amount compatible with workability ingredients shall be accurately measured by volume in boxes especially constructed for the purpose by the Contractor.

Mixing shall be done immediately before usage, and the Contractor shall use the Dry-Mix method. In the Dry-Mix method, the materials for each batch shall be well fumed together until the even color of the mixed dry materials indicates that the cementitious material has been thoroughly distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained.

Mortar boxes shall be cleaned out at the end of each day’s work and all tools shall be kept clean.

Mortar that has begun to set shall not be used or retamped.

The mixing of mortar by hand will be permitted only when the quality of hand mixing is comparable to mechanical mixing. The CO reserves the right to reject hand mixing and require all mixing by mechanical means. Mortar shall not be retained for more than 1-1½ hours and shall be constantly mixed until used.

Pointing mortar shall be pre-hydrated mortar mixed dry and water added while mixing to obtain a damp, or workable mix. After one or two hours, enough water shall be added to bring it to proper consistency, which shall be somewhat drier than masonry mortar.

The color of mortars shall be uniform throughout for adjoining areas, and shall be satisfactory to the CO.

7.6.1 Installation

7.6.1.1 General

All masonry shall be laid plumb and true to lines and built to the thickness and bond required with courses level and joints and bond uniform. Masonry shall be carried up in a uniform manner. No one portion shall be raised more than one meter above adjacent portions, except with the approval of the CO.

7.6.2 Application

7.6.2.1 Scratch Coat

Cross scratch as soon as scratch coat has attained initial set and apply brown coat as soon as practicable.

7.6.2.2 Brown Coat

Scratch or brown finish shall be allowed to set hard. Keep brown coat moist until finish coat is applied.

7.6.2.3 Finish Coat

Bring to true, even surfaces with rods, darbles and trowel smooth, leaving finished surface free from tool marks and blemishes. Keep cement plaster moist for at least 3 days and protect against rapid drying until cured.

7.6.2.4 Patching

Patch plaster shall be done prior to preparation for painting works.

7.6.3 Concrete Hollow Block

Concrete blocks shall be laid in running bond, unless otherwise indicated, with joints not exceeding 10mm and uniform throughout and finished slightly concave and smooth. Pointing shall be performed with the proper tools to a dense and neat finish. Finger pointing will not be allowed. All blocks shall be laid in a full bed of mortar applied to shell and webs. Apply mortar to the vertical joints of blocks that have already been set in the wall and all contact faces of the unit to be set. Each unit shall be placed and shoved against the previously laid block to produce a well compacted vertical mortar joint for the whole shell thickness. Intersecting bearing walls shall be tied together with metal ties at 0.80 meter vertical spacing. Bends of tie and reinforcing bars shall be embedded in cells filled with mortar.

All necessary block cutting shall be neatly done by saws.

Control joints shall be installed at the locations noted and detailed on the Drawings. The joints shall be raked out to a depth 20mm for the full height of the walls and

caulked. The maximum length between joints shall be 10 meters if not shown otherwise on the Drawings, or directed by the CO.

All horizontal and vertical reinforcing bars shall be anchored at a minimum of 20 bar diameter into the concrete walls, columns, slabs and girders.

Joints made at the intersection of block walls with structural concrete and all door, window and louver frames and where indicated shall be filled with mortar grout and pointed.

Unless otherwise shown on the Drawings, install all door, window and louver frames using screws and expansion shields, and set all frames tightly against the masonry walls.

7.6.3.1 Concrete Hollow Block to be Plastered

Concrete block wall which are to be plastered shall be laid in running bond. Joints are to left rough to assist in the bounding of plaster. Otherwise, concrete block masonry shall conform to the previous paragraph 2- Concrete Hollow Block.

7.6.3.2 Concrete Hollow Block to be Tooled Jointed

Concrete block walls to be tooled jointed as indicated on the Drawings shall be laid in stack bond with uniformly maintained joints not exceeding 13mm. All joints shall be tooled smooth to a stripped finish as soon as the mortar has set sufficiently. No cold chiseling will be permitted. Finishes shall be as indicated in the Drawings.

7.6.3.3 Lintels, Ties and Miscellaneous Items

The Contractor shall build in all miscellaneous items specified in other sections to be set including frames, lintels, reinforcing steel, electrical boxes and fixtures, sleeves, anchors and other miscellaneous items. All anchorage attachments and bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar.

7.6.3.4 Grouting

Grout and cement mortar for setting structural columns, railings, frames in walls and where otherwise required shall be done with mortar of 1-part cement to 1-part sand. Before placing grout thoroughly clean all surfaces. Grout shall be tamped into place with a blunt tool to fill the entire void. In the event space does not permit tamping, the Contractor shall build the necessary forms and place the grout by pouting from one side only. When grout is placed by pouring, a head of grout shall be maintained in the form. Grout shall be kept wet for three days and after the temporary supports or adjusting wedges are removed, the empty spacer shall be grouted, and the surrounding grout pointed.

7.6.3.5 Cleaning

All exposed masonry work shall be thoroughly cleaned. Mortar smears and droppings on concrete block walls shall be dry before removal with a trowel. Masonry work may be cleaned using a mild muriatic acid solution.

7.6.3.6 Storage and Handling

Masonry units shall be handled with care to prevent chipping and breakage. Storage piles, stacks or bins shall be so located as to avoid being disturbed

or shall be barricaded to protect chase materials from damage due to construction operations and traffic. Masonry units shall be stacked on platforms and covered or stored in any other approved manner that will insure the protection these materials from weather. Cement and lime shall be stored off the ground under watertight cover and away from sweating walls and other damp surfaces until ready for use. Damaged or deteriorated materials shall be removed the premises.

8.0 METAL WORKS

8.1 Description

The work includes the furnishing of all labor, materials, equipment and transportation required to complete fabrication, delivery and erection of all railings for buildings and other such similar structure in accordance with this specification and in conformity with the plans.

Railing shall not be considered a part of the structural system of the building unless it is stated in the design.

8.2 Reference

The following publications of the issues listed below, but referred to thereafter by basic designation only, form part of this specification to the extent indicated by the reference thereto:

American Society for Testing and Materials (ASTM) Publications:

A 276 M	Standard Specification for Stainless Steel Bars and Shapes
ASTM E 935	Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings
ASTM B 221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 308	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles

American Association of State Highway and Transportation Officials (AASHTO) Publications:

AASHTO M 193	Standard Specification for Cast Aluminum Alloy Railings Posts
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DPWH Standard Specification on Item 1051 - Railings

8.3 Requirement

In conformance with the General Conditions, the Contractor is required to furnish a certificate from the manufacturer or producer, certifying that all materials or products delivered to the job site meet the measurements specified herein.

8.4 Shop Drawings

The Contractor shall submit shop drawings to the Construction Engineer for approval in accordance with the General Conditions. Shop Drawings shall consist of all shop and erection details. All members and connection for any portion of the structure shown or not shown on the contract drawings shall be detailed by the fabrication and indicated on the shop symbols in accordance with the American Welding Society (AWS) Structural Welding Code.

8.5 Materials

Materials shall conform to the respective publications and other requirements specified herein and as shown, and shall be the approved products of manufacturers regularly engaged in the manufacture of such products.

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

- Stair Railings: 50 x 8mm thk GI pipe, or as indicated on plans.
- Stair Handrail: 50 x 10mm thk pipe, Stainless steel or as indicated on plans.

Steel base metal to be welded shall be open-hearth or electric furnace steel conforming to AASHTO M 183 unless otherwise shown on the approved Plans.

Stainless Steel shall conform to the requirements of ASTM A 276 M, Standard Specification for Stainless Steel Bars and Shapes or as called for in the Plans.

Paint railings with shop-Coat Red Lead primer, consisting of pure red lead pigment dispersed in vehicle of medium length linseed oil alkyd, linseed oil, thinner and driers.

Steel Pipe shall conform to ASTM A53, Grade b.

Aluminum shall conform to the requirements of AASHTO M 193, Standard Specification for Cast Aluminum Alloy Railings Posts, ASTM B 221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes or ASTM B 308 – Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles or as called for in the Plans.

Fastenings shall be of commercial type, 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.

Materials shall be delivered, stored, handled and installed in a manner to protect them from all damage during the entire construction period. Storage conditions shall be approved by the Construction Officer in accordance with the General Conditions.

8.6 General Fabrication

8.6.1 General

As much as possible, fit and assemble at shop, ready for erection, and in strict accordance with drawings, details and approved shop drawings. Railings shall not reflect any unevenness in the structure/ building. All railing posts shall be set plumb unless otherwise indicated in the Plans.

Metal works shall be prepared for painting in accordance with the section entitled PAINTING and primed with paint material specified. All materials shall be cleaned and straight. If straightening is necessary, it shall be done by a process and in a manner that will not damage the material.

Metal railings shall be fabricated in accordance with the dimensions shown on the approved Plans. In case of welded railings, all exposed joints shall be finished by grinding or filing after welding to give a neat appearance. Welding may be substituted for rivets or bolts with the approval of the Construction Officer.

Stainless steel railings shall be fabricated in accordance with the dimensions shown on the Plans. During installation, stainless steel railing shall be free from rust and surface blemish. It shall be rust free until ten (10) years after completion.

8.6.2 Installation

Drill or punch holes for fasteners. Mill joints to a close fit. Cope or miter the corner joints to a well-formed shape and true alignment with the adjacent item. Fabricate and form joints exposed to weather to prevent water intrusion. Ensure that all castings are sound and free from warp or defects that impair their strength and appearance, with a smooth finish and sharp well-defined vertical and horizontal lines on all exposed surfaces. Shearing, Flame cutting, and Chipping, shall be done carefully and accurately. Flame-cut edges of members shall have all knicks removed.

For railing 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

8.7 Refurbishment of Existing Railing Details

Missing, damaged, or deteriorated railings especially in ornamental or decorative elements, should be repaired or replaced following: a) testing the material composition of the elements; b) basing the replacement or reproduction on historical references; c) should there be no historical references available, especially if the loss is significant, the replacement or in-fill for the loss can be designed following the perceived thematic pattern of existing or surviving extant portions, and should be decided after consultation with the owner/custodian of the property and the members of the architectural team.

As much as possible, fit and assemble on site, with minimal dismantling of original or historic metalwork and in strict accordance with historical data, drawings, details and approved shop drawings. Metal works shall be prepared for painting in accordance with the section entitled PAINTING and primed with paint material specified. All materials shall be cleaned and straight. If straightening is necessary, it shall be done by a process and in a manner that will not damage the material. Any historical techniques for the fastening, painting, or application of metalwork and its incidentals shall be adhered to in the restoration of or addition to existing railings.

8.8 Painting

The type of paint, the number of coats, and the extent of the painting shall be in conformance with the section entitled PAINTING. In general, all exposed surfaces of steel work shall be painted. Surfaces where the shop coat has been damaged shall be retouched using the same system as the original shop painting. Surfaces which will be contact after erection, except when in contact in welded or bolted connections, shall be given one finish coat or welds and the areas adjacent thereto shall be done promptly after the acceptance of the weld and shall be as specified under shop painting.

8.9 Inspection

Inspection shall be made promptly to permit immediate correction of defects. The inspector will mark each piece which is accepted, with the mark assigned to him. Unrestricted inspection shall be conducted in both shop and field, to verify preparation, size, gauging, location, acceptability of welds, identification marking and operation and current characteristics or welding sets in use.

8.10 Final Clean Up

Upon completion of erection and before final acceptance, the erector shall remove from the jobsite all false-works, rubbish, and temporary structures furnished by him.

9.0 THERMAL INSULATION AND MOISTURE PROTECTION WORKS

9.1 Roofing

9.1.1 Description

The work includes the repair/refurbishment of pre-painted Rib-type Long-span roofing complete with hardware and accessories.

9.1.2 General

The work includes furnishing all materials and requirements performing all operations to provide a long span corrugated twin ribbed roofing and miscellaneous roofing works as required to provide an acceptable installation. Surfaces to which metal formed roofing sheets are to be applied shall be thoroughly cleaned and prepared, free from any defects that may affect the application. Metal formed roofing shall be locked and lapped and installed as applicable. Specific installation details shall be in accordance with manufacturer's recommended installation practice.

Metal formed roofing and sheets and accessories shall always be carefully handled in strong and handling to prevent damage to the surfaces, edges and ends and shall be slightly elevated for drainage.

Metal formed roofing and sheets and accessories shall be delivered to the site in the original sealed container or packages bearing the manufacturer's name and brand designated where materials are covered by a reference specification number, type and class as applicable

9.1.3 Installation

Lay and install the first sheet with the turned down edge towards the outside of the area to be covered. Overlap the next sheet to the previous sheet in such a manner that the exposed edge is turned down and the covered edge is turned up. Side up fasteners should be done by rivets and washers spaced from 300 mm to 450 mm on centers.

Care should be exercised in the proper anchorage of all roof frames.

Ridge strips for ridge rolls and ridge flashings are attached to the roofing sheets by means of rivets. Other flashings are to be fabricated from plain sheets of the same materials as the roofing in accordance with details and/or site requirements. These are also attached to roofing sheets by means of rivet.

9.1.4 Temporary Protection

Metal formed roofing sheet surfaces requiring protection from stains, discoloration, surface abrasion and other construction abuses shall be suitably protected in accordance with the manufacturer's recommendations.

9.1.5 Final Clearing

Upon completion, the Contractor shall clean the metal formed roofing sheets surfaces and drain line of burrs, leaves, stones and other foreign matter that may impair the flow of water. Surface shall be kept clean by periodic inspection.

9.2 Radiant Heat Barrier

9.2.1 Scope of Work

The Contractor shall furnish and install all labor and material to complete the work.

9.2.2 Material

9.2.2.1 Radiant Barrier

Radiant Barrier shall be fire retardant aluminum foil for roof insulation. It shall have a 6-layer fire retardant double-sided aluminum foil laminate with superior radiant heat barrier properties. It shall be tearproof, waterproof and possesses the following properties.

Elongation	:	150% ASTM D882
Water Vapor Transmission	:	Greater than 5000 Mns/g ASTM E96-E
Water Vapor Permeance	:	Less than 0.20 ng/Ns Less than 0.004 (Perms) ASTM E96-E
Tensile Strength	:	M.D. 6.6 KN/m D.D. 5.0 KN/m C.D. 4.7 KN/m ASTM 828
Puncture Resistance	:	1.0 Joules T.APPA T800
Reflectivity	:	86% ASTM E466-71
Emissivity	:	5%
Roll Size	:	1.25m x 60m = 75.00 sq.m.
Weight	:	200 g/m2
Thickness	:	0.190mm
Total R-Value (M2K/W)	:	1.72
Fire Retardant BS476	:	Part 6 Class 0 Part 7 Class 1

9.2.3 Workmanship

The product shall be delivered to the site in its original package or container bearing the manufacturers name and brand designation.

All materials shall be installed by skilled and selected workmen familiar with the product.

9.2.4 Installation

The installation shall have a joint overlap of 75mm. It shall be unrolled foil down length of roof from ridge.

For further information, see manufacturer’s specifications.

9.3 Elastomeric Waterproofing Membrane

9.3.1 Scope of Work

The Contractor shall furnish and install all materials and labor required to provide waterproofing on designated locations.

9.3.2 Material

Elastomeric waterproofing membrane shall be liquid applied single component and made by a reputable manufacturer.

9.3.3 Preparation

All surfaces to be waterproofed should be clean, sound and dry. Concrete surfaces should have a light steel-trowel followed by a fine hair-broom or equivalent finish that is dry and free from dust, oil and other contaminants. Remove all high spots. Moss and lichen must be removed physically followed by treatment with fungal wash down through and allow to dry. Lattence should be removed from concrete by grit blasting, wire brushing or water jet blasting and allowing to dry.

For installation procedure and other information, see manufacturer's specification.

9.4 Closed-Cell Spray Applied Polyurethane Foam Insulation

9.4.1 Scope of Work

The Contractor shall furnish and install all materials and labor required to provide closed-cell spray applied polyurethane foam insulation on designated locations.

9.4.2 Material

Closed-cell polyurethane foam insulation shall be a pressurized, spray applied viscous two component product comprised of diisocyanate and blended components including polyols, fire retarding compounds, catalysts, stabilizers, and non-ozone depleting blowing agents and made by a reputable manufacturer.

- Material should have the following specifications:
- Density of 40-50kg/m³ at 1 inch thickness
- Compressive Strength of 0.19 MPa
- Thermal Conductivity at 25°C of 0.019 W/m-K
- R-Value of 6.9/ inch (ASTM C-518)
- Fire Rating of B3 (DIN 4102)
- Sound Transmission Coefficient of 43 (ASTM E-90-85/E413)

9.4.3 Preparation

All surfaces to be waterproofed should be clean, sound and dry. Metal surfaces shall be prepared by removing all dust, oil and other contaminants. Roofing shall be made water-tight before application. Closed-cell spray applied polyurethane foam insulation is to be applied to the roofing surface to a thickness of two (2) inches, measured from the roof profile. Polyurethane membrane to be painted with one coat base primer and two coats acrylic type elastomeric roofing paint. Color as specified by C.O. or Architect.

For installation procedure and other information, see manufacturer's specification.

10.0 ARCHITECTURAL WORKS

10.1 Cement Finishes

10.1.1 Scope of Work

This work includes furnishing of all materials, equipment and labor, and other facilities necessary to complete all scored cement finish.

10.1.2 Materials

Normal Portland Cement conforming to ASTM Standard C150.

Sand shall be hard, sharp, well washed, siliceous, clean and free from deleterious materials conforming to ASTM Specifications C40.

10.1.3 Workmanship

Thoroughly clean concrete surface of all dirt, dust, oil patches and other foreign matters. Apply the 1:2 mix cement mortar, trowelled and leveled in accordance with the required slope in the plane. After the mortar has hardened initially, apply scored finish in accordance with the approved sample.

10.2 Cement Mortar

10.2.1 General

Plastering work shall be properly coordinated with the work of other trades. The work of other trades shall be adequately protected from damage during plastering operations. Finishing work shall be protected with a covering of heavy Kraft waterproof paper or other approved protective covering with lapped and sealed joints. Scaffolding shall be amply strong, well braced, tied, securely and inspected regularly. Overloading on scaffolding shall not be permitted.

10.2.2 Delivery, Storage and Handling of Materials

Manufactured materials shall be delivered in the manufacturer's original unbroken packages or containers which are labeled plainly with the manufacturer's names and brands. Cementitious materials shall be kept dry until ready to be used. They shall be stored off ground under cover and away from seating walls and other damp surfaces.

10.2.3 Materials

Portland cement shall conform to the Standard Specifications ASTM C-150, Type 1, latest edition.

Sand shall be hard, sharp, well-washed, siliceous, clean and free from deleterious materials, conforming with ASTM C-40.

Water shall be fresh, clean and free from organic matter, acids and alkalis.

10.2.4 Mixture

Plaster materials, specified on a volumetric basis, shall be measured accurately in approved containers that will insure the specified proportion. Measuring materials with shovels (shovel count) shall not be permitted. Mortar for plastering shall be mixed in the proportion by volume of one part Portland Cement, 3 parts sand and 25% part hydrated lime. Mortar for finish coat shall be of the same proportioning as specified for plastering except that proportion of sand be increased to not more than 4 parts.

10.2.5 Workmanship

Plastering work shall be finished level, plumb, square and true with a tolerance of 0.30mm to 3.00mm, without waves, cracks, blisters, pits, crazings, discoloration's, projections, or other imperfections. Plastering work shall be formed carefully around angles, contours, and well up to screeds. Special care shall be taken to prevent sagging and consequent dropping of applications. There shall be no visible junction marks in the finish coat where one day's work adjoining another

10.2.6 Application

Surfaces to receive plaster shall be cleaned of all projections, dust, loose particles, grease bond breeders and other foreign matter. Plaster shall not be applied directly to

- (a) concrete masonry surfaces that have been coated with bituminous compound
 - (b) surfaces that have painted materials or previously plastered.
- Before the plaster work is started, masonry surfaces shall be wetted thoroughly with fog spray of clean water to produce a uniformly moist condition. Metal grounds, corner beads, screed and other accessories shall be checked carefully for alignment before work is started.

Brown coat shall be applied with sufficient pressure to fill the grooves in hollow block of concrete to prevent air pockets and secure a good bond. Brown coat shall be lightly scratched and broomed. Each coat of cement plaster shall be kept moist for 48 hours after application and then allowed to dry.

Finished coat shall be applied until after brown coat has seasoned for 7 days. Just before application of the finished coat, brown coat shall again be evenly moistened with fog spray. Finished coat shall be floated first to a true and even surfaces then trowelled in a manner that will force the sand particles down into the plaster. Plastered surfaces shall be smooth and free from rough areas, trowel marks, checks and blemishes. Thickness of plaster shall be 3/8” on vertical concrete and on masonry.

10.3 Plain Cement with Floor Hardener

10.3.1 Scope of Work

This work includes furnishing all labor, materials, equipment, and other facilities, and the satisfactory performance of all work necessary to complete all plain cement with floor hardener work specified herein.

10.3.2 Materials

Floor hardener shall be non-rusting and on titanium base, to provide extreme hard and highly abrasion and impact resistant floors. It shall be monolithic bonded with base concrete, impact resistant, oil and grease resistant., dense and non-porous, free from rust-stain, easy to install and highly abrasion resistant. Verify color.

10.3.3 Workmanship

10.3.3.1 Delivery

Materials shall be delivered to the site in their original packages of containers bearing the manufacturers name and brand designation.

10.3.3.2 Preparation

Floor hardener shall be prepared and applied strictly in accordance with the manufacturer’s printed instruction. Flat troweling shall be done keeping the trowel flat and only after the surface has sufficiently set, a second and flat trowelling shall be done. Continue trowelling process until the desired surface finish is achieved.

10.3.3.3 Consumption

Heavy duty:	4	- 6 kg/sq.m. Floor Hardener
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	4	- 6 kg/sq.m. Cement
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10.4 Tile Works

10.4.1 Scope of Work

The work includes the supply and furnishing of materials and performing labor necessary for the complete installation of all ceramic tile-work as shown or indicated on drawings and as specified herein.

10.4.2 Samples

Submit samples of floor and wall tiles, and countertop marble slab including all required beads and moldings to the C.O. before purchase for approval as to quality and shade or color.

10.4.3 Delivery of Materials

Deliver all materials in original cartons and containers with labels intact and seals unbroken.

10.4.4 Measurement and Coordination

The Contractor shall coordinate with other trades involved before starting finishing work. He shall protect works of other trades from damage while finishing works is in progress. Tile work shall not be started until roughing-ins for plumbing and electrical work have been completed and tested.

10.4.5 Protection of Finished Work

Cover floors with heavy building paper before foot traffic is permitted over finished tile floors. Lay board walkways on floors to be used as passageways.

10.4.6 Products

All materials shall be of the best of their respective kinds, in sizes and colors as shown on the plans, details and finish schedules or otherwise specified herein or as will be approved by the Architect / Engineer upon submission of samples. Samples of all tiles shall be submitted to the Architect / Engineer for approval before placing orders. All tiles shall be delivered to the jobsite in unopened grade-sealed containers.

Tile Colors and patterns shall be selected. Colors and patterns by reference to manufacturer’s name and designations are for color and pattern identification only and are not intended to limit selection of other manufacturer’s products with similar color and patterns.

10.4.6.1 Tiles

Glazed Wall Tiles - standard glaze bright or matte glazed. Square edge or cushion edge with integral spacers approximately 8 millimeters (5/16 inch.) thick. Sizes and colors shall be as indicated on drawings.

Unglazed Floor Tile - standard grade homogenous ceramic floor tiles with cushioned edges. Sizes and colors shall be as indicated on drawings.

Granite slabs for countertops shall be of the size, grade, shade or color specified in the plans and specifications. It must be free from imperfections that will affect its quality, appearance and strength after polishing.

10.4.6.2 Grout Materials

Portland Cement Grout:

Scratch Coat : 1 part portland cement to 5 parts damp sand to 1/5 part hydrate lime.

Mortar Bed : 1 part portland cement to 5 parts sand to ½ part hydrated lime.

Bond Coat : Neat portland Cement paste.

10.4.7 Execution

10.4.7.1 Application of Scratch Coat

Thoroughly dampen, but do not saturate surfaces of masonry or concrete walls before applying the scratch coat. Surface areas shall appear slightly damp. Allow no free water on the surface. On masonry, first apply a thin coat with great pressure then bring it out sufficiently to compensation for the major irregularities on the masonry surfaces to a thickness of not less than 6 millimeters (¼ inch) at any point. On surfaces not sufficiently rough to provide good mechanical key, dash on the first coat with a whisk broom or fiber brush using a strong whipping motion. Do not trowel or otherwise disturb mortar applied by dashing until it has hardened. Evenly rake scratch coats, but not dash coats, to provide good mechanical key for one (1) subsequent coat before the mortar has fully hardened.

