Project Name:	ONE (1) LOT LABOR AND MATERIALS OF THE PROPOSED CONVERSION OF ODTRU ROOF DECK TO TRAINING AREA
Project Location:	BGHMC COMPOUND, BAGUIO CITY

TECHNICAL SPECIFICATIONS

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PART 1: GENERAL PROVISIONS AND CONDITIONS

1. GENERAL

These specifications shall encompass all the work necessary for the building construction for the Project for Construction of **"ONE (1) LOT LABOR AND MATERIALS OF THE PROPOSED CONVERSION OF ODTRU ROOF DECK TO TRAINING AREA"** and as further defined herein. The work shall include furnishing all labor, materials, equipments, tools, facilities and transportation to complete the project in accordance the drawings and specifications.

The project site is located in BGHMC Compound, Baguio City, Philippines.

The work is implemented by the BGHMC.

Utilities for the temporary facilities shall be borne by the contractor such as, electricity, water and means of communication during the implementation of the Project.

The Project Management Team shall act as the client's representative for the building construction of the Project and provide construction supervisory services in an effort to ensure compliance by the Contractor with the contract document.

2. DEFINITIONS

The" Project"	means the Project for the "ONE (1) LOT LABOR AND MATERIALS OF THE PROPOSED CONVERSION OF ODTRU ROOF DECK TO TRAINING AREA" to be located at BGHMC Compound, Baguio City.
The "Client"	means the Baguio General Hospital and Medical Center, and shall include any person or persons authorized to act in behalf BGHMC
The "PMT"	means the Project Management Team which consist of engineers and architects hired by BGHMC to oversee the construction of the Project and shall include any person or persons authorized to act on behalf of the client.
The "BGHMC Project Manager"	means the person Designated by the Project Management Team as the over-all project manager who's tasked to coordinated with the contractor's technical personnel, end-users, suppliers and other persons involved in the project as the PMT representative
The "Work"	comprises the completed construction required in the tender documents and includes all labor, services, materials and equipments incorporated in the construction.
The "Contractor"	means the construction firm or company who has been awarded the contract by the client by due process of law and includes the Contractor's personal representatives, successors and authorized assigns.
The "Supplier"	means the person, persons or company where in the materials and equipments are awarded for the supply and installation if any.

3. CONTRACT DOCUMENTS

Unless otherwise when clearly described, the drawings have the priority to the Specifications; the general notes in the drawings and subsequent design drawings shall prevail over the provisions described in the Specifications herein in case of discrepancies.

4. PERMITS AND LICENSES

The Contractor shall secure all the permits, except for the Building permission undertaken by the Client and licenses necessary for progression of work and negotiate and obtain permission with the related authorities.

5. WORKMANSHIP AND SAFETY

The Contractor shall so conduct his operations as to work in harmony with the various trades involved and so conduct his work as not to endanger, damage, or interfere with or delay the operations of the Client and the Supplier during the Contractor carrying out all operations in connection with this contract.

Specially, the Contractor shall cooperate with the Supplier and coordinate his work with that of the latter with regard to the installation and testing of all the equipments.

The Contractor shall provide adequate temporary barracks and communal/sanitary facilities for his constituent or employee including health and insurances as defined under the National Labor Code and Safety.

6. PRESENCE OF THE PMT

Where so required in the Specifications, the Contractor shall carry out the work in the presence of the PMT representative.

The Contractor shall ask the PMT if his attendance to inspect required for any work, inspection is impossible or difficult after completion of the work, in the course of the work.

7. MEASUREMENT SYSTEM

The measurement system for the work shall be metric system.

8. APPLICABLE STANDARDS AND CODES

The National Building Code of the Philippines and its implementing rules and regulations
The Fire Code of the Philippines and Regulations
Japanese Industrial Standards (JIS)
American National Standards (ANSI)
International Electrical Commission (IEC)
National Structural Code of the Philippines (NSCP)
International Organization for Standardization (ISO)
American Society of Testing Materials (ASTM)
National Fire Protection Association (NFPA)
National Organization of Building Officials (NCBO)
National Bureau of Standards (NBS)
National Electrical Code of the Philippines (NEC)
Sanitation Code of the Philippines (SCP)
Plumbing Code of the Philippines (PCP)
General Specifications for Building Construction Works

9. MATERIALS AND GOODS

Unless otherwise specified, all materials and goods shall be new and unused and all workmanship and materials shall meet and conform to the standards specified in the relevant sections of these Specifications. The Contractor shall carry out inspection of the materials to be used immediately upon the delivery to the site and shall promptly report the result of the inspection, any damage or substandard materials to the PMT. The PMT will judge whether they are satisfactory based on these Specifications. The materials and goods which are judged by the PMT unsatisfactory must not be used and be promptly removed from the site.

10. SAMPLES

The Contractor shall furnish for the approval of the PMT, with reasonable promptness all samples as specified in the relevant sections of these Specifications or as directed by the PMT. The work shall be in accordance with approved samples clearly marked must be kept on site at all times until final approval of the workmanship or fixing of the materials to which they apply.

11. APPROVAL OF MANUFACTURERS

The Contractor shall submit to the PMT for his approval a list of materials and equipments to be used and their manufacturer.

Where a name of trade firm or supplier is specified in the Contract Documents, no other products or services of other firms may be used. A substitution may be used subject to the PMT's written approval where it is in all respects equal or superior to the original specification.

12. SHOP DRAWINGS

The Contractor shall check and verify all site measurements and shall submit three (3) shop or setting out drawings and schedules with such promptness as to cause no delay in his own work or in that of any contractors. All of shop drawings shall be done by professional and shop draftsmen.

No Work shall commence before the approval of the PMT on such drawings and schedules.

The Contractor shall submit shop drawings for review by the PMT on a regular basis before required for construction or manufacturing.

The Contractor shall inform the PMT of any discrepancies or contradictions found in the Contract Documents, prepare proposals for resolving the problem.

Prior to every shop drawing, the Contractor shall submit the General Shop Drawings,1:50 scale plans and interior elevations and ceiling reflected plans drawn all visible things including electrical, plumbing, air-conditioning and ventilation works.

All shop drawings shall be reduced to A3 size bond paper and be submitted to the PMT upon completion of the work.

Shop drawings are subjected to be drawn computer aided. Data of working drawings will be allowed to be used for reference of them.

13. TEST AND INSPECTIONS

Each part of the Work shall be inspected and tested to confirm that the workmanship is satisfactory for the requirements specified in the design documents at each stage of the work or when so directed by the PMT.

The Contractor shall consult with the PMT as to the program of the inspection and test and shall ask the PMT's attendance to the inspection and test. Upon the practical completion of the work, the Contractor shall, in the presence of the PMT, inspect and test the whole of the works to confirm that all the work done is in conformity with the requirements specified in the design documents.

Any defects found during this inspection shall be repaired to the satisfaction of the PMT before the agreed repairing period is over.

All concrete test cylinders, water and reinforcing bars shall be tested at an authorized testing laboratory approved by the PMT and tested with the presence of the PMT representative/s.

All manufacturers' instructions must be strictly observed and adhered to with respect to workmanship, handling and conditions at time of installation or application.

The Contractor shall record the results of each inspection and test and submit them for the PMT's approval without undue delay.

14. RECORDS, REPORTS AND CONFIRMATION

The Contractor shall take photographs of the Site before starting the construction and keep detailed records as specified below and as directed by the PMT and submit diurnally to the PMT for his approval. Photographs shall be taken by digital camera and be submitted by data too.

Daily Weather Conditions
Progress of Work including photographs showing the progress
Delivery of materials and equipment
Site labor time sheets
Details of all visitors to the site

The Contractor shall always be requested to confirm and inspect whole process of the work and shall report that process and inspection record in writing before requesting the inspection by the PMT without failure. No exception shall be accepted.

The Contractor shall submit from time to time to the PMT reports, notices and other documents as specified in the Specifications and as directed by the PMT such as,

Notification of commencement and information of works
Manufacturer's List
General Work Schedule
Monthly Progress Reports
Work Diary
Detailed Work Schedule
Shop Drawings and Construction Details
Test Results
Daily Activities Report (Submitted Weekly and signed by Contractor and Client representative)

15. CONSTRUCTION AND INSURANCES

The Contractor shall at its expense buy and maintain the following insurance effective during the performance of the Contract such as, Erection All Risk Insurance, Third party Liability Insurance and Workers' Compensation.

15. REPORTS AND SUBMITTALS

The Contractor shall submit to the PMT their daily activity reports every last working day of the week. Use format shown below.

COMPANY NAME AND LOGO

DAILY ACTIVIES REPORT

PROJECT:
PROJECT LOCATION:
DATE:

WEATHER CHART			
TIME:	REMARKS	TIME	REMARKS
7:00 AM	FAIR	7:00 PM	NR
8:00 AM	FAIR	8:00 PM	NR
9:00 AM	FAIR	9:00 PM	NR
10:00 AM	FAIR	10:00 PM	NR
11:00 AM	RAINY	11:00 PM	NR
12:00 PM	RAINY	12:00 AM	NR
1:00 PM	FAIR	1:00 AM	NR
2:00 PM	FAIR	2:00 AM	NR
3:00 PM	FAIR	3:00 AM	NR
4:00 PM	FAIR	4:00 AM	NR
5:00 PM	FAIR	5:00 AM	NR
6:00 PM	FAIR	6:00 AM	NR

EQUIPMENT			
ITEM	DESCRIPTION	QUANTITY	UNIT
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

MANPOWER					
Qty	Description	Qty	Description	Qty	Description
1	Engineer	5	painter		
3	Mason/tile settler				
2	labor				

ACTIVITIES		ACCOMPLISHED	
ITEM	ACTIVITY DESCRIPTION	QUANTITY	UNIT
1			
2			
3			
4			

PROBLEM ENCOUNTERED										
1										
2										
3										

SUPPLEMENT PICTURES

* Daily Activity Report Format

QUALITY REQUIREMENTS:

A. This Section specifies administrative and procedural requirements for quality control services that are to be performed by the Contractor and his subcontractors for all aspects of project coordination, administration, monitoring and execution. This procedure requires that the Contractor establish an independent internal team staffed apart from the Contractors
administrative team whose sole responsibility is to provide quality assurance monitoring and quality control reporting and implementation of specified standards. This independent team
shall act as a separate audit and shall report to the Project Manager and Contractor's administrative staff on a weekly basis covering all aspects of work or preparation for work not yet began and implementation of repair works and monitoring of repair.

PART II: PRELIMINARY WORKS

A. GENERAL

This section covers the requirements for providing all the temporary work at the Project Site. The work shall include all labor, materials, equipment, tools and transportation necessary to complete the temporary work specified herein.

B. TEMPORARY CONSTRUCTION AND FACILITIES

The Contractor shall provide and maintain all temporary construction and facilities necessary to complete the Work as shown on the drawings and as specified herein. All temporary installation used for the work shall be removed after completion of the Work.

C. BENCH MARK

The Contractor shall relate his site level to the nearest official Benchmark established by the Municipal Government. Should this prove impractical then the Contractor shall refer to site datum level benchmark to be established inside the site boundary in the presence of the PMT, where it shall rigidly set in position and where it can remain undisturbed during the whole progress of the Work and be provided with adequate protection. It shall be adequately maintained and inspected at regular intervals.

D. PREVENTION OF ACCIDENTS

It is a standard procedure for the Contractor to maintain proper safety inside and around the premises of the job site for his employees, constituents and pedestrians. Adequate gadget for fire and other ways and means shall be readily available at all times in case of emergency and disaster.

PART III: EARTHWORKS WORKS AND SITE WORKS

A. GENERAL

This section covers the requirements for performing all filling works, excavation required for the construction of footing and foundations, the subsequent backfilling of excavated materials to the designated grade, the disposal of all excavated materials not required for backfill, foundation sub grade works, the preparation of hard core for pavements and other related items necessary to complete the Work indicated on the drawings and specified herein.

Items of works shall include but not limited to the following

a. Excavation
b. Removal of excess ground water
c. Fills and backfill
d. Disposal of excess excavated materials
e. Preparation of hard core
f. Foundation sub-grade work
g. Termite control

B. SAFETY MEASURE

The Contractor shall survey the existing condition of the site and the adjacent areas noting the subsurface condition and water table level, and shall take proper safety measure not to adversely affect the site condition.

C. FILLS

PREPARATION OF SITE

Grass, stumps, masonry, rubbish, weeds and other unsuitable materials shall be removed from the construction site. In case of low lying area, mud shall be removed.

FILLING MATERIALS

Sand, earth such as clay loam and laterite, or their combination without rubbish, chemicals weeds and other unsuitable materials can be used for fills subject to the PMT's approval.

PROCEDURE

a. If earth is used, every layer of 30 cm in depth shall be compacted by roller weighing not less than 3 tons. In case of wet soil tamper shall be used for compaction.

b. If sand is used, every layer of 30 cm in depth shall be compacted by rollers weighing not less than 3 tons, using water. In case of low lying area where sand could be wash away, clay embankment shall be used to confine sand.

COMPACTION

Compacted layer of fill material shall have an in-place density not less than 96 % of maximum density.

LEVEL

The surface of the finished fill shall be flat and level and shall have correct elevation as specified. After finishing fill, level and elevation of the fill shall be inspected and shall be obtained PMT's approval.

D. EXCAVATION

Prior to the start of excavation, the Contractor shall survey the filled site level and verify the designated datum level in the presence of the PMT's representative/s.

All excavation shall be carried out with and adequate angle of repose to avoid the Collapse of ground material. The slope shall be properly protected to the satisfaction of the PMT during the excavation work.

During the excavation work, any settlement or movement of the site or adjacent land and any changes in bearing capacity or water table level shall be recorded and be informed to the PMT as require. If any adverse effects are found as the result of such measurement, the Contractor shall report it to the PMT and shall take proper safety measures without delay.

In the event the excavation work encounters unexpected obstacles, the Contractor shall keep the PMT informed and shall take all possible steps to remove such obstacles after checking to see that is safe to do so or suggest, for the PMT's approval, any remedial action required to prevent delay in the progress of the work.

The Contractor shall excavate to the depths and extend indicated on the drawings and allow additional space as required for construction operations and inspections of foundation.

Bottoms of excavations shall be accurately finished level to the grades shown on the drawings or agreed on site. Excavations for footings carried below the specified grades shall be backfilled to grade at no extra charge. Any disturbed portions shall be compacted to equal or exceed the bearing capacity of surrounding areas. When excavation work reaches the designated levels the PMT's approval must be obtained before proceeding with the Work.

If a suitable bearing capacity is not encountered in the subsoil at the depth indicated on the drawings for foundations, the Contractor shall immediately notify the PMT.

E. REMOVAL OF EXCESS GROUND WATER

The Contractor shall keep the whole of the excavations free from water arising from rain, drains, flood, springs or any other cause by pumping, bailing or drainage.

Care shall be taken not to disturb subsoil conditions while providing drainage ditches or pits.

The Contractor shall keep the site clear of water at all times until 30 days after completion of the foundation work.

F. BACKFILL

All soil used for backfilling shall be approve by the PMT.

No backfilling shall be commenced without the prior approval of the PMT. While backfilling, the soil shall be evenly backfilled and have an optimum water content ratio. Every layer or 30 cm in depth or less shall be compacted enough by tamper, roller or hammer.

Compacted layer of fill material shall be tested for every 30 cm in depth and must have an in-place density not less than 96 % of maximum density.

Any portion of soil which cannot be compacted by rollers after backfilling shall be well compacted with a hammer or the like. During backfilling work, care shall be exercised not to damage the structure.

Where residual settlement can be reasonably expected after backfilling, extra fill shall be provided as instructed by the PMT.

G. DISPOSAL OF EXCESS EXCAVATION MATERIAL

Excavated material not required for backfill shall be disposed of by filling site areas, filling in building areas or otherwise as directed. All remaining material shall be evenly spread within the site under the PMT's instructions.

It must be the Contractor's responsibility to secure permits for the disposal locations of excess material excavated.

H. PREPARATION OF HARDCORE

Crushed stones to be used for hard-core shall be of a suitable mixture of grades between 30mm mesh and 50 mm mesh conforming to JIS A 5001 "Crushed Stone of Road Construction." Materials for blinding and making up levels shall be fine crushed stones.
Crushed stones shall be laid on the excavated surface in a thickness as indicated on the drawings and be thoroughly rammed.

I. FOUNDATION SUBGRADE WORK

	RUBBLE SUB-GRADE	
TYPE	THICKNESS	LOCATION
Rubble or crushed stone	150 mm	below on grade Below spread footing
Sand	60 mm	below grade beam

Rubble and gravel shall be well compacted. Rubble sub grade below slabs on grade shall be compacted enough by load roller, vibration roller or other proper tools. Care shall be taken to avoid unfavorable effects on the ground below sub grade work by compaction.

Provide P.E. sheets on top of compacted fill for Slab on fill prior to concrete pouring to serve as moisture and thermal protection.

J. LEAN CONCRETE

Unless otherwise indicated in Bill of Quantities or Plans, the specifications for lean concrete shall be the following:

Compressive strength of concrete: F'c = 14 MPa (28 days' cylinder test)
Proportion : 1:3:6
Thickness : 50 mm
Where used : As indicated on the drawings

For systems and procedure for the Lean Concrete, Chapter IV of this specification shall also apply.

PART IV: STRUCTURAL WORKS

CHAPTER I: CONCRETE WORKS

A. GENERAL

This section covers the requirements for performing all the work required to construct reinforced concrete work at the Clients' project site. The Provision of this specification shall govern wherever applicable except as otherwise provided in the design drawings. In case of conflicting with requirements, the design drawings shall govern.

B. SUBMITTALS

1. Source of materials
2. Material data
3. Concrete Compressive Test results of the Concrete Trial Mix
4. Shop drawing of the layout as per actual dimensions for PMT's approval.
5. Inspection Request. Inspection request must be submitted at least 2 days before concrete pouring scheduled time.
6. Concrete Compressive Test results of the Concrete actually placed
7. Other Test Results required by PMT

B. MATERIALS

1. CEMENT

The Cement shall be equal to ASTM C 150 Type 1 or Portland Cement Type 1.

The brand of cement to be used for concrete work shall be approved by the PMT and must not be changed during the progress of work unless otherwise approved by the PMT.

The amount of free alkali content shall not exceed the value of 0.6 percent by weight.

The cement shall be used in the order of delivery. No cement shall be used which has been moistened or which has been delivered to the site more than 1 month prior to its proposed use, unless otherwise approved by the PMT.

2. AGGREGATES

The aggregates shall be well graded, clean, hard particle of sand, gravel or crushed stone and conform to ASTM C33 "Standard Specification for Concrete Aggregates".

The aggregates shall have strength higher than that of the cement paste when hardened in concrete. The source of aggregates supply shall not be changed during the course of the work.

a. Coarse Aggregates: Coarse aggregates shall consist of gravel, crushed stone or a combination thereof and shall be clean, hard, durable uncoated particles free from salt, organic matter and clay more than 0.25% by weight. Course aggregates shall be well graded between the following limit sizes and conform to the sieve analysis requirements.

b. Fine Aggregates: Fine aggregates shall be river sand free from salt and organic matter, and shall be composed of clean, hard, strong and durable spherical or cubical particles, Clay shall not be contained more than 1%.

c. Maximum Size of Aggregates: The maximum size of aggregates shall not exceed 1/5 of the narrowest part of pouring form, ¾ of the spacing between each reinforcements or each bundle of reinforcement or 25 mm.

3. WATER

Water to be used in mixing concrete shall be clean and free from matters such as salt, oil, acid, alkaline, organic matter or other substances, in a quantity which will be harmful to concrete or reinforcement.

4. ADMIXTURES

Proper mixtures may be used in concrete, unless it adversely affects the quality of concrete.

Admixture to be used in concrete, when required, shall be subject to prior approval by the PMT and shall conform to the appropriate specifications listed below:

1. Air Entraining Admixtures:
2. ASTM C260 "Specification for Air – Entraining Admixture for Concrete"
3. Water-reducing, retarding, and accelerating admixtures:
4. ASTM C494 "Specifications for Chemical Admixture"
5. Other rational specifications with prior approval by the PMT.

Admixture containing chloride ions shall not be used in concrete.

5. REINFORCEMENT

In general, all Reinforcement steel bars shall be in conformance to "Chapter IV" of this Part of specification.

6. STORAGE OF MATERIALS

a. Cement shall be stored in a proper manner above the ground not less than 30 cm and in a well ventilated water-tight shed to prevent deterioration.

b. Cement bags shall not be piled up to the heights exceeding 10 bags and shall be kept neat for easy inspection.

c. Coarse and fine aggregates shall be stored separately on clean and hard surfaces, and mutual mixing or contamination by organic material shall be prevented.

d. Care shall be taken to avoid segregation of large and small particles of coarse aggregates in delivery or stockpiling. Stockpiles of aggregates shall be as low as possible and be allowed to drain.

e. Any materials that has deteriorated or has been contaminated shall not be used for concrete.

C. MIXING OF CONCRETE

1. GENERAL

a. All concrete shall be so mixed that the required strength, workability, uniformity and durability will be obtained.

b. Prior to the commencement of the work, the contractor shall determine concrete mix proportions and submit a mixing plan to the PMT prior for his approval.

c. Standard design strength, dry unit volume and slump of concrete shall be as specified on the drawings.

2. PROPORTIONING

a. For general reinforced concrete work with specified compression strength less than 240 kg/cm², the quantity of cement used must not be less than 280kg/cm³ (7bags/m³) but not more than 380kg/cm³(9.5bags/m³).

b. When the selection of concrete proportioning is done by laboratory trial by batches, the strength test shall be made in accordance with the "Methods for Compressive Strength of Cylindrical Concrete Specimens" (ASTM C39) and "Methods of Making and Curing Test Specimen in the Laboratory" (ASTM C192). The highest water-cement ratio used in concrete for structural work shall be based on readings from the curve of relationship between the ratio of water-cement and the compressive stress in order to obtain the stipulated compressive stress except when there are other necessities requiring the reduction of water-cement ratio, or the increasing of compressive strength.

c. If the appropriate data from laboratory trial batches or field test are not readily available. The maximum permissible water-cement ratio which is given in the table below may be used for concrete proportioning. This table shall be used only for concrete which uses cement in accordance with the standard of Portland Cements in accordance with ASTM C150.

LIMITS OF HIGHEST WATER-CEMENT RATIO IN CONCRETE		
Required Compressive	Highest Water-Cement	
F'c	Ratio by Weight	Air entrained concrete
180	0.65	0.54
210	0.58	0.46
240	0.51	0.40
280	0.44	0.35
310	0.38	

3. MEASUREMENT OF MATERIALS

a. The Contractor shall submit a measurement plan indicating method and equipment of measurement to the PMT for his approval.
b. Each material shall be separately measured on a batch method by weight.
c. Cement shall be measured by weight or by number of bags.
d. Workability aids shall be accurately measured in diluted solution.

4. MIXING

a. Concrete shall be mixed in a power batch mixer of an approved type unless hand mixing is approved by the PMT. Concrete mixer shall not rotate faster than 30 times per minute.

b. The batch mixer shall be thoroughly cleaned after each round by running for at least 15 minutes with medium and coarse aggregate and a lavish supply of water. The water used for cleaning shall be kept away from the formwork or placed concrete.

c. All the materials for each batch shall be put into the drum at one time. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity specified by the manufacturer.

d. Mixing shall be continued for a period of not less than one and half minutes after all materials have been put in the drum and until there is a uniform distribution of materials and the mass is uniform in color. The mixing time of batch shall be kept uniform throughout the work. Standard mixing shall be according to the table below.

STANDARD CONCRETE MIXING TIME		
Capacity (m^3)	Mixing Time	
	Minimum	Maximum
Less than 2	1 min. 45 sec.	5 min. 15 sec
Less than 3	2 min. 30 sec.	7 min. 30 sec.
Less than 4	2 min. 45 sec.	8 min 45 sec.
Less than 5	3 min.	9 min.

e. Each batch mixer shall be thoroughly emptied and cleaned before for the next batch is put into the drum.
f. Concrete which has set shall not be used nor re tempered, but shall be discarded.
g. Before each run of a cleaned batch mixer a preliminary mix of sand and cement shall be run then discarded.

4. SLUMP

a. A consistency of concrete shall be such that the mixture will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excessive free water to collect on the surface.

b. The slump of concrete shall be the minimum that is practicable. When vibrators are used to consolidate concrete, the slump shall not exceed 4-inches (10cm); otherwise, the slump shall not exceed 5-inches (12cm). Addition of water during hot weather to maintain the same slump must be compensated by adding more cement to retain the water-cement ratio.

5. TRANSPORTATION OF CONCRETE

a. The concrete shall be transported to from the place of final deposit as rapidly as practical, by means which will prevent segregation, consolidation, leakage or drying out.

b. If segregation is found in concrete during transportation, such concrete shall be mixed again to obtain a uniform distribution of materials.

c. When a bucket with an opening at the bottom is used for transportation, such concrete such that the opening is at the center of the bottom, easily operated and allows no leakage.

d. Pouring bucket shall be such a type to deposit concrete uniformly.

e. The delivery distance by barrows or Lorries shall not exceed 60 m, and a smooth road for such transportation shall be provided to prevent segregation.

f. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than mom long and chute not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

g. All equipment used for transporting the concrete shall be thoroughly cleaned at the end of each operation or work day.

6. PLACING OF CONCRETE

a. Prior to the commencement of placing, a placing plan indicating locations, sequence and amount of concrete to be placed shall be submitted to the PMT for approval.

b. Concrete shall not be placed before all forms, reinforcement, embedded items and the surfaces upon which the concrete is to be placed have been approved by the PMT.

c. Before placing concrete, all rubbish, standing water and loose material shall be removed. The face of the formwork in concrete with the concrete shall be sprayed with clean water immediately prior to concreting.

d. Before placing concrete in sub grade, semi porous sub grade shall be sufficiently sprinkled with fresh water in order to eliminate suction, and porous sub grade shall be sealed in an approved manner.

e. Slabs on grade shall have a base of rubble compacted and rolled to a dense condition.

7. PLACING

a. Concrete shall be placed within 30 minutes after discharge from the mixer but in no case more than 60 minutes from the time water was added.

b. Indiscriminate addition of water to increase slump shall be prohibited. Concrete shall be spaded and worked by hand and vibrated to assure close contact with all surfaces of forms and reinforcements and leveled off at proper grade to receive finish. No concrete that has partially hardened or been contaminated by foreign materials shall be deposited in the work, nor shall re-tampered concrete be used.

c. All concrete shall be placed continuously, or in layers not over one-half meter deep, upon clean, well thawed, damp surface free from water, and never upon soft mud nor dry porous earth.

d. When concrete is deposited in layers, concrete to be superimposed on the preceding layer shall be placed within two hours after previous concrete has been placed.

e. Concrete shall not be permitted to drop freely over two meters in un exposed work nor over one meter in exposed work to avoid segregation. Where greater drops are required, tremies or other approved means shall be used. Tremie discharge shall be controlled so that concrete may be compacted effectively into horizontal layers not over 30 cm thick.

f. When concrete is conveyed by chute, a continuous concrete flow shall be maintained. Discharge chute end shall be provided with baffle plate to prevent segregation.

g. If chute discharge end height is over two meters, a spout shall be used and its lower end maintained as near deposit surface as practicable.

h. When pouring is intermittent, a discharge chute shall be thoroughly cleaned before and after each run. Waste material and flushing water shall be discharged outside forms.

i. Concreting for such vertical portions as columns and walls shall be made up to the bottom of beams, placing of concrete in supported elements shall not be started until the concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.

j. No concrete shall be placed during rain, and any freshly placed concrete shall be protected from rainfall.

k. The temperature of the concrete shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints and should not exceed 32°C, pre cautionary measures approved by the PMT shall be put into effect. When the temperature of the steel is greater than 49°C, steel forms and reinforcements shall be sprayed with water just prior to placing the concrete.

l. Before placing fresh concrete on or against concrete that has set, concrete shall be thoroughly cleaned so as to expose the coarse aggregate. Forms shall be retightened and all surfaces moistened.

8. CONSOLIDATION

a. All concrete shall be thoroughly consolidated by vibration, spading, rodding, forking or other suitable means during placement, so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honey combing, pitting, or planes of weakness.

b. Internal vibrators shall have a minimum frequency of 8,000 vibrations per minute and sufficient amplitude to consolidate concrete effectively. They shall be operated by competent workmen.

c. Use of vibrators to transport concrete within forms shall not be allowed. Vibrators shall be inserted and withdrawn at points approximately 50cm apart.

d. At each insertion, the duration shall be sufficient to consolidate the concrete but not sufficient to cause segregation, generally from 5 to 15 seconds.

e. A spare working vibrator shall be kept on the job site during all concrete placing operations.

f. Where the concrete is to have an as-cast finish, full surface of mortar shall be brought against the form by the vibrating process, supplemented if necessary by spreading to work the coarse aggregate back from the formed surface.

g. Concrete in slabs shall be thoroughly consolidated. Internal vibration shall be used in beams and girders. Consolidation of slabs shall be obtained with vibrating screeds, roller pipe screeds, and internal vibrators or approved means.

9. CURING OF CONCRETE

a. GENERAL:

Concrete shall be protected against moisture loss, excessively hot temperature, rapid temperature change, mechanical injury from rain or flowing water for the period of the first at least 7 days after placement.

Curing procedure shall conform to ACI 308 "Recommended Practice for Curing Concrete" and ACI 305 "Hot condition at temperature above 10 C but not over 32 C.

The Contractor shall prepare a curing plan taking the weather conditions on site into account and submit it to the PMT for his approval.

b. CURING MATERIAL

Waterproof paper: Non-staining reinforced waterproof curing paper, conforming to ASTM C171, or approved equivalent.

Impervious sheeting: ASTM C171 or approved equal, type optional, except that polyethylene sheeting shall be 0.1 mm minimum thickness, white opaque. In areas of high winds the impervious sheeting shall not be used.

Burlap: Clothe made of jute or kenaf shall conform to AASHTO M182 or approved equivalent and shall weight a minimum 0.29 kg/m2.

Liquid membrane forming compound: ASTM C309, Type 1 or approved equal. When non-pig mental compound is used, it shall contain a fugitive dye.

c. PRESERVATION OF MOISTURE

For concrete surfaces not in contact with forms, one of the following procedures shall be applied immediately after completion of placement and finishing:

- Ponding or continuous sprinkling
- Application of absorptive mats or fabric kept continuously wet
- Application of sand kept continuously wet
- Continuous application of steam (not exceeding 65 C) or mist pray
- Application of waterproof sheet materials, conforming to ASTM C171 or approved equivalent
- Application of other moisture-retaining covering as approved
- Application of a curing compound conforming to ASTM C309 or approved equivalent

Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal, the concrete shall be cured for at least 7 days by one of the methods above.

d. TEMPERATURE, WIND AND HUMIDITY

Hot weather: When necessary, provision for windbreaks, shading, and fog spraying sprinkling, ponding, or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.

Rate if temperature change: Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 3 C in any 1 hour or 28 C in any 24 hours' period.

10. PROTECTION FROM MECHANICAL INJURY

During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials or methods, by

application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

D. FAIR-FACED CONCRETE

GENERAL

1. This subsection covers fair-faced concrete which will be exposed to view as indicated on the drawings.

2. Prior to the construction, the Contractor shall prepare a 'construction joint' program, formwork drawings, clean out details and proposal for remedial and patching methods and submit them to the PMT for his approval.

3. During the whole of the construction, the work shall be properly observed. At least one observer shall be provided for each stage of the work i.e. formwork construction, reinforcement bar arrangement, concrete mixing pouring and vibration, curing and striking.

REMEDY AND PATCHING

1. Remedy and Patching of fair-faced concrete shall be minimized in frequency, and if unavoidable, be carried out carefully according to the approved program (see 9.1.b) only with the consent of the PMT.

2. Whereas-cast finishes are specified, the total patched area shall not exceed 0.2 m^2 in each 100 m^2 of as-cast surface. This is in addition to form tie patches, if the drawings permit ties to fall within as-cast areas.

3. Any patches in as-cast fair-faced concrete shall closely match the color and texture of surrounding surfaces.

The mix formula for patching mortar shall be determined by trial to obtain a good color match with the concrete when both patch and concrete are cured and dry. After initial set, surfaces of patches shall be dressed manually to obtain the same texture as surrounding surfaces.

4. Patches in fair-faced concrete surfaces shall be cured for 7 days. Patches shall be protected from premature drying to the same extent as the body of the concrete.

E. TESTS AND INSPECTIONS

GENERAL

1. This subsection describes the item, frequency and methods of tests and inspections.
2. Concrete materials and operations will be tested and inspected as the work progresses. The PMT reserves the rights to order tests on any materials to be used in the mixing of concrete and reinforced concrete, at any time, to examine whether such materials and concrete comply with the specified quality or not. All expenses for tests and inspections shall be borne by the Contractor.

3. The Contractor shall test and inspect the aggregates, cement, any other additives and the concrete mix before and during construction as specified herein. The results of all such tests and inspections shall be satisfactory to the PMT.

4. All tests shall be done by a testing laboratory provided by the Contractor and approved by the PMT, and done according to the standards of the Science Department, Ministry of Industry, or the ASTM methods and procedures. Testing laboratory may supervise the mix and delivery of all concrete.

5. To facilitate testing and inspection, the Contractor shall:

a. Furnish any necessary labor and convenience to assist the testing laboratory in obtaining and handling samples at the project site or other sources of materials.

b. Advise the testing laboratory sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.

c. Provide and maintain for the sole use of the testing laboratory adequate facilities of safe storage and proper curing of concrete test specimens at the project site.

d. The Contractor shall keep a record of all tests during the construction and for at least two years after the whole construction has been completed.

TEST OF MATERIALS

Materials used shall be tested in accordance with the table

TABLE 5.10.1 Material Test Method

Material	Frequency	Number of Specimens	Test	Method (ASTM)
Cement	Minimum once for Each different type, Brand and cement Work	1 lot= 100 at minimum 1 specimen Per lot	Air content of Mortar Chemical Analysis False Set	C185 C114 C451
Aggregates	Minimum once for Each source and Location	Minimum 2 Specimen per Lot	Grading Washing Unit Weight Organic Impurities Clay lump Soundness Abrasion	C136 C117 C29 C40, C87 C142 C83 C131, C535
Water	Minimum once for Each source of Supply	Minimum once	Chemical analysis	As per JASS 5T-301
Reinforcing Bars	Minimum one rod for each source of Supply per batch rods per lot Per size	1 lot=50 ton minimum 3	Mechanical test (tension bending)	A370

Remark: Standards for the method of test indicated herein may be replaced by appropriate JIS Standards with prior approval of the PMT.

SAMPLES

1. Samples from stock on the site shall be taken by the Contractor as indicated by, and in the presence of the PMT.

a. Cement: Sampled cement shall be tested by the approved testing laboratory. Certified copies of laboratory test reports shall be furnished for each lot of cement and shall include all test data, results and certification that the sampling and testing procedures are in conformance with the specifications.

No cement shall be used until its test results are satisfactory to the PMT. Cement that has been stored for more than four months after being tested shall be retest before use.

b. Aggregates: Aggregate sampling shall conform to ASTM D75. Aggregates shall be sampled and tested by the testing laboratory. No aggregate shall be used until its test results are satisfactory to the PMT.

2. Samples of fresh concrete shall be obtained different batches of concrete on a random basis in accordance with ASTM C172, and shall be transported to a placed in the site where tests can be made and cylinders stored without being disturbed for the first 24 hours.

TRIAL MIX TESTS OF FRESH CONCRETE

1. Trial mix test shall be conducted at least once for each mix proportion in accordance with table 5.10.2 Tests shall be carried out in the presence of the PMT more than 28 days before concrete placing.

Table 5.10.2 Trial Mix Test

Items	Test	Method
Workability	Slump	ASTM C143
	Air content	ASTM C231
Strength	Compression	ASTM C39
Weight	Unit weight	ASTM C138

Note: Other rational standards such as JIS will be accepted instead only with prior approval of the PMT.

2. Compression strength tests shall be carried for each three specimens at 7 days and 28 days.

FRESH CONCRETE INSPECTIONS

1. Inspections must be carried out closely adjacent to the site of pouring in accordance with table 5.10.3

Table 5.10.3 Fresh Concrete Inspections

Items	Minimum number of Specimens	Test	Method
Fresh Concrete	1 lot= 10 m^3 minimum 1 specimen Per lot	Slump	ASTM C143
		Air content	ASTM C231
	1 lot= 10 m^3 Minimum 3 specimens per lot on a random basis per concrete pouring	Compressive strength	ASTM C39

Note: Other rational standards such as JIS will be accepted instead only with prior approval of the PMT.

2. Where any test result proves unacceptable to the PMT, the Contractor shall be discarded the whole of the concrete batch.

3. Slump tests and air contents tests shall always be made from the same batch from which compressive strength tests are made.

4. The standard age of concrete for strength test shall be 7 days and 28 days. For strength test at 7 days the Contractor shall provide three test specimens for each test taken in the presence of the PMT less than once for each 10 m^3 or fraction thereof nor less than once a day, or less than once for each 500 m^2 of floor area of each class of concrete placed. Samples shall be secured in accordance with ASTM C172 or approved equivalent standards. Test specimens shall be made a cured in accordance with ASTM C31 or approved equivalent standards.

5. Test specimens for strength tests shall be evaluated for each class of concrete specified in conformance with ACI 318, Chapter: 4 "Concrete Quality" or approved equivalent standards

6. When the results of the strength test of the specimens indicate deficiency in specification requirements or where there is other evidence that the quality of the concrete is below specification requirements, core boring tests shall be made in conformance with ASTM C42 or approved equivalent standards, at the Contractor's expense. If deficiency discovered, the Contractor shall ask the PMT for the treatment, and shall yield to the instruction of the PMT.

CONTINUOUS INSPECTION

1. In concrete work, the PMT will inspect the works in every stage and every step of the work.

2. The PMT will supervise and ascertain that the concrete work is in accordance with the plans and specifications, and shall keep records which shall be submitted by the Contractor and cover the followings:

a. Quantity and proportion of materials for the mixing of concrete
b. Placing and curing of concrete
c. Reinforcement
d. Formwork and shoring
e. Placement of important load on the floor during the construction
f. general progress of work

3. When air temperature rises above 35 deg Celcius, a complete record shall be kept of the temperature of concrete and the concrete shall be protected during placing and curing operations.

G. PAYMENT METHODOLOGY

The work under this item shall be measured by the volume of concrete actually installed as per planned. Excess of the quantity due to Contractors corrections such as increase of dimensions shall not be considered in the pay item.

For a work to be considered finished, the concrete must have undergone all the necessary work from preparation, curing and satisfactory test results. The quantities to be paid shall only include those of which completely finished, inspected and acceptable to the PMT.

In cases that the concrete does not pass the required compression test, it is the responsibility of the Contractor to perform any of the following without the expense of the owner.
1. Removal of Concrete installed
2. Retrofitting up to PMT's satisfaction.

CHAPTER II: PRECAST CONCRETE

GENERAL REQUIREMENTS

1. Structural pre cast concrete shall be manufactured in fabrication shop or site fabrication shop.

2. Concrete, reinforcement and other materials used in structural precast concrete members are uniform in color and appearance.

3. Following submittals shall be prepared by the Contractor and submitted to the PMT for his approval.

   a. Shop drawing showing layout, unit locations, fabrications details, unit identification marks, reinforcement, connection details, support items dimensions, openings and relationship with adjacent materials.

   b. Product, data showing standard component configurations, deflections, cambers and bearing requirements.

   c. Fabricator's installation instructions

FABRICATION

1. Plant or job site plan record and quality control program during production of pre cast concrete members shall be maintained and reported to the PMT as per his request.

2. Reinforcing steel, anchors, inserts plates, angles and other cast-in items shall be embedded and located accurately as indicated on the drawings.

3. Pre cast concrete members shall be cured under identical conditions to develop required concrete quality and minimize appearance blemishes such as non-uniformity, staining or surface cracking.

DELIVERY STORAGE AND HANDLING

1. Pre cast concrete members shall be handled in position consistent with their shapes and design. They shall be lifted and/or supported only from support points.

2. Lifting or handling devices shall be capable of supporting member in position anticipated during manufacture, storage, transportation and erection.

3. Members shall be protected to prevent staining, chipping or spalling of concrete.

4. Each member shall be marked with the date of production and final position in structure.

TOLERANCE OF PRODUCTS ANDS INSPECTION

1. The dimensional errors of fabricated products shall be as follows:

   a. Maximum variation from nominal dimension: 6 mm
   b. Maximum dimension from intended camber: 25 mm
   c. Maximum out of square: 3 non-cumulative
   d. Maximum bowing of members: Length bow/360

2. All products shall be visually inspected by Contractor. All dimensional errors shall be precisely measured by proper means as approved by the PMT. The PMT shall make out and submit the inspection report to the Consultancy for his approval.

3. PMT inspects the products at random. The Contractor shall provide all necessary help and convenience in men materials, instruments, etc. for the inspection of the PMT.

4. Material product or workmanship not in reasonable conformance with the provisions of this specification may be rejected at any time during the progress of work. Any material or workmanship which is rejected by the PMT shall be promptly removed and replaced by and at the expense of the Contractor.

ERECTION

1. Members shall be erected without damage to structural capacity, shape or finish. Damaged members shall be replaced or repaired.

2. Members shall be aligned and maintained uniform horizontal and vertical joints, as erection progress.

3. Temporary bracing shall be maintained in place until final supports is provided. Members shall be protected from staining. Temporary lateral support shall be provided to prevent bowing, twisting or warping of members.

4. Differential camber between pre cast members shall be adjusted to tolerance before final attachment.

5. Tolerance of erection shall be as follows

   a. Maximum variation from plane or location indicated on drawings: 6 mm in every 3 m and 9 mm in every 30 M, Non-Cumulative
   b Maximum offset from true alignment between members: +3 mm
   c. Maximum variation from dimension on drawings" +3 mm

6. When members cannot be adjusted to conform to design or tolerance criteria, the work shall be ceased and modification shall be executed as directed by the PMT.

CHAPTER III: FORMWORKS AND SCAFFOLDING

DESIGN OF FORMWORK

1. All formwork shall be designed to resist the working loads, and the vertical load and the lateral pressure of the wet concrete, having regard to incidental loading and vibration of the concrete.

2. The formwork shall be sufficiently rigid to prevent undue deflection and bulging during the placing of the concrete. Forms shall be properly braced or tied together to maintain position and shape. The Contractor shall submit design drawings and calculations for the proposed formwork to the PMT for their approval.

3. Forms shall be substantial and sufficiently tight to prevent leakage of mortar.

4. The design and engineering of the formwork, as well as its construction, shall conform to AC1 301 "Specifications for Structural Concrete for Buildings" and AC1 347 ": Recommended practice for Concrete Formwork".

5. All formwork shall be so arranged as to permit easing and removal without damaging concrete.

6. Slip form type formwork shall obtain the prior approval of the PMT.

MATERIALS

2. All materials used shall be suitable and adequate for the use to which they are put.

3. The form facing material shall produce a smooth, hard uniform texture on the concrete. The Contractor shall submit to the PMT a certificates and samples of the form boards for his approval.

4. All form boards shall be new. If re-used, they shall be approved by the PMT.

5. Cones for the form ties shall be of wood.

6. Form liners shall be of sound and suitable materials to accurately and safely cast the incite concrete structure as shown on the drawings.

7. Timber form boards where used for fair-faced concrete shall be of such new materials as not to cause any defects to the surface of the concrete. Special care shall be taken in fabrication, storage and protection of these boards.

CONSTRICTION AND ERECTION

1. For constriction of forms, fabrication and erection, drawings shall be prepared as required and approved by the PMT.

2. All formwork shall be accurately constructed to meet the requirement shown on the drawings as to position, shape and dimension of members and be fixed in perfect alignment, level and plumb within the tolerances specified (Tolerances)

3. Column bases and wall bases shall be carefully cleaned out and observed immediately before concrete is placed, and temporary openings shall be provided at the base of column forms and wall forms to enable this to be done. The openings shall be after cleaning to prevent leakage of cement paste.

4. Pipes, boxes, embedded steel and inserts placed in the formwork shall be securely fixed in position to prevent displacement during Concreting.

5. The formwork for slabs and beams shall be laid with an upward camber where necessary to ensure a level ceiling and beam soft.

6. No formwork shall be connected to scaffolding or other temporary provisions.

7. All formwork shall be properly protected from impact and vibration due to workmen, materials and equipment.

8. If form boards are reused, the surfaces in contact with the concrete shall be thoroughly cleaned off and be sufficiently repaired before reuse.

9. All formwork shall be fabricated in a place protected from the sunbeam, rain and wind.

10. Where more than one piece of formwork is required, care shall be taken to ensure that the grain, color, and texture of the form boards are well balanced to obtain a uniform concrete surface from the different units of formwork.

11. Corners of beams, columns and openings shall be chamfered adequately.

12. All formwork for fair-faced concrete shall be inspected by the PMT after fabrication for shape, dimension, transition, nail head, grain texture.

TOLERANCES

1. The formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits listed in Table 3.2.1

2. The Contractor shall establish and maintain in an undisturbed condition and until final completion and acceptance of the project sufficient control points and bench marks to be used for reference purposes to check tolerances.

Table 3.2.1 Tolerance for Formed Surfaces

	Items	Tolerance
(1) Variation from Plumb (e/H)	H > 5 m	e/H ≤ 1/600 and e ± 8mm
(2) Variation From level (e/L)		e/H ≤ 1/600 and e ≤ ± 12mm
(3) Variation From Position (e)	General	e ±8mm
	Footing	e ±10mm
(4) Errors in Span		

Length and story Height (e)		e ±8mm
(5) Surface Irregularity (e)	Fair Faced Surface	e ≤ 7mm for every 3m
	Plastered Surface	e ≤ 7mm for every 2m
(6) Surface Transition (e)	Fair Faced Surface	e ≥ 3m
	Plastered Surface	e ≥ 5m
(7) Variation in sizes And location of Sleeves and Openings		e ≥ ±10m
(8) Variation in Cross Sectional Dimensions of Members	Size of columns and beams	5m +15mm
	Thickness of Slabs and Footings	0mm +10mm for every 3m
	Size of Footings+20m	10m

PREPARATION OF FORM SURFACES

1. All surfaces of forms and embedded materials shall be cleaned of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed in them.

2. Before placing of either the reinforcing steel or the concrete, the surfaces of the forms shall be covered with an approved coating material that will not stain the concrete surfaces. A field applied form release agent or sealer of approved type or a factory applied no absorptive liner may be used.

3. Excess form coating material shall not be allowed to stand in puddles in the forms nor shall such coating be allowed to come in contact with hardened concrete against which fresh concrete is to be placed

FORMWORK TIES

Tie bars, if necessary, shall be sufficiently strong and so spaced to withstand the lateral pressure of wet concrete on the formwork without allowing any deflection. The insert holes of the tie bars shall be filled with synthetic resin mortar on the outside surface and left exposed on the inside surfaces.

SHORING

1. All shores for the formwork shall steadfastly and adequately support the weight of formwork, wet concrete and construction loads above. Adequate safety margins shall be included in all structural calculations for shores. The shores shall be carefully positioned to secure a rigid installation.

2. Materials

   a. Steel pipes. All tubular steel shores for beams and slabs shall meet the requirements of JIS A 8651 "steel Pipe Supports" or approved equivalent standards.

   b. Timbers and Composite Members. Wherever timbers or composite support members are used, they shall be sufficient to provide a safe and rigid support to the weight of formwork, wet concrete and construction loads above.

3. Erection of Shores

   a. Wherever both steel and timber shores are employed they shall never be used to support the same formwork to avoid the adverse effects caused by differential compression.

   b. Centering of all vertical shores shall be adequate to carry the vertical loads on the formwork without causing undue deflection in the horizontal support members.

   c. Ample strut supports, braces and guys shall be provided to prevent overturning or twisting due to horizontal loads on formwork for slabs and beams during concreting.

   d. Where the shores for formwork of excessive floor-ceiling heights stands on the staging, the staging and the supports shall be securely fixed, and well braced and laterally supported to prevent undue overturning, twisting and buckling due to various loads during concreting.

   e. Where vertical shores stand directly on the ground, care shall be taken to prevent any settlement when such shores is loaded with wet concrete and other loads.