10.4.7.2 Floor Tile Installation on Mortar Bed

Before spreading the setting bed, establish lines of borders and center the fieldwork in both directions to permit the pattern to be laid with a minimum of cut tiles. Clean concrete sub-floor then moisten but not soak. Afterwards, sprinkle dry cement over the surface and spread the mortar on the setting bed. Mix mortar 1 part Portland Cement to 3 parts sand. Tamp to assure good bond over the entire areas and screed to provide a smooth and level bed at proper height and slope. Pitch floor drain as required. After setting bed has been set sufficiently to be worked over, sprinkle dry cement over surface and lay tile. Keep tile joints parallel and straight and lay tile. Keep tile joints parallel and straight over the entire area by using straight edges. Tamp the tile solidly on to the bed, using wood blocks of size to endure solid bedding free from depressions. Lay tiles from center lines outward and make adjustments at walls.

10.4.7.3 Wall Tile Installation on Mortar Bed

Before application of mortar bed, dampen the surface of scratch coat evenly to obtain uniform suction. Use temporary or spot grounds to control the thickness of the mortar bed. Fill out the mortar bed even with the ground and rod it to a true plane. Apply the mortar bed over an area no greater than what can be covered with tiles while the coat is still plastic. Allow no single application of mortar to be 19 millimeters (¾ inch) thick. Completely immerse glazed wall tile in clean water and soak it at least 1/2 hour. After removal, stack tile on edge long enough to drain off excess water. Re-soak and drain individual tiles that dry along edges. Allow a bond coat 0.80 millimeters to 1.6 millimeters coats of paint over the shop prime coat. Touch up all exposed metal with anti-rust.

10.4.7.4 Stone Slab Installation

Bedding

Bedding mortar shall consist of one (1) part portland cement to three (3) parts sand mix thoroughly until required consistency is reached.

Horizontal

Bedding mortar setting bed is spread, thoroughly clean concrete or masonry surface, making sure that it is free from dust or dirt accumulation and thoroughly moisten it with clean, fresh water. Spread mortar until surface of mortar setting bed is absolutely true and even in place, either leveled or uniformly sloped for drainage, as required. Place at one operation as large an area as can be covered with tiles before mortar reaches its initial setting.

Vertical

Where tiles are to be applied to masonry construction thoroughly clean and directly moisten surface before applying scratch coat. Properly moisten scratch coat or plumb coat, when there is one, prior to placing of tiles. Spot scratch coat or plumb coat when there is one, with pieces of tiles mortared in place to accurately indicate plane of tile when wall is finished. Butter each slab with setting mortar applied as butter coat, consisting of one (1) part portland cement, one half ($\frac{1}{2}$) to one (1) part lime putty and three (3) parts sand or a compatible adhesive suitable for vertical installation of stone slab. Cover back of each slab with setting mortar and bring to plumb and true surface flush with spot tiles previously mortared in place into scratch or plumb coat to indicate plane of finished wall.

Polishing Surface

After all stone slabs had been laid it shall be wet ground with an electric grinding machine to a smooth, even surface. For vertical surfaces use an electric sanding machine. Use No.24 grit abrasive stone for the initial rubbing follow by No. 80 grit abrasive stone.

Finishing

Final rubbing shall be done by the use of abrasive stone no coarser than No.80 grit. and shall remove scratches and produce a true surface. The finish surface, after final grinding and rubbing shall not show a wave exceeding one thirty second ($\frac{1}{32}$) of an inch, when tested with steel straight edge, three (3) feet long. After final grinding, it shall be thoroughly cleaned and left in a finished polished condition using an electric buffing machine.

10.4.7.5 Cleaning

The contractor shall clean all paints, spots, daubs, oil and stain in their entirety from all similar items and leave the work in perfect condition upon completion, satisfactory in every respect to the Owner and the Construction Officer.

10.4.7.6 Guarantee

The Contractor shall guarantee his work in strict accord with the requirements for "Guarantee" as set forth in the General Conditions of the Contract Documents.

10.5 Stamped Concrete Floor Finish

10.5.1 Scope of Work

The work includes the supply and furnishing of materials and performing labor necessary for the complete installation of all decorative stamped concrete flooring and paving as shown or indicated on drawings and as specified herein.

10.5.2 Samples

Submit samples of stamped concrete floor finish and swatches to the C.O. before purchase for approval as to quality and shade or color.

10.5.3 Delivery of Materials

Deliver all materials in original cartons and containers with labels intact and seals unbroken

10.5.4 Measurement and Coordination

The Contractor shall coordinate with other trades involved before starting finishing work. He shall protect works of other trades from damage while finishing works is in progress. Topping work shall not be started until roughing-ins for plumbing and electrical work have been completed and tested.

10.5.5 Protection of Finished Work

Cover floors with heavy building paper before foot traffic is permitted over finished resilient floors. Lay board walkways on floors to be used as passageways.

10.5.6 Products

Concrete Topping and Hardener pursuant to ASTM C 309 and ASTM C 979, Liquid Integral Concrete Color compliant with ASTM C 979. Dry Integral Concrete Color compliant with ASTM C 979, Colored Bond Breaker, Colorless Bond Breaker, Stamping Mats, Curing Compound (ASTM C979 compliant), Concrete Cleaner as specified by manufacturer

10.5.7 Execution

Apply stamped concrete materials in accordance with manufacturer's instructions at locations indicated on the Drawings.

10.5.8 Cleaning

The contractor shall clean all paints, spots, daubs, oil and stain in their entirety from all similar items and leave the work in perfect condition upon completion, satisfactory in every respect to the Owner and the Construction Officer.

10.5.9 Guarantee

The Contractor shall guarantee his work in strict accord with the requirements for "Guarantee" as set forth in the General Conditions of the Contract Documents.

10.6 Fiber Cement Boards

10.6.1 Scope of Work

The work includes the supply and furnishing of materials and performing labor necessary for the complete installation of all fiber cement board ceiling panels as shown or indicated on drawings and as specified herein.

10.6.2 Samples

One of each type of cement board showing the texture, finish and color. Standard catalog data for cement board. Maintenance Manuals: Maintenance instructions for cement board ceiling.

10.6.3 Delivery of Materials

Deliver all materials in original cartons and containers with labels intact and seals unbroken.

10.6.4 Measurement and Coordination

The Contractor shall coordinate with other trades involved before starting finishing work. He shall protect works of other trades from damage while finishing works is in progress. Topping work shall not be started until roughing-ins for plumbing and electrical work have been completed and tested.

10.6.5 Products

Fiber Cement Board:

For acoustical board undersheeting for walls and ceilings: use 6mm thick fiber cement board.

For undersheeting: use 6mm thick fiber cement board.

For replacement of existing damaged and dilapidated fiber cement ceiling board, all existing plywood ceiling boards and all deteriorated plywood partition: use 6mm thick fiber cement board with the same finish, color and design of the existing ceiling/partition material.

10.6.6 Execution

Boards are to be fixed as shown on plans. See details of plans for the installation of fiber cement board where it is applied as finishes.

10.6.7 Cleaning

The contractor shall clean all paints, spots, daubs, oil and stain in their entirety from all similar items and leave the work in perfect condition upon completion, satisfactory in every respect to the Owner and the Construction Officer.

10.6.8 Guarantee

The Contractor shall guarantee his work in strict accord with the requirements for "Guarantee" as set forth in the General Conditions of the Contract Documents.

10.7 Gypsum Boards

10.7.1 Scope of Work

This Item shall consist of furnishing and installing gypsum board for ceiling and walls in accordance with this Specification and at the locations shown on the Plans, or as required by the Architect.

10.7.2 Samples

One of each type of gypsum board showing the texture, finish and color. Standard catalog data for cement board. Maintenance Manuals: Maintenance instructions for cement board ceiling.

10.7.3 Delivery of Materials

Deliver all materials in original cartons and containers with labels intact and seals unbroken.

10.7.4 Measurement and Coordination

The Contractor shall coordinate with other trades involved before starting finishing work. He shall protect works of other trades from damage while finishing works is in progress. Topping work shall not be started until roughing-ins for plumbing and electrical work have been completed and tested.

10.7.5 Products

Gypsum board shall comply with the Standard Specification for Gypsum Board, ASTM C 1396 regular and Type X (special fire-resistant gypsum board) with thicknesses as indicated on drawings, 1200 mm wide by maximum practical length, ends square cut and edges bevelled.

Joint materials shall be as recommended by gypsum board manufacturer for intended purpose.

Metal furring runners, hangers, tie wires, inserts, and anchors galvanized.

Drywall furring channels shall be 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

Resilient drywall furring shall be 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

Nails shall conform to ASTM C 514. f. Steel drill screws shall conform to ASTM C 1002

Laminating compound shall be as recommended by the manufacturer, asbestos-free.

Casing beads, corner beads, control joints and edge trim shall conform to ASTM C 1047, metal, zinc-coated by hot-dip process 0.5 mm base thickness, perforated flanges, one piece length per location.

Insulating strip shall be rubberized, moisture resistant, 3 mm thick cork strip, 12 mm wide with self-sticking permanent adhesive on one face, lengths as required.

Joint compound shall conform to ASTM C 475, asbestos-free.

10.7.6 Application

a. Gypsum board shall not be applied until bucks, anchors, blocking, sound attenuation, electrical and mechanical works are approved.

b. Single/double layer gypsum board shall be applied to wood or metal furring or framing using screw fasteners. Maximum spacing of screws shall be 300 millimeters on center.

c. Base layer shall be applied to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 millimeters.

d. Base layers shall be applied at right angles to supports unless otherwise indicated.

e. Base layer on walls and face layers shall be applied vertically with joints of base layer over supports and face layer joints offset at least 250 millimeters with base layer joints.

f. Single layer gypsum board shall be applied to concrete or concrete block surfaces, where indicated, using laminating adhesive.

g. Gypsum board shall be braced or fastened until fastening adhesive has set.

h. Gypsum board shall be mechanically fastened at the top and bottom of each sheet

10.7.7 Installation

Gypsum board shall be installed in accordance with ASTM C 840 and manufacturer's instruction, except as otherwise specified. Gypsum boards shall be used in maximum practical length to minimize number of end joints. Provide and install moisture and mold resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C 1658 where shown and in locations which might be subject to moisture exposure during construction. Gypsum board shall be brought into contact, but shall not be forced into place.

For Ceilings:

1. For single-ply construction, perpendicular application shall be used.
2. For two-ply assemblies: a. Perpendicular application shall be used. b. Face ply of gypsum board shall be applied so that joints of face ply do not occur at joints of base ply with joints over framing members.

For Walls (Except Shaft Walls):

1. When gypsum board is installed parallel to framing members, space fasteners shall be 300 millimeters on center in field of the board and 200 millimeters on center along edges.
2. When gypsum board is installed perpendicular to framing members, space fasteners shall be 300 millimeters on center in field and along edges.
3. Screws shall be staggered on abutting edges or ends.
4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except when gypsum board shall be applied vertically over "I" furring channels.
5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
7. No offset in exposed face of walls and partitions shall be permitted because of singleply and two-ply or three-ply application requirements.

8. Installing Two Layer Assembly Over Sound Deadening Board: a. The face layer of wallboard shall be applied vertically with joints staggered from joints in sound deadening board over framing members. b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 millimeters on center around perimeter, and 400 millimeters on center in the field.

9. Control Joints shall conform to ASTM C 840 and as follows: a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout. b. Not required for wall lengths less than 9000 mm (30 feet). c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.

For Accessories:

1. Accessories shall be set plumb, level and true to line, neatly mitered at corners and intersections and securely attach to supporting surfaces as specified.

2. Install in one piece without the limits of the longest commercially available lengths.

3. Corner Beads: a. Shall be installed at all vertical and horizontal external comers and where shown. b. Use screws only. Do not use crimping tool.

4. Edge trim (casings Beads): a. At both sides of expansion and control joints unless shown otherwise. b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment. c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.

For Finishing:

1. Joints, edges, comers, and fastener heads shall be finished in accordance with ASTM C 840. Level 4 finished shall be used for all finished areas open to public view.

2. Before proceeding with installation of finishing materials, the following shall be assured: a. Gypsum board is fastened and held close to framing or furring. b. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

3. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non-decorated smoke barrier, fire rated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintains the integrity of the smoke barrier, fire rated and sound rated construction. Sanding shall not be required of non- decorated surfaces.

10.7.8 Cleaning

The contractor shall clean all paints, spots, daubs, oil and stain in their entirety from all similar items and leave the work in perfect condition upon completion, satisfactory in every respect to the Owner and the Construction Officer.

10.7.9 Guarantee

The Contractor shall guarantee his work in strict accord with the requirements for "Guarantee" as set forth in the General Conditions of the Contract Documents.

10.8 Painting Specifications

10.8.1 Work Included

The work includes furnishing of all labor, painting equipment, scaffolding, protective coverings and materials, including those classified more in particulars as paint, hereinafter.

“Paint” as referred in this specifications shall mean and include the surface finish treatment consisting of any, all or some of the following items, primers, fillers, body and final coats, emulsions, vanish, stain or enamels.

10.8.2 Work Not Included

All ornamental metal works such as those of aluminum, stainless steel, brass except where otherwise required.

All shop and prime coats specified as part of the work of other trades.

All held painting of electrical and mechanical equipment, all piping including painting of pipe classification color designation.

All finished surfaces like washout finish, glazed tiles, glass, plastic, etc.

10.8.3 General Requirement

The Contractor shall examine the specifications for the various other trades and shall thoroughly familiarize himself with all of the items and surfaces of work to be included.

The Contractor shall protect the work of all other trade against damage or injury by the Contractor’s employees, or by the materials, tools or utensils used in connection with the work. The Contractor shall at his own expense repair all work damaged as a result of the prosecution of this Contract.

10.8.4 Materials

All paint materials to be used shall meet the requirement of the Products Standard Agency (Department of Trade and Industry).

Painting materials shall be BY REPUTABLE LOCAL SUPPLIER or equivalent.

The manufacturer’s certificate of origin and quality shall be submitted to the Construction Officer for inspection and approval before using any of the paint materials herein specified.

Paint materials such as linseed oil, shellac, turpentine, etc., shall be pure, of highest quality and should bear identifying label on container.

The use of white zinc (lithopone) shall not be allowed.

Finish paint, in general, shall be as prepared by paint manufacturers, and no mixing at site shall be permitted.

10.8.4.1 Tinting Color

Tinting colors for oil paints shall be colors in oil, ground in pure linseed oil, and of highest grade obtainable. Acrylic color for all water emulsion paints.

Color pigments shall be used to produce the exact shades of paint which shall conform to the approved color scheme of the finished coat. The first coat shall be white.

10.8.4.2 Ready Mixed

With the exception of ready mixed materials in original containers, all mixing shall be done at jobsite. No materials are to be reduced or changed except as specified by manufacturer of said material.

10.8.5 Delivery and Storage of Materials

All materials shall be delivered to the jobsite in manufacturer's factory sealed materials containers with the manufacturer's brand and name clearly marked and intact. All materials shall be stored only in one place assigned for this purpose, and such storage shall be kept clean and neat and all damage hereto, or its surroundings, shall be made good. All necessary precautions shall be taken in the storage of paints, oils, etc. to prevent fires by complying with all applicable fire prevention and safety ordinances. Paints shall be kept covered at all times.

10.8.6 Workmanship

10.8.6.1 Inspection of Surface to be Painted

The Contractor shall inspect all surfaces to be painted and all defected shall be remedied before starting work. Commencing of work by the Contractor indicates his acceptance of the surface. No work shall be started unless the Contractor shall have made certain as to the dryness of surfaces. Tests shall be made in the presence of the Construction Officer or his authorized representative, to verify dryness of surface to painted.

10.8.6.2 Preparation of Metal Surfaces

Wash all metal surfaces with mineral sprays or detergents to remove any dirt or grease before applying materials. Where rust or scale is present, wire brush or sandpaper clean before painting. Treat rusty portions with Metal Etching Solution # 71 or approved equivalent. Rinse and let dry.

10.8.6.3 Preparation of Exterior and Interior Concrete

WALLS - Prepare masonry surface to be painted by removing all dirt, dust, oil and grease stains and efflorescence. Treat with masonry Neutralizer # 44 or approved equivalent. Mix one liter of Masonry Neutralizer with 16 liters of water, then apply liberally by brush and let dry overnight before rinsing with water. Let dry.

10.8.6.4 Preparation of Woodwork

Woodwork that is to have a finished of treatment, whether executed as field Woodwork work or shop finished, shall be smooth and free from raised grain or other surface imperfections that would affect its appearance, and shall be slightly sanded or steel wool between coats or finishes. All woodwork shall be sanded lightly with #100 sandpaper between coats. Paint shall be thoroughly dried before sanding.

Before applying succeeding coats, primers and undercoats shall be complete Integral and performing the function for which they are specified. Properly prepare and touch up all scratches, abrasions, or any other disfigurement and remove any foreign matter before proceeding with the following coat.

Do not apply final coat on interior work until other trades are finished with their work in any given area in normal sequence and all materials and debris removed and the premises left in satisfactory broom-clean condition as approved.

10.8.6.5 Preparation of Concrete Mortar Surface

Concrete or cement mortar surfaces shall be thoroughly dried before painting and shall be cleaned by brushing of dirt or deposits of foreign materials. Porous concrete surfaces shall be treated with a synthetic emulsion clear sealer, polyvinyl chloride or epoxy sealed as suited for the base material. Cracks and holes shall be filled with putty, polyvinyl chloride or epoxy sealed as suited for the base material. Cracks and holes shall be filled with putty, polyvinyl chloride putty or epoxy putty. Monolithic concrete or porous concrete surfaces shall be putted with cement filler, synthetic emulsion putty, polyvinyl chloride putty or epoxy putty, and the putty scraped off to a smooth surface. Use putty that is compatible with the surface to be painted and the paint materials. When required, the surfaces shall be sanded with sandpaper # 120-180.

10.8.6.6 Protection of Hardware and Accessories

Remove or protect hardware, hardware accessories, plates, lighting fixtures and similar items placed prior to painting, and reposition or remove protection upon completion of each space. Disconnect equipment adjacent to walls, where necessary, move to permit painting of wall surfaces, and following completion of painting, replace and reconnect.

Paint backsides of access panels, removable or hinged covers and the like.

10.8.6.7 Mixing

Painting Contractor shall provide galvanized iron pans of suitable size in which all mixing pails shall be placed. No mixing shall be permitted outside these pans where rust inhibitive painting at the jobsite is not practicable, the surfaces shall be given 2 coats of rust-inhibitive paint at the fabrication shop.

Immediately after delivery of metal materials to the site, all marred or other defective paint coat shall be remedied by touch-up painting.

Field painting shall be applied after installation or fabrication and when welding has been completed. Welded portions shall be cleaned of deposits of foreign materials and given 2 coats of rust-inhibitive paint, provided that portions where painting after installation is not practicable, they shall be painted before installation.

Rust inhibitive paint may be applied by dipping.

Hole Filling

Deep holes, indented portions and large services of wood doors and wood furnishing shall be spot leveled with filling putty. Each application of putty shall be kept thin and additional coats be

applied after the previous coat has been dried, resulting in a smooth surface which will not thin down. Sand-papering over putty not dried nor hardened shall not be allowed.

Application of Putty

Putty shall be applied to denied portions, services and irregularities with wood or metal spatulas to a thin coat and to meet the surface conditions. After putty coat has dried, the surfaces shall be sanded with # 120-180 sandpaper to a smooth surface by repetitive sanding.

Sealing

When coloring is required for base wood surfaces which are subject to irregular absorption, base wood surfaces shall be sealed. Sealing shall be done by brush applying sealing compound uniformly or by spraying, sealing compound with a spray gun to a thin coat.

Wood Filling

Wood filling compound shall be applied into holes with a brush of hard bristles or a wood spatula and surplus filling compound shall be scraped off. After leaving for a short period and when the compound is still sticky, the surface shall be rubbed with cotton waste or rough cloth in the direction perpendicular to grain of the wood and finish wiped with soft cloth.

Care shall be taken not to leave surplus filling compound at corners and moldings.

When coating is made for wood filling, the surface shall be finished wiped carefully nor to remove colored coat and not to leave surplus compound.

After wood filling and when required time has elapsed, setting of wood filling shall be performed by brush applying setting compound uniformly or by thin application with a spray gun.

10.8.6.8 Application

All painting and varnish work shall be done in workmanlike manner by skilled painter and varnished only.

All materials shall be evenly applied so as to form a film of uniform thickness, free from sags, runs, crawls, or other defects. Paint shall be thoroughly stirred so as to have the pigment evenly in suspension while paint is being applied.

In general and unless otherwise specified, and/or instructed by the Construction Officer due to actual conditions on the job, no less than 24 hours time shall elapse between application of succeeding coats. Each coat of paint shall be allowed to dry thoroughly and inspected for approval before the succeeding coat is applied.

No painting shall be done in damp weather.

Except where otherwise noted or specified, all paints shall be applied in three (3) coats.

No work shall be done under conditions unsuitable for the production of good results. No painting or varnishing on woodwork shall be done while plastering is in process of drying.

Surfaces which cannot be satisfactorily finished on the number of coats specified shall have additional coats, or such preparatory coats and subsequent coats as may be required to produce satisfactory finished work at the expense of the Contractor.

All parts of molding and ornaments shall be left clean and true to details.

All finishes shall be uniform as to sheen color and texture except when glazing is required.

Brush Painting

Painting brush including roller brush shall be the products manufactured for application of specific type painting materials and shall be of proper shape with bristles suited for use at the painting locations.

Brush painting shall be executed uniformly with special care at joints of colors, caved or convicted corners and with true brush marks, free from unpainted portions, drippings, flows, bubbles or other defective works.

Spray Painting

Spray gun application shall be used where indicated in the color scheme schedule.

Spray painting shall be executed with spray painting guns suited for the use Spray painting shall be performed carefully so that smooth planes with uniform paint coats are attained, free of unpainted portions, paint irregularities, flows, drippings, bubbles or other defective works.

Rust-inhibitive Painting for Ferrous Materials

Rust-inhibitive paint shall be applied immediately after removal of dirt, oil and rust.

10.8.6.9 Paint Finishes

ITEM	REMARKS
Exterior and Interior Concrete Walls	Apply one (1) coat of flat latex or approved equivalent as primer/sealer by brush or roller. Let dry for 2 hours before recoating. Putty cracks, crevices and surface defects with acrylic emulsion, crevices and surface defects with acrylic putty or approved equivalent using putty knife. Let dry, sand and spot prime puttied area with primer Apply two (2) coats latex Topcoat (semi-gloss or approved equivalent. Off White) by brush or roller. Allow 2 hours drying in between coats.
Interior / Exterior Woodwork	1 st Coat: Flat wall enamel or approved equivalent. Putty: Glazing Putty #311 or approved equivalent

		2 nd and 3 rd Coats: Semi-Gloss Enamel #200 or approved equivalent Off-White
All Works	Metal	Primer: Red Lead Primer #37 or approved equivalent Topcoat: Quick Drying Enamel #600 or approved equivalent Accent Color

10.8.6.10 Sample

Before ordering material, sample applications of each type of finish and color shall be submitted to the Architect for approval.

10.8.6.11 Cleaning

The Contractor shall clean all paints, spots, daubs, oil and stain in their entirety from all similar items and leave the work in perfect condition upon completion, satisfactory in every respect to the Owner and the Construction Officer.

10.8.6.12 Guarantee

The Contractor shall guarantee his work in strict accord with the requirements for "Guarantee" as set forth in the General Conditions of the Contract Documents.

11.0 DOORS AND WINDOWS AND ACCESSORIES

11.1 Metal Flush Doors

11.1.1 Scope of Work

Furnish materials and equipment and perform labor including plant and other facilities to complete the required steel doors to replace all non-functional and defective doors as shown on the drawings and as specified herein.

11.1.2 General Requirement

Doors shall be of the quality and workmanship acceptable to the Officer. Doors shall be of the size and type indicated in the schedules and as specified herein guarantee finished doors against twisting, warping, cracking and such other defects due to construction and installation for a period of three hundred sixty hundred sixty days after final acceptance of the building.

11.1.3 Materials

All members shall be rolled billet steel. Frames and ventilator shall be special angle shapes not less than 1" deep from front to back, not less than 1/8" in thickness. Weathering projections shall be rolled integral with the sections to provide overlapping, parallel contacts at both inside and outside points of closure on all four sides of the vent.