INSPECTION OF FORMWORK

Prior to concreting all formwork shall be inspected by the PMT to check their correctness and that all dimensions, positions and quantities of conduits, inserts, cones, boxes for chases, sleeves, pipes and services are correct, and meet the drawings.

REMOVAL OF FORMS AND SHORES

1. All forms and shores shall be removed without shock, vibration or any damage to the concrete.

2. The period in which formwork shall be left in place after concreting be determined from the concrete mix portion, position and size of members, test results of compression strength, loading, climate and other curing conditions and shall be agreed with the PMT.

3. Formwork shall remain in place after concreting for a period specified in the Table 4.2.2, in a general way.

Table 4.2.2 Minimum Periods for "Striking" Formwork

Formwork Type	Form Boards			Shores
Members	Foundation, Sides of Beams, Columns And walls	Slab & Beam Soffits	Slab Soffits Beam	Soffits

Curing days	4	7	20	25
Compressive Strength of Concrete	80 kg/cm☐	50% of the specified compressive Strength	85% of the specified Compressive strength	100% of the specified compressive strength

Notes: 1. form boards may be removed after reaching of either required curing days or required compressive strength of concrete.
2. Shore shall be left in place until both them have been reached.

4. Where concreting loads on the upper floor are transmitted to the lower floors by shores, the member's stresses in the lower floors shall be examined, and if necessary the shores for lower floors shall be left in place for a longer period than stated above until they can be removed without any damage to the structure.

5. Struts supporting cantilevered beams and slabs shall be left in place until struts for upper floors have been removed.

6. Where formwork is provided for long span beams or slabs, or carries particularly heavy loads, the period in which formwork must remain in place shall be extended to avoid damage to the concrete.

RESHORING AND REPOSITIONING OF SHORES

No re shoring and repositioning of shores shall be permitted. If repositioning is unavoidably needed, it shall be approved in advance by the PMT.

INSPECTION AFTER REMOVAL OF FORM BOARDS

Upon striking of form boards, the surfaces of concrete shall be inspected by the PMT and any defective portion shall be promptly repaired.

JOINTS AND EMBEDDED ITEMS

CONSTRUCTION JOINTS

1. Construction joints shall be made only where shown on the drawings or in positions approved by the PMT, so as not to impair the strength of the structure. Construction joints shall be reduced to the minimum.

2. In general, joints in floors shall be located near the middle of the spans of slabs, beams or girders, unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset distance equal to twice the width of the beam. Joints in columns shall be at the top of slabs, beams, girders and footings, and at the underside of beams and girders.

3. Joints shall be perpendicular to the main reinforcement.

4. The upstanding edge beams as parapets shall be poured continuously and monolithically with the roof slabs.

5. The surface of concrete at all construction joints shall be thoroughly cleaned and all laitance and standing water removed prior to placing adjoining concrete.

6. When required or permitted, bond shall be obtained by roughing the surface of the concrete in tan approved manner which will expose the aggregate uniformly and will not leave laitance, loosened particles of aggregate or damaged concrete at the surface, or by other means approved by the PMT.

EXPANSION JOINTS

1. Reinforcement or other embedded items bonded to the concrete shall not be permitted to extend continuously through any expansion joint.

2. Pre molded expansion joint filler and sealant shall be of the type required by the drawing and shall conform to one of the following:

a. "Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)" (ASTM D944) or approved equivalent.

b. "specifications for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non extruding and Resilient Non bituminous Types)" (ASTM D1752) or approved equivalent

JOINTS IN SLABS ON GRADE

Joints in the slabs on grade or concrete pavements shall be located and detailed as indicated in the drawings. If saw-cut joints are required or permitted, cutting shall be timed properly with the set of the concrete: cutting shall be started as soon as the concrete has hardened sufficiently to prevent aggregates being dislodged by the saw, and shall be completed before shrinkage stress became sufficient to produce crackling.

EMBEDDED ITEMS

1. All sleeves, inserts, anchors, and embedded items required for adjoining work or its support shall be placed prior to concreting.

2. All sub-contractors whose work is related to the concrete of must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

3. Expansion joint material, water stops, and other embedded items shall be positioned accurately and supported against displacement.

4. Voids in sleeves, inserts and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete or mortar into the voids.

CONRETE PLACING AND CURING

1. Before placing concrete, all formwork shall be thoroughly sprinkled with water.

2. Construction joints shall be provided as the approved program (see 9.1 b) Special care shall be taken to follow the construction joint 'shutter stop' and finish the concrete true to line and level with the top surface of the 'stop'. Also all starter bars be well protected with taped polythene to prevent rust from staining the surface of concrete.

3. While placing concrete, the coarse aggregates shall be worked back from the forms, leaving a full surface of mortar but avoiding the production of surface voids.

4. Vibrators shall be allowed to contact the formwork for expose concrete surfaces.

5. After removal of formwork, where necessary, the surface of fair-faced concrete shall be protected against staining by suitable Kraft paper and against physical damage by adequately robust boards or sheet material.

6. After striking the formwork, all concrete surface shall be inspected by the PMT, it shall be promptly treated in the approved manner (see 9.1b)

CHAPTER IV: REINFORCEMENT

A. GENERAL

1. This subsection covers steel reinforcement for cast- in-place concrete, where indicated on the drawings, where required and as specified herein.

2. Shop drawings, showing all fabrication dimensions and locations for placing of reinforcing steel and accessories shall be submitted to the PMT for his approval. Approval shall be obtained before fabrication.

3. Details of concrete reinforcement and accessories not covered herein nor on the drawings shall be in accordance with the regulations of "Building Code Requirements for Reinforced Concrete" (ACI 318) and "Manual of Standard Practice for Detailing Reinforced Concrete Structure" (ACI 315)

B. FABRICATION

1. Prior to the fabrication and placing of reinforcing steel, the Contractor shall prepare detailed fabrication and placing drawings and submit them to the PMT for his approval.

2. Bars with bends not shown on the drawings shall not be used.

3. All reinforcement shall be accurately bent cold to the required sized and shape with care taken not to damage it

4. Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

a. Sheared length : $\pm$2.0 cm

b. Depth of truss bars : $\pm$1.5 cm

c. Overall dimension of Stirrups, ties and Spirals : $\pm$1.5 cm

d. All other bends : $\pm$2.0 cm

C. PLACING

1. Reinforcing steel shall be accurately placed and spaced in accordance with the drawings. All bars shall be firmly supported and fastened together to prevent displacement during the placing of concrete. Over formwork, concrete metal, plastic or other approved bar chairs and spacers which will not adversely affect the concrete shall be used

2. Minimum concrete protective covering for reinforcement shall conform to the standard details of the drawings and within a tolerance of $\pm$5 mm for slabs and $\pm$10mm for all other members

3. The intersections of all bars shall be securely tied with galvanized soft iron wire of not less than 1.20 mm in diameter in compliance with TIS 138, the ends being turned into the body of the concrete.

4. Bars shall be placed within the following tolerance:

a. Clear distance to formed surfaces	:	$\pm$0.6 cm
b. Minimum spacing between bars	:	$\pm$0.6 cm
c. Top bars in slabs and beams		
Members 20 cm deep or less	:	$\pm$1.3 cm
Members more than 20 cm but Not over 60 cm deep	:	$\pm$2.5 cm
d. Crosswise of members	:	Spaced evenly within 5.0 cm
e. Lengthwise members	:	+5.0 cm

5. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to approval.

6. Vertical bars in columns shall be offset at least one bar diameter at lapped splices as shown on the drawings.

7. No reinforcement shall be embedded after concreting.

8. Unless permitted by the PMT, reinforcement and column dowels shall not be bent after being embedded in hardened concrete. If any correction in the position of reinforcement of dowels by bending is necessary after concrete has been placed, the reinforcement position shall be corrected over as long as possible a distance with a deviation of not more than 1:7.

D. CLEANING OF REINFORCEMENT

1. All reinforcement, at the time concrete is placed, shall be free from mud, oil, and paint, lose scale or other materials which may adversely affect or reduce the bonding capacity.

2. After bending and placing of reinforcement, not more than a light rust of ferrous oxide will be permissible before concreting commence.

3. Where loose rust scaling has occurred on bars, the bars shall be well brushed with stiff wire brushes to remove all loose scale.

4. Where reinforcing bar are kept exposed for a long period after placing, they shall be inspected again before concreting and cleaned as necessary.

E. SPLICES

1. All splices in reinforcing bars shall be made with a lapped splice. Other suitable means of splicing may be used subject to approval of the PMT.

2. The locations, length and anchorage of splices shall be as specified on the drawings. Any changes in locations shall be subject to the approval of the PMT.

3. All splices not shown on the drawings shall be subject to approval of the PMT.

F. INSPECTION AND REPAIR

1. All reinforcement after placing shall be inspected and approved by the PMT before concrete placing.

2. All incorrect position and location of reinforcement shall be promptly repaired, and all mis- fabricated and damaged bars removed and replace with new bars, as directed by the PMT.

G. PAYMENT METHODOLOGY

The work under this item shall be measured by the weight of Reinforcing steel actually installed as per planned. Excess of the quantity due to Contractors corrections such as increase of dimensions shall not be considered in the pay item.

For a work to be considered finished, the surface must have undergone all the necessary work from surface preparation to final coating of paint. The quantities to be paid shall only include those of which completely finished, inspected and acceptable to the PMT.

For uniformity of computations, the weight of Deform reinforcing bars shown at table below shall be used in this contract.

Diameter (mm)	Weight (kgs/m)	Diameter (mm)	Weight (kgs/m)
6	0.222	20	2.466
8	0.395	22	2.984

10	0.617	25	3.853
12	0.888	28	4.834
14	1.208	32	6.313
16	1.578	40	9.865
18	1.998		

CHAPTER VI: STRUCTURAL STEEL WORKS

SCOPE

The work to be undertaken in this section shall comprise the furnishing, fabrication, reassembly in site, painting, delivery, erection, and installation of all materials including anchor bolts, base plates, erection bolts, bracing and all other structural steel work indicated in the plans or specified herein.

SUBMITTALS

The contractor shall submit to the PMT for his approval of samples of all materials required of this section such as but not limited to:

a. Fabrication drawings. Prior to the commencement of the work, Contractor shall submit construction drawings and details to the PMT for his approval of the position of the Structural Steel and layout of steel section.
b. Fabricator certificates. Prior to the commencement of the work, Contractor shall submit construction drawings and details to the PMT for his approval of the position of the Structural Steel and layout of steel section.
c. Material test results. Dimensions conformity, Bending and Tensile stress test results
d. Weld test results. X-ray weld test results

MATERIALS

a. Unless otherwise indicated in the plans, structural steel shapes and plates shall conform to ASTM -A36. Certified Mill Test and shall be submitted by the fabricator to the PMT.
b. Light-Gauge Cold-formed structural steel shall conform to pertinent specifications of the American Iron and Steel Institute (AISI)
c. Machine Bolts shall conform to ASTM A-307. Each bolt shall be provided with standard nuts and washers.
d. Anchor Bolts shall conform to ASTM A-141
e. Cross Bracing with turnbuckles shall conform to ASTM A-307
f. Welding shall conform to AWS standard, and E60 or E70 electrodes shall be used unless otherwise specified by the Structural Engineer.
g. The fabricator shall have the welds tested by X-ray method by an independent company engaged in non-destructive testing as directed by the Structural Engineer. The welds are considered satisfactory if 9 out of 10 samples passed the requirement otherwise the welds shall be corrected.

FABRICATION

a. Field fabrication shall be kept to a minimum. Shop fabrication shall be employed to the greatest extent possible with members' shop fabricated as practicable with a minimum requirement for field connections.
b. Contractor shall submit shop drawing showing complete detailed connections for approval by the Structural engineer. No material shall be ordered nor fabrication started until the PMT approves such drawings.
c. All dimensions in the plans shall be verified by the steel fabricator in the field in coordination with the Contractor and the PMT.
d. Unless otherwise specified in the plans, gusset plates and stiffeners shall be minimum thickness of 6 mm.
e. Splices shall be kept at minimum and shall be staggered. No splices shall be permitted at point where critical stressed occur. Splice plate shall have a minimum length of 300 mm. the contractor shall submit drawing for the locations of splice for the structural engineer's approval.
f. All bearing plates shall have a minimum thickness of 12 mm
g. All erection bolt holes shall be 3 mm plus nominal bolt diameter
h. All cuttings shall be neat cut
i. Shop paint (epoxy primer; 2 coats) shall be provided.

j. Any work that is not in conformance with these specifications will be rejected at any time during the progress of the works.

ERECTION

a. The erection of all structural steel shall conform to the applicable requirements of the AISC Specification and AISC Code of Standard Practice. All structural steel work shall be erected accurately to the lines and levels shown on the Drawings. All columns and other vertical members shall be plumb and horizontal members level before permanent connections are made. All temporary bracing, guys and bolts as may be necessary to insure the safety of the structure until the permanent connections have been made shall be provided by the Contractor. Members shall be connected, as erection progresses, to resist all dead load, wind and erection stresses.

b. Bolted Connections. Malling faces of bolted connections shall be cleaned to bare steel, free from paint, grease and other foreign matter. Field connections shall be accurately fitted up before the bolts are taken up. Drifting shall be only such as will bring the parts into position and shall not be sufficient to enlarge the hole or to distort the metal. All unfair holes shall be drilled or reamed. After joints are fitted up properly, bolts shall be tightened by the turn-of-nut method.

c. Cutting and Burning. The use gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. Its use may be permitted on minor members if the member is not under stress and then only after the written approval of the Structural Engineer has been obtained.

d. Tolerances. The tolerances of erection and fabrication of structural steel, unless otherwise specified, shall comply with the AISC Specification. The maximum deviation from true vertical shall be one part in 500.

CHAPTER IX: TINNERY WORK

GENERAL

Scope

The section covers the requirements for providing all the roofing work at the Project site. The work shall include all the furnishing all the labor, materials, equipment, tools and transportation necessary to complete the roofing work indicated on the drawings and the specified herein.

Drawings

Prior to the commencement of the work, the Contractor shall submit construction drawings and details for the PMT for his approval.

Samples

The Contractor shall submit to the PMT for his approval samples of all materials required in this section.

MATERIAL

Metal roofing

a. Accessories and fasteners of roof tiling, such as ridge tiles, gable tiles, galvanized battens and rafters, nails, screws, and wires shall be manufacturer's standard and conform for the requirements of applicable to the Industrial Standard.

b. Galvanized steel sheet sealing strip shall be used at eves- end of roof tiling against entering of birds.

WORKMANSHIP

Roof Tile

Roof tile shall head lap 75- 100 mm, side lap 35 mm and shall be fastened by stainless nail. Top course tile should always be a full tile and tiling shall be staggered line. Roof tile should be well arranged to prevent rain water from entering the building. At ridge the gable roof tiling joining the wall, reinforced beam shall be made and covered to prevent rain water getting into the building and be sealed by mortar bed.

PART V: CIVIL WORKS

CHAPTER I: MASONRY WORKS

A. GENERAL

This section covers the furnishing and installing complete on all stone work, and concrete blocks shown on the drawings and as specified.

B. SUBMITTALS

DRAWINGS

Prior to the commencement of the work, Contractor shall submit construction drawings and details to the PMT for his approval of the position of the reinforced concrete and joint layout of blocks. Unless otherwise specified, of the contactor or his sub-contract shall furnish all materials, tools, equipment, apparatus, appliances, transportation, labor, and supervision required to furnish and place all cement and masonry works shown on the Drawings and as specified herein.

SAMPLES

The contractor shall submit to the PMT for his approval samples of all materials required of this section.

C. MATERIAL

A. Masonry Products

1. Reinforced concrete blocks and structure concrete blocks shall conform on requirements of JIS A 5406 (Hollow concrete block) and shall be 1st class and no defects.
2. Concrete blocks shall comply with JIS A 5406 (Hollow concrete block) C-Grade unless otherwise specified.
3. Maximum grain of coarse aggregate for concrete fill shall be less than 1/5 width of maximum void of block. Sand for mortar for joint of block shall be passed through sieve 2.5 mm clean and hard.
4. Reinforcement bar and binding wire shall conform to CHAPTER VI of Part IV
5. Deformed bar and other special steel shall be stated in the particular specification.
6. Water-proof agent for water-proofed mortar shall conform to Section 7 Water-proofing work.
7. Mixture for mortar bedding and filling shall be class B (Cement: Sand=1:3)

B. Concrete Hollow Block

Unless otherwise specified, concrete hollow blocks shall be in modular dimensions. Blocks shall be standard machine vibrated and shall have fine, even texture and well defined edges. The load bearing concrete hollow blocks shall have a minimum compressive strength of 1,000 psi computed for the individual unit. For non-load bearing, 350 psi computed form the average of five (5) units based on the average area and a minimum of 300 psi for the individual unit.

1. Visual Inspection

b. All units shall be sound and free form cracks and other effects that interfere with the proper placing of unit or impair the strength or permanence of the construction.

c. Units that are intended to serve the base for stucco shall have a sufficient rough surface to afford good bond.

d. All units shall bear mark of the manufacturer or shall be otherwise readily identified as to origin.

2. Sample and Testing

a. Samples shall be taken to the delivered batch and shall be represented by three (3) blocks for every thousand pieces of strength, absorption and moisture content determinations.

b. Units shall be tested to the accordance with the Standard Method of Masonry Units of the American Society for Testing Materials (ASTM) Designation C- 140 and or by the Division of Materials Testing and Physical Research, Ministry of Public Highways. No blocks shall be used unless result of the tests are known and duly approved by PMT.

c. Test shall be at the expense of the Contractor.

3. Rejection

a. In case the shipment of the CHB to conform for the requirements, the manufacturer sorts it and new specimens shall be selected again on random from the retained lot and expense of the Contractor. In case the second sets of specimens fail to conform the test requirements, the entire lot shall be rejected.

b. Cement shall be Port Land Cement conforming to ASTM Specifications C- 150 type 1.

c. Water for mixing shall be clean, portable and free from injurious amounts of oil, soluble salts, acids, alkalis of organic matter, or other deleterious substances.

d. Sands shall be clean, hard and deleterious substances.

e. Lime shall be type S, ASTM Specifications C207 for hydrated lime for masonry purpose or quick lime for structural purposes C- 5.

f. Reinforcements

1. Lintel and vertical reinforcing bars shall conform to ASTM Specifications A- 15 "Specification of Billet Steel Bars of Concrete Reinforcements". Allowable fs = 18,000psi.

2. Horizontal reinforcing bars shall conform to ASTM Specifications A- 82.

4. Anchors and Tiles

a. For metal anchoring devices such as angles, slots, and bars, anchor clips, dowelling pins, and dwelling tubing, use galvanized metals as shown on plans.
b. Galvanizing procedure shall be in accordance with ASTM Specimens.

D. WORKMANSHIP

Delivery, Handling, Storage and Protection

A. Masonry Units
Immediately upon delivery upon delivery to site, concrete masonry shall be stocked on platforms or stored in such manner as to protect them from contract with soil or weather care in handling masonry units shall be exercised to avoid chipping and breakage. Strong piles stocks or bins shall be protected from unnecessary traffic construction or operations or any kind of damage.

B. Lime and Cement Materials
Cement and limes shall be stored off the ground under weather tight cover and away from sweating walls or other damp surfaces until ready for use. Damaged or deteriorated materials shall be removed from the premises.

Mixing Mortars

Mortars shall be prepared in batches of volume and used before initial set takes place, in no case longer than 45 minutes before delivery to mason mortar board at points of use. Mortar shall be mixed in clean mechanical mixer with only sufficient water to produce required plasticity conforming of one (1) part Portland cement, ¼ part hydrated limes and three parts sand. Re- tampering of mortar after began to set shall not be permitted.

Erection

A. Wet the block thoroughly before using. The first row of blocks must be thoroughly anchored to the concrete walls, columns and slobs. Coarse shall be running bond and vertical faces truly vertical and set true to line.

B. All horizontal and vertical reinforcing bars shall be anchored 10 mm dia. into the concrete walls, columns and slabs. Dowel bars are properly placed into the walls columns or slabs during pouring and hooked to the vertical bar and leaving another 10 mm dia. exposed to the splice to the reinforcing bars of the hollow block walls during construction.

C. Reinforcements for 100 mm thick hollow block shall consist of 10 mm diameter at 0.6 m vertical bars and 10 mm diameter horizontal bar for every 3 layers of blocks. Reinforcement for 150 & 200 mm thick shall be 10 mm diameter bar spacing the same as that 100 mm thick concrete hollow block. All cells of concrete hollow blocks below and above ground level shall be filled with 1:3 cement mortar. Bond beam shall be filled with class "A" (1:2:4). Pours shall be stopped five (5) cm. below of a top of a coarse to form a key of four (4) joints. Reinforcing bars shall have a lap of 40 x bar diameter. All horizontal reinforcements shall be tied to the vertical reinforcements of their intersection.

Note: Reinforcement of CHB identified or specified on structural plans shall govern over the reinforcement specified herein.

D. at door and window openings, unless otherwise shown on detail, the jamb blocks and beam blocks over opening and below window sill shall be reinforced as follows:

1. Jamb blocks for 100 mm and 150 mm thick walls, use two (2) 10 mm diameter bars.

2. Jamb blocks for 200 mm thick walls, use two (2) 10 mm diameter bars.

3. Beam blocks below window sill, use two (2) 10 mm bars for 100 mm, 150 mm, and 200 mm thick walls.

4. Beam blocks for 100 mm and 150 mm thick walls, use two (2) 12 mm dia. bar up to 1.20 m wide.

5. Beam blocks over opening for 200 mm walls, use two (2) 12 mm dia. bar up to 1.50 m wide.

6. Reinforcing over for beam blocks over opening other that those specified above are shown on plans.

Surface Treatment and Furnishing

The exposed surface of the concrete hollow blocks without specific finish shall be 12mm cement mortar into two (2) applications (scratched and finished coats) consisting of 15.9kg (94 1bs.) of PORTLAND Cement, and 0.11 cu. m. (4 cu. ft.) of clean river sand properly screened and all thoroughly mixed together before the necessary amount of water is added to form a workable mix. The scratch coat shall be left to season fully for at least three (3) week to about a month. After this period, keep the surface wet at least two (2) hours before applying the finished coat.

E. REPAIR, POINTING, AND CLEANING

Repair

Masonry units which are loose, chipped, broken stained or damaged shall be removed and replaced, and new units shall be provided to match adjoining units and installed in fresh mortar and gout.

Pointing

Upon completion of all work, all holes and joints are exposed masonry surface shall be pointed completely filling with mortar.

Cleaning

After pointing, all exposed masonry shall be wetted and then cleaned with a 10 percent solution of muriatic acid, applied with stiff fiber brushes leaves the masonry clean, free or mortar daubs, and thigh mortar joints throughout.

Immediately after cleaning, masonry surfaces shall be rinsed down with clean, clear water.

Visual Inspection

a. All units shall be sound and free from cracks or other defects that interfere with the proper placing of unit or impair the permanence of the construction.

b. Units that are intended to serve as a base of plaster or stucco shall have sufficiently rough surface to afford good bond.

F. PAYMENT METHODOLOGY

The work under this item shall be measured by the area of actually installed as per planned. Considered area surface area are those of which covered by gypsum/fiber cement board only disregarding support extensions. Excess of the quantity due to Contractors corrections such as increase/decrease of dimensions shall not be considered in the pay item. The pay item shall be in inclusive of all the materials and labor required to accomplish this work.

For uniformity, the method of measurement shall be used:

1. Measure the area of the CHB wall using the center of wall along its thickness.
2. Openings such as doors and windows shall not be considered as pay item
3. Structural members, lintel beams and stiffener columns shall not be considered in the computation of area as these are different items of work.

For a work to be considered finished, the wall must have undergone all the necessary work from framing to installation of board walls. The quantities to be paid shall only include those of which completely finished, inspected and acceptable by the PMT.

CHAPTER II: PLASTERING WORKS

GENERAL

1. Scope

This section covers the requirement for providing all plastering work at the Project site. The work shall include furnishing all labor, materials, equipment, tools and transportation necessary to complete the plastering work indicated on the drawings and specified herein.

2. Materials

Cement

Cement shall be ordinary Portland cement and white cement conforming to JIS R 5210 "Portland Cement"

Sand

Sand shall be clean, hard and free from soil, salt and other organic foreign matter. The grading of sand shall be as follows.

Coat	Percentage by weight passing sieves	
Scratch and Brown Coat	Passing 5 mm sieve	: 100%
	Passing 0.15 mm sieve	: 10%
Finished Coat	Passing 2.5 mm sieve	: 100%
	Passing 0.15 mm sieve	: 10%

Water

Water shall be clean and free from objectionable salt, iron, sulfur and other organic matte.

3. Storage of Materials

a. The Contractor shall inspect the brand and quality of all materials and store them neatly to prevent damage and mixing.

b. Cement and plaster shall be stored off the ground in a storage shed and kept absolutely dry. No pile of bags shall exceed 10 bags in height.

4. Workmanship

Protection

a. The Contractor shall provide proper protection so as to prevent damage to adjacent finished surfaces such as door frame and window frame during plastering work to the satisfaction of the PMT.

b. All surfaces to be plastered shall be protected by sheets or other appropriate covering to prevent them from becoming excessively dry due to exposure to the sun or wind.

c. All plastered surfaces shall be properly protected to prevent any dirt, stains or damage from spoiling work.

Prevention of Cracks

a. Where any adhesives are used on the bed surfaces or mixed into the cement mortar, they shall be approved by the PMT.

b. Connections of different materials and other portions prone to cracks shall be provided with pointed joints.

c. Where surface abrasion is observed on the plastered surfaces, they shall be chipped of and be made good to the satisfaction of the PMT.

d. Where cracks occur on the scratch coat or the brown coat, they shall be filled and sanded before the following coat.

e. Large areas of plastered surfaces of floors exposed to weather shall be provided with expansion joints not more than 4-5 m unless otherwise noted and detail shall be as follows.

Draw illustration

Recess by plastic or wooden
Mold & sealed
f. Scratch and brown coat shall be left at least 1 month before finish coating.
g. Wall control joints: see 4.4 application f. wall joints

Mix Proportions and Thickness of Cement Mortar

The mix proportions and thickness of cement mortar shall be as follow:

		Mix (by volume)		Thickness (mm)			
Base	Location	Scratch Coat	Brown and finish coat	Scratch coat	Brown coat	Finish coat	Total
Concrete and or Brick	Floor under bed	1:3	1:3	21		6	27
	Floor finish	1:2.5	1:2.5		30		30
	Interior wall	1:2.5	1:3	6	15	3	24

For brown and finish coats of interior walls, admixtures may be mixed to a proportion 1:3 (cement admixture) subject to the PMT's approval.

Application

a. Base Preparation
All the base surfaces to be plastered shall be thoroughly cleaned immediately before plastering.

The base surfaces shall be dampened to have a regular absorption characteristic.
b. Mixing of Plastering Materials
All plastering materials shall be mixed in power- operated mixer to ensure a uniform distribution of materials.
c. Scratch coat
A scratch coat shall be adequately trowel led on the bed surface to prevent voids on coated surfaces, and be scratched to provide an adequate key for the following coat.

Coated surfaces shall be left at least two weeks to allow cracks to occur for the interior and four weeks for the exterior. The cracks shall then be filled and sanded smoothly before the application of the following coat.

d. Brown coat
A brown coat shall be screeded and wood floated
Corners and reveals shall be screeded before brown coating
e. Finish coat

When the brown coat has properly dried, the finish coating shall be applied in such a manner as will produce perfectly smooth surface. Reveals shall be coated to form an even surface of accurate dimension.

Trowel led finishes shall be achieved with a steel finishing trowel when the surfaces have properly dried.

Brush finishes shall be formed using a brush in a regular pattern after wood floating. For wet brushing, care shall be taken that excessive water is not used.

f. Wall Control Joints & Reinforcement

Wall to be plastered shall be provided with plastering battens to ensure a straight and accurate surface. After the area has been plastered the battens shall be carefully removed and the gap pointed smooth.

All plastered finishes shall have control joint & reinforcement with joint metal devises for the purpose to allow movement of finish material. Divided area of these finishes shall be approx. every 5-6 m, and necessary reinforcement shall be taken as mentioned below unless otherwise noted in the Drawings.

These conditions shall be strictly carried out in any parts of the building to avoid the crack and no exception shall be accepted.

The expansion reinforcement devices shall be manufactured by the Expanded Metal Co., Ltd. (EXPAMET) as follows or approved equivalent.

Forms movement joints in render: Movement bead w/ PVC extrusion
Forms & protects lower "bell cast" edge: Render stop
Finishes render edges for doors & windows: Stop bead
Conner applications: Angle bead
Render joints between conc. Structures and brick or conc. Block: Rib-lath

Notes:
For the application of above mentioned devices for outdoor & semi-outdoor where covered area but not enclosed as interior, interior of toiled, shower room & other humid rooms, materials shall be stainless steel and for interior use other than above, steel material can be used.

g. Floor Screeding

Concrete surfaces shall be chipped off to remove laitance, cleaned and dampened.

A guide or leveling string shall be used to indicate the finished levels of the screed.

Mortar shall be applied with a brush to the concrete surface and then a stiff-mixed screed shall be applied as the first coat to be screeded.

When the screeded surfaces have properly set, a 6 mm finish coat shall be applied and be well trowel led.

PART VI: WATERPROOFING WORK

GENERAL

Scope

This section covers the requirement for providing all the waterproofing work at the Project site. The work shall include furnishing all labor materials, equipment, tools, and transportation necessary to complete the waterproofing work indicated and drawings specified herein.

Item of Work

Item of the work shall include but not limited to the following:

a. Cement mixed waterproofing finishes.

b. Polyurethane resin coating (for roof area)

c. Polyurethane waterproofing (for interior floor area)

d. Sealing work

MATERIAL

Waterproofing materials used shall be as follows:

a. Cement mixed waterproofing agents shall be synthetic resin type or as approved by the PMT and the owner/'s representative prior to approval and application.

b. Cement and sand shall be specified in SECTION 13.

The contractor shall submit a certificate and samples of the materials to the PMT for his approval before use.
All water proofing materials shall be properly protected so as to prevent damage before use.

GENERAL REQUIREMENTS

Climatic Conditions

The contractor shall be responsible for determining the consultation with the PMT whether or not the waterproofing shall be carried out when rain is expected or base surfaces are wet due to rain or under inverse climatic conditions as storing winds or high humidity.

Base Preparation

a. all cement rendered and or concrete surfaces to receive the waterproofing work shall be cleaned and be free from dust, staining, oil, and laitance.

b. All base surfaces shall be all finished true to slope as specified and well drained, especially around drained outlets.
Waterproofing Test

When the PMT deems necessary to inspect the waterproofing work, the contractor shall test in the accordance with instruction of the PMT.

APPLICATION

Cement Mixed Waterproofing

a. Mixing

Mixing shall be conducted with accordance with Manufacturer's Instructions.

b. The waterproofing mortar shall be applied to have the thickness of 25- 30 mm and three coat work.

Polyurethane Resin Coating

a. Polyurethane resin coating shall be applied to the roof area where the indicated on the drawings.

b. Polyurethane resin coating shall be complied as followings.

1. Primer
2. Undercoat
3. Middle coat
4. Overcoat
5. Finishing

c. Corner shall be reinforced with fiber mesh after undercoat.

d. Application shall be conducted in accordance with the Manufacturer's instructions.

Polyurethane Waterproofing (Due for approval)

a. Polyurethane waterproofing shall be applied to the interior floor where indicated on the drawing.

b. Polyurethane Waterproofing shall be complied as follows.

1. Primer
2. Undercoat
3. Fiber mesh reinforcement
4. Middle coat
5. Overcoat
6. Finishing

c. Application shall be conducted in accordance with the Manufacturer's Instructions.

CURING AND PROTECTION

Cement Mixed Waterproofing
Applied service shall be protected to prevent over rapid drying and be allowed to harden completely before supporting traffics.
Polyurethane Resin Coating and Polyurethane Waterproofing
Curing and protecting shall be done on accordance with Manufacturer's Instructions.

SEALING WORK

Materials
Sealing materials shall conform to JIR\S A 5758 "Sealing Compounds for Sealing and Glazing in Buildings" and as following or approved equivalent.

a. Silicone sealing compounds
b. Modified silicone sealing compounds
c. Polysulfide sealing compounds
d. Other materials such as primer, back- up bond breaker of curing tape shall be necessary and in accordance with Manufacturer's Instructions.

Traders

Sealing work shall be carried out by a sub- contractor with well experienced and who specialize in the work specified herein and is approved by the PMT.

Application

a. Silicone sealing shall be filled for metal- metal joints, glass- glass joints and metal- glass joints.
b. Modified silicone sealing shall be filled with metal- concrete or tiles joints and concrete- pre cast concrete or tiles joints as indicated in the drawing.
c. Poly-sulfide sealing shall be filled for all exterior construction joints, around exterior door and windows and other joints as indicated on the drawings.

WARRANTY PERIOD

Warranty period of Polyurethane resin coating and polyurethane waterproofing shall be 10 years or as per manufacturer/dealer's standard after the date of delivery of the buildings.

PART VII: ARCHITECTURAL FINISHES

CHATTER I: VINYL FLOORING

A. GENERAL

The work to be undertaken in this section shall comprise the furnishing, fabrication, and installation of all materials including testing as indicated in the plans or specified herein.

B. SUBMITTALS

1. Manufacturer's full range of samples conforming to the specifications
2. Test results required by PMT
3. Shop drawing of the layout of flooring as per actual dimensions for PMT's approval.
4. Installer certificate

C. MANUFACTURER/SUPPLIER

Provide each type of flooring as provided by a single manufacturer, including recommended primers, adhesives, sealants, patching and leveling compounds.

D. TESTING

The following are the applicable ASTM test standards that the PMT may require to the contractor befor the approval of the materials.

1. F137 Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus
2. F141 Terminology Relating to Resilient Floor Coverings
3. F386 Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces
4. F410 Test Method for Wear Layer Thickness of Resilient Floor Coverings by Optical Measurement
5. F925 Test Method for Resistance to Chemicals of Resilient Flooring
6. F970 Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading
7. F1514 Test Method for Measuring Heat Stability of Resilient Flooring by Color Change
8. F1515 Test Method for Measuring Light Stability of Resilient Flooring by Color Change
9. F1914 Test Methods for Short-Term Indentation and Residual Indentation of Resilient Floor Covering

E. MATERIAL SPECIFICATIONS

1. VINYL SCHEDULE OF FINISHES

a. Non-directional Vinyl Roll Floor Finish (F-2)

- Vinyl Composition: Homogenous throughout its thickness, Anti-static, anti-bacterial
- Dimension: not applicable
- Minimum width: 2.0 meters
- Minimum Thickness: 2 mm
- Pattern direction: Non-directional
- Finish, Color, & Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) or combination of finish, color, or pattern)

b. Directional Vinyl Roll Floor Finish (F-1a)

- Vinyl Composition: Homogenous throughout its thickness, Anti-static, anti-bacterial
- Dimension: not applicable
- Minimum width: 2.0 meters
- Minimum Thickness: 2 mm
- Pattern direction: Directional
- Finish, Color, & Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) or combination of finish, color, or pattern)

c. Vinyl Tile Floor Finish (F-2)

- Vinyl Composition: Homogenous throughout its thickness, Anti-static, anti-bacterial

- Dimension: as per specified on plans
- Minimum Thickness: 3 mm
- Finish, Color, & Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) or combination of finish, color, or pattern)

2. VINYL FLOORING PRIMER
   a. Water based solvent free
   b. Low odor

3. SELF LEVELING COMPOUND
   a. Fast drying and ready to receive adhesive when dry.
   b. Bulk density of 1200 kg/m3
   c. Minimum compressive strength: 22 MPA after 28 day
   d. Minimum tensile/bending strength: 5 MPA after 28 day

4. VINYL FLOORING ADHESIVE
   a. Water based acrylic co-polymer blend
   b. Odorless when dry

5. COVE FORMER
   a. Rubberized
   b. 25 mm radius

6. CAPPING STRIP
   a. Vinyl cap
   b. Color: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) or combination of color)

7. FLOOR POLISH
   c. Protective liquid floor polish as per manufacturer's recommendation.

F. MATERIAL DELIVERY, STORAGE AND HANDLING

All vinyl, adhesive, primers, and other accessories delivered shall be in their original containers, seals unbroken, and labelled as follows:

1. Color name or code
2. Volume/Weight content (for primers, adhesive and levelling compound)
3. Date of production and expiration date
4. Product major constituent's contents
5. Application instructions and warnings
6. Maintenance data

G. PAYMENT METHODOLOGY

The work under this item shall be measured by the area of surface actually installed as per planned. Excess of the quantity due to Contractors corrections such as increase of dimensions shall not be considered in the pay item. The pay item shall be in inclusive of all the materials and labor required to accomplish this work.

For a work to be considered finished, the flooring must have undergone all the necessary work from surface preparation to polishing and covering of floor. The quantities to be paid shall only include those of which completely finished, inspected and acceptable by the PMT.

H. INSTALLATION

1. Installer Qualifications

   Installer must be experienced in performing work of this section. Whenever possible, the installer must be employed by the manufacturer of the flooring vinyl and must be certified by the manufacturer as their installer. When the installation is not to be done by direct employee of the supplier/manufacturer, the installer must have at least installed 200 sq.m. of vinyl flooring.

2. Pre- installation

Obtain Architect's acceptance of finish color, texture and pattern, and workmanship standard. It is the Contractor's responsibility to comply with the following"

a. Size and Location of Mock-Up: [Specify the size and location of the mock-up.]
b. Maintenance of Mock-Up: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
c. Approval of Mock-Up: Upon the PMT's approval of the mock-up, this installation shall be considered the standard of quality and basis of comparison for the balance of the project. Areas to be found deficient by specification standards or application procedures shall be repaired or replaced at the contractor's expense.
d. Incorporation of Mock-Up: The mock-up may be incorporated into final construction upon PMT's approval.

3. Sub-floor Preparation

a. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer
b. Sand blast or grind the sub floor to obtain rugged surface.
c. Apply a good quality 2 mm – 5 mm levelling compound filling layer and allow a drying time of 4 to 8 hours.
d. Use an 80 grain size sand paper to obtain a smooth surface.
e. Perform Alkalinity, Adhesion, moisture testing and other test required by PMT before proceeding to installation

4. Floor Installation

a. Unroll floor coverings and allow them to stabilize before cutting and fitting
b. Install Capping Strips and Cove Former using contact cement and as per manufacturer's instructions. Cove floor coverings must be at least 100 mm high or as indicated on plans.
c. Apply Primer as per manufacturer's instructions.
d. Apply floor adhesive as per manufacturer's instructions.
e. Install vinyl flooring as per manufacturer's instructions. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
f. Seams between adjacent areas are obtained by cutting the overlapping edges.
g. Install welding rod at all seams
h. Protect flooring from heavy traffic for at least 24 hours.

5. Cleaning and Polishing

a. Wet mop using a high quality floor cleaner having neutral or mild alkaline properties and follow the instructions. Remove all stains immediately to avoid permanent marks on the floor. Stain removers to be used shall not damage the floor coverings.
b. Apply at least three (3) coats of liquid floor polish.

6. Protection before turn-over

a. After inspection and acceptance of work, the Contractor shall protect the flooring with covering until usage by end-user.

CHAPTER II: TILE WORKS

A. GENERAL

This section covers the requirements for providing all the Tile works at the Project site. The work shall include furnishing and labor, materials, equipment, tools and transportation necessary to complete the tile works indicated on the drawings and specified herein.

B. SUBMITTALS

The Contractor shall submit to the PMT for his approval samples of the following.

1. Manufacturer's full range of samples tiles conforming to the specifications (Provide full size of sample for 600mm x 300mm and below, for tiles greater than 600mm x 300mm, provide at least 150mm x 150mm cut sized from original dimension)
2. Shop drawing of the layout of flooring as per actual dimensions for PMT's approval. The Contractor shall submit to the PMT for his approval detailed drawings showing tile and terrazzo arrangements and joint layout.

    a. Tiles delivered to the Project site shall be inspected and sorted by color and dimensions before installation.

    b. All tiles shall be the type with dovetail of its back.

C. MATERIALS SPECIFICATIONS

1. TILE SCHEDULE OF FINISHES

a. Non-Skid Ceramic Floor Tile Finish (F3)

- Composition: Natural stone
- Tile Size: As per specified on plans/Bill of quantities
- Thickness: Minimum of 6.4 mm
- Surface: Slip-resistant (non-skid)
- Finish, Tile Color, and Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) finish, color, or pattern)
- Grout Color: As selected by Architect on Record from manufacturer's full range

b. Polished Ceramic Floor Tile Finish (F3a)

- Composition: Natural stone
- Tile Size: As per specified on plans/Bill of quantities
- Thickness: Minimum of 6.4 mm
- Surface: Polished
- Finish, Tile Color, and Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) finish, color, or pattern)
- Grout Color: As selected by Architect on Record from manufacturer's full range

c. Non-Skid Porcelain Floor Tile Finish (F4)

- Composition: Full Body Impervious Natural stone
- Tile Size: As per specified on plans/Bill of quantities
- Thickness: Minimum of 10 mm
- Surface: Slip-resistant (non-skid)
- Finish, Tile Color, and Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) finish, color, or pattern)
- Grout Color: As selected by Architect on Record from manufacturer's full range

d. Porcelain Floor Tile Finish (F4a)

- Composition: Full Body Impervious Natural stone
- Tile Size: As per specified on plans/Bill of quantities
- Thickness: Minimum of 10 mm
- Surface: Polished

- Finish, Tile Color, and Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) finish, color, or pattern)
- Grout Color: As selected by Architect on Record from manufacturer's full range

e. Non-Skid Porcelain Floor Tile with Anti-slip Grooves Finish (F5)
- Composition: Homogenous Full Body Impervious Natural stone
- Tile Size: As per specified on plans/Bill of quantities
- Thickness: Minimum of 10 mm
- Surface: Slip-resistant (non-skid) w/ anti-slip grooves
- Finish, Tile Color, and Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) finish, color, or pattern)
- Grout Color: As selected by Architect on Record from manufacturer's full range

f. Non-Skid Ceramic Wall Tile Finish (W4)
- Composition: Natural stone
- Tile Size: As per specified on plans/Bill of quantities
- Thickness: Minimum of 6.4 mm
- Surface: Slip-resistant (non-skid)
- Finish, Tile Color, and Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) finish, color, or pattern)
- Grout Color: As selected by Architect on Record from manufacturer's full range

g. Polished Ceramic Wall Tile Finish (W4a)
- Composition: Natural stone
- Tile Size: As per specified on plans/Bill of quantities
- Thickness: Minimum of 6.4 mm
- Surface: Polished
- Finish, Tile Color, and Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) finish, color, or pattern)
- Grout Color: As selected by Architect on Record from manufacturer's full range

h. Non-Skid Porcelain Floor Tile Finish (W5)
- Composition: Impervious Natural stone
- Tile Size: As per specified on plans/Bill of quantities
- Thickness: Minimum of 6.4 mm
- Surface: Slip-resistant (non-skid)
- Finish, Tile Color, and Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) finish, color, or pattern)
- Grout Color: As selected by Architect on Record from manufacturer's full range

i. Porcelain Floor Tile Finish (W5a)
- Composition: Impervious Natural stone
- Tile Size: As per specified on plans/Bill of quantities
- Thickness: Minimum of 6.4 mm
- Surface: Polished
- Finish, Tile Color, and Pattern: As selected by Architect on Record from manufacturer's full range (selection can be more than one (1) finish, color, or pattern)
- Grout Color: As selected by Architect on Record from manufacturer's full range

2. TILE ADHESIVE
   a. Cement Based
   b. Low VOC Levels
   c. Adhesive must meet specified requirements of ANSI standard A118.1

3. CEMENT
   Cement shall be ordinary Portland cement conforming to JIS R 5210 "PORTLAND CENTER".

4. SAND
   a. Sand shall be clean, hard and free from soil, salt and other organic foreign matter.
   b. The grading of sand shall be as follows:

Percentage by weight passing sieves			
0.5mm	0.6mm	1.2mm	2.5mm
	10% or less		100%

D. MATERIAL DELIVERY, STORAGE AND HANDLING

All tiles and tiling materials delivered shall be in their original containers and seals unbroken. Store materials in a clean and neat room. The Contractor shall ensure the protection of materials from extreme temperature exposure.

E. INSTALLATION

1. Pre-Tile installation
   a. Apply waterproofing membrane to substrate at wet areas in accordance to Chapter XII of this specification.
   b. Perform necessary test to ensure no water leaks.

2. Mortar
   a. Mixing proportion of cement and sand for mortar shall be 1:3 by volume.
   b. Grouting mortar shall be neat cement unless otherwise specified.
   c. Mortar shall be produced adding water within 2 hours after cement and sand are mixed. Mortar shall be used within 40 minutes after adding water. Mortar shall be 20 mm minimum thickness and well leveled.
   d. Use tile adhesive on floor before spreading cement-sand mix. Also, use tile adhesive on tile backing before laying in place.
   e. If waterproofing agents or additives are used in the mortar, the quality and proportions of such materials shall be approved by the PMT.

3. Wall tiling
   a. All wall surfaces to be tiled shall be thoroughly washed with clean water and leveled with mortar. All surfaces exposed with sunlight shall be protected with a suitable cover.
   b. After based coats have completely set, the surfaces shall be cleaned and dampened. Stretched strings shall be ensuring accurate alignment of the joint layout.
   c. Each tile shall be backed with adequate setting mortar and pressed onto the base mortar coat.
   d. Each tile shall be tamped in place with a wood hammer so the mortar completely covers the back of the tile and is forced out around the tile edges.
   e. If the mortar is not adequate, the void shall be filled with dry- mix mortar to ensure a full backing and pressure a plumb and true surface. In no case shall cement be use for fixing the voids.
   f. The interior tiling shall not exceed 1.8 m in height each day.
   g. As soon as the setting motor has sufficient hardened, the tile surfaces shall be brushed, washed with clean water and wiped with a clean cloth.

4. Floor tiling
   a. All floor surfaces to be tiled shall be thoroughly washed with clean water and be screened by mortar to a level surface. The base shall be laid to falls as necessary for drainage. Each mortar application shall not exceed 6 -8 m^2. All surfaces exposed to sunlight shall be protected with a suitable table.
   b. A bedding mastic 20 mm thick shall be provided beneath floor tiles on a leveling screed. The tiles shall be laid true to alignment without irregularities and be- well tamped with a wood hammer to force the mastic to exude around all edges of each tile as it is laid.
   c. Two hours after laying the tiles shall be damped to soak and the alignment shall be checked to ensure an even joint layout without any differences between prices.

d. All tiled surfaces shall be well cleaned with wet brushes, and cloths to remove all surface dirt, stains or water splashes. No foot traffic nor vibration shall be permitted within 24 hours of laying floor tiles.

5. Joints
   a. All joints shall be filled with grouting mortar at least 48 hours after tiles have been laid using a rubber spatula.
   b. The grouting mortar shall be used within 1 hour after adding water.
   c. Where the joint is not more than 3 mm, the gap shall be grouted with neat cement.
   d. Where the joint is between 4-7 mm, the gap shall be grouted with mortar having a cement and sand proportion of 1:0.25 by volume.

6. Curing & protection of finish material
   a. All tiled surfaces shall be properly cured to prevent rapid drying for 4 weeks after tile laying.
   b. All tiles surfaces shall be washed down with brushes and cloths to remove smears.
   c. At external corners or openings liable to damage, completed tiling shall be properly protected with wood boards.
   d. Floor surfaces shall be protected with both thick vinyl film and plywood at least t=3 mm for whole area immediately after the pointing mortar application.