11.1.4 Installation

Hinged doors shall be hung plumbed and fitted accurately allowing 1.5 mm clearance at the jambs and heads and 3 mm over thresholds. Clearance at the bottom of doors having no threshold shall be 9 mm. Lock stiles of doors 35 mm thick and thicker shall be leveled 3 mm. Knob locks and latches shall be installed 964 mm from the finished floors to the center.

Install in accordance with door and window manufacturer's printed instructions and details. Build in doors/windows as work progresses or install without forcing into prepared door/window openings. Set at proper elevation, location, and reveal; plumb, square, level, and in alignment. Brace and stay to prevent distortion and misalignment. Protect ventilators and operating parts against dirt and building materials by keeping closed and locked to frame.

Door and frame shall be factory finished with a rust inhibiting primer. Clean all surfaces of doors, fins, mullions, cover plates, and provide a hot-dip galvanized, phosphate-treated and shop primed finish.

11.2 Aluminum Doors and Windows

11.2.1 General Requirement

Furnish materials and equipment and perform labor required to complete the removal of all defective steel-framed doors and windows, and the installation of aluminum framed glass doors and windows.

All aluminum windows shall be products of reputable and nationally known manufacturers approved by the Construction Officer. Unless otherwise indicated, all window frames shall be constructed to withstand a minimum 1225 N/sq.m., windload with the sashes in closed position. Windows shall be designed for glazing from outside with continuous glazing heads.

The Contractor shall submit to the Officer shop drawings for approval showing design, elevation of windows, full of size sections of sash, frames and mullion, hardware, construction and assembly details. Details of anchorage, erection, proposed location and method of jointing and splicing of the unit to be installed shall be clearly shown. Fabrication shall not commence until these shop drawings have been submitted and approved.

11.2.2 Materials

Doors and windows shall be aluminum framed complete with snap-on glass fasteners, vinyl inserts, neoprene weatherstripping, Silicone caulking, and glass and glazing glass and glazing materials shall conform to Item 1000 10.5

Aluminum extrusions: ASTM Specification 6063 - 15.

Sheet aluminum: Aluminum Association alloy AA1100

Steel reinforcements: to CAN/CSA G40.21 M92.

Fasteners: aluminum, stainless steel type 316, or cadmium plated steel, finished to match adjacent material.

Weatherstripping: waterproof, rot proof pile fibre 4 mm high x 6 mm wide in neoprene backing of flexible vinyl.

Sills: sloped extruded aluminum sill sections including upturned end stops, chairs, anchors, splice plates; finish same as aluminum framing.

11.2.3 Construction

Factory prefabricate all frames in accordance to the designs and dimensions indicated in the drawings.

Cut, join and fit rails and stiles to hairline joints securely reinforced and jointed by means of concealed fastening wherever possible. Corners of frames and vents shall be mitered and internal corners coped; fitted with hairline joints.

Set and anchor as shown in details and in approved shop drawings. Set frames plumb and square and brace where necessary to prevent distortion. Wedge

clear of masonry all frames set in prepared openings 4.5mm (3/16") to 6mm (1/4") to allow for caulking.

Provide weep holes in horizontal members of exterior frames and screens. Drain weepholes to exterior.

11.2.3.1 Retrofitting of Historic Art Deco Grillwork

For fixed glass windows installed over historic grillwork, great care must be ensured to protect their existing finish and make. All glazing must be provided with a separate anchorage system set apart from existing grill work, with compatible materials and installation methodology that will introduce minimal disturbance to the existing works. Framing systems must not obstruct view of the original grillwork and must therefore be installed behind existing grillwork as viewed from a public space whenever possible.

The Contractor shall submit to the Officer shop drawings for approval showing design, elevation of windows, hardware, construction and assembly details. Details of anchorage, erection, proposed location and method of jointing and splicing of the unit to be installed shall be clearly shown. Fabrication shall not commence until these shop drawings have been submitted and approved.

11.2.4 Hardware

Hardware for doors and windows shall be acceptable foreign or local products of the types, material, sizes and mechanism as indicated on the drawings, and shall be free from any mark or other defect. For Construction Officer's approval.

Samples of each type of hardware shall be submitted to the Architect for approval.

Hinges and door closers shall be the type size and capacity as indicated on the drawings, however, the Contractor shall verify each hardware item as to weight and other load of doors and windows, and minor modifications may be made without change in construction cost.

Manufacturers' nameplates on doors or frames are not acceptable.

11.2.5 Finish

Finish on exposed aluminum surfaces shall be anodized, powder coated or otherwise specified by the Architect. Finishes shall be durable and resistant to fading. Coatings shall be a minimum of 6 micrometers thick. The selection of color or finish shall be by the Owner and Architect through swatches provided by the contractor for such a purpose.

Shop apply strippable protective coating or covering to finished aluminum surfaces until completion of the work.

Paint ungalvanized steel clips, supports and reinforcing steel with steel primer or bituminous paint.

11.2.6 Glazing

Glazing shall be as specified under the Section entitled GLASS AND GLAZING.

11.2.7 Painting

Protective Coating: Clean all surfaces and apply a protective coating of clear, water-white methacrylate-type lacquer, resistant to alkaline, mortar and plaster immediately after fabrication and may not be removed even after completion of installation.

11.2.8 Protection and Cleaning

The Contractor shall be responsible for protecting the windows and doors during construction and for cleaning at the completion of the building.

11.3 Repair of Existing Wooden Doors

11.3.1 Scope of Work

Furnish materials and equipment and perform labor including plant and other facilities to complete the required refurbishment of wood doors (including detached doors which are still functional) and rectify all defects prior to repainting or re-varnishing.

11.3.2 Materials

Existing materials shall be reused whenever possible in the repair and rehabilitation of wood doors. Replacement of door elements with new material shall be done only when originals are so deteriorated as to prohibit their useful function.

Wood used to replace deteriorated door members shall be of the same species and grade as the original, unless otherwise noted.

Existing intact original glass shall be reused. Any removed lights shall be reused in their original frames and positions. New glass and glazing materials shall conform to Glass Glazing Section.

All hardware for wood doors shall be replaced. Replacement hardware for doors shall be compatible with original in design, material, and finish.

11.3.3 Execution

The Contractor shall repair wood doors as indicated and shall return them to proper operation and sound condition.

An existing door of each type to serve as an example of the quality of repairs to be provided shall be prepared for inspection and approval by the Construction Officer.

The interior stops shall be removed first in a method so as to not scar the wood. Connecting hardware and operating mechanisms shall then be detached and the sash shall be removed from the frame. Removed sashes and frames shall be identified as to location to assure reinstallation in their original positions. The parting bead shall be removed so as to not scar the wood. Plastic covering or plywood shall be installed to cover the door opening during repairs.

Areas on frame, sill, sash and muntins where paint or varnish has peeled, alligatored, blistered or crazed shall have paint removed to bare wood or first sound paint layer, using non-destructive means such as a chemical stripper or heat gun.

Badly decayed areas (with more than 30 percent wood decayed) shall be removed from wood sash, sill, frame, and trim assemblies. Moderately decayed areas (less than 30 percent decayed), weathered, or gouged wood shall be patched with approved patching compounds and shall be sanded smooth.

Intact sash rails and stiles that are loose shall be repaired with new dowels to make joints tight.

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. The source or cause of wood decay shall be identified and corrected prior to application of patching materials. Wood that is to be patched shall be clean of dust, grease, and loose paint.

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.

Pieces decayed beyond repair shall be replaced with new pieces that match originals in all respects. Joinery shall match that of existing. Muntins shall have coped mortise and tenon joints. Molded members shall have mitered or coped joints.

11.3.4 Painting

Wood elements shall be primed and painted in accordance with the section on PAINTS AND COATINGS Section.

11.3.5 Reassembly

After repairs are completed, the door and window shall be reassembled with all parts tight, true and functioning properly. Wood surfaces shall be free of blemishes.

Final adjustment for proper operation of ventilating unit shall be made after reassembly. Adjustments shall be made to operating sash or ventilators to assure smooth operation and performance when locked closed.

11.3.6 Protection and Cleaning

The Contractor shall be responsible for protecting the windows and doors during construction and for cleaning at the completion of the building.

11.4 Glass Doors

11.4.1 Scope of Work

Provide complete tempered all glass swing entrance doors and sidelites which have been fabricated assembled and tested for proper operation at the factory. Includes all materials required for installation as shown on drawings and specifications.

11.4.2 Materials

Rails shall be 6063-T5 Aluminum extrusions. Endcaps shall be screw applied or welded (as specified by architect)

Glass shall be at least ½ " thick fully tempered, clear. Glass shall be in compliance with the requirements set forth by American Society for Testing Materials (ASTM) – ASTM C-1048-91 Type 1, Quality Q3, Consumer Products Safety Commission (CPSC) – CPSC Standard of Architectural Glazing Material 16CFR 1201,1,2 and American National Standards Institute (ANSI) – ANSI Z97.1 for fabrication and tempering. Glass shall be horizontally tempered; tong marks

are unacceptable Warpage shall be in compliance with ANSI Z97.1, ASTM C-1036-91 and ASTM C-1048-91. All exposed edges shall be flat polished.

11.4.3 Finishes

Finish on exposed aluminum surfaces shall be anodized, powder coated or otherwise specified by the Architect. Finishes shall be durable and resistant to fading. Coatings shall be a minimum of 6 micrometers thick. The selection of color or finish shall be by the Owner and Architect through swatches provided by the contractor for such a purpose.

Shop apply strippable protective coating or covering to finished aluminum surfaces until completion of the work.

Paint ungalvanized steel clips, supports and reinforcing steel with steel primer or bituminous paint.

11.4.4 Hardware

The door manufacturer shall furnish hardware for tempered glass swing entrance doors. Specify style, type, and finish as specified by the Architect. If conflict in standards occurs, comply with the portion of the specification that will result in the best quality product.

11.4.5 Execution

It is the responsibility of the contractor and sub-contractor to examine all doors and sidelites prior to installation. Qualified installers, in accordance with approved drawings and/or industry standards, shall install all glass swing entrance systems.

11.5 Glass Glazing

11.5.1 Scope of Work

This section of work includes furnishing of glass and labor required to complete all glass and glazing works.

11.5.2 Materials

11.5.2.1 Plate Glass

Plate glass used shall be mechanically ground and polished, distortion-free surfaces. Use where good vision is required.

11.5.2.2 Float Glass

Manufacture by "floating" continuous ribbon of molten glass onto a bath of molten tin where it is reheated to obtain a flat, fire-polished finish. It is then allowed to cool to a degree permitting it to be drawn on rollers in a long oven and then annealed.

11.5.2.3 Sheet Glass

Drawn either vertically or horizontally into sheets, then cut to size. Characterized by fire-polished surfaces with some inherent wave or distortion usually prominent in one direction.

11.5.2.4 Mirror

Silvering quality float glass, ¼ inch thick, recommended specifically for high humidity usage, double silvered produced by a coat of

electro-deposited copper. Furnish with edges polished, in one place unless otherwise, indicated on the drawing or approved.

11.5.2.5 Grading

Grade AA - Intended for uses where superior quality is required.

Grade A - Intended for selected glazing.

Grade B - Intended for general glazing.

11.5.2.6 Glazing Materials

Mastic - elastic compounds and non-skid compound

Putties - wood sash putty and metal sash putty

Sealants: Synthetic polymer - based sealants - resilient or non-resilient type

Performed caskets - Compression type, structural type

11.5.3 Workmanship

Glass for glazing shall be cut and finished by grinding accurately to true sizes to set with equal bearing on the entire width of pane. Glass shall be set properly with glazing putty and angle glazing chips for windows, and with glazing beads for doors.

11.5.3.1 Samples and Submittals

Submit samples of panel glass not less other than 2" x 3" and glazing materials in lengths not less than 6" for Construction Officer's approval. Submit manufacturer's specifications and recommendations for glazing conditions specified herein. Submit certificates of compliance, certifying conformity with requirements of this specification.

11.5.3.2 Delivery

All glass shall be carefully packed for transportation, exercising reasonable precaution to insure avoidance of damage during transit. Care shall be insured in unloading, unpacking and storage on arrival at jobsite to avoid damage. Deliver all glazing accessory materials in manufacturer's original unopened containers, clearly marked as to their contents.

11.5.3.3 Storage

Store all materials at the job site, in a manner assuring its safety from all forms of damage. Protect glass from soiling, condensation, etching, etc. Follow manufacturer's recommendations properly.

11.5.3.4 Glazing

Prevent glass from all contact with metal or any hard or sharp materials by use of resilient shims placed at quarter points. Use resilient sealants. Use stops in sizes permitting a "good grip" onto the glass. Install glass only in opening that are rigid, plumb and square. Allow sufficient clearance at edges of glass to compensate for its expansion or for some settlement of the building. Clearance should be ¼ from edge to frame and 1/8" for face, markings, banners, posters and other decal shall not be spelled directly to glass surface as these could cause thermal stress. Removal of party of glazing compound smears from glass shall be performed by the glazing

contractor during the materials normal work life. Failure to do so may result in damage to the glass.

12.0 FURNISHING

12.1 General

12.1.1 Scope of Work

The scope of work consists of the supply and installation of Stadium Seating including accessories to complete all in accordance with the Specifications and Drawings at location indicated on the Drawings.

12.1.2 Submittals

Drawings indicating metal thickness, fastenings, details of hinge mechanism, seat and back dimensions, proposed finish, and including seating plans showing row spacing, row lengths, the varying lateral spacing at backs and seats, back pitch, and chair widths for the various section lengths, floor pitch, and riser height, where applicable. Manufacturer's descriptive data, catalog cuts, and installation instructions.

12.1.3 Delivery and Storage

Stadium seating shall be delivered to the site in unopened containers clearly labeled with the manufacturer's name and container contents. Materials shall be stored in a safe, dry, and clean location. Handling of items shall be in a manner that will protect the materials from damage.

12.2 Products

12.2.1 Fixed Stadium Seating

Stadium Seating shall be High Density Polyethylene. Seating shall be floor mounted, with double-wall blow mould structure manufactured from HDPE with anti-UV, anti-oxidant, fire retardant, and anti-static additives with powder coated or hot galvanized magnesium alloy surface coated steel frame. Drain holes in the base must be provided to prevent water pooling.

Seating must conform to EN 12727 standard for mechanical testing.

Chair components and assembly shall be free from objectionable projections or irregularities. Corners and edges shall be smooth and rounded. Bolts, nuts, and other fastenings shall be capped. Steel shall be well-formed to shape and size required. Jointing of members shall be welded, riveted, or interlocked. Exposed welds shall be ground and dressed smooth. Casting shall be fine textured, sound, and free of pits, blow holes, and fins. Lines shall be true, accurate, and true-to- pattern with excess metal or imperfections removed. Fastening shall be concealed where possible.

12.3 Execution

Standards in each row shall be placed laterally so the aisle-end standards will be in alignment as indicated on seating layout drawing. The angle of inclination of backs shall be adjusted for variations in sightlines. Mechanical attachment of components shall be of sufficient flexibility so that when permanently assembled they will compensate for the changing dimensions laterally between standards caused by convergence toward the center. Seat and back attachments shall absorb inaccuracies in lateral spacing of standards at point of attachment caused by unevenness of floor. Varying lateral

dimensions of backs and seats shall be in accordance with approved seating layout. Minimum width of seating unit shall be 500 mm and may be used only to complete a specific row dimension.

Installation of stadium chairs shall be in accordance with the seating drawings and approved installation instructions.

13.0 ELECTRICAL WORKS

13.1 Work Included

All work under these specifications shall consist of furnishing and/or installing all labor, materials, tools and all services necessary unless otherwise indicated to complete and make ready for operation, the electrical power, lighting and other utility system described herein and/or indicated in the Electrical Plans except for Owner-furnished equipment and fixtures in accordance with the electrical plans and these specifications.

- 13.1.1 Furnish and install low voltage service entrance including accessories.
- 13.1.2 Furnish and install feeder distribution layout.
- 13.1.3 Furnish and install lighting and power system.
- 13.1.4 Furnish and install panel boards, circuit breakers, and disconnect switches.
- 13.1.5 Furnish and install outlets, switches and plates.
- 13.1.6 Furnish and install lighting fixtures and lamp (including T-runners & lighting diffusers)

13.2 Work Not Included

The following items of work shall be supplied by the Owner but to be installed by the Electrical Contractor or respective trade contractors or suppliers.

- 13.2.1 Motor, magnetic starters and controlling devices.
- 13.2.2 Electrical cooperative deposits

13.3 Code Regulations

All materials and equipment to be used in the electrical installations and construction shall be in accordance with the latest edition of the Philippine Electrical Code and the pertinent ordinances of the City Government.

All work shall comply with the rules and regulations of the local power company in so far as they are concerned in providing their respective permanent services to the building.

With respect to the local power company, it shall be the electrical contractor's sole responsibility to verify the point of service entrances and other requirements necessary for service connection of both abilities.

13.4 Drawings and Specifications

The electrical plans and these specifications are meant to be complementary to each other, and what is called for in one shall be as binding as if called for by both.

Any apparent conflict between the electrical plans and these specifications and any unclear points of controversial matters in either shall be referred to the owner's assigned representative for final decision.

Upon final completion of the work herein described, the electrical contractor shall furnish the Owner two (2) copies of the "As-built" plans for future reference and maintenance purposes.

The electrical plans indicate the general layout of the complete electrical system. Arrangement of feeders, circuit outlets, switches, controls, panel boards, service equipment and other work. Field verification of the scale dimensions on plane must be made, since actual locations, distances and levels will be governed by actual field conditions.

The Electrical Contractor shall check architectural, structural and plumbing plans be necessary to resolve such conflicts, the Electrical Contractor shall notify the Architect and secure approval and agreement on necessary adjustments before installation is started.

13.5 Permits and Inspection

The Electrical Contractor shall obtain all necessary permits and certificates of electrical inspection from the proper government authorities concerned, required both for the performance of the work involved and the operation of the system upon completion of the work.

The Electrical Contractor shall pay all necessary electrical fees for the securing of the above-mentioned permits and certificates of electrical inspection.

The Electrical Contractor shall as his own expense, reproduce the electrical plans for work to the necessary scale and size, complete them with the necessary information and requirements as required by the government authorities concerned with approving such plans.

The Electrical Contractor shall coordinate with the local power company regarding the power facilities and secure approval of the power requirements.

13.6 Materials and Workmanship

All materials to be installed shall be brand new, unused and shall in every case to be the best where such standard have been established for the particular type of materials used.

Only skilled workmen using proper tools and equipment shall be employed during the entire course of the installation work. All workmanship shall be of the best quality, all work to be done in accordance with the best engineering practice of the trade involved.

13.7 Wiring Method

Branch circuit installation for lighting and power layout shall be done polyvinyl chloride pipes (PVC) exposed, inside drop ceiling, wooden and concrete partitions.

All auxiliary layout shall be in uPVC piping.

Branch circuit layout run underground or embedded in concrete slab shall also be in PVC pipes.

Low voltage service entrance and all feeders shall be in Rigid Steel Conduit (RSC).

Use flexible metal pipe for connection between junction boxes inside ceiling and lighting fixtures and ceiling fans with standard fittings.

All conduits shall be standard mild steel; hot galvanized or sherardized with an interior coating.

Conduits shall be 15mm minimum nominal diameter or otherwise as indicated in the Drawings.

All conduits shall be laid during the construction and shall be concealed in ceiling. All boxes, cabinets and other equipment shall be installed flush-mounted unless specified

otherwise. All underground conduits shall be encased in concrete with minimum thickness of 10mm around conduit, and when outside the building, be reinforced sufficiently with steel bars.

All boxes for lighting outlets, convenience outlets, tumbler switches and other devices shall be galvanized and approved products of reputable manufacturers. Outlet boxes shall be 1.5mm thick (Gauge 16). Ceiling and wall outlet boxes shall be 10mm octagonal. Boxes for wall, 50mm x 100mm x 55mm deep, locally made. Cut ends of conduits shall be reamed and cleaned to remove burr and sharp edges. Threads cut on conduits shall be the same thread dimensions as factory cut conduit threads. Conduit joints shall be made straight and true. Elbows and offsets and changes in direction of runs and shall be uniform. Bends shall be made without chinking or destroying the cross-sectional contours of the conduits. Conduit terminals shall be provided at outlet boxes and cabinets with locknuts and bushing. Conduits shall be continuous from outlet and from outlet to pull boxes and cabinets in the manner that the conduit system shall be electrically continuous.

Where conduit runs are exposed, they shall be supported at an interval of 1.52m maximum with proper clamps and bolts or expansion shields or other means of support.

Wires shall be subject to the approval of the C.O. and Architect. Use one brand only.

All splices taps, junction in wires larger than 8.0 sq.mm. shall be done with solderless connectors or suitable sizes properly insulated with rubber tapes and protected by friction tapes, so that the insulation strength shall at least be equal to the insulation of the conductors they join.

Smallest size of wire to be used for lighting and power unless otherwise indicated shall be 3.5sq.mm.

13.8 Feeders

Feeders shall be laid out in accordance with the riser diagram shown in the electrical plans.

Unless otherwise specified type THHW wires shall be used for feeder lines. The wires and conduits sizes shown in the electrical plans shall be the minimum sizes to be used.

13.9 Wall Switches and Receptacles

Suitable single pole tumbler switches and three-way switches of the wide-series flush type, as approved by the C.O. and Architect to be furnished and installed by the electrical contractor as indicated in the electrical plans.

Wall switches intended to control more than 500 watts load shall be rated Amperes, 300 volts.

Ordinary convenience outlets shall be duplex flush type, 2 wires, 15 Amperes, 250 volts; Heavy duty convenience outlets shall be rated 250 volts, 2 wires, 20 Amperes.

All wall plates for switches, receptacles, telephone outlets and blank cover shall be of a consistent design, model, and make.

Wall tumbler switches shall be installed 1.40m above finish floor level.

Wall convenience outlets shall be installed 0.30m above finish floor or above the baseboard where there are baseboards

13.10 Main Switches and Panel Boards

The Electrical Contractor shall furnish and install main distribution panel, lighting panel boards as shown in the drawings.

The cabinets for the above must be of standard sizes and gauge and locally assembled.

Main circuit breakers for power and lighting panel boards shall be 250 volts, AC and shall be quick break.

Safety disconnect switches shall be fusible type.

13.11 General Lighting Fixtures

Install all lighting fixtures and lamps as specified and shown on plans. Lamps shall be operating before final review of the work is requested.

LED driver shall be installed in an electrical enclosure. Wiring inside enclosure shall comply 600V/105 degrees rating or higher. LED driver shall comply with UL standard UL1012. LED driver shall have Class A sound rating. LED driver shall be UL certified for use in a dry or damp location. LED driver shall tolerate sustained open circuit and short circuit output conditions without damage. LED driver shall comply with the requirements of the FCC rules and regulations, Title 47 CFR Part 15 Non-Consumer (Class A). Luminaires shall be controlled by photocells or automatic profile dimming & motion response override as required by the design. Outdoor luminaires shall have provisions for house side shield to prevent glare to uphill neighbors. Luminaire shall have door frame and lens with LED arrays and integral airflow ventilation system. The light distribution pattern of the luminaires shall be suitable for a S/H ratio of approximately 1.8. Pole mounted lights shall have in line/in pole fusing. The lighting system shall consist of the type and manufacturer as shown on the drawings or approved equal. If other than fixture shown is submitted complete illumination calculations are required to show equality.

FLUORESCENT Lighting fixtures shall include wiring channel, end plates, end caps, side panels, top reflectors, bottom closures, lamp holders, lamps, ballasts, suspension stems, wiring and all other necessary materials and devices. The wiring channel, end plates, and other sheet steel enclosure components shall be cold-rolled carbon sheet steel of commercial quality not less than No. 20 USS gauge in thickness. Wireway Channel Housings: Steel, not less than 20 gauge unless specified otherwise, fully enclosed, where mounted end-to-end, on fixtures where channel is exposed, internal type connection straps to prevent projections at connections. The ballasts and wiring shall be completely enclosed in the wiring channel and shall be accessible without the use of tools other than a common screwdriver or pliers. The ballast shall be replaceable without removing the fixture from its mounting. Lamps shall be replaceable without the use of tools and without the prior removal of other lamps and equipment. Fixtures shall be completely assembled, wired and ready for connection to the building lighting distribution system. Hangers for Pendant Fixtures: Rigid type, with not less than 5-thread engagement at each end, consisting of iron pipe, with brass or aluminum tubing casing, or supporting tubing not less than 0.040 inches thick; two hangers for fixtures 8 feet or shorter; one more than number of fixtures in each row for fixtures of longer length; install at the connector plates between fixtures. Installation of Ballast within Fixtures: Such that the ballast case temperature will remain below 90 deg C. for full ballast life.

High Intensity Discharge (HID) fixtures construction shall consist of a ballast aluminum housing and reflector system. The luminaires are open and ventilated. The light distribution pattern of the luminaires shall be suitable for a S/H ratio of approximately 1.8. Ballasts shall operate at 230-277 volts and be designed specifically for use with lamps specified. Ballasts shall be fully encapsulated, regulating type with a maximum

crest factor of 1.6. All HID ballast shall be fused for short circuit protection. The lighting system shall consist of the type and manufacturer as shown on the drawings or approved equal. If other than fixture shown is submitted complete illumination calculations are required to show equality.

Submit one (1) sample of each type of fixtures to the Architect for approval prior to manufacturing and installation.

For all lighting fixtures exposed to the elements, IP 66/67/68 rated fixtures must be used or otherwise prescribed by the C.O and Architect.

13.12 Architectural Lighting

For sports lighting and specialty lighting fixtures, these shall be installed by the manufacturer or his authorized representative, in accordance with approved shop drawings and manufacturers direction. All anchors, brackets and other work shall be located accurately. Upon completion, lighting fixtures shall be calibrated and commissioned and properly adjusted to operate in accordance with manufacturer specifications.

13.13 Water Pump

The electrical contractor shall install a complete wiring and conduit for the system including circuit breaker.

The water pump and accessories such as electric motor, magnetic starter, electrode water level controller and others are supplied and installed by others.

13.14 Guarantee

The electrical contractor shall guarantee his work for a period of one (1) year form the date of acceptance of the Owner, with which time, he shall repair any defects and failures in any part of the system and replace defective materials, except those to the Owner.

13.15 "As Built" Drawings

Upon completion and before first acceptance of the work, the contractor shall prepare at his own expense and submit to the Architect "as built" drawings indicating in all detail the actual as-built conditions of the work required.

14.0 FIRE DETECTION AND ALARM SYSTEM

14.1 General

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

FM P7825 (1999) Approval Guide

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits

NFPA 70 (2002) National Electrical Code

NFPA 72 (1996) National Fire Alarm Code

NFPA 90A (1996) Installation of Air Conditioning and Ventilating Systems

PEC (2009) Philippine Electrical Code

PNS (2002) Philippine National Standard

UL FPED (1999) Fire Protection Equipment Directory

UL 5 (1998) Surface Metal Raceways and Fittings

UL 467 (1996) Grounding and Bonding Equipment

UL 497B (1999) Safety Protectors for Data Communications and Fire Alarm Circuits

UL 514A (1998) Metallic Outlet Boxes

UL 514B (1998) Fittings for Conduit and Outlet Boxes

UL 1242 (1998) Intermediate Metal Conduit
UL 1449 (1998) Transient Voltage Surge Suppressors
UL 1971 (1997) Safety Signaling Devices for the Hearing Impaired

14.2 Description of Work

The work includes providing new interior fire alarm system including material, tools, equipment, installation, and testing necessary for and incidental to the provision of a complete and usable standard system conforming to the applicable requirements of NFPA 70, NFPA 72, and NFPA 90A and this specification. In referenced NFPA publications, the advisory provisions shall be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the Fire Protection Engineer. Materials and equipment to be furnished under this contract shall be essentially the current design products of manufacturers regularly engaged in production of such equipment and shall be listed by the Underwriters' Laboratories, Inc. in the UL FPED, or approved by Factory Mutual System and listed in FM P7825.

14.3 System Description and Power Calculations

Submit design calculations to substantiate that the battery capacity exceeds supervisory and alarm power requirements. Show comparison of the detector power requirements per zone versus the control panel smoke detector power output per zone in both the standby and alarm modes. Show comparison of the notification device circuit alarm power requirements with the rated circuit power output.

14.4 Submittals

14.4.1 Shop Drawings
System floor plans
System wiring diagrams
Conductor wire marker schedule
Product Data
Control panel and modules
Storage batteries
Battery charger
Manual pull stations
Heat detectors
Open-area (spot-type) smoke detectors
Alarm bells
Audio/Visual Alarm horns
Main annunciator
Remote annunciator panel
Graphic annunciator panel
Wiring
Ground rods
Conduit
Outlet boxes
Fittings for conduit and outlet boxes
Trouble buzzer
Surge suppression devices
Data which describe more than one type of item shall be clearly marked to indicate which type the Contractor intends to provide. Submit one original for each item and clear, legible, first-generation photocopies for the remainder of the specified copies. Incomplete or illegible photocopies will not be accepted. Partial submittals will not be accepted.

14.4.2 Design Data

Power Calculations

14.4.3 Test Reports

Open-area (spot-type) 2-wire smoke detectors

Preliminary testing

Final acceptance testing

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

14.4.4 Certificates

Qualifications of Installer

Qualifications of System Technician

14.4.5 Operation and Maintenance Data

Fire Alarm System

14.4.6 Closeout Submittals

System As-Built Drawings

14.5 Quality Assurance

14.5.1 Qualifications of Installer

The Contractor or installer shall have satisfactorily installed fire alarm systems of the same type and design as specified herein and shall be UL certified for the installation and testing of fire alarm systems.

Prior to commencing fire alarm system work, submit data showing that the Contractor or installer has satisfactorily installed three fire alarm systems of the same type and design as specified herein within the past three years and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

14.5.2 Manufacturer's Representative

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

14.5.3 Qualifications of System Technician

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

14.5.4 Drawing Requirements

14.5.4.1 System Floor Plans

Submit shop drawings of the system floor plans showing locations of initiating and indicating devices and end-of-line supervisory devices. Show wire color coding, wire counts, and device wiring order. Show candela rating of each visible notification device.

14.5.4.2 System Wiring Diagrams

Submit complete wiring diagrams of the system showing points of connection and terminals used for all electrical connections in the

system. Show all modules, relays, switches and lamps in the control panel.

14.5.4.3 System As-Built Drawings

Upon completion, and before final acceptance of the work, furnish to the Engineer 3 complete sets of as-built drawings, including complete as-built circuit diagrams, of the system. The as-built drawings shall be "A3" size.

14.5.4.4 UL Listing or FM Approval

Submit copies of UL listing or FM approval data showing compatibility of the smoke detector model being provided with the control panel being provided.

14.6 Maintenance

14.6.1 Spare Parts

Furnish the following spare parts:

- a. 5 complete sets of system keys
- b. 1 of each type of audible and visual alarm device installed
- c. 2 of each type of fuse required by the system
- d. 2 spare zone modules for modular type control panels in addition to those installed in the panel
- e. 2 of each type of smoke detector base and head installed
- f. 1 smoke detector manufacturer's test screen, card or magnet for each 10 detectors, or fraction thereof, installed in the system

14.6.2 Manuals

Submit operation and maintenance data. Inscribe the following identification on the cover: the words OPERATION AND MAINTENANCE MANUAL, the location of the building, the name of the Contractor, system manufacturer and the contract number. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: circuit drawings; wiring and control diagrams with data to explain detailed operation and control of each item of equipment; a control sequence describing start-up, operation and shutdown instructions; installation instructions; maintenance instructions; safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list.

14.7 Products

14.7.1 System Design

14.7.1.1 Operation

Provide a complete, electrically supervised, code 3 temporal common coded, manual and automatic, zoned, annunciated, fire alarm system as described herein, and as shown on the drawings. Provide separate circuits from the control panel to each zone of initiating devices as specified herein. Transmission of signals from more than one zone over a common circuit to the control panel is prohibited.

14.7.1.1.1 Fire Alarm Signal Initiation

Operation shall be such that actuation of any:

- a. Manual station
- b. Smoke detector
- c. Automatic fire sprinkler system
- d. Fire extinguishing system
- e. Fire standpipe system

Shall cause all of the following actions:

- a. All building evacuation alarm devices to operate continuously;
- b. The annunciator(s) to properly register;
- c. Heating, ventilating, and air conditioning equipment to shut down.

All operations shall remain in the alarm mode (except alarm notification devices if manually silenced) until the system is manually restored to normal.

14.7.1.1.2 Supervisory Signal Initiation

Operation of a sprinkler or standpipe control valve tamper or low air pressure supervisory switch or fire pump controller remote supervisory contact shall not cause an alarm, but shall cause operation of common system audible trouble signal, display of a visual indication distinct from that displayed to indicate a fire alarm or a fault in the supervisory circuit.

14.7.1.1.3 Monitoring Integrity of Installation Conductors

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

- a. Initiating circuits.
- b. Evacuation alarm (notification device) circuits (including both audible and visual notification devices).
- c. Battery power supply (low and no voltage across the standby battery terminals and open battery circuit).

14.7.1.1.4 Walk-in 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 walktest mode, after a preset delay system shall automatically return to normal standby mode.

14.7.1.1.5 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.

14.7.1.1.6 Primary Power

Primary power source shall be 240 volts AC service, transformed through a two winding isolation type transformer and rectified to 24 volts DC for operation of all initiating device, notification device, signaling line, trouble signal and tripping circuits. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the rated output of the system power supply module(s). Obtain AC operating power as shown on contract drawings. Provide an independent Enclosed Circuit Breaker (ECB), with provisions for locking the cover and operating handle in the "POWER ON" position for this connection located adjacent to main distribution panel. Paint the ECB red and identify it by the lettered designation "FIRE ALARM SYSTEM POWER".

14.7.1.1.7 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. Loss of AC power shall not prevent transmission of a signal to station fire alarm headquarters upon operation of any initiating circuit.

14.7.1.1.8 Storage Batteries

Provide sealed lead calcium or sealed lead acid batteries and charger. Drycell 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 tripping circuits 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. If calculations required by the paragraph entitled "Power Calculations" show that the total supervisory and alarm power requirements of the modified system exceed the capacity of the existing battery, provide a new battery as specified herein. Provide reliable separation between cells to prevent contact between terminals of adjacent cells and between battery terminals and other metal parts.

14.7.1.1.9 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 or battery cabinet.

14.8 Component Design

14.8.1 Control Panel

Provide modular type panel installed in a surface mounted steel cabinet with hinged door and cylinder lock. 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 one set of Form C dry alarm contacts per zone, a common system Form C dry alarm contact, and a common system Form C dry trouble contact. Provide panel with the following switches:

- a. Trouble silencing switch which silences audible trouble signals (including remote trouble devices, if provided) without extinguishing trouble indicating lamp(s). 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 alarm(s) from additional zone(s) 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. Operation of reset switch shall restore activated smoke detectors to normal standby status.
- e. Lamp test switch.
- f. HVAC shutdown bypass switch. Operation of the switch shall allow HVAC system to operate with detectors in alarm and shall cause operation of system trouble signals.

14.8.2 Main Annunciator

Provide integral with the control panel. Provide separate alarm and trouble lamps for each zone (initiating circuit) as indicated below and 4 spares, located on the exterior of the cabinet door or visible through the cabinet door. Lamps shall be Light Emitting Diode (LED) type. Zone modules for spare zones shall be provided in the control panel. Supervision will not be required provided a fault in the annunciator circuits results only in loss of annunciation and will not affect the normal functional operation of the remainder of the system. Each lamp shall provide specific identification of the zone by means of a permanent label. Provide engraved, silk screened, or machine-made labels. Handwritten labels are prohibited. In no case shall zone identification consist of the words "Zone 1," "Zone 2," etc., but shall consist of the description of the zone.

14.8.3 Remote Annunciator Panel

Provide panel located as shown. Panel shall duplicate all requirements specified for the control panel annunciator, except that individual zone trouble lamps are not required. Lamps shall be LED type, except lamps used in backlighted panels shall be LED or neon type. Panel shall have a lamp test switch. Zone identification shall be by means of permanently attached rigid plastic or metal plates. Panel shall be of the interior type surface.

14.8.4 Graphic Annunciator Panel

Provide panel located as shown. Panel shall be of the interior type surface. Panel shall be provided with the building room 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 annunciator panel and 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.

14.8.5 Trouble Buzzer

Provide a remote system trouble buzzer arranged to operate in conjunction with the panel's integral trouble signal. Locate remote trouble buzzer as indicated. Provide trouble buzzer with a rigid plastic, white on red engraved identification sign which reads "FIRE ALARM SYSTEM TROUBLE". Lettering on identification sign shall be a minimum 25 mm high.

14.8.6 Manual Pull Station

Provide non-coded double action type with mechanical reset features. Stations shall be surface 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(s).

14.8.7 Combination Fixed Temperature Rate-of-Rise Detectors (Spot Type)

Designed for surface outlet box mounting and supported independently of conduit, tubing or wiring connections. Contacts shall be self-resetting after response to rate-of-rise actuation.

14.8.8 Open Area (Spot-Type) Smoke Detectors

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.

14.8.9 Wire Smoke Detectors

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 detection initiating circuit (zone). Failure of the power circuit shall be indicated as a trouble condition on the corresponding initiating circuit.

14.8.10 Photoelectric Detectors

Operate on the light scattering principle using a LED light source. Detector shall respond to both flaming and smoldering fires.

14.8.11 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. In areas without finished ceilings, mount detectors at the underside of deck above unless otherwise indicated.

14.9 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. Submit calculations showing compliance with the above power consumption requirements with the calculations required by the paragraph titled "Design Data". Effective sound levels shall comply with NFPA 72. Provide devices addition to those shown if required in order to meet NFPA 72 sound level requirements. Finish devices in red enamel. For surface mounting provide device manufacturer's approved back box. Back box finish shall match device finish.

14.9.1.1 Alarm Horns

Surface-mounted grill, 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.

14.9.1.2 Visible Devices

Surface mounted assembly of the stroboscopic type suitable for use in an electrically supervised circuit and powered from the notification device circuit(s). 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. 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 device and as indicated. Visible devices may be part of an audio-visual assembly.

14.10 Valve Tamper Switches

Provide switches to monitor the open position of valves controlling water supply to sprinkler systems. Switch contacts shall transfer from the normal position to the off-normal position during the first two revolutions of the hand wheel or when the stem of the valve has moved not more than one-fifth of the distance from its normal position. Provide switch with tamper resistant cover. Removal of the cover shall cause switch to operate into the off-normal position.

14.11 Conduits

14.11.1 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

14.11.2 Surface Metal Raceway and Fittings

UL 5, two-piece painted steel, totally enclosed snap-cover type..Jj

14.11.3 Outlet Boxes

UL 514A, zinc-coated steel

14.11.4 Fittings for Conduit and Outlet Boxes

UL 514B, zinc-coated steel

14.11.5 Wiring

NFPA 70 and NFPA 72. Wire for 240V circuits shall be 3.5mm sq., minimum solid copper conductor. Wire for low voltage DC circuits shall be 2.0mm sq. minimum solid copper conductor. Insulation shall be 75 degree C minimum with nylon jacket.

14.12 Surge Suppression

Provide line voltage and low voltage surge suppression devices to suppress all voltage transients which might damage the control panel components. Mount suppressors in separate enclosure(s) adjacent to control panel unless suppressors are specifically UL listed or FM approved for mounting inside the control panel provided and approved for such use by the control panel manufacturer.

14.12.1 Line Voltage Surge Suppressor

Suppressor shall be UL 1449 listed with a maximum 330 volt clamping level and a maximum response time of 5 nanoseconds. Suppressor shall also meet IEEE C62.41 category B tests for surge capacity. Suppressor shall be a multi-stage construction which includes inductors and silicon avalanche zener diodes. Suppressor shall have a long-life indicating lamp (light emitting diode or neon lamp) which extinguishes upon failure of protection components. Fuses shall be externally accessible. Wire in series with the incoming power source to the protected equipment using screw terminations.

14.12.2 Low Voltage Surge Suppressor

Provide for all circuits which leave the building shell and as shown on the contract drawings. When circuits interconnect two or more buildings, provide an arrestor at the circuit entrance to each building. Suppressor shall be UL 497B listed with a maximum 30 volt clamping level and a maximum response time of 5 nanoseconds. Suppressor shall have multi-stage construction and both differential/common mode protection.

14.13 Execution

Installation shall be in accordance with the requirements of NFPA 70, NEC, 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 to match existing base color coding scheme. All wiring shall be in steel conduit or electrical metallic tubing, except surface mounted wiring may be in surface mounted metal raceway in finished areas. 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 or by heat-shrink type sleeves. 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." Electrical metallic tubing shall not be installed in exterior or wet locations and shall not be imbedded in masonry or concrete. 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.

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. Provide conduit seals for all raceway terminating at the control panel cabinet.

14.14 Field Quality Control

14.14.1 Preliminary Testing

Notify the 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. Ground Resistance: Prior to connecting control panel, test grounds for ground resistance value. Use a portable ground testing megger to test each ground or group of grounds. Make ground resistance measurements in normally dry weather, not less than 48 hours after a rainfall. Follow the directions provided by the equipment manufacturer for proper use of the equipment. Measure resistance of each connection to ground. Resistance of each connection to ground shall not exceed 10 ohms.

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

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

d. 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.

e. Duct Detector Differential Pressure Test: Measure and record the observed differential pressure between sampling tubes with completed HVAC system operating normally to verify airflow requirements through detector housing. Perform test on smoke detector heads as specified above for smoke detectors.

14.14.2 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. 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 date final testing is requested and the date the final acceptance testing takes place. The Contractor shall furnish all devices, equipment, instruments, and personnel for this test. Furnish a minimum of three two-way radios plus one additional radio for each remote annunciator, all operating on the same frequency. 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.

14.14.3 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.

14.14.4 Supervisory System

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.

14.14.5 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.

14.15 Guarantee

The electrical contractor shall guarantee his work for a period of one (1) year from the date of acceptance of the Owner, with which time, he shall repair any defects and failures in any part of the system and replace defective materials, except those to the Owner.

14.16 "As Built" Drawings

Upon completion and before first acceptance of the work, the contractor shall prepare at his own expense and submit to the Architect "as built" drawings indicating in all detail the actual as-built conditions of the work required.

15.0 BASIC FIRE PROTECTION MATERIALS AND METHODS

15.1 General Requirements

The work to be done under this Specifications consists of the fabrication, furnishing, delivery and installation, complete in all details, testing and commissioning of this subcontract, at the subject premises and all work materials incidental to the proper completion of the installation, except those portions of the work which are expressly stated to be done by others. All works shall be in accordance with the governing Codes and Regulations and with the specifications, except those where same shall conflict with such Codes, etc., which latter shall govern. The requirements with regard to materials and workmanship specify the required standards for the furnishing of all labor, materials, and appliances necessary for complete installation of the work specified herein and indicated in the drawings. The Specifications are intended to provide a broad outline of the required equipment, but are not intended to include all details of design and construction.

15.2 Description of Work

Under this section of the specifications, provide all labor, materials and equipment and perform all the work necessary for the complete execution of all the work as shown on Drawings and Specified in this specification.

15.2.1 Removal of existing fire protection system i.e. pumps, pipings, valves, and sprinkler heads.

- 15.2.2 Supply and installation of new piping, valves, flow switches, control valves, valve monitor supports, hangers and accessories for the automatic sprinkler system
- 15.2.3 Supply and installation of new fire pumps with motor, jockey pumps, pump controllers, alarm check valves, relief valves, alarm gong isolation, valves, suction strainer, pipe, manifolds, hose header and other accessories. All pipe fittings attached to water tank as part of the Fire and Jockey pump shall be included.
- 15.2.4 Supply and installation of new electrical motor controllers, power wirings and conduits from electrical provided disconnect means to mechanical motor controllers, switches, control wiring and conduits, control panels for all pump controllers and sprinkler system with provision of dry contact for the interface to fire detection system, which are under other subcontractors.
- 15.2.5 Supply and installation of new fire hose, cabinet.
- 15.2.6 Supply and installation of all sleeves through structural/non-structural members.
- 15.2.7 Painting of existing and new fire piping line, hangers, supports, metal work, etc.
- 15.2.8 Restoration of building structure affected by the abovementioned works.
- 15.2.9 Testing and commissioning.

15.3 Work Not Included

- a. All builder's work.
- b. All cutting and patching of concrete openings.
- c. Electric power terminating to the disconnect switch.
- d. Rehabilitation of Water Reservoir.
- e. Control wiring and conduits from dry contact (switches) to fire detection system and/or Building Management systems if there is any.

15.4 Building Provision

Existing provisions are located in the Building for the accommodation of this installation. These provisions include space allocation, holes through beams and structural slabs, etc. The provisions so made are shown on the drawings. Before proceeding with the Works, the Contractor shall check and confirm that the provisions are satisfactory for the Works, and where necessary, additional information and requirements is to be furnished.

It is the Contractor's responsibility to ensure that the Project Engineer is informed of all holes and any other provisions requested in the structure.

All pipe sleeves shall be supplied and installed by the Contractor.

15.5 Submittals

Detailed requirements for submittals are included in applicable specifications. In addition to those requirements, comply with all requirements specified herein.

- 15.5.1 The term "Shop Drawings" includes fabrication, erection, layout and setting drawings; manufacturer's standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control

diagram; and other drawings and descriptive data pertaining to materials, equipment, piping duct and conduit systems and methods of construction as required to show that materials, equipment, or systems, and positions thereof, conform to the Contract Documents. The term "Manufactured", term "Fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements. Shop Drawings shall establish actual detail of all manufactured or fabricated items, indicate proper relation to adjoining work, amplify design details of mechanical and electrical equipment structure, and incorporate minor essential changes or construction suit actual conditions.

- 15.5.2 The term "Samples" includes natural materials, fabricated items, equipment, devices, appliances, or parts thereof as specified, and other samples as may be required to determine whether kind, quality, construction, workmanship, finish, color and other characteristics of materials conform to requirement of the Contract Documents. Samples shall establish kind, quality, and other required characteristics of various parts of the work.
- 15.5.3 "Product Data" identifies pertinent products or models, shows performance characteristics, capacities, dimensions and required clearances, wiring or piping diagrams and controls. Supply only product data information specifically required for the work.
- 15.5.4 The Contractor will prepare, and submit Shop Drawings and Samples in accordance with the agreed Schedule with such promptness as to cause no delay in his own work. No extensions of time will be granted because of failure to have Shop Drawings and Samples submitted in ample time to allow for processing.
- 15.5.5 Submit three (3) prints and five (5) copies of product data to the Project Engineer and approval. The Project Engineer will return to Contractor one (1) print of each drawing submitted, each stamped "REVIEWED" and "A, B, or C" "ACTION". This process shall be repeated when necessary to gain final acceptance.
- 15.5.6 Shop Drawings, Product Data and Samples shall be properly identified with the name of the Project, the Contractor and the date. Each lot submitted shall be accompanied by an acceptable transmittal form referring to name of the Project, to the number of the Specification section, and to the paragraph number when applicable, for identification of each item. Shop Drawings for each section of the Work shall be numbered consecutively and the numbering system shall be retained throughout all revisions. Each Shop Drawing and Sample shall have a clear space for the stamps of the Contractor. Where clear space is not available on Samples, submit with tags or stickers attached thereto.
- 15.5.7 By Certification Stamping of Shop Drawings, Product Data and Samples, the Contractor represents that he has determined and verified materials, field measurements, and field construction criteria related thereto and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. Submissions without this approval and submissions which, in the Superintendents opinion, are incomplete, contain errors, or have not been checked or have only been checked superficially will be returned to resubmission. Proposed deviations from the Contract Documents shall be clearly noted on the Submittals.

- 15.5.8 Shop Drawings shall show in detail, materials, dimensions, thicknesses, methods of assembly, attachments, relations to adjoining work, and other pertinent data and information.
- 15.5.9 Samples of materials which are generally furnished in containers bearing manufacturer's descriptive labels and printed application instructions shall, if not submitted in standard containers, be furnished with such labels and application instructions.
- 15.5.10 Except for finish, color and other aesthetic matters left to the Engineer's decisions by the Contract Documents, the review of Shop Drawings and Samples is only for the convenience of the Owner in following the Work and shall not relieve Contractor from responsibility for any deviations from the requirements of the Contract Documents. The Engineer's review shall not be construed as a complete check nor shall it relieve responsibility for errors of any sort in Shop Drawings or Samples, or from the necessity of furnishing any work required by the Contractor Documents which may have been omitted on the Shop Drawings or Samples. The Engineer's review of a separate item shall not indicate review of the complete assembly in which it functions.
- 15.5.11 The Project Engineer and Engineer will review Shop Drawings, Product Data and Samples within 7 days, provided a Schedule for Submission of Shop Drawings and Samples has been submitted and agreed upon, and will return them to the Contractor with the results of the review noted thereon. Notations by the Engineers which increase contract cost or time of completion shall be brought to the Project Engineer's attention for approval before proceeding with the Work. Each submittals will be noted with the appropriate action as follows:
- “A” ACTION means that fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.
- “B” ACTION means that fabrication, manufacture, or construction may proceed providing submittal complies with the Engineer's notations and the Contract Documents.
- If, for any reason, Contractor cannot comply with the notations, the Contractor shall resubmit as described for submittals stamped “C” ACTION.
- “C” ACTION means that submittal does not comply with the Contract Documents and that fabrication, manufacture, or construction shall not proceed. Submittals stamped 'C' ACTION are not permitted on job site. Contractor shall make revisions and resubmit.
- 15.5.12 A Color Schedule prepared by the Engineers will be issued by the Project Management after commencement of the Work. The Main Contractor and his subcontractors including Specialist Suppliers shall cooperate in furnishing required color samples to aid in the final selection. Where special colors are selected by the Owner and Engineers, accurate reproductions of these colors are to be furnished on the base material to which the colors will be applied on the Work. These samples are to be submitted for review in accordance with the procedures set out above.