F. PAYMENT METHODOLOGY

The work under this item shall be measured by the area of surface actually installed as per planned. Considered area surface area are those of which covered by floor finished. Excess of the quantity due to Contractors corrections such as increase/decrease of dimensions shall not be considered in the pay item. The pay item shall be in inclusive of all the materials and labor required to accomplish this work.

For a work to be considered finished, the wall must have undergone all the necessary work from floor preparation up to the application of grout. The quantities to be paid shall only include those of which completely finished, inspected and acceptable by the PMT.

CHAPTER III: FIBER CEMENT WALLS AND GYPSUM WALLS

A. GENERAL

This section covers the requirement for providing all plastering work at the Project site. The work shall include furnishing all labor, materials, equipment, tools and transportation necessary to complete the works indicated on the drawings and specified herein.

B. SUBMITTALS

The Contractor shall submit to the PMT for his approval samples of the following.

1. Manufacturer's full range of samples conforming to the specifications
2. Manufacturer's specifications
3. Shop drawing of the layout of walls as per actual dimensions for PMT's approval.
4. Test result required by PMT

C. MATERIALS SPECIFICATIONS

1. Framing System

Framing system for Studs and Tracks shall be 35 mm x 76 mm x 0.7 mm thk. Galvanized material. Metal studs shall be straight, light, non-combustible and not susceptible to termite damage. Screws and power actuated shall be used to connect framing components and fasten other materials to the framing.

2. Board Finish

a. 1.2 m x 2.4 m x 6 mm thk fiber cement board Finish (W6)
b. 1.2 m x 2.4 m x 12 mm thk gypsum board Finish (W7)
c. 1.2 m x 2.4 m x 12 mm thk gypsum board Finish (W7a)

3. Revit and Screws

As per supplier's recommendation

D. STORAGE OF MATERIALS

1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
2. Store materials protected from exposure to rain, or other harmful weather conditions.

E. INSTALLATION

1. Framing system

Vertical studs shall be connected to the matching floor and ceiling track (runner) with pan head screws, spaced at 600 mm on center spacing. Horizontal studs shall be then installed across the vertical studs. Wallboard or other sheathing shall be then attached with type S (fine-tread) drywall screws.

2. Framing System Method of Installation

a. Cut studs and track to required lengths as you install using aviator snips or circular saw with abrasive, metal cutting blade.
b. Attach ceiling track. Use drywall screws to attach to joists. For parallel joists, bridge two joists with track spaced 61 cm o.c. or less and install ceiling runner across bridges.
c. Plumb to position floor runner directly below ceiling track.
d. Attach floor track. Use power-actuated fasteners for concrete floor. Use drywall screws for wood sub-floor. Same fastener spacing as ceiling track. Then mark stud locations 40.64 cm o.c. top and bottom starting from the same end.
e. Insert stud at slight angle into tracks – then twist into place. Be sure all studs are pointed the same way for easier drywall attachment and punch-outs are oriented the same way for easy plumbing or electrical installation.
f. Screw-attach stud to ceiling track and floor track with 1.11 cm pan or wafer-head screws. Hold stud flange to runner for easier screw attachment.

g. For door and window openings, cut track 10.16 cm longer than opening. Notch legs and bend web 90 deg. to attach to jamb stud.
h. Attach C-runner bracing across studs to support cabinet attachment. C-runner must be notched to fit between studs.
i. Insert grommets or pieces of pipe insulation into pre-punched holes whenever you pass through wiring or plumbing.
j. Screw-attach drywall to framing using drywall screws. Board should be attached to the open end of the studs first.
k. Install comer beads and trim with screws or staples.
l. Tape and finish with joint compound

3. Drywall Board Method of Installation

a. When board is installed parallel to framing members, space fasteners shall be 200 millimeters on center in field of the board and 200 millimeters on center along edges.
b. When board is installed perpendicular to framing members, space fasteners shall be 200 millimeters on center in field and along edges.
c. Screws shall be staggered on abutting edges or ends.
d. 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 board shall be applied vertically over "I" furring channels.
e. For two-ply 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.

F. PAYMENT METHODOLOGY

The work under this item shall be measured by the area of surface actually installed as per planned. Considered area surface area are those of which covered by gypsum/fiber cement board only disregarding support extensions. Excess of the quantity due to Contractors corrections such as increase/decrease of dimensions shall not be considered in the pay item. The pay item shall be in inclusive of all the materials and labor required to accomplish this work.

For a work to be considered finished, the wall must have undergone all the necessary work from framing to installation of board walls. The quantities to be paid shall only include those of which completely finished, inspected and acceptable by the PMT.

CHAPTER IV: FIBER CEMENT BOARD CEILING AND GYPSUM BOARD CEILING

A. GENERAL

This section covers the requirement for providing all ceiling work at the Project site. The work shall include furnishing all labor, materials, equipment, tools and transportation necessary to complete the work indicated on the drawings and specified herein.

Board can be either of the following depending on architectural drawing.

a. 6 mm thk fiber cement board Finish (C-3)
b. 4.5 mm thk fiber cement board Finish (C-3a)
c. 10 mm thk gypsum board Finish (C-4)

B. MATERIALS

Framing system shall be straight, light, non-combustible and not susceptible to termite damage. Screws and power actuated shall be used to connect framing components and fasten other materials to the framing. Materials are the following:

a. Board can be either of the following depending on architectural drawing.
   - 1.2 m x 2.4 m x 6 mm thk fiber cement board (C-1)
   - 1.2 m x 2.4 m x 4.5 mm thk fiber cement board (C-1a)
   - 1.2 m x 2.4 m x 10 mm thk gypsum board (C-2)
b. 19 mm x 50 mm x .4 mm thk. Double furring channel
c. 12 mm x 38 mm x 1 mm thk Carrying channel
d. Double furring clip
e. Wall Angle
f. 5/32" Blind rivet
g. 1-1/4" Concrete nail
h. Steel Angle
i. Suspension Clip
j. Suspension Rod

C. STORAGE OF MATERIALS

a. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
b. Store materials protected from exposure to rain, or other harmful weather conditions.

D. WORKMANSHIP

a. Fix and align accurately all steel angles at the maximum interval of 1.20 meter for longer side and maximum interval of 0.8 meter for the shorter side.
b. Tie the suspension rod securely to the steel angle.
c. Attach the carrying channel to the suspension clip then use the rod joiner to connect the suspension rod to the suspension clip.
d. Attach the metal furring to the carrying channel at right angle to each other using the furring clips. Metal furring shall be spaced with maximum distance of 0.40 meter o.c. and carrying channel shall be spaced with maximum distance of 1.2 meter o.c.
e. Ceiling boards (gypsum or fiber-cement) are attached to the metal framing by drywall screw. Screw shall be spaced at a maximum of 200 mm o.c.

F. PAYMENT METHODOLOGY

The work under this item shall be measured by the area of surface actually installed as per planned. Considered area surface area are those of which covered by gypsum/fiber cement board only disregarding support extensions. Excess of the quantity due to Contractors corrections such as increase/decrease of dimensions shall not be considered in the pay item. The pay item shall be in inclusive of all the materials and labor required to accomplish this work.

For a work to be considered finished, the wall must have undergone all the necessary work from framing to installation of board ceilings. The quantities to be paid shall only include those of which completely finished, inspected and acceptable by the PMT.

CHAPTER V: PVC CEILING

A. GENERAL

This section covers the requirement for providing all ceiling works using PVC ceiling at the Project site. The work shall include furnishing all labor, materials, equipment, tools and transportation necessary to complete the work indicated on the drawings and specified herein.

B. MATERIALS

Framing system shall be straight, light, non-combustible and not susceptible to termite damage. Screws and power actuated shall be used to connect framing components and fasten other materials to the framing. Materials are the following:

a. 200 mm wide PVC Ceiling Panels (C-7,
b. 19 mm x 50 mm x .4 mm thk. Double furring channel
c. 12 mm x 38 mm x 1 mm thk. Carrying channel
d. Double furring clip
e. Wall Angle
f. 5/32" Blind rivet
g. 1-1/4" Concrete nail
h. Steel Angle
i. Suspension Clip
j. Suspension Rod
k. Steel Angle Bracket
l. 3/8" Hex bolt w/ washer

C. STORAGE OF MATERIALS

c. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
d. Store materials protected from exposure to rain, or other harmful weather conditions.

D. WORKMANSHIP

a. Fix and align accurately all steel angles at the maximum interval of 1.20 meter for longer side and maximum interval of 0.8 meter for the shorter side.
b. Tie the suspension rod securely to the steel angle.
c. Attach the carrying channel to the suspension clip then use the rod joiner to connect the suspension rod to the suspension clip.
d. Attach the metal furring to the carrying channel at right angle to each other using the furring clips. Metal furring shall be spaced with maximum distance of 0.40 meter o.c. and carrying channel shall be spaced with maximum distance of 1.2 meter o.c.
e. PVC ceiling panels are attached to the metal framing by drywall screw. Screw shall be spaced at a maximum of 200 mm o.c.

F. PAYMENT METHODOLOGY

The work under this item shall be measured by the area of surface actually installed as per planned. Considered area surface area are those of which covered by PVC Ceiling only disregarding support extensions. Excess of the quantity due to Contractors corrections such as increase/decrease of dimensions shall not be considered in the pay item. The pay item shall be in inclusive of all the materials and labor required to accomplish this work.

For a work to be considered finished, the wall must have undergone all the necessary work from framing to installation of PVC ceilings. The quantities to be paid shall only include those of which completely finished, inspected and acceptable by the PMT.

CHAPTER VI: ACOUSTIC CEILING

A. GENERAL

This section covers the requirement for providing all ceiling works using acoustic ceiling at the Project site. The work shall include furnishing all labor, materials, equipment, tools and transportation necessary to complete the work indicated on the drawings and specified herein.

Board can be either of the following depending on architectural drawing.
a. 600 x 600 x 15 mm or 600 x 1200 x 15 mm Fiber Mineral Acoustic Ceiling Finish (C-5)
b. 600 x 600 x 15 mm or 600 x 1200 x 15 mm Non-Perforated Clean Room Rated Acoustic Tiles (C-6)

B. MATERIALS

Framing system shall be straight, light, non-combustible and not susceptible to termite damage. Screws and power actuated shall be used to connect framing components and fasten other materials to the framing. Materials are the following:

a. Fiber Mineral Acoustic Ceiling / Non-Perforated Clean Room Rated Acoustic Tiles
b. Main Tee Runner 10'-12' Length Powder Coated
c. Cross Tee 4' Length Powder Coated
d. Cross Tee 2' Length Powder Coated
e. Wall Angle Powder Coated
f. #10 GI Wire Hanger
g. Steel Angle Bracket
h. 3/8" Hex bolt w/ washer
i. 1-1/4" Concrete nail

Suspension System

a. Ceiling tile manufacturer;s standard suspension system fabricated of cold-rolled hot-dipped galvanized sheet steel components providing minimum 170 g/m2 zinc coating conforming BS 2989 or ASTM A 653. System shall be designed and fabricated to meet the requirements of ASTM C 635 or equivalent BS standards. Finish shall be electro-statically applied lpowder coated polyester paint, whit color or as approved by the Consustant.
b. Accessories: Edge Moldings, hold-down clips and other necessary accesories shall be provided in accordance with the consulatnts selection and approval.

Acoutical Ceiling Tile:

a. Acoustical ceiling tiles shall be of mineral fiber of modular design and sizes and shall be of size 600 x 600 x 15 mm thk, unless otherwise indicated on the drawings. Tiles shall be fit the pattern as shown on the drawings. Mineral fiwer tiles conforming to BS 476, class O, Class 1 or ASTM E 1264 or Federal Specifications FS-SS-S-118B, Type III,, form 1 units; Class A; STC Range of 34-40 Db; nrc FROM 0.50 TO 0.70; DENSITY OF 240-260 KG/M3; rh OF 90%; Flame Spread of 0-25 and Smoke Developed 0-50 in accordance with ASTM E 84 or equivalent standards.
b. Finish. Factory-applied washable white finish or as shown in the drawing and approved by the PMT, with light reflectance value of LR over 75 percent.
c. Access Hatches: Provide manufacturer standard access hatches which are designed specially for the acoustical ceiling systems. Provide the access hatches with complete features including door locks, frames, pivots, metal trims and gaskets.

C. STORAGE OF MATERIALS

Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Store materials protected from exposure to rain, or other harmful weather conditions.

D. WORKMANSHIP

1. Suspension system
    a. Installation of suspension system shall be in accordance with BS 8290 or ASTM C 636 and in accordance with manuacture's directions
    b. Rough suspension

- Space hanges wires at a maximum 900 mm on centers, each direcion. Supported to Steel angle by looping and wire tying.
- Hanges shall be installed at ends of each suspension member and at light fixtures, 150mm from vertical surface.
- Wires shall not be splayed more than 125 mm in a 1200 mm vertical drop
- Wire shall be wrapped a meinimum of three times horizontally, turning the ends upward.

c. System shall be level within tolerance specifiesd and parallel with walls.

d. Wall moldings shall be installed at intersetion of suspended ceiling an vertical surfaces.

- Corners sjall be mitered whiere wall moldings interxesct or coenwe caps shall be installed in lieu therof
- Continuous ribbon of acoustical adhesive or caulding compound shall be appllied on vertical web
- Attachement to vertical surfaces shall be by means of mechanical fasteners.

2. Ceiling Tiles
   a. Installation of acoustical ceiling shall not begin until the building has been closed to weather with relative humidity not more thatn 70%
   b. Ceiling tiles shall be in a leveled lplane and in straight line courses
   c. Provife sutting and patching for the passage of materials of other trades.

CHAPTER VII: PAINTING WORKS

A. GENERAL

This section covers the requirements for performing all the painting work at the Project site. The work shall include furnishing all labor, materials, equipment, tools and transportation necessary to complete the painting work indicated on the drawings and specified herein.

B. SUBMITTALS

- Product Data: Manufacturer's data showing conformance to the specification specified
- Color Swatches: Manufacturer's complete range of colors for selection
- Sample actual color from the selected color swatches

C. MATERIALS

Painting materials shall conform to specifications and approved by the PMT. The Contractor shall submit a certificate to the PMT, if required.

Any auxiliary materials for painting shall be those compatible with properties of the respective paint as designated by the paint manufacturer or approved by the PMT.

The Contractor shall submit a paint sample to the PMT for their approval for each type of paint to show the finish given by it.

All materials shall be delivered to the Project site in manufacturer's sealed containers with a trade mark, product name and ISO mark expressly indicated thereon.

All paint colors shall be plant mixed and shall be mixed not more than 6 months prior to the application of paint.

D. MATERIAL DELIVERY, STORAGE AND HANDLING

All paint delivered shall be in their original containers, seals unbroken, and labelled as follows:

1. Color name or code
2. Volume content
3. Date of production and expiration date
4. Paint product major constituent's contents
5. Paint application instructions and warnings

Store paint materials in a clean and neat room. The Contractor shall ensure the protection of paint materials from extreme temperature exposure.

E. PAINT SCHEDULE OF FINISHES

1. ACRYLIC SOLVENT-BASED PAINT FINISH (P1)

a. Features: Acrylic, weather proof & water repellant.
b. Sheen Level Finish: Mid Sheen
c. Color: Factory mixed
d. Paint Type: Acrylic Solvent Based

2. ELASTOMERIC PAINT FINISH (P2)

a. Features: Odorless, self-priming and water-proofing paint, 100% Acrylic system, UV and water resistant.
b. Sheen Level Finish: Mid Sheen
c. Color: Factory mixed
d. Paint Type: Water-based emulsion paint

3. ACRYLIC SEMI-GLOSS LATEX PAINT FINISH (P3)

a. Features: 100% Acrylic based, lead free, mercury free.
b. Sheen Level Finish: Sheen (Semi-Gloss)
c. Color: Factory mixed
d. Paint Type: Water-based

4. ANTI-BACTERIAL PAINT FINISH (P4)
   a. Features: Anti-Bacterial/Anti-fungal formulation, Odorless, Stain resistant
   b. Sheen Level Finish: Sheen (Semi-Gloss)
   c. Color: Factory mixed
   d. Paint Type: Water-based emulsion paint

5. ACRYLIC QDE PAINT FINISH (P5)
   a. Features: Quick Drying Enamel (QDE)
   b. Sheen Level Finish: high Sheen (Gloss)
   c. Color: Factory mixed
   d. Paint Type: Water-based

6. ALKYD QDE PAINT FINISH (P6)
   a. Features: Quick Drying Enamel (QDE)
   b. Sheen Level Finish: high Sheen (Gloss)
   c. Color: Factory mixed
   d. Paint Type: Oil-based

F. APPLICATION

1. PREPARATION AND CURING

All paints shall be freshly mixed before use. The Contractor shall adjust the mix according to the type of surface, absorption quality and climatic conditions to achieve optimum cover.

Prior to painting, adjacent surfaces shall be properly protected and the surface to be painted shall be well prepared by filling and rubbing down where necessary.

Surfaces to be painted shall be neutralize, washed, sealed and allowed to dry out for the periods as described and recommended by the Paint brochure and standard procedures. The moisture contents and pH values shall not exceed 5% and 9 respectively unless otherwise permitted.

The Contractor shall ensure that no exterior painting is carried out unless at least 10 hours drying time can be reasonably expected. In addition, the Contractor shall take all necessary steps to protect newly painted surfaces from over-rapid drying by excessive sunlight or high winds.

No painting shall be done when sand or dust under strong winds or any other adverse climatic or environmental conditions are likely to damage or stain the painted surface.

All areas where painting is in progress shall be kept well ventilated to prevent inhalation of solvent gases. Due care shall be taken during painting work to avoid a condition leading to explosion or fire.

2. SURFACE TREATMENT

   a. WOOD SURFACE

   Prior to paint application, the surface to smooth surface removing all plane marks and grain blistering in accordance with table below

Wood Surface Preparation		
Procedure	Preparation	Materials and tools
1	Thoroughly remove dirt, oil, adhesive and other foreign matter or loose or peeling as recommended Paint previously applied	as recommended
2	Remove sap streaks as appropriate by scalping off and by wiping.	Heated scraper, as recommended
3	Smooth surfaces if they have plane marks, grain blistering	Sandpaper, #120-#240
4	Cover knots and surrounding parts adjacent to them with two coats of paint	Knotting paint or, Shellac varnish
5	Fill cracks, holes or other voids to surfaces by	Filling putty

	suitable filler	
6	Smooth surfaces	Sandpaper, #120-#240

Procedures 4,5 and 6 shall be used under opaque paint only

b. CEMENT RENDER, CONCRETE AND ASBESTOS CEMENT BOARDS

- Rendered surfaces shall be trowel led to smooth and even surface with no float marks or surface irregularities.
- Prior to painting, surfaces of cement render concrete and asbestos cement boards shall be prepared as described in table below

Surface Preparation for Cement Render, Concrete and asbestos Cement Board		
Procedure	Preparation	Materials and tools
1	Remove dirt or foreign matter without damaging surface. Clean surfaces with water, If necessary	Scraper, etc
2	Treat surfaces with anti-Synthetic absorption agents	Synthetic, emulsion sealer
3	Damp and, then fill cracks or Synthetic holes with the putty specified	Synthetic emulsion putty
4	Fill depressions or indents with Cement filler a spatula to smooth and even surface	Cement filler
5	Lightly sandpaper corrected Sandpaper surfaces	Sandpaper, #120-#180; no water to be used.

c. FERROUS METAL SURFACES

- Ferrous metal surfaces shall be prepared as described in Table below according to the locations, painting environment and surface condition.

Surface Preparation for Ferrous Metal Surface		
Procedure	Preparation	Materials and Tools
1	Remove dirt, adhesives and other foreign matter using a scraper of wire brush	Scraper, wire
2	Wipe the surface with benzene	Benzene
3	Remove loose rust using a scraper, Scraper, wire brush or cloths	brush or cloth

- The preparation shall be carried out continuously.

d. GALVANIZED METAL SURFACES

- galvanized metal surfaces shall be prepared as describe in the table below

Surface Preparation for Galvanized Metal		
Procedure	Preparation	Materials and Tools
1	Expose galvanized metal to weather for at least three months	
2	Remove dirt or other foreign matter and wash with water	Cloth
3	Apply one coat of etching primer at spreading rate of 0.05 to 0.1 kg/m2 and level 2-8 hours	Etching primer

e. PLYWOOD, GYPSUM AND OTHER BOARD SURFACES

- Plywood, gypsum and other board surfaces shall be prepared in accordance with Table 13.4.5 unless specified in Table below

Procedure	Preparation
1	Nail heads or other projections shall be hammered down or pulled out to leave an even surface. Any ferrous metal on the surface shall be coated with a lacquer varnish.
2	Remove dirt or other foreign matter. Oil shall be wiped clean with benzene.
3	Make smooth using sandpaper #120- #150
4	Clean out and fill cracks, holes, voids or dents with zinc putty or synthetic emulsion putty.

3. METHODOLOGY

a. Sieving
Prior to paint application, paint shall be thoroughly paddled in a container and, if deemed necessary, sieved to ensure a uniform finish.

b. Puttying
Deep holes, dents and large voids shall be filled with filling putty, and hollows and irregularities be filled with putty for surface preparation to smooth surfaces.

c. Absorption Sealer
For wood, concrete and cement render with high absorption rate or with surface of irregular absorption characteristic, apply one or two coats of sealer by brush.

d. Staining
When staining, due regard shall be given to the surface condition such as moisture content and hardness. Any variation in color on the surface to be stained shall be corrected as far as possible.

e. Filler
Apply filler to wood surfaces evenly in coating especially where deep graining occurs.

f. Sand papering
All fittings such as doors and windows shall be well rubbed down with sandpaper starting with a suitable coarse grade and gradually progressing to finer grades until a suitably smooth surface is obtained. Where water is used to aid rubbing down a suitable grade of waterproof emery paper shall be used.

g. Brush Applied Paint
Each coat shall be smoothly and evenly brushed and shall free from brush marks, gaps, sagging, running, foams or other defects.

h. Spray Applied Paint
A spray gun shall be held at right angles to, and be always moved parallel with the surface being painted. Provide sufficient laps at all sides of an area sprayed in one continuous gun manipulation. Each pass of gun shall be at right angles to the previous pass. Applications shall be made in such a manner that an even finish free of color irregularities can be obtained.

i. Film Coloration
Prime, second and final coats shall be slightly varied in color to facilitate identification.

G. PAYMENT METHODOLOGY

The work under this item shall be measured by the area of surface actually painted as per planned. Excess of the quantity due to Contractors corrections such as increase of dimensions shall not be considered in the pay item.

For a work to be considered finished, the surface must have undergone all the necessary work from surface preparation to final coating of paint. The quantities to be paid shall only include those of which completely finished, inspected and acceptable to the PMT.

CHAPTER VIII: METALLIC EPOXY (F-7)

A. GENERAL

The work to be undertaken in this section shall comprise the furnishing, and installation of all metallic epoxy finishes indicated in the plans or specified herein.

B. SUBMITTALS

1. Manufacturer's full range of samples conforming to the specifications
2. Test results required by PMT
3. Shop drawing of the layout of flooring as per actual dimensions for PMT's approval.
4. Installer certificate

F. MATERIAL DELIVERY, STORAGE AND HANDLING

All vinyl, adhesive, primers, and other accessories delivered shall be in their original containers, seals unbroken, and labelled as follows:

1. Color name or code
2. Volume/Weight content (for primers, adhesive and levelling compound)
3. Date of production and expiration date
4. Product major constituent's contents
5. Application instructions and warnings
6. Maintenance data

G. PAYMENT METHODOLOGY

The work under this item shall be measured by the area of surface actually installed as per planned. Excess of the quantity due to Contractors corrections such as increase of dimensions shall not be considered in the pay item. The pay item shall be in inclusive of all the materials and labor required to accomplish this work.

For a work to be considered finished, the flooring must have undergone all the necessary work from surface preparation to polishing and covering of floor. The quantities to be paid shall only include those of which completely finished, inspected and acceptable by the PMT.