15.6 System Design Criteria

15.6.1 Code

- a. Applicable local ordinances of the City or Municipal.

- b. Fire Code of the Philippines.
- c. Uniform Building Code.

15.6.2 Standard

- a. Underwriters Laboratories (UL)
- b. American Society for Testing and Material (ASTM)
- c. American National Standard Institute (ANSI)
- d. National Electrical Manufacturer's Association (NEMA)
- e. American Society of Mechanical Engineers (ASME)
- f. Factory Mutual (FM)
- g. National Fire Protection Association (NFPA)

Proof of conformance shall be submitted to the Project Manager for approval.

Nothing contained in these specifications or shown on the drawings shall be constructed as to conflict with national and local ordinances or laws of the Philippines. All such laws and ordinances form part of this specification.

15.6.3 Hazard Classification

Hydraulic design will be based on light hazard occupancy.

15.7 Service and Maintenance During Defects Liability Period

15.7.1 During the Defects Liability Period, in addition to requirements included in applicable specifications, the Fire Protection Contractor shall be entirely responsible for:

- a. Carrying out regular inspections and full servicing of all plant installed under this specification.
- b. Providing a "call-out" service for breakdowns, at any time during the "Plant Operating Hours" specified below.

15.7.2 If during the Defects Liability Period any item of equipment should fail as a result of lack of proper serving, faulty materials or workmanship, or defective equipment design, then promptly replace all such equipment at no cost and with minimum inconvenience to the Owner.

- a. Allow to work overtime to meet this requirement.
- b. Where overseas equipment is involved, allow to air freight out any parts needed.
- c. If, during the Defects Liability Period, systems and/or equipment cease to operate within the design parameters for the Work, then promptly attend to such deficiencies and rectify them without delay.
- d. The cost of providing the above service shall be included in the bid.

15.7.3 The Contractor's order for the following specified equipment shall include the warranty service for same, for the duration of the specified Defects Liability Period. This is to ensure that the manufacturer is responsible for the servicing of his own equipment.

- a. Fire pumps

b. Sprinkler System Components.

15.7.4 Maintenance Work - General

Perform the minimum maintenance work specified herein, and any additional work needed to keep the plant in sound condition and operating satisfactorily, including work recommended by the manufacturers of items of plant and accessories, leaving all of the plant installed under this specification in perfect operating condition at the end of the Maintenance Period.

15.7.5 Maintenance Schedule

- a. Prepare a specially-formulated Maintenance Schedule for this Project which shall be used for each maintenance visit and present a complete record of the work carried out during the visit and the condition of the plant at the time. The latter shall be detailed by special remarks and listed readings of all instrumentation.
- b. It shall be based on the minimum requirements detailed in the pursuing clauses.
- c. The schedule shall be headed by the visit number, the month for which it is prepared, the names of services personnel attending and commencement time and date, followed by a signature of an authorized Owner representative.
- d. From here on, the schedule shall go into the detailed functions of the maintenance routine listing in the preferred sequence of plant rooms and plant areas each and every item of fire protection plant contained in those areas or places the necessary inspection, adjustment or service functions for each individual item of equipment
- e. It is suggested that the sequence of plant areas be arranged in a logical manner avoiding lengthy walks forward and backwards between areas.
- f. The Schedule shall also indicate visit numbers at certain types of equipment, electrical systems, controls, etc. which are not serviced monthly, by at 3, 6, 12 month intervals and at which number these services should occur.
- g. Separate reports for specialist services shall be submitted directly to the Owner.
- h. At the end of the Schedule, provisions shall be made for the serviceman's signature, departure time, Owner's representative signature sought at departure time and a list of items differed for attention at another time prior to the next visit.
- i. Submit a draft copy of this Schedule prior to the date of practical completion for approval.
- j. Provide a copy of each signed service sheet as the service is completed. Before Final Completion is granted, and all retention monies are released, it will be necessary to have provided the requisite number of service sheets as determined by the length of the Defects Liability Period specified.
- k. The Defects Liability Period for this project shall be 12 calendar months from the date of Practical Completion.

- l. A copy of each signed service sheet shall be submitted immediately after each service is completed. If the requisite number of service sheets are not presented, then the Defects Liability Period shall be extended by the number of months that the sheets have not been presented for.

15.7.6 Quarterly

- a. Obtain from the Owner a report on the system operation and problems incurred. List the main items.
- b. Lubricate all bearings other than those running in oil baths or provided with forced lubrication, or those not requiring regular lubrication, such as packed ball bearings and nylon bearings.
- c. Check oil levels in all oil baths, crank-cases and the like, and add oil as necessary to restore correct oil level.
- d. Check all drives, adjust tension and alignment if and as necessary.
- e. Ensure that drains from drip-pans, pump glands, etc. are clear.

15.7.7 Monthly

- a. Check all pump glands and adjust when necessary.
- b. Clean all strainers (first month only; quarterly thereafter).
- c. Check all pumps for unusual noises or vibration.

13.7.8 Quarterly

- a. Clean all water strainers.
- b. Service all controls. Systematically check the action of and adjust, calibrate and clean, if necessary, all system components.
- c. Examine all motors for damage and check for over-heating.
- d. Remove dust from all components inside switchboard and clean switchboard.
- e. Operate all valves; close-open-close.
- f. Lubricate all valve stems.
- g. Operate or trip all valve assemblies and alarm signaling devices.
- h. Clean valve and backflow preventor assemblies.
- i. Lubricate nozzles of Fire Department connections.
- j. Log weight and pressure of each container on tag attached to container.
- k. Clean and adjust detectors, alarms, interlocks.

13.7.9 Annualy

- a. Drain lubricating oil and refill to correct level with new oil in accordance with manufacturing recommendations based on hours of operation.
- b. Take oil samples and have them analyzed by a recognized chemical laboratory for acidity and water content.
- c. Investigate and report on causes for all acidic or hydrated oils.
- d. Certify yearly fire pump and transfer switch load tests.

15.8 Instructions and Training for Operation and Maintenance

15.8.1 General

In addition to requirements included in applicable specifications, the Contractor shall be responsible for the instruction and training of operating and maintenance personnel as specified below. Unless otherwise indicated the operating and maintenance instructions shall be given for minimum of ten (10) working days on each complete work described in these specifications and on the drawings.

15.8.2 Operation and Maintenance Trainings

The Contractor shall provide competent instructors for training of personnel designated by the Owner to operate mechanical and electrical building systems and equipment, perform the required preventive maintenance to minimize breakdown, and to perform the necessary repairs when malfunction or breakdown of equipment occurs, training for the periods specified, which shall be completed prior to acceptance of a system or equipment, as applicable. The instructor(s) shall have no other duties during the period of training. Classroom instruction shall not exceed fifty percent (50%) of the total training time, with the balance devoted to on-the-equipment demonstration and familiarization. Emphasis shall be given to both electrical and mechanical features, in accordance with approved training plans.

15.8.3 Arrangements

The training shall be for not less than the periods of time specified, five (5) days per week, and eight (8) hours per day. Each individual training session shall be presented one time only, and shall be scheduled in a manner acceptable to the Owner. The operating and maintenance manuals as specified to be furnished in these Specifications, shall be used as the base material for training.

15.8.4 Scheduling

Contact the Owner for the purpose of preliminary planning, scheduling and coordination of training, to maximize effectiveness of the training program for available operating and maintenance personnel. The outline shall contain sufficient detail to provide a broad indication of the type and scope of training to be given. It shall include, but not be limited to, the following:

a. Fire Protections

1. Sprinkler System On-site training
2. Fire Pump System On-site training

15.8.5 Plan

Submit two (2) copies of proposed training plan for approval not later than ninety (90) calendar days prior to start of any training, and a training and instructions plan which shall include the following:

- a. A weekly outline showing overall form and design of training presentation.
- b. A day-by-day schedule showing time of intervals; the major and subordinate subjects to be covered in each, the name of the instructor(s) and qualification summary of each, and identification of related handouts.
- c. Summary of the number of hours of classroom and on-the-equipment training.

- d. A list of reference materials to be provided to the trainees.
- e. A list and description of the training materials to be used, such as text, visual aids, mock-up, tools, etc.

Provide all training materials except the following: The Owner will provide space, chairs, and table for on-site classroom training.

15.9 Spare Parts

15.9.1 Spare Parts Information

In addition to requirements included in applicable specifications, provide spare parts as specified hereinafter and spare parts information for all equipment furnished under this contract. The information shall be complete, legible, organized, and submitted by system in five (5) copies, and shall include:

- a. A list of spare parts, special tools, and supplies, for each item of equipment, which are either normally furnished at no extra cost with the purchase of the equipment, of specified hereinafter to be furnished as part of the contract.
- b. A complete list of spare parts and supplies recommended by the manufacturer to assure efficient and continuous operation of each item of equipment for a period of one (1) year after final completion and acceptance of the entire work under this contract. The list shall show the recommended minimum stockage level for reordering and shall identify all long lead items. A long lead item is defined as any item of equipment which cannot be ready for delivery in less than six months after receipt of order. The lists shall include the following information for each recommended spare part:
 - 1. Manufacturer's Part Name.
 - 2. Manufacturer's Name and Address.
 - 3. Manufacturer's Part Number.
 - 4. Manufacturer's Drawing Number Showing Part.
 - 5. Next Higher Assembly.
 - 6. Equipment Symbol Keyed to Contract Drawings.
 - 7. Recommended Number of Spares.
 - 8. Net Unit Price.
 - 9. Quantity Installed Per Assembly.
 - 10. Lead Time.
 - 11. Shelf Life.
 - 12. Peculiar Cleaning, Calibration, Packaging and Preservation Requirements.
 - 13. Name and Address of the Authorized Spare Parts Representative and Spare Parts Stocking Source Nearest to the Project Site.
 - 14. Alternate Sources of Procurement.
- c. All parts and components data identity shall be based upon the true manufacturer. Nameplates of other manufacturer's or fabricators are

acceptable providing the true source identity remains intact and unobliterated. Any deviation from true source identity shall be subject to the written approval of the Owner. When spare parts are recommended and established by the manufacturer in the form of kits, these repair kits shall be listed in the recommended parts list.

15.9.2 SPARE PARTS

Provide the following spare parts in addition to those included in applicable specifications:

a. Pumps:

1. Bearings with set screw.
2. Packing/Seals.
3. Seal head and seat.
4. Wear ring.
5. Coupling.
6. Two (2) sets of bearings for each pump motor.

16.0 FIRE PUMP AND ACCESSORIES

16.1 Scope

Provide Pumping Equipment for Fire Service complete in all respects as specified herein and indicated on drawings including submittals, shop drawings, fire pumps, jockey pumps, controllers, electrical drives, tests, and all accessories required for complete Pumping Equipment for Fire Service, power wiring and motor starting equipment, control and panels.

16.2 Qualifications

16.2.1 All work shall comply with the following:

- a. National Building Code of the Philippines
- b. Fire Code of the Philippines
- c. Uniform Building Code

16.2.2 The Consultant drawings shall serve as bidding drawings for the general layout of the various items of equipment, accessories, piping and conduit are diagrammatic unless specifically dimensions, and do not necessarily indicate every item required for construction of the work and a complete installation.

16.2.3 No portion of any work requiring a submission to the Consultant for review shall commence until the submission has been reviewed by the Consultant and returned to the Sub-Contractor. All such work shall be in accordance with reviewed documents, and be constructed by tradesmen working from documents bearing the Consultant's stamp and review comments.

16.2.4 Listed and Approved

When the words "listed" and "approved" appear in the Contract Documents, or the Standard Specifications and Codes, they shall be interpreted to require products to bear labels indicating the listing, or approval of items of equipment, components, devices, assemblies and apparatus; by an internationally recognized testing laboratory for the specific service intended.

16.3 Standard Specifications and Codes

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

- a. NFPA-20; Centrifugal Fire Pumps

- b. NFPA-30; Flammable and Combustible Liquids Code
- c. NFPA-31; Installation of Oil Burning Equipment
- d. NFPA-70; National Electrical Code

16.3.2 Materials meeting authoritative standards of other rating agencies and organizations which will ensure an equal or higher quality than standards herein specified will also be accepted.

16.3.3 Comply with these Standard Specifications, including all appendices, as amended by Local Codes. When the word "should" appears in these Standard Specifications, provide all work as required, by substituting the word "shall" in place of "should". Where quantities, sizes or other directions included in the Contract Documents are in excess of the Standard Specifications and Local Codes, the Contract Documents shall govern.

16.3.4 Basis of Design

Reference to proprietary materials/brand names and catalog numbers is to indicate the basis of design when matching performance criteria. Equipment/System selection offered by bidders must provide equal or better performance criteria.

16.4 Service and Instruction

16.4.1 Upon completion of the work and the final Practical Completion Tests, the Contractor shall arrange for representatives of the pump, driver, and controller manufacturers to instruct the Owner's personnel in proper operation, adjustment and maintenance of the Pumping Equipment for Fire Service. This instruction shall be performed by competent, trained, full-time employees of the manufacturers who have a complete working knowledge of the equipment furnished and installed in this project.

16.4.2 At the time of instruction, turn over to the Owner's Representative any special tools and keys needed for the operation, adjustment or resetting of the Pumping Equipment for Fire Service, and any spare mechanical seal kits in a cabinet securely mounted as directed by the Owner's Representative.

16.5 Submittals

16.5.1 General

Submit to the Consultant for review in accordance with the requirements of the Contract Documents, detailed Shop Drawings, Operation and Maintenance Manuals, Product Data and Record Documents.

16.5.2 Shop Drawings

- a. Fire Pump Assembly Unit Contract Booklets: Two bound, tab indexed booklets containing dimensioned prints and schematic wiring diagrams for each pump set, including pump, driver, base and mounting details, controller and all auxiliary devices and components; within ten days of award of contract.
- b. General Arrangement and Installation Drawings: Refer to Section, Fire Sprinkler & Standpipe Systems.

16.5.3 Operation and Maintenance Manuals

Provide five (5) bound copies of data covering model, type and serial numbers, ratings and capacities and listed and approved ranges of service, and a

recommended preventive maintenance program and spare parts inventory for each item of equipment.

- a. Wiring and logic diagrams
- b. Panel layout drawings or illustrations
- c. Manufacturer's catalog sheets
- d. Inspection Agreement, refer to Section, Fire Sprinkler & Standpipe Systems.

16.5.4 Product Data

Product data sheets indicating necessary installation dimensions, materials, accessories, start-up procedures, and performance information. Performance information shall include complete electrical data, certified pump curve, underwriter's labels, pressure ranges and identifying types and numbers. Where pertinent, this data may be provided by standard sales catalog sheets marked to indicate the specific equipment, apparatus or device to be furnished.

- a. Pumps and drivers
- b. Starters and controllers
- c. Test headers, manifolds and metering apparatus
- d. Cabinet enclosures

16.5.5 Record Documents

Inspection and test reports, witnessed by the Owner's Representative and other Authority of jurisdiction shall be submitted to the Consultant within five days of each inspection of test.

- a. Manufacturer's Certified Pump Test Characteristics Curve
- b. Field Acceptance Test reports for each pump and controller set.
- c. Field Acceptance Test reports for each transfer switch

16.6 Instructions to Contractor

16.6.1 Fire Pump Assembly Unit Contract

The pumps, drivers and associated control equipment shall be purchased under a unit contract from the pump manufacturer, or his local authorized representative, and shall include all logic and devices required to signal remote pilot functions and alarms. One (1) fire pump is required in this project. The main pump is an electric motor driven pump located in the fire pump room adjacent to the new fire reserve tank.

16.6.2 Electric Motors

Power for electric motors shall be 230 volts three phase, 60 hertz unless otherwise noted and shown on plan; subject to an allowable fluctuation of plus or minus 10 percent. Motors shall have Class B insulation and continuous duty classification at a minimum service factor of 1.15 based upon a 50°C rise about a 40°C ambient temperature. The motor shall be of the weather protected Type I, for 230 volts and sized so as not to exceed the permissible loading limits of NFPA No. 20 (1983 Edition) at any point on the pump performance curve. Maximum motor HP shall be 40 hp.

16.6.3 Control Cabinet Assemblies

Factory assembled, wired and tested unit assemblies; furnished in drip-proof, steel cabinets bearing labels indicating listed and approved service.

- a. Pressure settings shall be established at the time of Practical Completion and the logic shall include an instantaneous recycle running period timer to keep the pumps operating for the following periods after each pump start, then

automatically shut down if all conditions are normal. Electric fire pumps and jockey pumps: one minute for each 7.5 KW, or fraction thereof; to a maximum time of 7 minutes.

- b. Provide a front mounted trouble alarm bell and an integral terminal blocks for extending wiring to all remote pilot devices and alarms for each pump zone set.
- c. Floor mounted units shall be set upon 150 mm high concrete housekeeping pads.
- d. Terminals shall be provided for connection to BMS. The signal includes for each pump.
 - 1. Status indication (on/off).
 - 2. Motor trip/fault.

16.6.4 Fire Pump Test Connections shall be located inside of the buildings parking area.

16.7 Fire Pumps

16.7.1 Provide electric motor driven vertical turbine fire pumps. Pumps shall be manual pushbutton start and automatic stop and pumps shall be automatic start and automatic stop. Each pump capacity at rated head shall be not less than that indicated in drawing. Each pump shall furnish not less than 150 percent of rated capacity at not less than 65 percent of total rated head. Pumps shall be of the centrifugal water lubricated, vertical shaft turbine type. Maximum pump, motor, and engine speed shall be 188 rad/sec.

16.7.2 Pump Unit Major Accessories

- a. Relief valve and discharge cone tee with wastecone.
- b. Capacity plate.
- c. Automatic air release valve and fittings.
- d. Pressure gauges, 80 mm (3 ½" dia.).
- e. Pressure switch.
- f. Flowmeter, Orifice or Venturi type.
- g. Low water level indicator.

16.8 Electric Fire Pump Controller

16.8.1 Starter shall be combined manual and automatic, 'Wye' Delta closed transition reduced voltage type with a mechanically interlocked isolating switch operable with the door open or closed. Logic shall include the ability to remote signal the following conditions: Fire Pump running, Power Failure, and Trouble Alarm.

16.8.2 Provide the following on the cabinet door

- a. Pilot lights: "POWER ON", "SUPERVISORY VOLTAGE NORMAL" and "TROUBLE ALARM".
- b. Push buttons: "START", "STOP", and "ALARM SILENCE".
- c. Selector switch: "MANUAL-AUTO-OFF".
- d. Pump Lead-lag selector.
- e. Pressure gauge and adjustable pressure switch.
- f. Pump run-hour meter.

16.8.3 Provide auxiliary contacts and terminal blocks for interphase with the building automation system to monitor the fire pump operation.

16.8.4 Provide built-in low reservoir alarm.

16.9 Jockey Pumps

16.9.1 Pressure Maintenance Pump

Provide pump with controller to maintain a pressure of the system. Pump shall be submersible vertical shaft, turbine type with volumetric capacity as specified in the drawing. Pump shutoff pressure shall not exceed the design working pressure of the system. Pump shall draft from the suction supply of the fire pumps on the upstream side of the fire pump suction shutoff valve and shall discharge into the system on the downstream side of the pump discharge gate. Provide approved indicating gate valves of the outside screw and yoke type in the maintenance pump suction and discharge piping. Provide pressure gage and an approved check valve in the maintenance pump discharge outlet.

16.9.2 Jockey Pump major accessories.

- a. Relief valve and discharge tee
- b. Capacity plate
- c. Pressure gauges, 80mm (3½"φ)
- d. Pressure switch

16.10 Jockey Pump Controller

16.10.1 Starter shall be across-the-line type. Logic shall include the ability to remote signal the following conditions: Jockey Pump Running, Power Failure, and Trouble Alarm.

16.10.2 Provide the following on the cabinet door

- a. Pilot lights: "POWER ON", and "TROUBLE ALARM".
- b. Selector switch: "MANUAL-OFF-AUTOMATIC".
- c. Pressure gauge and adjustable pressure switch.
- d. Push Buttons: "START", "STOP".

16.10.3 Provide auxiliary contacts and terminal blocks for interphasing with the building automation system to monitor the jockey pump operation.

16.10.4 Provide built-in low reservoir alarm.

16.11 Fire Pump Test Conditions

16.11.1 Flow Measuring Station

Listed and approved orifice, or venturi type; complete with a calibrated direct reading (in liters per second) manometer gauge, permanently mounted to the structure, including trim valving.

16.12 Maintenance Parts Cabinet

16.12.1 Cabinet Assemblies

Fabricate cabinet from cold-rolled, 1.3 mm furniture steel with 1.0 mm hollow tubular welded flush hairline stainless steel panel door, continuous piano hinge and cam action handle with chrome-plated tumbler lock provide sheet metal interior compartments for the maintenance parts and any special tools for each fire pump. Cabinet shall be shop painted; white enamel interior and ANSI Standard Color, Fire Protection Red exterior.

16.12.2 Identification

Stencil 40 mm high white enamel block type characters reading, "FIRE PUMP MAINTENANCE", on the front. Identify the interior compartment for each

pump's special tools and spare parts, with enamel lettering in red or black characters not less than 5 mm high. Pencil, ink, embossed plastic tape, crayon, etcetera, will not be accepted.

16.13 Protection of Work

16.13.1 Cover all equipment, devices and apparatus to protect against dirt, water, chemical or mechanical damage, both before and after insulation.

16.13.2 Any equipment, devices or apparatus damaged prior to Practical Completion of the work shall be restored to its original condition, or replaced.

16.14 Valve and Alarm Device Schedule

Refer to FIRE SPRINKLER AND STANDPIPE SYSTEMS Section.

16.15 Field Acceptance Tests

16.15.1 The acceptance test and payment for any inspection certificates for each pump installation shall be included in the Fire Pump Assembly Unit Contract and the format of the Field Acceptance Test Report shall conform to Figure A-11.2.6.3(f) of NFPA-20 (1980).

16.15.2 Contractor shall coordinate and schedule the Field Acceptance Tests at a time suitable to the Owner's Representative, the Consultant, the Owner's insurance underwriter, and any other Authorities of jurisdiction. Contractor shall notify the Consultant as to the time of the Field Acceptance Test a minimum of five (5) days in advance of any such tests.

16.15.3 Contractor shall provide all test equipment necessary to determine net pump pressures, rates of flow thru the pump, voltage and ampere readings for electric motor driven pumps and speed. Complete data shall be recorded for each pump set per the following scenario description and this data shall be plotted for comparison on a photocopy of the Manufacturer's Certified Pump Test Characteristic Curve.

- a. Pump running at, or about rated RPM with a flow thru the test measuring apparatus equal to the listed and approved capacity of the pump assembly.
- b. Pump running at, or about rated RPM with a flow thru the test measuring apparatus equal to 150 percent of the listed and approved capacity of the pump assembly.
- c. Pump running at, or about rated RPM with a flow at the hydraulically most remote hose connection equal to the minimum supply for the Class of Standpipe service, plus the minimum Sprinkler water supply.
- d. Electric motor driven pump running at, or about, rated RPM with no flow thru the pump other than as required by the casing relief valve; disconnect normal power at the switchboard to verify automatic transfer to emergency power under load.
- e. Where logic includes lead pump selection, simulate conditions to verify proper sequencing logic.
- f. Any other conditions as required by the Owner's underwriter and other authorities of jurisdiction.
- g. Jointed test with other trades e.g. BMS, electrical emergency test, fire alarm subcontractors etc.

16.16 Painting

16.16.1 Priming

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

16.16.2 Finish Painting

Refer to Section, PAINTING. Do not paint name plates, labels, placards, tags, stainless steel or plated times as valve stems, motor shafts, levers, handles, trim strips, etc. Exposed and visible piping, equipment, devices and apparatus in Fire Sprinkler and Standpipe systems shall be ANSI Standard Color, Fire Protection Red; except as directed otherwise by the Consultant.

16.16.3 Identification

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

17.0 MECHANICAL AND AIRCONDITIONING

17.1 Work Included

All work under these specifications shall consist of furnishing and/or installing all labor, materials, tools and all services necessary unless otherwise indicated to complete and make ready for operation, the mechanical systems of ITEM 1300 described herein and/or indicated in the Electrical Plans except for Owner-furnished equipment and fixtures in accordance with the electrical plans and these specifications. In general the work under this section shall include but not be limited to the following items:

- 17.1.1 Supply and installation of packaged air cooled air conditioning units, single split type and multiple split type air conditioning system including piping, ductworks, dampers and diffusers.
- 17.1.2 Furnish and install new exhaust ventilation fans as shown on plan.
- 17.1.3 Finishing works, such as painting of supports, brackets and hangers as required waterproof sealing of all penetrations to exterior walls.
- 17.1.4 Insulation, ductwork, air filters, grilles, louvers, equipment concrete pads and Supports, volume dampers accessories as specified or shown in the drawings.
- 17.1.5 Testing, balancing, and commissioning of the mechanical system.
- 17.1.6 Vibration Isolators for equipment, piping and ductwork as indicated in the drawings.
- 17.1.7 Electrical wiring from the equipment to designated circuit breaker/pull box/ convenience outlet.
- 17.1.8 Dismantling and removal of portions of existing air conditioning system inclusive of equipment and ductwork, piping as indicated in the drawings.

17.1.9 Restoration of building structure affected by the abovementioned mechanical works.

17.2 Work Not Included

The following items of work shall be supplied by the Owner but to be installed by the Electrical Contractor or respective trade contractors or suppliers.

15.2.1 Supply and installation of field supplied motor starters, Motor Control Center (MCC) panel, circuit breaker, pull box and convenience outlet. All controller panels shall be suitable for outdoor use.

17.3 Submittals

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

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

17.4 Drawings and Specification

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

17.5 Standard Compliance

When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), Air Movement and Control Association, Inc. (AMCA), American Refrigeration Institute (ARI), and Underwriters' Laboratories (UL), proof of such conformance shall be submitted to the Engineers for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization which is competent to perform acceptable testing and

is approved by the Owner or his authorized representative. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval. The certificate shall identify the manufacturer, the product, and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the reference standards listed.

17.6 Codes, Inspection, Permits and Fees

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

- i. Philippine National Building Code
- ii. Regulations of the Local Municipality

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

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

17.7 Operation and Maintenance Manual

Furnish an operation and maintenance manual for each item of equipment. Furnish three copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual prior to the time that the equipment are performed and furnish the remaining manuals before the contract is completed. Inscribe the following identification on the cover: the words OPERATION AND MAINTENANCE MANUAL, the name and location of equipment or the building, the name of the Contractor, and the contract number. The manual shall include the names, addresses, and the telephone numbers of each subcontractor installing the equipment, and of the local representatives for each item of equipment. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include : wiring and control diagrams with data to explain detailed operation and control of each item of equipment; a control sequence describing start-up, operation and shutdown; description of the function of each principal item of equipment; the procedure for starting; the procedure for operating; shutdown instructions; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range, and frequency, safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list. The parts list for equipment shall indicate the sources of supply, recommended spare parts, and the service organizations which is reasonably convenient to the project site. The manual shall be complete in all respect for equipment, controls, accessories, and associated appurtenances provided.

17.8 Posted Operating Instructions

Furnish approved operating instructions for each system and principal item of equipment for the use of the operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal item of equipment. Operating instructions shall be printed or engraved and shall be framed under glass or in an approved laminated plastic and posted where

directed by the Owner. Operating instructions shall be attached to or posted adjacent to each principal item of equipment and include directions for start up, proper adjustment, operating, lubrication, shut down, safety precautions, procedure in the event of equipment failure, and other areas as recommended by the manufacturer of each item of equipment. Operating instructions exposed to the weather shall be made of weatherproof materials or shall be suitably enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

17.9 Safety

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

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

17.10 Instruction to Owner's Personnel

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

17.11 Delivery and Storage

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

17.12 Materials and Products

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

completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures.

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

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

17.13 Manufacturer's Recommendations

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

17.14 Electrical Requirements

Electrical components of mechanical equipment and systems such as motors, starters, and controls shall be provided under this Division and shall be as specified herein and as necessary for complete and operable system. Extended voltage range motors will not be permitted. Interconnecting wiring for components of packaged equipment shall be provided as an integral part of the equipment. All interconnecting power wiring and conduit for field erected equipment and all control wiring rated at 100 volts or higher and conduit shall comply with applicable sections of the Philippine Electrical Code. Control wiring rated under 100 volts and conduit shall be as specified in Division 15. Motor control equipment forming part of motor control centers or switchgear assemblies and all necessary conduit wiring connecting such assemblies, centers, or other power sources to mechanical equipment shall conform to Electrical Standards and Codes. The mechanical contractor shall provide all power wiring from the motor control center to the motor or equipment. The Mechanical Contractor shall terminate the power supply to the MCC from the electrical disconnect provided by the Electrical Contractor to the MCC's main breaker.

17.14.1 Electrical Motors

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

Technical data shall be submitted for approval before the equipment is purchased. All motors 3 horsepower and larger shall operate on 230 volts, 3 phase, 60 hertz, alternating current except as otherwise listed. All motors below 3 horsepower shall operate on 230 volts, single phase, 60 hertz, alternating current except as otherwise listed.

Generally, all motors shall be at constant speed, squirrel-cage type motors and energy efficient. Single phase motors shall be capacitor start induction-run or

split phase type as approved for the service. All belt-connected motors shall have adjustable bases and set screws to maintain proper belt tension, and shall be provided with proper belt guards. All motors installed by this contractor shall be of one manufacturer.

All motors and accessories shall comply in all respect with NEMA Standards. Types shall be as required by Local Code. All motors shall be furnished with type "B" insulation and tropical fungus proofing according to NEMA standards.

17.14.2 Electrical Motor Control

The Electrical Contractor shall install the power wirings up to the circuit breaker/pull box/convenience outlet. The Mechanical Contractor will power wire from the disconnect switch up to the motor starters, controllers and up to the motors furnished as part of the Air Conditioning and Ventilating work. Remote push button control for all heating, ventilating, and air conditioning equipment shall be furnished and installed and wired completely by the Mechanical Contractor.

All starters for use with motor horsepower below 1/2 horsepower rated 230 volts, single phase, shall be of the manual motor switch type with thermal overloads except where interlocking duty is required, in which case, starters shall be single phase combination magnetic type with circuit breaker. All starters for use with motors rated 1/2 horsepower and above shall be combination magnetic type with circuit breaker except where motor comes equipped with magnetic starter only, in which case, circuit breaker with a rating as shown in the plans or as required by the equipment shall be furnished by this Contractor. All magnetic starters shall incorporate thermal overloads in all three legs and low voltage release protection. Motors 7 1/2 horsepower and above shall have reduced voltage soft starter unless otherwise stated. Below 7 1/2 horsepower, motors shall be full voltage starting unless stated otherwise.

For motors requiring electric interlock, remote control or sequence-starting control features, starters shall be equipped with the necessary auxiliary contacts or terminals to provide the control features required. A separate set of terminals is required for each control circuit. Such starters shall be provided with "run-stop-auto" selector switches. Other starters shall have start-stop push-button mounted on the cover.

Except where otherwise specified, enclosures shall be sheet metal with hinged cover, NEMA type, for general purpose indoor application. Starters shall be arranged for wall mounting. Enclosure for outdoor shall be NEMA type rated for seaside application.

Pilot lights shall be provided for all starters where the equipment is not visible from the starter. Where the starter is not within sight of the equipment, a lock out button or unfused disconnect switch shall be provided. Where possible, relays and switches which are part of the automatic control system shall be mounted on the same panel as the corresponding motor starters.

This Contractor shall furnish detailed wiring diagrams and furnish all information necessary to ensure the proper connection, operation and control of motorized equipment.

All magnetic starters shall be provided with extra dry contacts, one normally open and one normally closed for interphasing with the Building Management System (BMS).

17.14.3 Electrical Wiring

The Mechanical Contractor will erect all starting equipment furnished under this Section of the Specifications, except starters specified to be factory mounted and wired as part of the equipment, and will do all wiring necessary to supply power to the electric motors including connections from the starters and disconnect switches. Wiring in connection with thermostatic control items, remote push button control of air conditioning equipment and motor interlocks shall be installed by this Contractor.

This Contractor shall arrange for and be responsible for supervising and coordinating the electrical connection to ensure correct installation for satisfactory operation.

All wiring terminations to control panel and equipment shall be properly tagged for easy identification.

17.15 Equipment Supports

The Mechanical Contractor shall provide all equipment supports and bases except concrete pads and foundation of the mechanical equipment supplied in this contract. The contractor shall be responsible for the proper coordination with the main contractor of the location of these supports.

17.16 Single Split Type and Multiple Split Type Air-Conditioning System

Basic general requirements shall be as specified in section 15050 "Basic Mechanical Materials and Methods". Capacity of equipment shall not be less than that indicated. In the NFPA standards and SMACNA manuals referred herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears.

Reference to the "authority having jurisdiction" shall be interpreted to mean the Project Manager.

17.17 Corrosion Prevention

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

17.18 Safety Standards

- a. Design, Manufacture and Installation of Mechanical Refrigeration Equipment: ASHRAE Safety Code for Mechanical Refrigeration.
- b. Machinery Guards: Fully guard drive mechanisms, or other moving parts. Provide guards fabricated of steel and expanded metal, rigidly mounted, and readily removed without disassembly.

17.19 Products

17.19.1 Refrigerant Piping

- a. Refrigerant piping shall be type L hard drawn seamless copper suitable for a working pressure of 2413 kPa. Fittings shall be wrought copper or brass designed for use with high temperature solder and suitable for working

pressure of not less than 2413 kPa. Joints from soldered to threaded joints shall be made with standard adapter fittings using high temperature solder. Pipes or tubing shall be cut accurately to measurements established at the building lines. All piping shall be laid straight and no pipe or tubing shall be laid against other metal without insulation. After cutting, the tubing shall be reamed, all burns removed and the internal surfaces thoroughly cleaned. While soldering pipes and fittings together a sweep the internal surface of the tubing to avoid the formation of oxide inside.

- b. Condensate drain piping shall be of PVC pipe and sized to liberally dispose of the condensate to the nearest floor drain. A P-trap with a clean out plug shall be provided at the outlet for each drain pan.
- c. Pipe supports, and hangers shall be provided and fabricated in a workmanlike manner out of steel angles, rods and flat bars. Metal to metal contact between pipes and hangers must be voided by providing 3mm thick rubber in between. Supports on horizontal lines shall be spaced at not more than 1.80 meters on center. All pipings must be properly anchored so that no stress is placed on equipment connection by expansion.
- d. Pipe sleeves shall be of standard steel pipes with sufficient diameter to provide a minimum clearance of 6mm around the insulation. Pipe sleeves shall be installed not be permitted to pass thru

17.19.2 Valves, Dehydrators and Sight Glasses

- a. Refrigerant valves shall be installed in the suction and discharge lines adjacent to the compressor unless built-in valves are furnished and in the liquid line on the discharge side of the condenser. The valves shall be wrought copper or brass for use with R-22 and suitable for a working pressure of 2413 kPa.
- b. Thermostatic expansion valves of the proper capacity shall be installed in the refrigerant supply line to the evaporator. They shall be of the diaphragm type, externally equalized and must be of such optimum size as to maintain a fully active evaporator operation under all load conditions and yet reduce the possibility of flooding refrigerant to the compressor during light loads.
- c. Solenoid valves shall be installed where required and shall be designed for the operating pressure of the system. Valve capacities shall be based on a pressure drop across them not exceeding 21 kPa.
- d. Dehydrators in combination with strainers shall be installed on the refrigerant line on the inlet side of the thermostatic expansion valve and solenoid valves. They shall have brass or copper bodies designed for a working pressure of 2413 kPa. The dehydrator shall consist of solidified and activated alumina or silica gel capable of absorbing moisture, acids, and other products of oil decomposition. The strainer element shall consist of fine mesh monel screen.
- e. Sight glasses shall be a combination liquid and moisture indicator and shall be installed in the refrigerant lines to indicate whether or not the system is properly charged and whether or not the refrigerant in the system is dry.

17.19.3 Refrigerant Piping Insulation

Piping insulation shall be applied on all refrigerant suction lines and condensate drain lines. Insulation material shall be flexible elastomeric pipe

insulation 19 mm thick. Joints shall be sealed with appropriate contact adhesive. For pipes installed outdoors a weather-resistant protective finish is to be applied.

17.19.4 Equipment

17.19.4.1 Single Split Type Air-Conditioning Unit

a. The single packaged cooling unit shall be of the split type arrangement and applicable for duct system installation or direct ceiling mounting, as shown in the plans. Unit shall have factory-supplied piping and shall also consist of either an evaporator section or fan coil unit and an air-cooled condensing unit, or a fan coil unit with compressor/s and an air cooled condenser.

17.19.4.2 The evaporator section shall consist of the following components:

- a. Cooling coil shall be constructed of 13mm OD (1/2 inch OD) copper tubing mechanically bonded to aluminum plate fins. It shall be of the cartridge type and shall have sufficient surface area to meet the performance requirement set forth in the plans. The coil section shall be insulated with 25mm thick neoprene-coated fiberglass secured to the casing with water-proof adhesive and permanent fasteners.
- b. The fan section shall be constructed of heavy-gauge galvanized steel with rigid structural members for supporting the blower and motor. Blower shall be of the forward-curved type. Fan wheels shall be designed for continuous operation at the maximum rated fan speed for filter replacement.
- c. Filter section shall be capable of accepting 50mm thick replaceable filters. It shall have access panels for filter replacement.
- d. The condensate drain pan shall be heavy gauge corrosion protected steel with threaded drain connection on both sides and shall fully extend under the coil section. It shall be insulated with moisture resistant insulation with thickness suitable for the service, faced with aluminum vapor barrier, cemented between the outer steel pan. The pan shall be finished with a coating of corrosion resistant asphaltic based materials.
- e. Where indicated in the equipment schedule, the evaporator section shall contain single or two circuit cooling coil.

17.19.4.3 Air Cooled Condensing Unit and Air Cooled Condenser

- a. Air cooled condensing units shall be factory assembled and tested and shall consist of semi-hermetic reciprocating or rotary compressors, condensing coils, propeller type fans, vibration isolators, and pre-wired controls. Air cooled condensers shall be same except without compressors.
- b. Compressor shall be rated to operate at not more than 1750 rpm at full load. Units shall be equipped with reversible oil pumps, shut-off valves, oil level, sight glass, high and low pressure cut-outs, safety switch and crankcase heaters.

- c. Condensing coils shall be seamless copper tubing with mechanically bonded aluminum plate fins. Coil size, refrigerant circuiting and number of rows deep shall be compatible with the compressor displacement and capacity at the specified operating conditions with minimum refrigerant pressure drop.
- d. Condenser fans shall be statistically and dynamically balanced and shall be driven by totally enclosed and inherently protected motors. Motor mounting shall be of the resilient type to prevent undue vibration.
- e. Motor starters, control components and power terminal shall be grouped in an accessible control box inside the unit casing. Electrical component shall be protected by group fuses. Compressor protection devices shall be included and pre-wired with the control circuit. Control shall include automatic relays to prevent compressor short cycling.
- f. Casing shall be suitable for outdoor installation.

17.19.4.4 Multiple System Air Conditioning Unit

The air-conditioning equipment shall be air-cooled consisting of one outdoor unit and several indoor units, each having capability to cool independently of requirements of the rooms. Equipment shall operate on variable refrigerant flow system.

The condensing unit shall be equipped with inverter controller, to enable it to reduce minimum load down to 20% of the total. The system shall be able to reduce to its minimum load without having to utilize any hot gas by-pass system.

The condensing unit shall be suitable for mix-match connection to double and multiflow ceiling mounted type indoor units as shown on the drawing.

The system shall allow the refrigerant piping to be extended up to 100 meter length. In installation where there is level difference, 50 meter piping shall be allowable without any oil traps.

Both indoor unit and outdoor unit shall be factory assembled, tested and charged with refrigerant at the factory.

Indoor Unit

Each fan-coil unit shall be of the ceiling mounted, ceiling ducted, ceiling suspended floor mounted or wall mounted type as specified in the Drawing.

Each fan-coil unit shall be equipped with a self diagnosis remote controller and having the features of setting of room temperature (with digital indicator of room set temperature), timer air discharge direction (for cassette units), fan speed selections and self diagnosis circuit with malfunction code display.

All models except the floor mounted fan coil units shall have the facility for wireless remote function.

Ducted units shall have adequate external static pressure for connection to ductwork as shown on the Drawings.

Cross Fin Evaporator: The cross fin evaporator coil shall be constructed from strong clean copper tubes bonded to aluminum fins suitable space to ensure maximum heat transfer. The inlet of the coil shall be factory brazed to an electronic control valve. The face velocity shall be exceptionally low to ensure quiet operation.

The cross fin coil shall be designed to ensure highly efficient performance. Fin pitch shall not be less than 2.0 mm.

Electronic Control Valve: An electronic expansion valve shall be factory brazed to the inlet of the coil. It shall modulate the refrigerant volume continuously in response to load variations of the room thus maintaining a precise and constant room temperature within 0.5 °C.

Evaporator Fan: The evaporator fan shall be of the dual suction multi-blade type with its length designed to match the coil width. The fan shall be statistically and dynamically balanced to ensure low noise and vibration free operations. It shall be directly driven by a 2 speed induction motor. For ceiling ducted unit, the fan shall be able to develop the static pressure of the system as shown in the Drawing. The motor shall operate on 230 volts single phase 60 cycles.

Outdoor Unit

The air cooled condensing unit shall be factory assembled housed in a sturdy weatherproof casing constructed from rust-proof mild steel panels coated with polyester powder. The condensing unit shall be designed to operate safely when connected to multiple fan-coil units that have a combined operating nominal capacity varying from 8% to 130% of nominal compressors capacity. The noise level shall not be more than 57 dBA measured horizontally 1 m away and 1.5 m above ground. The condensing unit shall come equipped with one or two hermetically sealed scroll compressor. The condensing unit shall be modular in design allowing side by side installation.

- a) Compressor: The compressor shall be of high efficiency hermetically sealed scroll compressor, equipped with Inverter control to change the speed linearly to match closely the room load requirement.
- b) Condenser Assembly: The air cooled condenser shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil. The condenser shall have large face area to minimize noise and give a high EER for heat transfer efficiency performance. Condenser Fins & tube shall have durable anti-corrosion protection against sea coastal environment.
- c) Condenser Fan and Motor: The condenser fan shall be of multi-blade lowspeed low noise level type made from pressed out aluminum and dynamically and statistically balanced for minimum noise and vibration. The condenser fan shall be directly coupled to an induction motor. The axis of the fan shall be perpendicular to the face of the condenser to ensure smooth

air flow. The condenser fan and motor shall be of the high efficiency type with minimum power consumption.

- d) Refrigerant Circuit: The refrigerant circuit shall include an accumulator, liquid and gas shut-off valves, solenoid valves and an electronic expansion valve. All necessary safety devices to ensure the safety operation of the system.
- e) Accumulator: The cylindrical accumulator shall be constructed from mild steel plates pressed into shape. The accumulator shall have sufficient capacity to prevent any liquid refrigerant from flowing back into the compressor suction
- f) Safety Devices: The following safety devices shall be part of the condensing unit: high pressure switch, fuse, crankcase heater, fusible plug, over current relay for compressor, thermal protectors, recycling guard timer.
- g) Pressure Testing: The complete refrigerant circuit shall be subjected to a pressure test of 2.8 kg/cm² for at least 24 hours without any drop in pressure.
- h) Pipe Material: The refrigerant pipe shall be of de-oxidized phosphorous seamless copper pipe conforming to ASTM Standard or approved equivalent.
- i) Oil Recovery System: Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigerant piping (piping installed with oil traps are not acceptable).

1) Controls

The control system shall be connected by using 2-wire multiplex transmission system that links a single outdoor unit to multiple indoor unit with a 2-core cable. In addition, the control system shall come equipped with automatic address setting function. An automatic checking function for connection error of wiring and piping shall come standard with the system.

Computerized control shall be used to maintain a correct room temperature with minimum power consumption. Unit shall be equipped with its own 2 speed and controller, timer on/off switch, thermostat and LED indicators.

Soft Starters: All condensing units shall be of soft-start type to ensure low starting current.

The inverter compressor shall be able to start at the minimum load and gradually increase to the required frequency according to the actual load requirement.

A recycling guard timer shall be provided to prevent the compressor to restart again immediately after it was stopped.

2) Service Valve

A stop valve shall be provided on the branch pipe for both inlet and outlet of each fancoil unit for servicing purposes.

The valve shall be diaphragm type and employing highly durable stainless diaphragm suitable for refrigerant used.

Insulation shall be provided for the body of the stop valves, similar to that specified under pipe insulation.

All stop valve shall be able to withstand a test pressure of 54 kg/cm² and an operating pressure of 10 to 36 mm Hg.

Size and diameter shall be in accordance to the equipment manufacturer's recommendation and the valve shall be supplied by the same.

17.20 Installation

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

17.20.1.1 General

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

17.20.1.2 Unitary Air-Conditioning System

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

17.20.1.3 Electrical Work

Electric motor driven equipment specified herein shall be provided complete with motors, motor starters, and controls. Electrical equipment and wiring shall be in accordance with Section 16050, "Basic Electrical Materials and Methods". Motor starters shall be provided complete with properly sized thermal overload protection and other appurtenances necessary for the motor control wiring required for controls and devices but not indicated.

17.20.1.4 Piping

a. Pipe Sleeves. Pipe sleeves shall be as specified in Sub-section 2.1(d).

- b. Provide refrigerant driers, sight glass liquid indicators, moisture indicators, and strainers in furnished by the manufacturer as part of the equipment.
- c. Locate strainers close to equipment they are to protect. Provide a strainer in the common refrigerant liquid supply to two or more thermal valves in parallel when each thermal valve has a built-in strainer. Install strainers with screen down and in direction of flow as indicated on strainers body.
- d. Solenoid valves shall be installed in horizontal lines with stem vertical and with flow in direction indicated on the valve. If not incorporated as internal part of the valve, provide strainers upstream of the solenoid valve. Provide service valves upstream of the solenoid valve, upstream of the strainer, and downstream of the solenoid valve. Remove the internal parts of the solenoid valve when brazing the valve.

17.20.1.5 Auxiliary Drain Pans, Drain Connections, and Drain Lines

Provide auxiliary drain pans under all drain pans of the units located above finished ceilings or over mechanical or electrical equipment where condensate overflow over unit drain pan may cause damage to ceilings, piping, and equipment below. Provide drain lines for all drain and auxiliary drain pans. Trap the drain from bottom pan of airconditioning units to insure complete pan drainage. Drain lines shall be full size of opening. Traps and piping to drainage disposal points shall conform to Section 15400, "Plumbing Works".

17.20.1.6 Air Filters

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

17.20.1.7 Inspection Plates and Test Holes

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

17.20.1.8 Flashing and Pitch Pockets

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

17.21 Multiple System Air-Conditioning Unit

17.21.1.1 Installation

Installation of all Plant and Equipment shall be carried out under adequate supervision from skilled staff to the relevant codes and standards specified herein.

The Contractor shall be responsible for ensuring that sufficient provision is made to prevent the transmission of vibration from equipment to the supporting structure. This shall be done by rot and vermin-proof flexible connections and anti-vibration mountings of an approved type. Where the design of the structure is in reinforced concrete, supports shall be secured to the structure by means of rodheads, rawbolts or other approved means.

Where the Contractor proposes to secure his supports by other means than to the main structural concrete, he shall consult with the Engineer before proceeding.

17.22 Field and Pitch Pockets

17.22.1.1 Tests

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

a. Leaking Testing

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

b. Evacuation, Dehydration, and Charging

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

c. Start-up and Operation Tests

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

d. Performance Tests

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

e. Sound Tests-Air-Conditioners, Unitary, Split Type

Sound pressure level measurements shall be conducted on units designated by the Owner. Calculate sound power levels by ASHRAE

Systems Handbook and Product Directory. Submit test results and calculations.