H. INSTALLATION

1. Surface preparation:

   a. For Concrete:
      - Grind the area using mechanical grinders until surface is even.
      - Remove existing paint, oil, grease if any
      - Clean the surface dry
      - Repair cracks, joints with epoxy putty. Do not use body fillers on floors
      - Sand the area until epoxy putty is even
      - Remove all dirt, dust and other foreign materials then dry.

   b. For Vinyl Tiles:
      - lightly sand the area using 60 grit sandpaper for adhesion
      - Repair grout marks and damaged areas using epoxy putty on cracks, joints until smooth

   c. For Metals
      - Light sand the area using 60 grit sandpaper for adhesion

   d. For Wooden surface:
      - Completely sand area
      - Repair by using epoxy putty or body fillers on cracks joints and the sides of the wood until smooth

2. Application:
    a. Apply primer
    b. allow for at least 4-8 hours or until dry to touch
    c. Apply Metallic epoxy as per manufacturer's instructions

3. Curing
    a. It is the responsibility of the contractor to protect the flooring from dust, debris, contaminants and heavy traffic during curing period.
    b. Allow at least 24 hours of curing before soft traffic.
    c. Allow at least 3 days before subjecting to heavy traffic.

CHAPTER XIV: CARPENTRY AND JOINERY WORK

GENERAL

Scope

This section covers the requirements for providing all carpentry and joinery work at the project site. The work shall include furnishing all labor, materials, equipment, tools and transportation necessary to complete the carpentry and joinery work indicated on the drawings and specified herein.

Items of Work

Items of work shall include but not limited to the following:

a. Wall grounds and ceiling supports
b. Wooden frames for doors, windows and louvers
c. Base boards
d. Interior furnishing

DRAWINGS

The contractor shall submit to the PMT for his approval detailed drawings necessary for carpentry and joinery work specified herein.

Samples

The Contractor shall submit to the PMT for his approval samples of all materials required in this section.

MATERIALS

KIND OF WOOD
Unless otherwise specified, wood appearing in the following list shall be used:

a. MARINE PLYWOOD
Water resistant plywood shall be used for exterior including covered area where not enclosed as a room and humid room interior such as toilets, bath rooms, kitchens & rooms where much water or steam is used unless otherwise noted.

REMARKS

- In case of the PMT cannot identify the wood and decide whether it conforms to the Drawings and Specifications or not, it shall be the responsibility of the Contractor to identify with test certificate and stamping the name on the surface. This shall be submitted to the PMT for approval.
- Identified wood to be equal or equivalent to the ones specified can be used in the construction.
- Teak shall mean first or second class teak
- Miscellaneous wood shall mean any kind of aged wood.
- Plywood shall mean 3 layers of wood cemented with glue.
- Fiber board shall mean board made of compacted fiber. There are 2 kinds.
- Particle board is made of small pieces of wood pressed together with cementing material.

GENERAL CONDITIONS

a. Cut and shaved wood shall have the following dimensions:

Sizes of wood, cut and shaved

Nominal size	½	1	1 ¼	1 ½	2	2 ½	3	4

Inch								
Finished size Inch	3/8	13/16	1 1/16	15/16	1 ¾	2 ¼	2 11/16	3 5/8

For sizes over 4" shaving of ¼" is allowed. For wall and floor a tolerance of ½" is allowed.

b. Knots holes shall be smaller than indicated. Measurement of a hole or knot is done by drawing 2 parallel lines touching their circumferences and measure the distance between two lines. Wood having many knots close to each other shall be cut. Wood having soft or decaying grain can not be used can be used.

Sizes of knots or holes

Kind of knot or hole	Wood for building construction
Knot or hole everywhere within half of the Piece at the middle on narrow dimension Of beam combined.	Not more than 1.5 of narrow or dimension.
Any knot within 1/3 of piece at the Middle on narrow dimension of beam	Not more than 3/8 of narrow dimension.
Any knot within 1/3 of piece at the Extreme of narrow dimension of beam	Not more than ¾ of narrow dimension.
Any knot within the width of beam or Any face of column.	Not more than 3/8 of width or 11 centimeters where knot is at The middle of the width.

c. Any crack at the cross section of tip of beam or column may not extend into the piece more than 4/9 of the narrow dimension.

d. Weight
Unusual light weight wood shall not be used.

e. Moisture and expansion and contraction
Moisture content shall not exceed 20%. If unusual expansion and contraction occurs resulting in damage the Contractor shall replace or repair them.

f. Classification of Wood

Class1. Well selected, straight (not curved) no crack, no twist or loss of beauty and can be finished to obtain natural beauty of wood texture.

Class2. Un rotten, no hollow or rotten knot, no soft grain, no undue crack, can be shaped or repaired, suitable for painting.

WORKMANSHIP

1. Jointing is usually not allowed except when need arises. The consultant shall have the right to determine when such need arises.
2. Splicing shall be done as specified and shall be well done so that the surfaces of the wood snugly fit each other.

WOOD DRESSING AND ASSEMBLY

a. Parts which don't need shaving are the ones that can not be seen or the parts that not required to be smooth, for example roof truss, ceiling frame or where else indicated.

b. Parts which need shaving are the ones that can be seen the one that require a smooth surface like the lower parts of the ceiling.

c. Wood shaving shall be done to get smooth surface and to the desired dimension. Sand paper shall be used as knots.

d. Wood for floors shall be dry by natural process or oven dry or stored away from san, rain and moisture. The dimension shall be according to the specifications. If installation require grooving it shall be jacked so that the joints snugly fit each other.
e. Wood for walls that require grooving shall be done in the same way as for floor.

f. Wood for ceilings overlapping of not less than 2.5 cm shall be provided.

FASTENING OF NAIL AND SCREW

a. Kind of Size

Nail shall be at least 2.5 times longer than the thickness of wood.

Screw shall be bigger than no. 8 and at least two times longer than thickness of wood.

b. Guided holes for nails and screw

For nail; Size of hole shall not be more than 0.8 times the diameter of the nail.

For screw; Size of the hole shall not be more than 0.9 times the diameter of the nail.

c. Nail driving

1. Non Grooving
For wood not wider than 7", drive 2 nails in every joist.
For wood wider than 7", drives 3 nails in every joist.

2. Grooving
For wood wider than 8", 1 nail in every joist.
For wood wider than 8", 2 nails in every joist.

3. Spacing
Remarks Distance between rim of wood and center of nails shall not be less than 1cm and not more than 2 cm.

Spacing of nails

Distance	Distance=a x (diameter of nail)	
	Unguided nail	guided nail
Between tip of wood and Center of nails	20	10
Between rim of wood and Center of nails	5	5
Between row of nail	10	3
Between nails in a row	20	10

Remarks: Distance between rim of wood and center of nails shall not be less than 1 cm and not more than 2 cm.

d. Driving of screws are also be made according to 3.4.
Direct drive is prohibited. Proper screw driver should be used.

FASTENING BY BOLTS AND NUTS

a. Kind and size. Bolts and nuts shall be steel of proper length.
b. Hole shall be proper for bolts and shall not be wider than 106%.
c. Standard washers shall be used for bolts and nuts.

Spacing of bolts

Distance	Distance = a x (diameter of bolt)
Between rim of wood and bolt	

(a) for tension	7
(b) for compression	4
between row of bolts	4
between rim of wood subject compression and center of bolt	1.5
between rows of bolts measured	4 for bolts size ¼ thickness of wood

WOODEN FRAMES FOR DOORS, WINDOWS AND LOUVERS

Procedure

Frames shall be fabricated according to the Drawings and Specifications or as specified during construction. Approved slicing shall be done. Where wood ad joints concrete, frame shall be provided by groove not less that 10mm wide and deep for placing mortar.

Installation

Every installation every piece of wood shall be painted of one layer of oil or lacquer. It shall be fabricated according to the Drawings and Specifications. If wood frame is attached to the brick or concrete block wall, reinforced beam or column shall be made between wall and wood frame.

Installation of wooden frames attached to concrete

a. If wooden frame is installed before the concrete work, screws or bolts 3" long shall be attached to wood at 0.40 metro spacing. Head of screws or bolts shall be imbedded in concrete about 2".

b. If reinforced concrete has been made, screw or concrete nails spacing 0.40 metro shall be used.

c. To fasten with screw, drill hole in the wood for screw into concrete and place PVC in the hole of concrete and fasten tightly with screw. Head of screw shall be embedded in wood and covered by wood of similar texture and grain.

d. To fasten with concrete nail, drill hole in concrete nail into it. Head of nail shall be covered by wood as mentioned above.

INTERIOR FURNISHING

Counters, shelves and others of similar nature indicated on the drawings shall be furnishing by the Contractor ready for use applying the materials specified in the section.

All this wood work shall be provided and provided in all necessary finishing hardware such as, hinges, cabinets and drawer locks, and cabinet door and drawer pulls suitable for the service required and needed in their operation.

Finishing hardware specified in Section 13 "DOORS AND WINDOWS AND GRAZING WORK" of this specification are applicable to works included in this section.

PRESERVATIVE AND INSECTICIDE TREATMENT

The following parts of wood work shall be given two coats of creosote oil and insecticide unless otherwise specified:

a. Concealed surfaces liable to become damp.
b. Wood blocks shall be embedded in structural concrete.
c. Roof structures
d. Wall grounds and ceiling supports

CURING

At parts liable to damage or staining during the work, completed carpentry or joinery materials shall be properly protected.

Parts above ceilings, below floors, etc. not readily accessible shall be cleaned prior to installing finishing boards.

If the lumber is damaged during the installation, the damaged portion shall be repaired to the satisfaction of the Consultant.

CHAPTER XV: METAL WORK

GENERAL

Scope

This section covers the requirements for providing all the metal work at the Project site. The work shall include furnishing all labor, materials, equipment tools and transportation necessary to complete the metal work indicated in the drawings and specified herein.

Items of Work

Items of the work shall include but not be limited to the following:

a. Gratings
b. Pit cover
c. Railings and balusters
d. Wall grounds and ceiling supports
e. Stainless steel work
f. Aluminum work

MATERIALS

All metal products used for this work shall be new, true to shape and free from unsightly stains or defects.

All the materials shall meet the qualitative requirements of the applicable JIS. All the shapes, dimensions, colors and finishes shall be as shown on the drawings and schedules.

Manufactures or suppliers shall be as approved by the PMT.

The Contractor shall submit certificates or samples of all the materials to the PMT for his approval.

Fasteners such as inserts, anchor bolts, anchor screws, washers, screws and pins shall meet the requirement of JIS wherever applicable and be suitable for their locations, fixing methods and installation conditions. The Contractor shall submit samples to the Consultant for his approval where required.

GALVANIZING

Galvanizing applied to ferrous metals shall conform to JIS H 8610 "Electroplated Coatings of Zinc or Iron or Steel" or JIS H 8641 "Zinc Coating [Hot-Dipped] on Iron or Steel". The thickness of Galvanizing shall be as follows:

JIS	Type A	Type B	Type C
JIS H 8610	Not less than 0.02 mm	Not less than 0.02 mm	Zinc coating shall not flake off after being bent in two directions.
JIS H 8641	Not less than 0.043 mm	Not less than 0.034 mm	ditto

RUSTPROOFING TREATMENT

All ferrous metals shall be galvanized as follows, unless otherwise indicated on the drawings or specified in these Specifications.

a. Where ferrous metals are exposed to rain or water, whole surface of them shall be applied JIS H 8641, Type A

b. Where ferrous metals are exposed to open-air, whole surface of them shall be applied JIS H 8641, Type B.

c. When ferrous metals are difficult to be applied Hot-Dipped Zinc Coating such as bolts and nuts, whole surface of them shall be applied JIS H 8610,Type A.

d. All other ferrous metals shall be applied JIS H 8610, Type B.

Ferrous products shall be provided with two coats of rust-inhibiting paint unless otherwise specified in Section 15 "Painting Work" or these Specifications.

GRATINGS

Gratings for reinforced concrete gutters or drainage pits or rain water reservoir tank shall be of cast iron and be provided with rust-inhibiting paint or hot-applied coal tar and provided with frames, unless otherwise specified into the drawings.

PIT COVER

Pit covers for kitchen shall be of readymade market products of punched stainless steel cover.

RAILINGS AND BALLUSTERS

Otherwise indicated on plans and approval of the owner, use 1-1/2" ~ 2" diameter GIP, schedule 20 for exterior stair railings and balusters. All stainless steel railings members shall be SUS304 unless specified in the plans.

WALL GROUNDS AND CEILING SUPPORTS

Wall grounds and ceiling supports shall be of galvanized or rust-inhibiting shop painted steel. The Contractor shall submit samples to the PMT for their approval.

Light gage steel wall grounds for the interior partition shall be generally as follows

Steel Stud	C-65 x 45x 0.8 @ 450
Steed runner	C-67 x 40 x0.8
Reinforcement Against bending	C-25 x 10 x 1.2:
Reinforcement Against bending	Z-25 x 10 x 1.2:
Reinforcement Of opening	C-50 x 16 x 1.4

STAINLESS STEEL WORK

a. Stainless steel work such as sink, table or counter top and others as shown on the drawings shall be made from hot rolled or cold rolled stainless steel sheet conforming to JIS G 4304 or JIS G 4305.

Finish shall be of hairline finish unless otherwise specified on the drawings.

b. Sizes, thickness and finish are indicated on the drawings.

PART VIII: DOORS AND WINDOWS AND GLAZING WORK

GENERAL

Scope

This section covers the requirements for providing all the doors and windows and glazing work at the Project site. The work shall include furnishing all labor, materials, equipment, tools and transportation necessary to complete the doors and windows and glazing work indicated on the drawings and specified herein.

Items or Work

Items of work shall include but not be limited to the following:

a. Doors, windows and louvers
b. Insect screens and bird nets
c. Glass and glazing
d. Finish Hardware
e. Keys

Drawings

The Contractor shall submit to the PMT for his approval all necessary drawings as specified below:

a. Plans showing locations, symbols and methods of opening
b. Schedules showing symbols of types, shapes, dimensions, materials, finishes, glass types, hardware and quantities
c. Details showing precise dimensions, glazing, joints and installation of hardware.

Manufacturers

The work of the doors and windows shall be carried out by personnel who has experienced and specialized in the work specified herein and shall be approved by the PMT,

MATERIALS

General

a. Steel and aluminum materials shall be free from distortion, crack, rust or other defects and shall conform to the following requirement.
b. Lumber used shall be seasoned, free from rot, insect attack, shakes, split or other defect

1. Steel

a. Rolled steel for general structure shall conform to JIS G 3101
b. Hot rolled mild steel shall conform to JIS G 3131
c. Cold rolled carbon steel shall conform to JIS G 3141

2. Stainless Steel

Stainless steel shall conform to JIS G 4304 of JIS G 4305 and shall be SUS-304 (18-8 nickel chrome)
Aluminum
Aluminum shall conform to JIS H 4100 and JIS A 4706
Lumber and Plywood
Lumber and plywood shall meet the requirements of Section 9 "CARPENTRY AND JOINERY WORK" of these specifications.

3. Adhesives

Adhesives used shall be of a sole or mixed product conforming to JIS K 6901 "Urea Resin Adhesives for Wood" K 6802 " Phenol Resin Adhesives for Wood" or K 6904 "Polyvinyl Acetate Emulsion Adhesive for Wood".

Nails, Screws and Rivets

Nails shall conform to JIS A 5508. Screws shall conform to JIS B 1135, JIS B 1101 and JIS B 111 respectively. Rivets shall conform to JIS B 1213 and JIS H 4040. All nails and screws used for beads shall be made of brass or stainless steel.

4. Glass

a. Sheet Glass shall be ordinary sheet glass, Grade B to JIS R 3201
b. Figured Glass – patterned glass shall conform to JIS R 3203
c. Film for sheet glass to prevent scattering shall be "Scotch Tint IN50CL" of Sumitomo 3M or approved equivalent.
Silicone sealing compounds
Silicone sealing compounds shall be used for glazing generally.

5. DOORS, WINDOWS AND LOUVERS

Wood doors
Wood doors shall be as indicated and specified on the drawings.
a. Flush doors

Flush doors shall be skeleton framed, made of glued laminated lumber shall be strengthened by the core into the door and shall be covered on both sides with plywood 5.5 mm thickness for painting. The doors shall be lipped and edged with hardwood strips t=5mm at all edges, and shall be fitted and hung to the frames unless otherwise specified.

All flush doors at lavatories and other areas exposed to water splash shall be made of waterproof type plywood 5.5 thicknesses.

b. Toilet booth door

The finishing material shall be Formica thickness 1.2 m/m with stainless channel bottom cover thickness=0.8 holding Formica tight unless otherwise noted.

Fabrication

a. The frames integrated with doors and windows shall be fabricated at the manufacturer's shop

b. All joints of steel doors and louvers shall be welded and fixed with metal fasteners.

c. All joints of wood doors shall be made by mortises and tenons and be bonded with adhesive, fixed with metal fasteners.

d. Glazing beads for fixed doors and windows shall be screwed to rails and stiles at both ends and at intermediate points so that screw spacing does not exceed 250 mm.

Installation

a. Preparation

1. Prior to the installation of doors and windows, warpage, inclination and other defects of the frames shall be corrected.

2. Steel doors shall be free from distortion, crack, rust or other defects and reinforcement of the opening shall properly be temporarily fitted to frames, and after making necessary adjustments they shall be permanently hung in position.

b. Installation

1. Doors and windows shall be hung accurately in position to ensure a tight fit and in such a manner as will not wrap or dislocate causing undue force on door and window hardware.

2. When doors and windows have been hung in place, they shall be tested to see that they function properly. All locksets and other hardware shall be carefully checked before inspection by the Consultant. Any damage or malfunctioning shall be corrected to the satisfaction of the Consultant.

Finish Hardware

a. Finish hardware shall be of YALE brand or any approved brands. As far as possible, hardware shall be made by the same manufacturer to maintain continuity of finish, style, and to simplify maintenance and replacement.

b. Basic materials for hardware shall comply with the applicable JIS

c. Hardware shall conform to the applicable JIS requirements and be of the types and quantities as specified on the drawings.

d. The portions where locksets are installed shall be suitably reinforced with proper splices. Where door closers and hinges are installed reinforcing plates of suitable size and the same material as the stiles and rails shall be provided.

e. Operator of jalousie type transom window when its height exceeds 2100 mm from floor shall be ball chain tele operator, unless otherwise noted.

f. Master key system shall be work included. (see Architectural drawings).

GLASS AND GLAZING

Glazing

a. Depth of rebates to receive glass panes shall be at least 5 mm or 1.5 times the glass thickness.
b. Sheet glass shall be installed in such a manner that rolled strains are in a horizontal direction.
c. Prior to glazing surfaces of rebates in contract with glass shall be primed with paint of the same color as the outside finish and allowed to dry thoroughly.
d. When installing glazing, the panes shall be forced into the bedding putty until the putty is pushed out. Then, the panes shall be fastened with clips and silicone sealing compound applied.

Protection and Cleaning

a. Upon ht completion of glazing, all glass panes shall be clearly marked to prevent accidental breakage. Any defective glass shall be immediately removed and replaced.

b. All glass surfaces shall be given a thorough final cleaning after it has been confirmed that the glass will not become dirty or be smeared before occupancy. The Contractor shall not be used any detergent liable to damage adjacent surfaces.

PART IX: PLUMBING AND SANITARY WORKS

CHAPTER I: HEALTHCARE PLUMBING FIXTURES

A. GENERAL

This section covers the requirements for providing all Plumbing fixtures. The work shall include furnishing and labor, materials, equipment, tools and transportation necessary to complete the installation fixtures indicated on the drawings and specified herein.

B. SUBMITTALS

The Contractor shall submit to the PMT for his approval samples of the following.

1. Manufacturer's full range of products for selection

C. MATERIALS SPECIFICATIONS

1. WATER CLOSET

a. Regular Water Closet Type 1

Specifications

- Composition: Ceramic
- Dimensions: Length: 745mm, Width: 380mm, Height: 825mm
- Rough-in from wall finish: 300/400 mm
- Assembly Set-up: Closed Coupled
- Flush System: Siphon Jet
- Flush System Mechanism: Push button dual flush
- Water Consumption (Liters per flush): 4/6 LPF

Accessories

- Stainless Steel (SUS304) two-way angle valve
- Stainless Steel (SUS304) Flexible Hose
- Stainless Steel (SUS304) Spray Bidet
- Heavy Duty Toilet Seat
- Drainage Accessories
- Mounting Accessories

b. Regular Water Closet Type 2

Specifications

- Composition: Ceramic
- Dimensions: Length: 725mm, Width: 360mm, Height: 405mm
- Rough-in from wall finish: 300mm
- Assembly Set-up: One Piece
- Flush System: Siphon Jet
- Flush System Mechanism: Flush Valve
- Water Consumption (Liters per flush): 4.8 LPF

Accessories

- Flush Valve (Composition: SUS304, Vacuum breaker Diameter Size: 32mm)
- Stainless Steel (SUS304) one-way angle valve
- Stainless Steel (SUS304) Flexible Hose
- Stainless Steel (SUS304) Spray Bidet
- Heavy Duty Toilet Seat

2. URINAL

a. Regular Urinal Type 1

Specifications
- Composition: Ceramic
- Dimensions: Length: 480mm, Width: 355mm, Height: 8745mm
- Rough-in from floorl finish: 450 mm
- Assembly Set-up: One Piece
- Flush System Mechanism: Flush Valve
- Water Consumption (Liters per flush): 45 LPF

Accessories
- Flush Valve (Composition: SUS304, Vacuum breaker Diameter Size: 32mm)

3. LAVATORY

a. Pedestal Lavatory Type 1

Specifications
- Composition: Ceramic
- Dimensions: Length: 500mm, Width: 375mm, Height: 790mm
- Drainage Rough-in from floor finish: 480 mm
- Water Source Rough-in from floor finish: 560 mm
- Flush System Mechanism: Flush Valve
- Water Consumption (Liters per flush): 45 LPF

Accessories
- Stainless steel (SUS304) Single hole, Single Lever Gooseneck faucet
- Stainless Steel (SUS304) one-way angle valve
- Stainless Steel (SUS304) Flexible Hose
- Stainless Steel Pop-up Drainage Plug
- Drainage system accessories
- Water System Accessories
- Mounting Accessories

4. WASH SINK

a. Wash Sink, under counter Type 1

Specifications
- Composition: 3mm thk Stainless steel (SUS 316)
- Dimensions: L>550 mm x W>440 mm x H>220 mm
- Finish: Polished
- Other features: High temperature degreasing and decontamination layer, High temperature sealing anti-corrsion layer, add-base neutralization rust layer, drawing process coating

Accessories
- Stainless steel (SUS304) Single hole, Single Lever Gooseneck faucet
- Stainless Steel (SUS304) one-way angle valve
- Stainless Steel (SUS304) Flexible Hose
- Drainage system accessories
- Water System Accessories
- Mounting Accessories

b. Wash Sink, with Stand Type 1

Specifications

- Composition: 3mm thk Stainless steel (SUS 316)
- Dimensions: As per planned
- Finish: Polished

Accessories

- Stainless steel (SUS304) Single hole Gooseneck faucet, Foot operated
- Stainless Steel (SUS304) one-way angle valve
- Stainless Steel (SUS304) Flexible Hose
- Drainage system accessories
- Water System Accessories
- Mounting Accessories

5. SLOP SINK

a. Slop Sink Type 1

Specifications

- Composition: 3mm thk Stainless steel (SUS 316)
- Dimensions: L>550 mm x W>440 mm x H>220 mm
- Finish: Polished
- Other features: High temperature degreasing and decontamination layer, High temperature sealing anti-corrsion layer, add-base neutralization rust layer, drawing process coating

Accessories

- Stainless steel (SUS304) Single hole, Single Lever Gooseneck faucet
- Stainless Steel (SUS304) one-way angle valve
- Stainless Steel (SUS304) Flexible Hose
- Drainage system accessories
- Water System Accessories
- Mounting Accessories

6. SHOWER

a. Slop Sink Type 1

- Composition: stainless steel (SUS 304) Shower head and stainless steel (SUS 304) Hose Bib
- Finish: Polished

Accessories

- Stainless steel (SUS304) shower valve
- Water System Accessories
- Mounting Accessories

7. EMERGENCY EYE SHOWER

a. Emergency Eye Shower

Specifications

- Construction: 1-1/4" LPS Shedule 40 hot dipped galvanized steel pipe and fiitings along with powder coated cast-iron 22.9 cm diameter floor flange and 27.9 cm stainless steel receptor provide an additional corrosion resistance in a long lasting product.

- Quality Control: Eye/face wash and valve assembly are pre-built and fully water/pressure tested to ensure no leaks and proper function which ultimately reduces installation time.
- Valves: Eyewash and shower ball valves are designed to make the flushing of contaminants occur with the simple pull of a lever or push of a stainless steel flag. Both valves come equipped with stainless steel ball and stem to provide greater protection against corrosion and breakage.
- Strainers/Filters: Chrome-plated brass in-line 50 x 50 mesh water strainer prevents debris from reaching the eyewash so the unit stays functioning at its best. Strainer is easily serviceable.
- Showerhead: ABS plastic showerhead must be hydrodynamic design to give equal distribution of water throughout the entire footprint of flow
- Eye/Face Wash: eye/facewash head must have an inverted directional laminar flow to sweep contaminants away from the vulnerable nasal cavity.

Accessories

- Mounting Accessories

D. PAYMENT METHODOLOGY

The work under this item shall be measured by set installed as per planned and specifications. The pay item shall be in inclusive of all the materials and labor required to accomplish this work.

For a work to be considered finished, the wall must have undergone all the necessary work from installation to testing. The quantities to be paid shall only include those of which completely finished, inspected and acceptable by the PMT.

CHAPTER 2: PIPE MATERIALS

SECTION I: PPR WATER LINES

A. GENERAL

The work to be undertaken in this section shall comprise the furnishing, fabrication, and installation of all materials including anchor bolts, base plates, erection bolts, bracing and all other structural steel work indicated in the plans or specified herein.

B. SUBMITTALS

1. Material specifications
2. Shop drawing of the pipe layout as per actual dimensions for PMT's approval. Including Pipe fittings such as elbows, tee, valves, etc.
3. Test results required by PMT

C. MANUFACTURER/SUPPLIER

Provide each type of flooring as provided by a single manufacturer, including recommended primers, adhesives, sealants, patching and leveling compounds.

D. TESTING

The following are the applicable ASTM test standards that the PMT may require to the contractor before the approval of the materials.

E. MATERIAL SPECIFICATIONS

Composition: Polypropylene random copolymers resins
Heavy Metal Free (HMF Certified). Minimum presence test required: Cadmium, Lead , Mercury)
Inspected and tested in conformance to ISO 15874 (Plastics Piping Systems for Hot and Cold Water Installations)

PIPE DIMENSION STANDARDS					
Pipe Size Designation on Plans	Nominal Pipe Size	PN10		PN20	
		Outside Diameter	Wall Thickness	Outside Diameter	Wall Thickness
20 mm	20 mm	20 - 20.3 mm	1.9 mm	20 - 20.3 mm	3.4 mm
25 mm	25 mm	25 - 25.3 mm	2.3 mm	25 - 25.3 mm	4.2 mm
32 mm	32 mm	32 - 32.3 mm	2.9 mm	32 - 32.3 mm	5.4 mm
40 mm	40 mm	40 - 40.4 mm	3.7 mm	40 - 40.4 mm	6.7 mm
50 mm	50 mm	50 - 50.5 mm	4.6 mm	50 - 50.5 mm	8.3 mm
63 mm	63 mm	63 - 63.6 mm	5.8 mm	63 - 63.6 mm	10.5 mm
75 mm	75 mm	75 - 75.7 mm	6.8 mm	75 - 75.7 mm	12.5 mm
90 mm	90 mm	90 - 90.9 mm	8.2 mm	90 - 90.9 mm	15.0 mm
110 mm	110 mm	110 - 111.0 mm	10.0 mm	110 - 111.0 mm	18.3 mm
Standard Pipe Length: 4.0 meters					

SECTION II: uPVC SEWER LINES

A. GENERAL

The work to be undertaken in this section shall comprise the furnishing, fabrication, and installation of all materials including anchor bolts, base plates, erection bolts, bracing and all other structural steel work indicated in the plans or specified herein.

B. SUBMITTALS

4. Material specifications
5. Shop drawing of the pipe layout as per actual dimensions for PMT's approval.
6. Test results required by PMT

C. MANUFACTURER/SUPPLIER

Provide each type of flooring as provided by a single manufacturer, including recommended primers, adhesives, sealants, patching and leveling compounds.

D. TESTING

The following are the applicable ASTM test standards that the PMT may require to the contractor before the approval of the materials.

E. MATERIAL SPECIFICATIONS

Composition: Polypropylene random copolymers resins
Heavy Metal Free (HMF Certified). Minimum presence test required: Cadmium, Lead , Mercury)
Inspected and tested in conformance to ISO 15874 (Plastics Piping Systems for Hot and Cold Water Installations)

uPVC DIMENSION STANDARDS							
Pipe Size Designation on Plans (mm)	Nominal Pipe Size (mm)	S-600		S-1000		SDR 34	
		Outside Diameter (mm)	Wall Thickness (mm)	Outside Diameter (mm)	Wall Thickness (mm)	Outside Diameter (mm)	Wall Thickness (mm)
50	57	57.00 – 57.30	1.85-2.24	57.00 – 57.30	2.54-3.00	_	_
75	82	82.35 - 82.75	2.54-3.00	82.35 - 82.75	3.70-4.27	_	_
100	107	106.84 – 107.28	2.54-3.00	106.84 – 107.28	3.81-4.39	_	_
150	160	_	_	_	_	160.00 – 160.40	4.70 - 5.40
200	200	_	_	_	_	200.00 – 200.50	5.90 – 6.70
250	250	_	_	_	_	250.00 – 250.50	7.30-8.30
300	315	_	_	_	_	315.00 – 315.60	9.20 – 10.40
400	400	_	_	_	_	400.00 – 400.70	11.70-13.10
500	500	_	_	_	_	500.00 – 500.90	14.60-16.30
Standard Pipe Length: 3.0 meters							

PART X: AUXILIARY WORKS

CHAPTER I: VOICE AND DATA COMMUNICATION SYSTEM

1. GENERAL

1.1 SUMMARY

A. Section Includes: UTP cabling, Singlemode optical fiber cabling, Network switches and routers, and IP phones.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

C. Source quality-control reports.

D. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Products referenced under this section establish the minimum acceptable standards of products quality, features and performance.

1. Codes
    a. Philippine Electrical Code (PEC 200 Edition)
    b. National Electrical Code (NEC 1999 Edition)
    c. Philippine Fire Code (PFC Revised Edition)
    d. National Fire Protection Code (NFPC)
    e. Applicable Local Ordinances
    f. Revised National Building Code
    g. Philippine Electronics Code (PECE) Vol.1 and 2
2. Standards
    a. Underwriters Laboratory (UL)
    b. American Society of Testing and Materials (ASTM)
    c. National Electrical Manufacturers Association
    d. National Fire Protection Association (NFPC)
    e. Institute of Electrical and Electronics Engineers (IEEE)
    f. American National Standards Institute (ANSI)
    g. International Electro-Technical Commission (IEC)
    h. International Standard Organization (ISO: 9000)
    i. Other Internationally Accepted Standards

B. Engineer in-charge supervising the work shall be a duly Registered Electronics under the supervision of a Professional Electronics Engineer as required by R.A. 9292 and revised National Building Code.

1.4 DELIVERY, STORAGE AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP and optical fiber cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling:

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
   a. Cablofil Inc.
   b. Atlanta Industries, Inc.
   c. Total Power Box Solution, Inc.
   d. LJ Industrial Fabrication, Inc.
2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by hot-dip galvanizing:
   a. Basket Cable Trays: 6 inches (200 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
   b. Trough or Ventilated Cable Trays: Nominally 6 inches (150 mm) wide.
   c. Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
   d. Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
   e. Solid-Bottom or Nonventilated Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with solid covers.

C. Conduit and Boxes:

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Belden CDT Inc.; Electronics Division.
   2. Hikvision Digital Technology Co.
   3. D-Link International Pte Ltd.

B. Description: 100-ohm, four-pair UTP.
   1. Comply with TIA/EIA-568-B.1 for performance specifications.
   2. Comply with TIA/EIA-568-B.2 and TIA/EIA-568-C.2, Category 6a Balanced twisted fair Telecommunication Cabling & component Standard.

2.3 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. American Technology Systems Industries, Inc.
   2. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
   3. Dynacom Corporation.
   4. Hubbell Premise Wiring.
   5. KRONE Incorporated.
   6. Leviton Voice & Data Division.
   7. Molex Premise Networks
   8. Nordex/CDT
   9. Panduit Corp.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110 style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare; integral with connector bodies, including plugs and jacks where indicated.

2.4 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Berk-Tek; a Nexans company.
   2. CommScope, Inc.
   3. Corning Cable Systems.
   4. General Cable Technologies Corporation.
   5. Mohawk
   6. Nordex/CDT
   7. Optical Connectivity Solutions Division; Emerson Network Power.

8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: Singlemode, tight buffer, optical fiber cable.
1. Comply with TIA/EIA-568-B.3 for performance specifications and TIA/EIA 568 C.3 optical fiber cabling components.
2. Comply with TIA/EIA-492AAAA-B or TIA/EIA-492AAAA-A for detailed specifications.

2.5 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ADC.
2. American Technology Systems Industries, Inc.
3. Berk-Tek; a Nexans company.
4. Corning Cable Systems.
5. Dynacom Corporation.
6. Hubbell Premise Wiring.
7. Molex Premise Networks; a division of Molex, Inc.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Optical Connectivity Solutions Division; Emerson Network Power.
10. Siemon Co. (The).

B. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

2.6 NETWORK SWITCHES AND ROUTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mikrotik
2. Hikvision
3. TP-Link
4. D-Link
5. Cisco

2.7 IP PHONE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Grandstream
2. Panasonic
3. Yeastar

4. Cisco
5. Avaya

3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   1. Comply with TIA/EIA-568-B.1.
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

C. UTP Cable Installation:
   1. Comply with TIA/EIA-568-B.2 & C.2.
   2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:
   1. Comply with TIA/EIA-568-B.3 & C.3.
   2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
   3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:
   1. Install plenum-rated cable only.
   2. Install cabling after the flooring system has been installed in raised floor areas.
   3. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (305 mm) in diameter below each feed point.

G. Separation from EMI Sources:
   1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
   2. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
   3. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.2 IDENTIFICATION

A. Identify system components, wiring, and cabling according to TIA/EIA-606-A.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for UL or third- party certification markings. Inspect cabling terminations to confirm color- coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross connection.
    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical Fiber Cable Tests:
    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Link End-to-End Attenuation Tests:
        1) Singlemode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
        2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

CHAPTER II: RACEWAYS AND BOXES

1 – GENERAL

1.1 DESCRIPTION

A. Provide raceways and boxes in accordance with the Contract Documents.

1.2 STANDARDS

A. American National Standards Institute (ANSI): ANSI 61 - Gray Enamel Finish Coat.

ANSI C80.1:	Rigid Steel Conduit, Zinc-Coated.
ANSI C80.3:	Electrical Metallic Tubing, Zinc- Coated.
ANSI/NEMA FB 1:	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

B. National Electrical Manufacturer's Association (NEMA):

NEMA OS 1:	Sheet -Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
NEMA VE 1:	Metallic Cable Tray Systems

C. Philippine Electrical Code (PEC): PEC 2000 (PART 1:2000)

1.3 SUBMITTALS

A. Conduit, Boxes, Wireways and Auxiliary Gutters:
   1. Manufacturer's product data sheets
   2. Samples

B. Shop Drawings:
   1. Size and location of main feeders. Size and location of panels and pull boxes. Layout or required conduit penetrations through structural elements.
   2. The specific item proposed and its area of application shall be marked on the catalog cuts.

1.4 IDENTIFICATIONS

A. Paint fire alarm and life safety system boxes and conduits red.

B. Paint boxes and conduits of other auxiliary systems in a color coding system or provide color bonding for system every after 5m.

2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Conduit
   1. Metal Conduit: Allied, Matsushita/Panasonic, Mcgill Smart tube, Royal Steel
   2. PVC Conduit: Atlanta, Emerald, Moldex, Neltex

B. Wireways and Auxiliary Gutters: Cablofil Inc., Atlanta Industries, Total Power Box Solution, LJ Industrial Fabrication

2.2 WIREWAYS AND AUXILIARY GUTTERS

A. Sizes and shapes as indicated and/or as required.

B. Provide necessary elbows, tees, connectors, adapters, etc.

C. Continuous removable cover secured with screws and keyhole slots. Hinged cover where installed above suspended ceiling.

D. Provide wire retainers at not greater than 30 cm on center. Outlet, Junction, and Pull Boxes

3 – EXECUTION

3.1 GENERAL

A. Provide raceways for all systems. Complete runs before pulling in cables or wires. Provide insulated grounding conductor in metallic or nonmetallic raceways. Minimum conduit size shall be 25 mm. Wiring of each type and system shall be installed in separate raceways.

B. Protect metallic raceway in earth or fill from corrosion with two coats of corrosion resistant paint or tape wrap.

C. Locate raceways so that the integrity of structural members is not affected and they do not conflict with the services of other trades. Draw up couplings and fittings full and tight.

D. Provide raceway expansion joints for exposed and concealed raceways at expansion joints and between structures to compensate for differential movement. Provide bonding conductor.

E. Provide pull cord in empty raceways. Tag both ends noting destination.

F. Clear raceway of all obstructions and dirt prior to pulling in wires or cables.

G. Secure raceway clamps or supports to masonry materials with toggle bolts, expansion bolts, or steel inserts. Install raceway on steel construction with approved clamps which do not depend on friction or set-screw pressure alone.

H. Install exterior underground conduits 60 cm minimum below finished grade. Do not penetrate waterproof membranes unless proper seal is provided.

I. Raceways above Suspended Ceilings:

1. Single runs of 15 mm or 20 mm raceways may be supported from ceiling support wires where permitted by the rating of the ceiling system.
2. Provide independent support of raceways larger than 20 mm. Provide independent support of multiple raceways (more than one). Provide unistrut support and threaded rod to structure above. Attachment to ceiling support wires is not permitted.
3. Provide independent support of raceways installed above fire rated ceilings. Attachment to ceiling support wires is not permitted.
4. Install conduit 30 cm minimum above top of ceiling.

J. Conduit connected to rotating or vibrating equipment shall be flexible metal conduit or liquid tight flexible conduit.

K. Raceways Embedded in Floor Slabs:

1. Raceways shall not be installed in slab without the approval of the Structural Engineer.
2. Raceways shall not interfere with placement of floor slab reinforcement components.
3. Install raceways between the upper and the lower layers of reinforcing steel.

4. Space raceways not less than 200mm on centers except where they converge at panels or junction boxes.
5. Raceways running parallel to slabs supports, such as beams, columns and structural walls, shall be installed not less than 300mm from such supporting elements.

3.2 WIREWAYS AND AUXILIARY GUTTERS

A. Install wireways above suspended ceilings such that cover will hinge upward from side.

B. Provide 30 mm clear from wireway cover when in open position.

3.3 CABLE TRAY/TRUNKING/LADDER

A. Cable Raceway shall be supported at a maximum of 1.5 meters on centers and at each bend, tee, cross, and elbow fitting. Supports shall be threaded rod trapeze style hangers or wall brackets. Side rails shall bear on the supports; rungs shall not bear on the supports.

B. Coordinate location of cable raceway with other trades to avoid conflicts and maintain accessibility. Where installed above a ceiling, cable trays shall be not less than 30 cm above the bottom of the finished ceiling. Vertical clearance above the tray shall be a minimum of 30 cm.

C. Cable Raceway shall be continuous. Where cable raceway run is interrupted at a fire rated wall, provide three 10 cm sleeves in fire rated wall. Provide bonding jumpers where cable trays are interrupted at fire rated walls and floors or are otherwise rendered electrically discontinuous.

D. The thickness of material of metal trunking shall be as the following table:

Nominal Size (mm)	Min. Thickness of Body (mm)
50 x 50	1.0
75 x 50	1.2
75 x 75	1.2
100 x 75	1.2
100 x 100	1.4
150 x 100	1.4
150 x 150	1.6

Covers of the cable trunkings shall be of the quick fix pattern with center captive screw. Other fixing arrangement will not be accepted.

E. Cable trunkings in vertical runs shall be fitted with pin racks inside the trunkings to support the weight of the cables, and to enable the cables to be secured during installation. These pin racks shall consist of steel pins sheathed with insulating materials and shall be mounted on backing-plates at intervals of 3 meters.

3.4 OUTLET, JUNCTION, AND PULL BOXES

A. Provide outlet, junction, and pull boxes as indicated and as required for a complete installation and to facilitate proper pulling of wires and cables. Boxes shall be sized per electrical code as minimum. Plug open knock outs.

B. The exact location of outlets and equipment is governed by field conditions. Where necessary, relocate outlets so that fixtures and equipment are symmetrically located in accordance with

the room layout and will not interfere with other work or equipment. Verify final location of outlets, fixtures, and equipment with Architect.

C. Back-to-back outlets in the same wall, or "through-wall" type boxes are not permitted. Provide 30 mm minimum spacing for outlets shown on opposite sides of a common wall. Provide acoustical potting compound on outlet boxes installed in private offices and conference rooms.

D. Fit outlet boxes in finished ceilings or wall with appropriate covers, set flush with the finished surface. Where more than one switch or device is located at one point, use multiple gang boxes and covers. Provide tile box or a 10 mm square box with tile ring in masonry walls not plastered or furred. Where drywall material is utilized, provide plaster ring. Provide outlet boxes of type and size suitable for the specific application. Provide barriers where required for voltage or systems separation.

E. Provide pull boxes so that an individual run of conduit does not contain more than the equivalent of 4 ninety degree bends (360 degrees total).

F. All boxes and conduit accessories shall be fully weather-proof when used in outdoor locations, weatherproof boxes and conduit accessories shall also be used in locations other than outdoors when so specified on the Drawings.

G. Provide nameplate/identification

CHAPTER III: FIRE DETECTION AND ALARM SYSTEM (FDAS)

1 – GENERAL

1.1 DESCRIPTION

A. Provide fire detection and alarm system in accordance with the Permit Documents.

B. The fire detection and alarm system shall be a stand alone system operating independently of other control systems.

1.2 QUALITY ASSURANCE

A. Fire Department approval of fire detection and alarm system.

B. Manufacturer and equipment supplier shall have a minimum of ten years experience as contractor of fire detection and alarm system and shall have at least five completed or on going FDAS installation in the Philippines.

C. Equipment supplier shall have 24 hour parts and labor service available with a maximum 4 hour response time.

D. Prior to making required submittals, system supplier shall meet with the Fire Department and make an informal presentation of the fire alarm and detection system. Meeting minutes shall be issued and comments incorporated into the required submittals.

E. Engineer In-Charge supervising the work shall be a duly registered Electronics Engineer supervising by a Professional Electronics Engineer or registered Electrical Engineer supervising by a Professional Electrical Engineer as required by RA 9292 and the revised IRR of The National Building Code of the Philippines.

1.3 STANDARDS

A. Fire Department Requirements

B. National Building Code of the Philippines

C. National Fire Protection Association (NFPA 72, 101, 5000)

D. Underwriters Laboratories, (UL):

UL 268 - Smoke Detectors for Fire Alarm System

UL 268A - Smoke Detectors for Duct Application

UL 521 - Heat Detectors for Fire protective Signaling Systems

E. National Fire Code of the Philippines

1.4 ABBREVIATIONS

A. MFACP: Main Fire Alarm Control Panel

B. FACP: Fire Alarm Control Panel

C. FTS: Firefighter's Telephone System

D. FCIP: Fire Command Center Intercom Phone

E. FCC: Fire Command Center

1.5 SUBMITTALS

A. Minutes of system supplier's meeting with the Fire Department.

B. Manufacturer's product data sheets for equipment including Fire Marshal listing numbers.

C. Floor plans (minimum 1:100 scale) showing device locations and interconnecting conduit and wire. Floor plan (minimum 1:25 scale) of the Reception indicating fire management system equipment, equipment furnished by others, tables, plan racks, and required clearances. Elevations (minimum 1:25 scale) of each wall of the Reception.

D. Riser diagram showing devices, equipment, and interconnecting conduit and wire. Indicate points of connection to other equipment such as motor control centers, damper actuators, fire pump controllers, dry pipe sprinkler systems, elevator machine rooms and shafts, electric door locking hardware, and magnetic door holders.

E. Scaled detail drawings of FACP.

F. Wiring diagram for each device.

G. Wiring diagrams for smoke control sequence.

H. Voltage drop calculations.

I. Battery sizing calculations.

J. Visual alarm power supply sizing calculations.

K. Power supply calculations and interface installation shop drawing for magnetic door holders, and electric door locking hardware.

L. List of all devices with address identification.

M. Seismic restraint calculations.

1.6 FIELD TESTING

A. Wiring shall be inspected and tested for continuity and short circuits. The minimum allowable resistance between any two conductors or between conductors and ground is ten megohms measured with a 500 volt megger.

B. Field Test Reports:

1. Certification that equipment has been properly installed and is in satisfactory operating condition.
2. Sensitivity settings for smoke detectors.
3. Detailed operational test report in matrix form indicating each initiating device, each signaling device, each communication device, and each control and indicating light on each piece of equipment. Report shall certify the following:
    a. Successful operation of each alarm and supervisory initiating device.
    b. Successful operation of each signaling device.
    c. Successful operation of automatic smoke control sequences.
    d. Successful operation of FACP.
    e. Successful operation of FTS
    f. Successful operation of elevator recall sequence.
    g. Successful operation of line supervision devices.
    h. Successful operation of off site alarm monitoring system connection (optional).
    i. Successful operation of unlocking electronically locked doors.

1.7 IDENTIFICATION

A. Provide an identification nameplate for each equipment cabinet.

1.8 TRAINING

A. The Contractor shall provide appropriate training for the operation and maintenance of the fire detection and alarm system.

2 – PRODUCT

2.1 ACCEPTABLE MANUFACTURERS

A. Fire Alarm and Detection System components shall be of the same manufacturer, unless otherwise noted.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Honeywell Notifier
2. UniPOS
3. Tyco/Simplex
4. Cooper Edwards
5. Bosch (UL Certified devices only)

C. Contractor must have at least 10 years of experience and existence.

2.2 FIRE ALARM CONTROL PANEL (FACP)

A. Steel enclosure in standard finish, with hinged, locking door. Integral power supply, standby batteries, and battery charger.

B. Provide power on LED, power failure LED, system trouble LED, system reset switch, alarm silence switch, trouble silence switch, manual evacuation switch, alarm acknowledge switch, trouble acknowledge switch, supervisory service acknowledge switch, lamp test button, tone alert, battery supervision LED, auxiliary relays, and other system indicators and controls necessary for processing alarm and signaling functions. Indicating lamps shall be LED type.

C. Provide appropriate permanent identification labeling of control and indicating functions.

D. Annunciation:

Serial annunciator with back lit, alphanumeric, 80 character liquid crystal display indicating clear language information as to the type of alarm (device type), point status (alarm or trouble), number of alarms on the system, and a custom location label. Ability to scroll back through prior system actions.

E. System shall utilize analog type smoke detection with alarm verification, self test feature, individual sensor automatic timed sensitivity adjustment, individual smoke sensor field adjustable sensitivity set from FACP, and automatic maintenance alarm feature.

F. Provide at least one (1) spare loop for maintenance purposes.

2.3 FIRE ALARM INITIATING DEVICES

A. General:

1. Provide auxiliary relays where required to satisfy system operational requirements.
2. Smoke detectors shall be conventional type.

B. Manual Pull Stations:

1. Furnish and install where indicated on plan.
2. All manual pull station shall be single action non-coded break glass type.
3. Manual station shall be constructed of Die Cast Metal with clearly visible operating instruction.
4. Station shall be suitable for surface mounting on matching back box.