17.23 Testing and Inspection

17.23.1.1 Multiple System Air Conditioning Unit

- a. Site Tests: The Contractor shall supply all instruments and equipment necessary to carry out Factory and Site Tests and shall arrange with other contractors for the testing of associated equipment which may affect the performance of the Plant installed under these Works.
- b. Commissioning: Following Site Tests and prior to taking-over of the Works by the Employer, the air-conditioning system shall be balanced by use of the control equipment so as to give the required room temperature, refrigerant flow rates and pressure in all sections of the system served by the said system. The complete air-conditioning system shall be commissioned as a whole.

When the system has been balanced to the satisfaction of the Engineer, it shall be run under complete automatic control for 24 hours continuous operation to ascertain any faults in operation before acceptance and takeover.

Any faults discovered during this time shall be corrected and a further test or tests of 24 hours duration shall be carried out to ensure satisfactory operation, all at the expense of the Contractor.

18.0 PLUMBING, SANITARY AND DRAINAGE WORKS

18.1 Scope of Work

The Contractor shall complete the plumbing and drainage system as shown on the Plans and as specified herein in accordance with the National Plumbing Code of the Philippines and all other applicable local codes.

The Contractor shall execute his branch of work completely, even though some requirements are not contained the specification or indicated on the Plan.

The Contractor shall furnish and perform all skilled and unskilled labor, as well as all materials, piping, fittings, valves, fixtures and appliances necessary and required in doing and completing the entire plumbing and drainage installation. All excess materials, refuse, etc., are to be removed from the premises by him upon completion of his contract.

18.2 Materials

All material, piping, fittings, valves, fixtures and appliances hereinafter specified and shown on the Plans and those which are essential and have not been specified shall be new and of the highest grade and quality, free from defects, such as breaks, flaws, or other imperfections.

18.2.1 Storm Drain

The storm drain is to be constructed of concrete pipe and fittings as indicated in the plans and extended from the connection in the street on the base of all catch basins as shown on the Plan. The joints are to be made of cement mortar consisting of a 50%-50% cement and sand mix.

18.2.2 Drainage Pipes

Plain concrete drain pipe and fittings, T&G for 10-20 centimeters (4" to 8") diameter conforming to ASTM C-14-58; and reinforced concrete drain pipes and fittings for 10 and larger, centrifugal cast or vibrated, T&G conforming to ASTM C-76-59.

18.2.3 Jointing Material

Use the part cement to two (2) parts sand in proportion, with yarning.

18.2.4 Downspout, Fittings and Connections

PVC pipes as indicated in plans.

18.2.5 Roof Drains

Cast iron body, with removable lock type mushroom dome strainer clamping collar with Integral gravel guard, corrosion resistant clamping bolts, bronze expansion joint with graphite asbestos packing. Inside caulk connections, as indicated on the drawings.

18.2.6 Area Drain – Catch Basin

Load-bearing concrete hollow blocks (CHB), or reinforced concrete with R.C. grating covers as shown on the drawings.

18.2.7 Manholes

Manholes for the drainage lines outside the building shall be precast R.C. sections with galvanized steel ladder rungs and cast-iron frame and cover.

18.2.8 Building Storm Drain Connect to Mains

Use concrete wye branch and cleanout, T & G or by the use of junction boxes.

18.2.9 Solid – Waste – Vent Line

All soil stacks are to be constructed of Waste Vent 4" (100mm), unless otherwise indicated on the Plans. Unplasticized Polyvinyl chloride (PVC) pipe and fittings shall be well supported and extended through the roof with at least 150mm from the roof surface. All waste pipes are to be constructed of PVC as approved by C.O. and Architect.

The soil, waste, and vent must be provided with cleanouts to make them accessible, and when completed be subjected to a water test in the presence of a local authority and the Construction Officer.

All drains installed in connection with waterproofed roofs shall be equipped with a clamping device.

When drains are installed in connection with membrane waterproofing, a sheet of 454 grams (16 oz.) copper sheet 30 centimeters square (1 square foot) shall be placed between the layers in an approved manner with hot asphalt, bonded to the membrane.

18.2.10 Sewer Pipe

Plain concrete sewer pipes and fittings, B & S for 100 to 200 millimeters (4" to 8") diameter conforming to ASTM C-14-59 and reinforced concrete sewer pipes and fittings for 300mm (12") and larger, B & S centrifugal cast or vibrated conforming to ASTM C-76-59T.

18.2.11 Yarning Materials

Use Oakum for B & S joint with cement mortar filling the remaining annular space.

18.2.12 Sewer Junction Box

Reinforced concrete with precast concrete cover as shown on the drawings

18.2.13 Soil and Waste Pipes

Use uPVC pipes as called for in the Plans

18.2.14 Vent Pipes

Cast iron soil pipes service weight or uPVC as indicated on the Plans

18.2.15 Shower and Floor Drains

Use high grade strong, tough and even grained metals. No shower floor drains must be on the way of people who may step on them.

18.2.16 Waste Distribution System

The building service is to be extended from the city main with Polyvinyl Chloride (PVC) pipe of extra strong quality and laid on a shelf in the trench of the storm drainage. It is to be equipped with a corporation stop, a curb stop with stop box extended flush with the grade and a meter stop.

18.2.17 Service Pipe from Existing Water Main

Either galvanized iron pipe ASTM schedule 40 with tar coating or approved equivalent as indicated on the Plan.

18.2.18 Pipes for Cold Water Line and Toilet Roughing-In

Polypropylene (PPR) pipes Schedule 40 and/or PVC as indicated on the Plans.

18.2.19 Free Lines for Stand Pipes

G.I. Pipes Screwed Fittings shall be bended galvanized malleable iron, 1.72 Mpa (250 Psi) working pressure.

18.2.20 Unions

Unions on ferrous pipes shall be malleable iron and shall conform to the requirements of U.S. Federal Specifications WW-U0-531, Type B zinc-coated.

18.2.21 Plumbing and Fixture Trim

Plumbing and fixture trim shall be provided complete with fittings. Exposed traps and supply pipes for all fixtures and equipment shall be connected to the rough piping systems at the wall unless otherwise indicated. Floor plates, wall plates and escutcheons shall be as required by the fixtures specified. Straps shall be provided at each fixture. Plumbing fixture compound shall be fixed for fixture connections between earthen ware fixtures and flanges on soil pipe. Closet bolts shall be not less than 8m. The exposed piping, fittings and trimmings shall be chromium-plated or nickel-plated brass with polished bright surfaces.

Water Closet: ANSI A112.19.2; floor-mounted siphon-jet vitreous-china closet bowl, with elongated rim, 1-1/2 inch spud, china bolt caps. C. Flush Rate: the flush rate shall be 1.6 gallons per flush or less.

Or approved equal.

Urinal: ANSI A112.19.2; vitreous china, wall-hung washout urinal with shields, integral trap, removable stainless-steel strainer, 3/4-inch top spud, and steel supporting hanger. Flush Valve: ANSI A112.18.1; exposed, chrome-plated, diaphragm type with oscillating handle, escutcheon, integral screwdriver stop. Flush Rate: Pint unit, the flush rate shall be 1/8 gallons per flush or less.

Or approved equal.

Basin: ANSI A112.19.2; vitreous-china, pedestal mounted lavatory with 4-inch high back, drillings on 4 inch centers, rectangular basin with splash lip, front over flow, and soap depression. Faucet: Two-handle mixing disc valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

Or approved equal.

18.2.22 Valves

All valves shall be of same manufacturer for each class of piping insofar as possible for the entire project. Gate, globe, and angle valves must be of disc type permitting repacking under pressure when wide open.

Gate valves shall be indicated with supervisory switch, OS &Y type.

Provide special tools required for repacking and disassembling valves. Valves should bear manufacturer's permanently affixed stamp for TAG indicating manufacturer, catalog number, pressure, and temperature rating.

18.2.23 Drains

Provide with double drainage flange, perforated or slotted cast bronze or nickel bronze, stainless steel, or chromium plated copper alloy strainer, and adjustable collar. Drains of sizes 50, 80, and 100mm shall have strainers with minimum free drainage area of 3225, 7100, 11,610 square mm, respectively.

18.2.24 G. I. Pipes and Fittings

ASTM A-120/A53 Schedule 40 GI Pipes and Accessories. Fittings shall be malleable iron, class 150, use screwed connection from 12mm dia. to 65mm dia. and flanged connection from 75mm dia. and larger. Apply seal tape, or paint with red oxide paint at all joint lengths. When buried underground, the GI pipe shall be coated with coal tar and wrapped with burlap for corrosion protection.

18.2.25 PVC Pipes and Fittings

Polyvinyl Chloride Piping shall be Series 1000 conforming to ASTM D 2729/ASTM D2665

18.2.26 Polypropylene Pipes and Fittings

Random Type 3, PN 20, high resistance to pressure and temperature, conforming to DIN specifications DIN 8077, DIN 8078, and DIN 16962 forming polyfusion homogenous joint. All threaded inserts should be made of nickel-plated brass conforming to DIN 2999.

18.3 Submittals

Submit samples of fixtures and pipes to Construction Officers (CO) prior to installation. Also submit working drawings upon the dictation of the CO.

18.4 Workmanship

All materials installed are to be concealed in building partitions wherever possible.

All piping must be substantially supported to overcome sagging and be so arranged that it may be easily drained.

18.5 Installation

18.5.1 Storm Drainage System

Provide a complete system of storm drainage piping for all roofs, set-back areas, parking areas and canopies. Connect to the house drainage system at the building wall.

Provide all drains required to conduct rain water from the building surfaces to the storm drainage system, including all of the scheduled drains and any special drains indicated on the Architectural and/or Plumbing Drawings. Take special care in roof drains to assure that they are set at an elevation which will practice the formation of puddles.

Install connectors to roof drains in conjunction with the roofing specified under specification of another trace and at all times as designated by the General Contractor so that the building is adequately protected from damage by storm water during construction, Storm drainage pipes, underdrains, open canals of trenches shall have slopes of not less than 0.005.

Make all branch connections to drainage system "wye" and long "tee-wye" fittings. Do not use short $\frac{1}{4}$ bends, common offsets and double hubs. Use short "tee-wye" fittings, in vertical piping only, and only where space conditions will not permit the use of long turn fittings. Use only fittings that conform to code requirements.

18.5.2 Drain Waste and Vent System

18.5.2.1 House Sewer System

Provide house sewers to conduct the sanitary drainage from the building to the main sewer system, including all piping, trenching, shoring, manholes and/or pumping as required, backfilling, final connection to the main sewers, street openings and repaving as required to make the system complete.

Make the connection to main sewers, open the street and repave in accordance with the requirements of the authorities.

Commence the sewer pipe installation at the connection to the main sewer with all spigot and pointing to the direction of flow. Lay all pipes with ends abutting and in a true line carefully centered from a sewer with uniform inverts.

18.5.2.2 Drainage Vent

Provide ventilating pipes from the various sanitary plumbing fixtures and other equipment which drainage connections are made. Connect ventilating pipes to the discharge of each trap and carry individually to a point above the rim of the fixture before connecting with any other pipe. In general, this will be approximately 1.067 meters (3 feet, 6 inches) above the finish floor. Pitch branch vents back to the fixtures.

Collect individual vent pipes together in branch vent lines and connect to vent stacks, paralleling soil and waste stacks. Whenever possible, vent stack offsets shall be made with 45-degree fittings. Vent stacks shall be connected to adjacent soil stacks at the base of the stacks

Extend the tops of ventilating stacks independently through the roof or collect together and run through the roof in series of larger pipes, as shown on the drawings. Provide roof couplings at a level 45 millimeters (18 inches) above the finished roof to receive flashings.

18.5.3 Cold Water System

Provide a complete cold-water distribution system to supply water to all fixtures, water consuming equipment and valve outlets for the use of other Trades.

The system shall include the required meters and meter accessories.

The water supply system shall be complete with all pipe fittings, valves, meters, trenching, shoring, backfilling, mains, risers, branches, air chambers, controls, hangers, anchors, protective painting, insulation, tests, and the like, all as shown on the drawings, as hereinafter specified and in accordance with the regulations of authorities having jurisdiction.

Provide all metering devices, strainers, test connectors, etc., as required by the authorities and shall obtain approval of the installation without additional cost to the Owner.

Use materials as scheduled.

All equipment used in this system shall have capacities as scheduled.

Adjust all fixtures stops so that flush valves, faucets, etc., function quietly and efficiently before final acceptance by the Owner.

Provide tapping valves, curb valves, boxes and signs where required by the authorities having jurisdiction.

Provide all pipes, fittings, valves, street openings, excavation, backfill, repaving and the like, required to make the system complete.

19.0 RECOMMENDED STANDARDS OF CONSTRUCTION IN ACCORDANCE WITH THE WORLD SQUASH FEDERATION (WSF)

19.1 Match Officials

19.1.1 There shall be space provided for a marker and a referee, who shall be able to see the whole of the court and shall be able to hear the play and the players and be heard by them.

19.1.2 The space for the marker and the referee shall be behind the line of the back wall.

19.2 Spectators

19.2.1 Spectator areas may be located behind the line of any wall of the court.

19.3 Camera Facilities

- 19.3.1 Play may be televised, filmed, photographed or recorded in any way from above the court or through any of the clear walls.
- 19.3.2 No camera or other equipment may project into any part of the court or below the minimum clear height above the court specified in clause 19.4.4 below.
- 19.3.3 Players inside the court should not be distracted by any camera or other equipment, or any persons operating the cameras or other equipment, behind either the front or the side walls during play.
- 19.3.4 Camera panels may be incorporated in any part of the court playing walls provided that any such panel shall be flush with the adjacent wall surfaces on the court side and match as closely as possible the colour of the adjacent surfaces on the court side and conform to 19.3.3
- 19.3.5 Camera panels shall have similar rebound characteristics to the surrounding court playing surface, be fixed in such a way as to withstand indefinitely the impact of the ball, rackets and players in normal play and be constructed of a material (for example safety glass) which will not be liable to cause serious injury to players or spectators if it breaks.

19.4 Court Dimensions & Tolerances

- 19.4.1 Spectator The finished plan dimensions of the International singles court, measured 1000mm above finished floor level, shall be:
 - Length: 9750mm plus or minus 10mm
 - Width: 6400mm plus or minus 10mm
 - Diagonals: 11665mm plus or minus 20mm
- 19.4.2 The finished plan dimensions of the International doubles court, measured 1000mm above finished floor level, shall be:
 - Length: 9750mm plus or minus 10mm
 - Width: 7620mm plus or minus 10mm
 - Diagonals: 12375mm plus or minus 20mm
- 19.4.3 The finished plan dimensions of the International Competition width doubles court measured 1000mm above finished floor level, shall be:
 - Length: 9750mm plus or minus 10mm
 - Width: 8420mm plus or minus 10mm
 - Diagonals: 12883mm plus or minus 20mm
- 19.4.4 For all singles and doubles courts the clear height above finished floor level (i.e. the height to the underside of the lowest obstruction including lights, ventilation grilles etc.) shall be not less than 5640mm above the playing area except that the height may reduce gradually to 5000mm from a point 1000mm away from the front wall and reduce gradually to 4000mm from a point 3000mm away from the back wall.

Notes:

- 1. When designing a court layout it is important to note that the above dimensions are to the internal finished wall playing surfaces and allowance must be made within the building structure for the thickness of plaster or other wall lining materials or panels.
- 2. For existing courts, it is recognised that on occasions where the wall playing surface has deteriorated beyond economic repair then the use of a wall renovation system might be considered. In these circumstances, it is recommended that the court plan dimensions are not reduced by more than 80mm from those noted above.

19.5 Court Markings

19.5.1 Generally

19.5.1.1 All court markings shall be 50mm wide and contrast in colour to adjoining surfaces, all wall markings shall be the same colour and all floor markings shall be the same colour.

19.5.1.2 All court markings shall be straight to within plus or minus 2mm in 3 metres and within +/- 5mm from the stated dimensions.

19.5.1.3 The maximum variation from the correct position of any court marking at any point shall not exceed 5mm, except that the Tin shall not be more than 2mm from the correct height at any point.

19.5.1.4 All vertical dimensions are from the finished floor surface to the underside of wall markings

19.5.2 Front Wall Markings

19.5.2.1 The front wall line - a horizontal line at a height of 4570mm to the underside indicating the height of the play area. Ideally the line should be shaped so as to deflect any ball striking it.

19.5.2.2 The service line – a horizontal line at a height of 1780mm to the underside indicating the lowest height of a service. The line shall be marked on the court surface and shall not deflect any ball striking it.

19.5.2.3 The upper 50mm of the Tin – shall project into the court by not more than 15mm at the top and 45mm at the bottom and shall be shaped so as to deflect any ball striking it and all edges of the Tin shall be rounded. Below the upper 50mm, for the full width of the court, the Tin shall be constructed in such a manner as to make a distinctive noise when struck by the ball.

19.5.2.4 As an alternative to the upper 50mm of the Tin electronic devices may be used providing they emit an audible sound when the ball passes within the 50mm line zone that they replace and be unaffected by external conditions such as vibrations, atmospherics or illuminance variations.

Notes:

1. The standard tin height is 480mm however a lowered tin height of 430mm is preferred for all PSA sanctioned tournaments. Tournaments with a tin height of 480mm may be sanctioned for some PSA tournament levels.
2. For courts where the holding of tournament events is a possibility the use of a tin that can be adjusted between 430mm and 480mm is recommended and if an International Competition width of 8420mm is being provided then the tin height should also be capable of being set at 330mm.

19.5.3 Back Wall Markings

19.5.3.1 the back wall line – a horizontal marking on the back wall at a height of 2130mm to the underside except that if the court has a transparent wall 2130mm high above finished floor level the back wall line shall be omitted.

19.5.3.2 if the court has a transparent back wall which is 2180mm or more high above finished wall level, the back wall line shall be marked on the inside (court) face of the wall.

19.5.3.3 if the court has a solid back wall, the back wall line shall ideally be so shaped as to deflect any ball striking it or shall be marked on the bottom edge of a sounding board not less than 200mm deep across the full width of the court. Any such sounding board

may project up to 5mm into the court.

19.5.4 Side Wall Markings

19.5.4.1 The side wall line – a diagonal line joining the ends of the front wall line and the back wall line. If the back wall line is omitted as allowed above, the side wall line shall join the ends of the front wall and an imaginary back wall line. The side wall lines shall not project into the court but should ideally be so shaped as to deflect any balls striking them.

19.5.5 Floor Markings

19.5.5.1 the short line – shall be parallel to the front and back walls of the court. The distance to the nearest edge of the Short Line from the back wall shall be 4260mm. The Short Line shall be marked for the full width of the court.

19.5.5.2 the half court Line - shall be parallel to and equidistant from the side walls. It shall run from the back wall to the Short Line.

19.5.5.3 the service boxes - one on each side of the court behind the Short Line. Each service box shall be square with internal sides of 1600mm and shall be bounded on three sides by lines and bounded on the fourth side by one of the side walls.

19.5.5.4 court markings on the floor shall be flush with the finish and be anti-slip.

19.6 Court Walls

19.6.1 Tolerances

19.6.1.1 The court Walls shall be vertical to within plus or minus 5mm in a height of 2000mm when measured within 250mm of each corner of the court and at three additional intermediate points evenly spaced along the length of each wall.

19.6.1.2 The walls of the court shall be straight to within plus or minus 15mm in the length of any wall when measured horizontally at a height of 1000mm above finished floor level.

19.6.1.3 The walls of the court shall be plane and have no indentations, holes or open joints of more than 2mm across in any dimension in the plane of the wall

19.6.1.4 The walls of the court shall have no variations from the true surface of more than 3mm when measured in any direction with an 1800mm long straight edge.

19.6.2 Construction

19.6.2.1 Each wall of the court shall be of the same construction over the whole of the playing area except as allowed under 3.00 above. Adjacent walls need not be of the same construction.

19.6.2.2 Strength - The walls of the court and all components of them shall be capable of withstanding all the stresses which may be placed upon them in normal play and shall not suffer any permanent or temporary damage as a result of the impact of balls, rackets or players.

19.6.2.3 Impact - The impact of players is defined as equivalent to that of a human body with a mass of 100kg and a coefficient of absorption of 47% (i.e. 47% of the impact energy is absorbed by the body and 53% transmitted to the wall), travelling at the moment of impact at a speed of 4.5 metres per second and

striking the wall at right angles to it over an area of not more than 0.25 square metres at a height to the centre of the impact area of 1.47 metres (plus or minus 50mm) over the whole of its length.

19.6.2.4 Deflection – The walls of the court shall not deflect under the impact of the ball in normal play to such an extent that the rebound of the ball is affected.

19.6.2.5 The walls may deflect due to the impact of players if it is necessary for their structural integrity however they should not deflect to such an extent or in such a manner so as to affect the safety of the players, officials or spectators.

19.6.2.6 Any wall which deflects as above wall shall return to its original static position within one second of the initial impact and shall not suffer any breakage nor any permanent or temporary damage as a result of the deflection.

19.6.3 Finishes

19.6.3.1 All playing walls of the court shall have a hard smooth finish.

19.6.3.2 Reflectance - the average reflectance of the front and side walls shall not be less than 50% at any point when in a clean condition.

19.6.3.36 The reflectance of the front and side walls shall not vary at any point by more than plus or minus 5% of the average reflectance.

19.6.3.4 Ball Rebound – The ball shall rebound truly on striking all parts of the playing walls. The ball rebound shall be consistent over the whole area of each wall, see Note 2 below for Accredited products.

19.6.3.5 Surface Friction - All wall surfaces including transparent materials shall have surface friction such that the pace and wall angle characteristics are similar to that encountered in a plaster court.

19.6.3.6 Joints in Playing Surfaces - Any joint in the finish of a wall or panel shall:

- ☐ not deflect the rebound of the ball in any way
- ☐ not be wider than 2mm in the plane of the wall surface
- ☐ be constructed in such a manner as to ensure that adjacent areas of the finish cannot move relative to one another at right angles to the plane of the wall following the impact of the ball, a racket or a player.

Notes:

1. The WSF Accreditation scheme requires that the wall surface be guaranteed for 5 years of normal competitive use and from January 2017 will carry out independent accelerated wear tests on all existing and potential accredited products.
2. The WSF Accreditation Scheme tests wall surfaces for consistency of rebound using a pendulum hammer device.

19.6.4 Junctions

19.6.4.1 Wall to Wall Junctions - There shall be no protrusions of any kind into the court at the junction of one wall with another.

19.6.4.2 Wall to Floor Junctions - There shall be no protrusion of any kind into the court at the junction of any wall of the court with the floor. An expansion joint may be provided at the junction of any

wall of the court with the floor, but this shall not exceed 6mm in any dimension or at any point where the adjoining surfaces meet except that where, for technical reasons, the floor playing surface requires perimeter ventilation then the joint shall not exceed 12mm.

19.6.5 Moveable Walls

19.6.5.1 Where courts are provided with moveable walls these walls shall comply in all respects with the general requirements of the Court Specification as if they are of a permanent construction.

19.6.5.2 It is recognised that moveable walls require construction tolerances to ensure safe and effective operation, movement joints may be provided as follows:

- a horizontal movement joint between the moveable wall and the floor no greater than 12mm when the wall is in the fixed position

- a vertical movement joint between the moveable wall and the adjoining side and back walls no greater than 15mm when the wall is in the fixed position.

19.6.6 Transparent Walls

19.6.6.1 Where courts have transparent walls they shall be constructed of safety materials tested in accordance with the appropriate national standard to a test energy equivalent to that defined in 19.6.2.3 above and shall meet the stated requirements for safe breakage.

19.6.6.2 In the absence of an appropriate National Standard the requirements of BS EN 12600:2000 and North American ANSI Z97.1 1984 are among those considered acceptable.

19.6.6.3 Transparent walls shall comply with all other aspects of clause 19.6 including construction, surface friction and general playing characteristics.

19.6.6.4 Any front or side walls, or any transparent panel in the playing surface of the front or side walls, shall be treated and/or lit in such a manner as to make it non-reflecting when viewed from inside the court.

19.6.6.5 It is important that when glass or other transparent materials are used for side walls or front walls of a squash court then the surface is treated in such a way as to enhance both player ball visibility and spectator viewing by providing a form of 'one way vision'.

Note:

Clause 19.6.6.5 is mandatory for Accredited glass or other transparent side and front walls.

19.7 The Door

19.7.1 Position of the Door

It is recommended that the door to the court is located in the middle of the back wall, but in any event should be in the middle third area of the court and shall open into the court.

19.7.2 Inside Surface of the Door

The inside surface of the door shall be plain and shall be flush with the adjacent wall surfaces when the door is closed. It shall be fitted with a flush

handle and a restraining device which shall stop the door opening through 180 degrees and hitting the court wall.

The door shall match the colour, texture and ball rebound characteristics of the adjacent wall surfaces as closely as possible and shall be fitted with a latch or other mechanism which will prevent the door opening following an impact of a player with it on the court side.

19.7.3 Size of the Door

The door shall be between 750mm and 900mm wide by 2130mm high except when disabled access is required in which case it may be increased to 1000mm subject to technical appraisal by the manufacturer and compliance with clause

19.6.2 when transparent materials are being used.

19.7.4 Finger Traps with Transparent Doors

The amount by which the edge of any transparent door, or adjacent transparent panel, deflects relative to any part of the frame or edge of any adjacent panel following an impact as specified in Clause 6.02.03 shall not exceed:-

- ☐ the thickness of the transparent panel plus 2mm at an impact velocity of 3 metres per second

- ☐ the thickness of the transparent panel plus 12mm at an impact velocity of 4.5 metres per second.

Note:

The WSF Accreditation Scheme requires that all transparent doors are fitted with 3 point restraint on the closing side and doors 1000mm wide or above are fitted with 3 point restraint on both sides

19.8 The Floor

19.8.1 Surface Finish

The floor shall be hard, smooth, have limited spring and provide a firm footing in normal play.

19.8.2 The floor shall either be:-

- ☐ able to absorb small amounts of moisture without becoming slippery or

- ☐ if provided with an impervious surface be tested in accordance with Appropriate National Standards to demonstrate adequate slip resistance.

19.8.3 In the absence of any National Standards the requirements of the BS EN 14904:2006 is considered acceptable.

19.8.4 The floor shall be kept clean of all rubber, dust particles and other depositions which may reduce its slip resistance.

19.8.5 When viewed from vertically above the line of flight of the ball, the linear path of the ball shall not be affected when it bounces on the floor.

19.8.6 Colour Reflectance

- ☐ The floor shall have a matt finish.

- ☐ The floor shall have a natural wood finish or be otherwise coloured as below with a minimum reflectance value of 50% + or - 10%.

Notes

1. Whilst it is not uncommon to leave a court floor unsealed this does make the surface susceptible to staining from dirt, blood injuries and other deposits as well as making the surface more difficult to clean. A number of manufacturers pre-treat their floor products in factory controlled conditions which provides protection to the playing surface but still ensures the floor surface maintains its slip resistance.

2. The Professional Squash Association (PSA) issue guidelines for Court preparation in connection with Tournament play which includes a section on establishing the suitability of the court floor as regards slip resistance.

3. For Tournament play it is common to use a white ball so that it contrasts with the wall playing surface and is more visible for media transmission. In these circumstances it is also necessary to have a darker coloured floor surface with a suggested reflectance value no higher than 25%.

19.9 The Ceiling & Out of Court Areas

19.9.1 Shape of the Ceiling

19.9.1.1 The ceiling shall be a simple shape against which the players shall be able to sight the ball without difficulty.

19.9.1.2 The clear height above the court to the underside of the ceiling shall be 5640mm above however may be reduced to the area above the front and rear of the court as clause 19.4.4 above.

19.9.2 Ceiling Finish

The ceiling shall have a plain matt finish and shall be a light colour against which the players shall be able to sight the ball without difficulty. The minimum reflectance value shall be 80% as below and for the purposes of this paragraph the ceiling shall include all areas in view from the court against which players may have to sight the ball.

Note:

Where 4-sided glass courts are used in a stadium setting the ceiling is usually part of the building enclosure rather than part of the court. In these circumstances Clause 19.2 as regards reflectance values will not apply.

19.9.3 Roof Lights

There shall be no windows or other areas of glazing over any part of the court.

If windows are provided in any walls above or adjoining the court they shall be provided with blinds.

19.9.4 Out of Court Wall Areas

The walls of the court may be extended upwards as required but shall not project into the space above the court. Any wall so extended upwards shall have a plain matt finish and shall be white or a light colour against which the players shall be able to sight the ball without difficulty with a minimum reflectance value of 50% as below.

19.10 The Use of Colour & Designs

19.10.1 There shall be no more than three different colours on the wall playing surfaces within the court.

19.10.2 Each of the side walls shall be of one colour and each side wall shall be the same colour.

19.10.3 The front wall may be two colours, one below and one above the service line.

19.10.4 The front wall colours need not be the same colour as the side wall colours.

19.10.5 The floor shall have no more than two colours and each colour shall be bounded on at least two sides by the floor markings. The use of colours shall be symmetrical about the half court line. Natural wood materials shall be

considered to be of one colour providing the whole complies with clause 19.10.5.

19.10.6 All colours shall have a minimum reflectance value of 50% and all colours shall

be of the same reflectance value + or - 10%.

19.10.7 Colours will be permitted on all new and existing courts providing that the average illumination does not fall below the recommended standard of 500 lux or the minimum standard of 300 lux.

19.10.8 Out of court wall surfaces shall have a reflectance value the same or higher than any of the colours used on the play wall surfaces.

19.10.9 The ceiling shall have a minimum reflectance value of 80%.

19.10.10 Stripes or patterns of any type will not be permitted on the wall playing surfaces except on the back wall up to a height of 750mm and on the front wall at a minimum height of 3600mm above the floor where a logo, club or sponsors name may be used providing it is not more than 750mm square and is located central on the front wall.

19.10.11 A logo, club or sponsors name on the floor will not normally be permitted however individual designs may be specifically approved by the WSF upon request.

19.10.12 The minimum reflectance value of any of the colours used in any logo or name shall be 30%.

19.10.13 The Tin, below the top 50mm, may be of any colour and contain advertising, logos, club or sponsors names providing no part has a reflectance value of less than 30%.

19.10.14 The court play lines may be any colour providing they contrast with all colours used on adjoining play surfaces. Wall play lines need not be the same colour as floor play lines.

19.10.15 Patterns and coaching aids on either the floor or the walls will not normally be permitted however individual designs may be specifically approved by the WSF upon request and following play testing to determine ball visibility.

19.10.16 All lines colours or other markings on the floor shall be anti-slip in accordance with the Squash Court Specification.

19.11 Lighting

19.11.1 Court Lighting Installation

The court shall be lit by artificial light. The level of illumination measured 1000mm above the finished floor shall be:-

19.11.1.1 Minimum standard 300 lux

19.11.1.2 Recommended standard 500 lux

19.11.1.3 Recommended standard for LED installation 600 lux

19.11.2 The walls of the court shall be lit in such a way as to appear evenly and uniformly illuminated and the lux levels shall not vary at any point by more than 15% from the average level of illumination.

19.11.3 The lighting shall be shadow-free and free from any visible stroboscopic effects.

19.11.4 In courts with transparent walls, the level of illumination outside of the court will need to be adjusted to suit specific site conditions. In normal circumstances a glass back wall needs lighting levels to be the same both side of the glass whereas in 4-sided courts the lighting level inside the court needs

to be higher than immediately outside the court. A difference of approximately 30% is considered to be a normal installation

19.11.5 The use of LED Lamps & Fittings

19.11.5.1 LED lamps provide a significant increase in light output per fitting and are considerably cheaper to run than other lamps. Since the recommended standard of 500 lux can be achieved with fewer fittings the variation in the level of illumination is likely to be greater than permitted by clause 11.02.

19.11.5.2 It is therefore recommended that a minimum of 6 LED fittings be provided in a singles court and 8 in a doubles court so as to provide an even distribution of light

19.11.5.3 It is recommended that the LED lamps be in the colour temperature range of 3,500 degree K or above commonly referenced as 'cool white'.

19.11.6 Lighting for TV Transmission

There are no set standards for the lighting levels required for TV transmission however 1200 lux should be considered a minimum and advice sought from proposed TV providers on an individual basis when transmission is anticipated.

Note:

The majority of tournament play attracting TV transmission will involve the participation of professional players. Advice should therefore also be sought from the Professional Squash Association (the PSA)

19.12 Heating & Ventilation

19.12.1 Temperature

19.12.1.1 It is recommended that a Squash court and any adjacent spectator areas including the space for the marker and referee) shall be provided with a heating and/or air conditioning system which is capable of maintaining a temperature of between 15 and 25 degrees Celsius with an ideal range of 18 to 20 degrees Celsius.

19.12.1.2 Local variations in external temperature and humidity may result in temperatures outside of the above ranges being acceptable to players.

19.12.2 Ventilation System

19.12.2.1 The court and any adjacent spectator areas (including the space for the marker and referee) shall be provided with a ventilation system which shall provide not less than four complete air changes per hour when the court is in use.

19.12.3 Condensation

19.12.3.1 The court walls and floor shall be constructed, insulated, heated and/or ventilated in such a way as to ensure that they remain free of condensation when the court and any adjacent spectator area is in use.

19.12.4 Location of Grilles & Other Equipment

19.12.4.1 The only part of the court which may be used as a location for any heating or ventilation equipment shall be below the top 50mm of the Tin on the front wall, provided that the sounding

characteristics are maintained and that there are no projections into the court.

19.12.4.2 No part of any heating or ventilating or other equipment may project into the clear space above the court required by clause 19.4.4 of this Specification, excepting that equipment may be mounted on the front wall above the playing surface provided that:

☐ no part of any such equipment is less than 5000mm above the floor level in the court nor projects into the court outside of the triangle formed by the reduced height above the front wall

☐ no part of any such equipment projects more than 150mm into the clear space above the court

☐ no shadows are thrown onto the front wall

20.0 HEALTH AND SAFETY

General Guidelines

In compliance with Section 17 of DOLE D. O. No. 13, the implementation of construction safety shall be considered in all stages of project procurement (design, estimate, and construction) and its cost shall be integrated to the overall project cost under Pay Item "SPL- Construction Safety and Health" as a lump sum amount, to be quantified in the detailed estimate. Likewise, all requirements, provisions, and instructions pertaining to the implementation of Construction Safety and Health in every project shall be included in the project bidding documents specifically under the Instructions to Bidders.

Further considering industry practices and applicable government requirements, the following guidelines are hereby issued to all concerned:

20.1 Definition of Terms

As used herein, the terms below shall be defined as follows:

a. Occupational Safety and Health – As defined is the:

- 1) Promotion and maintenance of the highest degree of physical, mental, and social well-being of workers in all occupation;
- 2) Prevention among its workers of any departures from health caused by their working conditions;
- 3) Protection among workers in their employment from risk usually from factors adverse to health; and
- 4) Placing and maintenance of worker in an environment adopted to his/her psychological ability.

b. Occupational Safety and Health Standard (OSHS)

By the powers vested in the Department of Labor and Employment under Article 162 of the Labor Code of the Philippines, the Occupational Safety and Health Standards (OSHS) was promulgated for the guidance and compliance of all concerned with the main objective of protecting every workingman against the dangers of injury, sickness or death through safe and healthful working conditions, thereby assuring the conservation of valuable manpower resources and the preservation of loss or damage to lives and properties, consistent with national development goals and with the State's commitment for the development of every worker as a complete human being.

Likewise, further described as: rules and regulations implementing Article 162 (Safety and Health Standards), Book IV, Title I, P. 0.442; set of mandatory OSH standards which codifies all safety orders being enforced prior to its promulgation; and - contains administrative requirements, general safety and health rules, technical safety regulations, and other measures to eliminate or reduce OSH hazards in the work place.

c. Construction Safety and Health Standards – shall mean Rule 1410, Construction Safety and other relevant rules of the Occupational Safety and Health Standards (as amended) of the Department of Labor and Employment (DOLE).

d. Construction Safety and Health Program– refers to a set of detailed rules to cover the processes and practices that should be utilized in a specific construction site in conformity with the OSHS including the personnel responsible and the penalties for violations thereof.

e. Construction Safety and Health Officer – refers to safety personnel or any employee/worker trained by his employer to implement occupational safety and health programs in accordance with the provisions of DOLE D.O. No. 13 and the Occupational Safety and Health Standards (OSHS).

f. Personal Protective Equipment (PPE) and Devices – are equipment and devices designed to protect employees from workplace injuries or illness resulting from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. It also includes variety of devices and garments such as face shields, safety glasses, hard hats, safety shoes, goggles, coveralls, gloves, vests, earplugs, respirators, safety harness and lifelines.

20.2 Purpose

The purpose of these guidelines is to establish a uniform methodology in estimating the required resources (manpower and equipment) for the implementation of Construction Safety and Health Standards in the workplace in compliance with the provisions of DOLE D.O. No. 13.

20.3 Methodology

The minimum construction safety and health requirements for project shall be prepared during the detailed engineering stage.

In order to establish a uniform basis for estimating the required quantity of resources (manpower and equipment) for a project the following methodology shall be used.

a. Construction Safety and Health Program (CSHP)

Section 5 of the DOLE D.O. NO.13 provides that every construction project shall have a suitable Construction Safety and Health Program (CSHP).

For the purpose of these guidelines, all projects regardless of amount, funding source and mode of implementation shall comply with the minimum safety and health requirements.

The contractor's proposed CSHP shall be in accordance with DOLE D.O. No. 13, series of 1998 and its Procedural Guidelines to be submitted as part of the first envelope (Technical Proposal) during the bidding process and later the winning bidder shall submit the same for approval of the DPWH authority, subject to concurrence by DOLEBWC.

For project to be implemented by administration, a CSHP shall also be prepared by the DPWH Implementing Office in accordance with the requirements of DOLE

D. O. No. 13, s. of 1998 and likewise it shall also be submitted to DPWH authority for approval and thereafter to be concurred also by the DOLE-BWC.

The required Construction Safety and Health Program (CSHP) for specific project shall include but not limited to the following:

- a. composition of the Safety and Health personnel responsible for the proper implementation of CSHP;
 - b. specific safety policies which shall be undertaken in the construction site, including frequency of and persons responsible for conducting toolbox and gang meetings;
 - c. penalties and sanctions for violations of the Construction Safety and Health Program;
 - d. frequency, content and persons responsible for orienting, instructing and training all workers at the site with regard to the Construction Safety and Health Program which they operate; and
 - e. the manner of disposing waste arising from the construction.
- b. Construction Safety and Health Organization

To ensure that the Construction Safety and Health Program are observed and implemented at the project site, at the start of D.O. No. 56 s. 2005 construction, each site shall have an established construction safety and health organization composed of the following personnel:

b.1 Safety Engineer/Officer

Section 7.1 of D.O. NO.13 states that "The general contractor must provide for a full time Officer, who shall be assigned as the General Construction Safety and Health Officer to oversee full time the overall management of the Construction Safety and Health Program".

Section 7.2 states that " The general contractor must provide for additional Construction Safety and Health Officer/s in accordance with the requirements for Safety Man / Officer of Rule 1033, Training and

Personnel Complement, as amended by DOLE D.O. No. 16 depending on the total number of personnel assigned to the construction project site, to oversee the effective compliance with the Construction Safety and Health Program at the site, under the direct supervision of the General Construction Safety and Health Officer".

For the purpose of these guidelines, and as recommended by DOLE, for every construction project with 100 and above workers, an accredited safety officer by DOLE-BWC shall be employed. Only the cost for the Construction Safety and Health Officer, whether on full time or part time basis, actually assigned at the construction site shall be included in the cost estimate.

On the part of the government, the implementing office shall designate as part of their project staff a Safety Engineer who shall be responsible for ensuring compliance with the pertinent DOLE Guidelines as well as the DPWH Guidelines on Occupational Safety and Health during the execution of the construction. The counterpart safety and health officer of the contractor shall closely coordinate and report to the government Safety Engineer.

b.2 Health Personnel

Rule 1412.01 of OSHS states that "at every construction site there shall be an organized and maintained medical and dental health service and personnel' conforming with Rule 1960 Occupational Health Services.

For the purpose of these guidelines only the medical and dental practitioners actually assigned in the project site and as required on the above stated Rule shall be included in the total cost of safety.

Manpower rates shall be based on the prevailing rates of such professionals in the area which is found favorable to the government.

Employment period shall be based on the approved project duration and shall be adjusted correspondingly as the duration increases/decreases.

c. Personal Protective Equipment and Devices (PPE)

Section 6 (Personal Protective Equipment) of D. O. No. 13 guidelines states that "every employer shall, at his own expense, furnish his workers with protective equipment for eyes, face, hands and feet, lifeline, safety belt/harness, protective shields and barriers whenever necessary by reason of the hazardous work process or environment, chemical or radiological or other mechanical irritants of hazards capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical agent".

All Personal Protective Equipment and Devices shall be in accordance with the requirement of the Occupational Safety and Health Standards (OSHS) and should pass the test conducted and/or standards sets by the Occupational Safety and Health Center (OSHC).

For General Construction Work the required Basic PPEs for all workers shall be Safety Helmet, Safety Gloves and Safety Shoes. Specialty PPEs shall be provided to workers in addition to or in lieu of the corresponding basic PPE as the work or activity requires.

d. Signages and Barricades

Construction Safety Signages and Barricades shall be provided as a precaution and to advise the workers and the general public of the hazards existing in the worksite.

For road construction signages and barricades, it shall be in accordance with or in compliance to Department Circular No.9, Series of 2004 (Re: Road Safety Manuals and Handbooks) particularly on the 'Road Works Safety Manual.

e. Facilities

Section 16 of DOLE D.O. NO.13 requires that the employer shall provide the following welfare facilities in order to ensure humane working conditions;

- a. adequate supply of safe drinking water;
- b. adequate sanitary and washing facilities;
- c. suitable living accommodation for workers, and as may be applicable, for their families; and
- d. separate sanitary, washing and sleeping facilities for men and women workers.

For the purpose of these guidelines, facilities related to construction safety and health shall be in accordance with OSH Standards and the manner of costing shall

be based on previously approved guidelines of the Department, duly quantified as a separate pay item.

f. Safety and Health Training

Section 13 of DOLE D.O. No. 13 requires that the contractor shall provide continuing construction safety and health training to all technical personnel under his employ.

20.4 Costing

In consideration of the cost involved of providing the necessary safety equipment and manpower for an effective implementation of safety in the workplace, and in compliance with DOLE D.O. No. 13, with safety as a separate pay item, the following shall be used as a guide:

a. Personal Protective Equipment

The PPEs shall be provided by the Constructor, and its cost shall be duly quantified and made part of the overall cost of safety and health (SPL). The use of PPEs shall conform to Rule 1080, Personal Protective Equipment and Devices of OSHS.

b. Clinical Materials and Equipment

Clinical materials and equipment such as medicines, beds and linens, other related accessories shall be to the account of the Constructors implementing the project and shall be in accordance with Rule 1960, Occupational Health Services of OSHS.

c. Signages and Barricades

The quantities and cost of signages and barricades necessary for a specific item of work shall be quantified and made part of that particular pay item of work.

For general signages and barricades not included in specific pay item of work but necessary for promoting safety in and around the construction site, the quantities and cost shall be a separate pay item and included in the overall cost of safety and health (SPL).

d. Facilities

Facilities such as portable toilets, waste disposal, sanitary and washing facilities, convenient dwellings and office, adequate lighting, and other facilities related to construction safety and health shall be in accordance with OSH Standards and previously approved guidelines of the Department and shall be quantified and the cost thereof be made a separate pay item under "Facilities for the Engineers" and "Other General Requirements" as required in the DPWH Standard Specifications.

e. Salaries/wages of Health and Safety Personnel

Labor cost for the medical and safety personnel actually assigned in the field shall be included in the overall cost of safety and health (SPL). Duration of employment shall be based on project duration of the particular project.

f. Safety and Health Training

Cost associated for the provision of basic and continuing construction safety and health training to all safety and technical personnel shall be made part of the indirect/overhead cost of the project.

ITEM NUMBER	DESCRIPTION	UNIT OF MEASUREMENT
SPL – 2	Provision on Health and Safety	l.s.

21.0 SECURING OF OCCUPANCY PERMIT

The Occupancy building permits, clearances or licenses (when necessary) shall be provided by the Contractor. The Contractor shall pay all fees and other incidental expenses. The Contractor shall provide as-built plans/drawings (if applicable), duly accomplished construction logbook, certifications and other necessary documents to secure the Occupancy Permit in favor of the Philippine Sports Commission.

22.0 CLEANING / HAULING OF WASTES AND DEBRIS AND CLEANING OF SITE

After final inspection of all the works undertaken, remove all paint stains, temporary structures, installation, unused/scrap materials, wastes and debris. Dispose of them properly.

IV. GENERAL NOTES

The contractor shall be responsible in securing the necessary permits/ licenses (Building, Electrical, Mechanical, Sanitary/Plumbing, Electronics & Communication and Fire Safety) from the Local Government Units (LGU's) and other government agencies in connection with the implementation of the Rehabilitation of RM Badminton Hall.

Other materials and workmanship not included on the above list but found necessary to complete the work shall be for the account of the contractor.

Sub-contractor/ suppliers of major finishing materials (ceiling panel, tile, glass, waterproofing, paint, etc) shall be a local or multi-national company with wholly owned Philippine subsidiary and shall have a similar local project of supply and installation of the above stated materials.

Sub-contractor of major finishing materials (ceiling panel, ceramic tiles, etc.) shall be a member of association of specialists on cleaning and restoration.

The contractor shall be responsible for the safety measures during the implementation of the project and must submit methodologies in every finishing materials required in the project.

Branded materials stated in the plans and specifications is the designer's reference of quality standards.

These products can be replaced provided that the replacement are approved of the same or higher quality.

Restoration of floors, walls, ceiling affected by the Mechanical, Electrical and Communication works outside the area shall be the sole responsibility of the contractor.

The contractor shall coordinate with PSC Project Architects, Engineers and Coordinators in connection with the implementation of the project so as not to hamper with PSC operations.

The contractor is required to have the necessary and appropriate tools, instruments and equipment for the proper implementation of the project.

The contractor shall submit the as built plans to PSC after the completion of the project.

It is assumed that the bidder shall have full knowledge of the work and site condition, shall have reviewed the plans and specifications and bid documents, and thus warrants the availability of the work and materials upon submission of his bid proposal.

The contractor shall coordinate all aspects of the works in order to ensure a harmonious progress without interruptions, delays of modifications to work already completed.

The prospective bidder/ contractor shall possess and submits with the eligibility documents a valid track record in undertaking related works.

All electrical (lighting systems, etc), mechanical (duct facilities, etc.) and electronics and communications facilities and other related facilities/ equipment not included in the program of works that will be affected during the implementation of the project should be restored to their original operating condition/s at no additional cost to PSC authority.

V. PREVENTION OF ACCIDENTS AND PUBLIC NUISANCE

General

The Contractor shall formulate adequate control measures in accordance with the relevant local laws and regulations regarding prevention of accidents, fires and public nuisances during the execution of the work.

The Contractor shall ensure that his workmen are aware, and shall so instruct the workmen, of good and safe working practices.

The Contractor's safety plan shall take into account, among other items, working in Restricted Areas, Contractor's Equipment; hand held power tools; percussion guns; air compressors and hoses; electrical equipment; fuels; use of dust masks, ear protectors, safety helmets and safety lines.

Prevention of Accidents

The Contractor shall formulate a safety plan for work at the Site to provide proper protection, especially at such places in the airfield Restricted Areas.

Pollution Control

The Contractor shall take all necessary steps to minimize noise, vibration, dust, soot, and other pollution resulting from the execution of the work.

VI. PERIOD OF WORK

The Contractor shall complete the work within **one hundred twenty (120) calendar days** upon receipt of the Notice to Proceed. The Contractor shall work **twenty four hours per week (24/7)** to finish the work on time.

VII. WARRANTY PERIOD

The Contractor shall submit a surety bond for a warranty period of one (1) year on materials and workmanship.

Any item found to be defective within the aforementioned period, the contractor shall immediately replace the said item/s at their own expense and no cost to PSC.

Any damage to life and property caused by the contractor operation within the vicinity of the facility covered by the project shall be the sole responsibility of the contractor.

VIII. CONTRACTORS RISK AND WARRANTY SECURITY

1. The Contractor shall assume full responsibility for the works from the time of construction commenced up to final acceptance by the Procuring Entity's Representative/s and shall be held responsible for any damage or destruction of the works except those occasioned by force majeure. The Contractor shall be fully responsible for the safety, protection, security and convenience of his personnel, third parties and public at large, as well as the works, equipment, fabrication and installation and the like to be affected by his construction works and deliveries.
2. The defects liability period shall be one (1) year from the contract completion. The certificate of acceptance shall be issued by PSC after all defects have been corrected.

IX. ACCEPTANCE OF THE PROJECT

Certificate of Acceptance will be issued upon approval of the END USER and the Head of the Procuring Entity.