C. Smoke and Heat Detectors:

1. Photoelectric smoke detector:

a. LED light source, silicon photodiode receiving element. Line filter and time delay circuitry to prevent transient false alarms.

b. 360 smoke entry, locking tamper screw, pulsating on power LED

c. indicator, UL 268.

d. Adjustable obscuration/smoke detection levels.

e. Provides maintenance identification alarm.

f. Provides two LED function/working indication.

g. Base sounders shall sound output not less than Y5dBA at pillow level.

2. Heat detector:

a. 135 Combination fixed temperature and rate of rise heat detector

b. Locking tamper screw, UL 521.

c. Provides maintenance identification alarm.

d. Provides two LED function/working indication.

D. Device Monitoring Module

1. The device monitoring module shall permit the use of conventional detecting devices including sprinkler flow switches and supervisory switches on the system. The module can be mounted together in the fire alarm cabinet or be in the standard outlet boxes located near the device being monitored.

E. Speaker- Strobes

1. Fire lights shall ba a xenon-strobe type or equivalent. It shall be low-voltage (24VDC).

a. The maximum pulse duration shall be 2/10ths of one second (0.2 second with a maximum duty cycle of 40%). A pulse duration is defined as the time interval between initial and final points of 10% of maximum signal.

b. The intensity shall be minimum of 75 candela.

c. The flash rate shall be minimum of 1Hz and a maximum of 3Hz.

2. The color shall be clear or nominal white (i.e. unfiltered or clear filtered white light).

3. Electric, utilizing solid state electronic technology operating on a nominal 24 VDC, with a nominal rating of 82 dBA at 3m.

F. Annunciator Panel- Back Lit Graphic Type

1. Graphic annuciator showing the site plan, and access way shall be provided.

2. Indicating Lamps

a. Provide supervised light emitting diodes (LED's) for indication.

2.4 BATTERY AND CHARGER

A. Battery: Nickel cadmium (NiCd) type, 24 volt nominal with sufficient capacity to power the fire alarm system for not less than twenty four (24) hours upon a normal AC power failure.

B. Charger: Automatic with constant potential charger maintaining the battery fully charged under all service conditions. Charger will operate at 230 volt, 60 Hz source.

3 – EXECUTION

3.1 GENERAL

A. All equipment shall be installed and connected in accordance with the manufacturer's recommendations. Following the required specifications indicated here.

B. Wiring shall be color coded, and in accordance with the manufacturer's recommendations and Fire Department requirements. Install wiring in an independent, dedicated metallic raceway system.

C. Connections to devices installed in accessible tile ceilings shall be in flexible conduit. Device back boxes shall be securely attached to framing members.

D. Provide wireways above and/or below equipment cabinets to accommodate large concentrations of wiring. Conductors within equipment cabinets shall be carefully formed and harnessed.

E. Connect equipment to emergency power system.

F. Furnish a fire alarm speaker and a firefighter's plug in jack for each elevator. Coordinate installation with elevator equipment supplier.

3.2 TESTING AND COMMISSIONING

A. Provide the service of a competent factory-trained engineer or technical authorized by the manufacturer of the fire detection and alarm system equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the Project Manager.

B. When the system has been completed, and prior to the final inspection, furnish testing equipment and perform the following tests in the presence of the Engineer and the Local authority having jurisdiction.

1. Check installation, supervision and operation to ascertain that they will function as specified.
2. When any defects are detected, make repairs or install replacement components, and repeat the test.

C. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall perform the required test. In addition, the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of the Owner's Representative, Project Manager, Consultant and the local authority having jurisdiction.

CHAPTER IV: INTEGRATED SECURITY MANAGEMENT SYSTEM

1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish all labor, materials, supplies, equipment, devices, appliances and perform all operations necessary for the installation of the complete IP based/capable Integrated Security Management System.

B. Any equipment not specifically mentioned in the Specifications or not shown on the Contract Drawings, but deemed necessary for the satisfactory operation of the system, shall be provided. All cost of such equipment shall be included in the bid price.

C. The Contractor shall be responsible for coordination having properly assessed the fire alarm, elevator control and other specified interfacing requirements and the conduit and wiring requirements relevant to their full compliance with this Specifications.

D. The system shall be capable to provide complete integration of doors access, elevator control, alarm monitoring, and CCTV control.

E. A closed circuit television (CCTV) shall be installed and fully integrated with the Security System allowing real time control and feedback from a CCTV camera directly from the Security System Administrator workstation.

F. All wiring and roughing-ins work for power and signal circuits of all security system (CCTV cameras, control and monitoring modules, etc.) shall be by the Specialty Contractor.

G. Separate wiring and conduiting for power and signal system shall be provided by the Specialty Contractor.

H. During bid stage, the Contractor shall adequately and accurately describe the proposed system at the time of bidding.

I. System is easily expandable to accommodate fit-out and future expansion.

1.2 QUALITY ASSURANCE

A. The entire security system installation shall be carried out in accordance with the PEC, The Fire Code of the Philippines & Regulations, NFPA, latest National Building Code and applicable local ordinances of Baguio City.

B. The Contractor shall have 5 years minimum experience and with 24 hours service department.

C. Engineer in-charge supervising the work shall be a duly Registered Electronics Engineer under the supervision of a Professional Electronics Engineer as required by R.A. 9292 and the revised National Building Code.

1.3 SUBMITTALS

A. The Contractor shall supply a full set of drawings, specifications and catalogue sheets describing the various components belonging to the offered system.

B. The following list of equipment does not require samples but shall have specification sheets and catalogues, with sufficient details of mounting in control consoles, submitted before installation. Logo of UL listings shall be clearly indicated.

1. CCTV cameras, lenses and monitors

2. CCTV video management system, network video recorder (NVR), Core Switches and video alert systems
3. Computer software

C. The following shop drawings are required as minimum:
1. System Block Diagram
2. Cabling & Wiring Diagrams
3. Connection Diagrams
4. Drawings showing field of view and depths of focus of CCTV cameras

D. Submit O&M manuals, including test results.

1.4 APPROVED MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:
1. Hikvision Digital Technology
2. Uniview Technologies
3. Dahua Technology
4. ZKTeco

1.5 TRAINING

A. The Contractor shall provide appropriate training for the operation and maintenance of the security system.

2 – PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

A. All materials, equipment, components and devices shall be new and unused, of current manufacture and first quality. All equipment shall be previously tried and tested successfully in the field.

B. All materials, equipment, components and devices shall be clearly marked and suitable for the electrical power supply system to which it will be connected.

2.2 CLOSED-CIRCUIT TELEVISION SYSTEM (CCTV)

A. General requirements are as follows:
1. All devices equipment and enclosure shall be UL listed or equivalent.
2. The CCTV system shall utilize PoE (Power-over-Ethernet) technology based on IEEE 802.3af standard Relay Servers (Integrated Security Switch) which shall serve as power supply for IP-based cameras.
3. Each camera and each relay server shall have an IP address on a network (i.e. LAN, WAN, VPN).
4. All control commands shall be transmitted over the network using TCP/IP protocol.
5. System administration functions must be achieved from a web browser from either local or remote locations.
6. Viewing of video shall be through a PC or other client device accessing a relay server.

B. Video cameras shall comply with the following minimum requirements:
1. The Contractor shall propose the suitable lenses appropriate to the viewing areas and the sensor elements. Automatic aperture control shall be provided. Where zoom lenses are specified, these shall be motorized and shall also have an auto-iris and spot filter. The zoom lens shall be rated at 10:1.

2. Video cameras shall comply with the following technical data (IP-based):

Resolution :	min 30/25FPS, 2560 x 1440 pixels (4MP)	
Illumination (min):	Color: 0.01 Lux @ (F1.2, AGC ON), 0.018 Lux @ (F1.6, AGC ON), 0 Lux with IR	
Video Compression:	Main stream:	H.265/H.264
	Sub-stream:	H.265/H.264/MJPEG
	Third stream:	H.265/H.264
Power Supply:	Power over Ethernet (IEEE 802.3af compliant) or 24VDC	

3. Universal mounting bracket for wall, ceiling and support mounting plate shall be used for the installation of cameras. The proprietary bracket shall be compatible to the camera and housing. All brackets, mounts, housing and accessories, used both internally and externally, shall be suitably manufactured and installed to prevent corrosion, rusting and deterioration.
4. Cabling to all cameras shall be neatly loomed, and where housings are installed contained within a flexible conduit or similar. Flexible steel conduit shall be used for all external cameras. Sufficient, but not excessive, slack shall be provided to allow camera alignment and minimize mechanical stress on both the cable and associated connectors.
5. The PVC jacket of the cables shall be of a different color from the cabling used for communication systems.

C. Monitors shall comply with the following requirements:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. TCL
   b. Sony
   c. Hisense
   d. Sharp
   e. Xiaomi
   f. Skyworth
   g. Philips
2. High resolution color video LED monitors confirming with PAL/NTSC standards shall be provided. Monitor size shall be as indicated in the drawings and can be used as desktop units or rack or console mounted. The equipment shall meet or exceed the following standard:

Operating System:	Android 9.0 or higer
Resolution:	Ultra HD (3840 x 2160 pixels)
Input:	HDMI 2.0
Internet Link:	2.4GHz Wi-Fi 802.11 b/g/n 2T2R
	Ethernet Network (RJ45)

D. Network Video Recorders shall comply with the following features and requirements:

1. Remote Image through Network (i.e. LAN, WAN, VPN) with password protection for viewing.
2. Decoding Format of H.265/H.265+/H.264/H.264+/MPEG4.
3. Remote connection of up to 128 users.
4. Image enhancement, zoom & scaling up to any size on screen.
5. Video and Audio recording over TCP/IP networks.

6. Multitasking simultaneously record, playback, search, transmission, schedules, alarm trigger etc.

E. Network Switches

1. Subject to compliance with requirements, provide products by one of the following:
   a. Hikvision
   b. TP-Link
   c. D-Link
   d. Cisco
2. Device Performance: Provides Gigabit Uplink Connectivity and IEEE 802.3af compliant for PoE camera availability.

2.3 PRODUCT DELIVERY AND STORAGE

A. Deliver and store security system equipment in undamaged factory packaging.

B. Store security system equipment on elevated platforms in a clean, dry location. Protect from dirt, water, construction debris, and traffic.

2.3 INTRUSION DETECTION AND ACCESS CONTROL SYSTEM

A. General requirements are as follows:

1. Magnetic door contacts shall be provided on selected doors (e.g. Highly- secured areas, fire exit stairs, plant rooms.
2. Alarm contacts of door detector shall be closed under normal conditions and open on alarm.
3. The security control panel shall be able to differentiate between open line conditions and alarms, and shall display a trouble condition in case of wire breaks.
4. All devices, equipment and enclosure shall be UL listed or approved equal.

B. The access control terminal shall comply with the following requirements:

1. The Access Control Terminal shall have a face recognition sensor and deep learning algorithm, which helps to recognize the face faster with higher accuracy. The face recognition distance shall be between 0.5m to 1.5m and shall have a capacity of at least 3000 faces and 3000 cards.
2. The Access Control Terminal shall support multiple authentication modes such as Face, Mifare card, and Fingerprint Authentication.
3. The system shall also be protected from voltage surges or line transients including RFI and EMI.
4. The system shall be connected to a wall-mounted Uninterruptible Power Supply with 12V backup batteries and overdischarge protection.

C. Magnetic door detectors shall be recessed type suitable for mounting on all types of doors and on any part of the door. The switch mechanism shall have dust-tight housing, which shall be connected to a terminal box with tamper proof cover. The magnetic switch contacts shall be closed by a magnetic repelling action.

D. The Electro-Magnetic lock shall be durable, easy installation to any type of door (swing or slide, singles or pairs, manual or automatic, hollow metal, wood, aluminum or herculite) and no maintenance required. Holding force shall be field adjustable from 100lbs. to 1500lbs. with no residual magnetism. The Electro-Magnetic lock shall be positive fail-safe type, protected against

power surge and shall have battery power capability. All wiring to the unit shall be self-contained. Electro-Magnetic lock shall be UL listed.

2.4 INTERFACE WITH OTHER SYSTEMS

A. CCTV Interface:

1. The CCTV system shall be fully integrated with the Security System and as such they should perform in unison. When an alarm event is reset on the Security System is shall not be necessary to reset the CCTV digital video recorder.

B. Fire Alarm System interface

1. The Security System Contractor shall provide a complete security/fire interface between the Security System and the main fire indication panel provided by the FDAS Contractor in the Security Room to comply with the full requirements in this Specification.
2. On receipt of the general fire alarm signal, the Security System shall, in accordance with pre-programmed database operations, release any electric locks on all emergency evacuation procedures are maintained in accordance with the building codes applicable. The doors shall remain unlocked until the fire alarm is reset.

3 – EXECUTION

3.1 INSTALLATION

A. All wiring shall be in a complete conduit system separate from other building wiring.

B. Wiring color code shall be maintained throughout the scope of the work.

C. Installation equipment and services that pertain to other work in the Contract shall be closely coordinated with the appropriate Contractors.

D. Coordinate with the Fire Alarm Contractor to ensure that:

1. Interfacing compatibility between the Security and Fire System is achieved.
2. The Security and Fire Systems are fully operational and have been tested and commissioned fully and meets the requirements of this Specification.
2. Inter-system cabling is terminated in an agreed fashion and documented to a level satisfactory to both Contractors.
3. Junction boxes, properly labeled termination strips, conduits, cables are suitably located for the Security-Fire system interface.
4. Location of intercom within the Security Control Room (on console) and associated installation is in accordance with the Security Control Room design.
5. All Fire-Security interfaces are fully documented to the satisfaction of the Security System and Fire Contractors.

E. Unless specified otherwise, the manufacturer's recommendations shall be followed with regard to workmanship and associated materials, equipment, components and devices, whether or not the particular manufacturer has been specified.

F. The layout, dimensions and positions of equipment shown on the Drawings are diagrammatic and indicative only and exact positions shall be determined on site.

G. Variations of positions shall be affected without cost variation if the change is advised before the equipment is cabled and it is not more than ten (10) meters distant.

H. All equipment and/or appliances provided under this Specification shall be designed so that no interference shall caused to any radio or other electronic transmitting or receiving equipment in the same locality. In the event of the inherent characteristics of the electrical installation being such that

interference is possible efficient devices capable of eliminating such interference shall be provided by the Security System Contractor.

I. Equipment supplied and installed shall be such that interference from outside sources (magnetic, electrical or EMI noise distortion, etc.) shall not be accepted as reasons for non-operational equipment or systems.

3.2 TESTING AND COMMISSIONING

A. Provide the service of a competent factory-trained engineer or technical authorized by the manufacturer of the security system equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the Project Manager.

B. When the system has been completed, and prior to the final inspection, furnish testing equipment and perform the following tests in the presence of the Engineer and the Local authority having jurisdiction.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity and insulation.
2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
3. Test all security system devices circuits for open and ground and verify response of trouble signals.
4. Check installation, supervision and operation to ascertain that they will function as specified.
5. When any defects are detected, make repairs or install replacement components, and repeat the test.

C. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall perform the required test. In addition, the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence o the Owner's Representative, Project Manager, Consultant and the local authority having jurisdiction.

CHAPTER V: PUBLIC ADDRESS (PA) SYSTEM

1 – GENERAL

1.1 WORK INCLUDED

A. Furnish and install a complete and functional Background Music (BGM) and Public Address (PA) System.

1.2 SCOPE OF THE SPECIFICATION

A. The specification covers the provision, installation and maintenance of the Background Music & Public Address System (BGM/PA) which includes various functional requirements of the system.

B. Selection and combination of the required system units shall provide the specific functions needed in any individual situation. The system can be extended in functionality and size by adding the required number of compatible units, thereby providing simple and cost effective solutions.

1.3 SYSTEM DESCRIPTION

A. The work covered in this Section of the Specification includes the furnishing of all labor, equipment, materials and performance of all operations associated with the installation of the background music and paging system as shown on the drawings and as herein specified.

B. All works shall be in accordance with governing Codes and Standards, Drawings, Specifications and all related Bid Documents.

C. Any equipment/components not specifically mentioned in the specifications or not shown on the Contract Drawings but deemed necessary for the satisfactory operation of the system shall be provided. All cost for such shall be included in the bid price.

D. All major equipment and materials used for the installation shall be of the same make and type to ensure uniformly of standard and composition. All equipment and components shall be new and the manufacturer's current model.

E. All materials, appliances, equipment, and devices shall be tested, used, and listed by Underwriters Laboratory (UL).

F. All equipment shall be mounted on standard equipment racks.

1.4 QUALITY ASSURANCE

A. Electronic Components: Comply with latest applicable standards of EIA; PEC/PECO; standard industry grade; types and ratings commonly available in local distributor without prior written approval from the Project Manager.

B. Entire system, including mounting, installing, connecting, aligning, testing, and adjusting, to be the responsibility of one Contractor.

1.5 ACCEPTABLE MANUFACTURERS

A. The complete background music and paging system shall be from one of the following manufacturers.

1. TOA
2. Bosch
3. Philips
4. Bose

5. Sony
6. Pioneer
7. Yamaha

1.6 SUBMITTALS

A. The Contractor shall submit a detailed schematic wiring diagram showing all component units with type references, gain or loss, designed to operate to give the system performance as specified.
B. The Contractor shall provide a description of the methods proposed to show that the actual performance will be in accordance with the specifications for technical performance, including necessary test methods, procedures, and equipment that will be used.
C. Submit samples of cables and other components as required.
D. Submit as-built drawings to include the following
   1. Floor plan layouts, sectional view and installation details.
   2. List of major components and their place in the system
E. Submit O&M manuals, including test results.

1.7 TRAINING

The Contractor shall provide appropriate training for the operation and maintenance of the background music and paging system.

1.8 PRODUCT DELIVERY AND STORAGE

A. Deliver and store background music & public address system equipment in undamaged factory packaging.
B. Store background music & public address system equipment on elevated platforms in a clean, dry location. Protect from dirt, water, construction debris, and traffic.

2 – PRODUCTS

2.1 POWER AMPLIFIER – 240W

A. The main function of the power amplifier is the amplification of audio signals for the loudspeakers. The unit shall be certified to be compliant to IEC60849 and compliant to other relevant local standards.
B. Inputs: Mic/Line input × 3, Telephone paging input, BGM input × 2, Power amplifier input, External speaker line input
C. Outputs: Speaker output, Direct speaker line output, Line output, Recording output, Preamplifier output

2.3 TERMINAL BLOCKS

A. Cable terminal blocks shall be arranged in accordance with the group of speakers, areas and function. These shall be capable of terminating 1.5mm copper wires and shall be conveniently located in the upper or lower portion of the rack.

2.4 POWER SUPPLY

A. The Contractor shall make due allowance by providing all necessary power supply units, voltage regulators, spike eliminators, step down transformers, rectifiers, relays, radio suppresser, converters, etc. to ensure that all his equipment will perform completely and satisfactorily.

B. All necessary power supply required for the operation of amplifiers, speaker, sound equipment, devices, controls etc. after the main power supply point, shall be supplied and installed by the Contractor.

2.5 EQUIPMENT RACK

A. All equipment such as power amplifiers, DVD/CD Player, tuner, etc. shall be mounted onto a standard equipment rack.

B. Forced ventilation fans shall be incorporated for the equipment rack.

C. All wiring within the rack shall be fixed securely without strain. For the purpose of certification, all wires shall be numbered and/or color-coded. The wiring shall be formed in a neat and systematic manner, with cable supported clear of panels and without crossovers.

2.6 CEILING MOUNTED LOUDSPEAKERS

A. All ceiling mounted loudspeakers shall be suitable for both voice and music broadcasting and shall be recess mounted in the false ceiling. Where there is no false ceiling, surface type shall be provided.

B. They shall have at least a frequency range of 65 Hz to 18,000 Hz at rated output.

C. The loudspeakers shall have an output impedance of 8 ohms and power output tappings of 1.5, 3 and 6 watts (max.)

D. Each loudspeaker shall be equipped with a line-matching transformer. Transformer shall be provided for each speaker with power tap settings for 100V lines.

2.10 VOLUME CONTROL(WHEREVER APPLICABLE)

A. Volume control shall be provided with appropriate wall plates, flush mounting over standard utility box and appropriate size of junction box.

B. Irrespective of the control position, it shall be capable to make the impedance of the circuit constant.

2.11 WIRING

A. Wiring shall be in accordance with National Codes (e.g. NEC Article 760) and as recommended by the manufacturer of the system. All wires and cables shall comply with the requirements of the Underwriters Laboratories, and local agencies responsible. The size of conductor shall not be less 0.75 mm2 as indicated on the plans.

B. Wiring and terminals cabinets shall be permanently tagged and identified with metal phenolic tags attached by nylon ties.

3 – EXECUTION

3.1 INSTALLATION

A. General

1. All works shall be conducted under the supervision of company trained personnel, and shall be responsible for supervising the installation to the endorsement of the Project Manager.
2. All wirings inside panels and trunkings are to be properly grouped, strapped and fixed in location by endorsed type cable strap.
3. All wiring to be labeled with numbering markers on both ends which correspond to the numbering scheme of the shop drawings. All edges of the panel, support, frame etc.

to be properly rounded off to prevent damage to the insulation. All wiring shall be terminated.

4. Proper segregation shall be maintained throughout for cable wiring carrying different voltage range. All signal and power cables shall be furnished with cable markers for distinguishing from other cables.

B. Electrical Power

1. Fabricate and install 3-wire isolated ground AC power strips in all floor mounted equipment racks, each with an adequate number of receptacles for all equipment served plus two additional utility receptacles. Provide separate 20A circuits for signal processing equipment and power amplifiers, distributing power amplifier loads such that no circuit draws more than 12A maximum under full power conditions.
2. Provide isolated ground receptacles for all power strips. Isolate AC power grounds from the power strip ducting and equipment racks, gather all grounds to a common 8mm2 bus, and terminate the ground bus to the equipment rack unipoint ground busbar with an 8mm2 minimum insulated cable.

C. Cabling:

1. Provide identical conductor color coding for all cables furnishing identical functions throughout the systems, isolate all audio and video lines from the conduit systems. Insulate shield drain wires with insulating heat-sink tubing.
2. All cables shall be run in conduits. The space factor for cables installed in conduit shall not exceed 40%.

D. Labeling:

1. Each of the sound rack, wall plate and interfacing termination cabinet shall be labeled on the front cover indicating the field equipment controlled by the unit.
2. Cables shall be labeled at appropriate locations for identification.
3. All equipment items, device plates, equipment rack panels, devices, controls, receptacles, and cables shall be labeled as to the function performed and the area served.

E. Equipment Racks

1. Arrange equipment to prevent temperatures form rising above 37.7°C with ambient room temperature of 21°C. Mount perforated ventilation panels above, below and between each power amplifier and at top and bottom of each equipment rack.
2. Install equipment to provide free access to all equipment terminations.
3. Install hinges on any chassis over which mounts wired components for contractor fabricated equipment items. Dress and secure associated wiring.
4. Allow sufficient space for cooling of power amplifier heat sink.

3.2 TESTING AND COMMISSIONING

A. Perform loop continuity test and megger test on all single core and multicore cable with electronic components and equipment removed.

B. Test all equipment and system according to manufacturer's recommended procedure.

C. Check proper connection and labeling of all system wiring.

D. For main background music equipment rack, adjust the system to proper condition and output levels. Check operation of all equipment. Check and adjust output levels of all pre-amp and amplifiers so that they are not operated in saturation conditions.

E. Check that all connectors and plugs are compatible and the complete microphone cassette player, amplifier and speaker can operate in harmony without mismatch.

F. Check zoning operation of speaker system under emergency override conditions.

G. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall repeat all the above tests. In addition, the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of the Project Manager.

CHAPTER VI: COMMUNITY ANTENNA TELEVISION (CATV) SYSTEM

1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The work covered in this section shall include the supply, delivery, installation, testing, commissioning, and furnishing of all passive materials for the distribution and satisfactory operation of the Cable TV System to be provided by a Cable TV Service Company.

B. The Contractor shall provide the complete Raceway System to include use of shared raceways complete with pullwires, junction boxes and other accessories.

C. The Contractor shall construct the system following good engineering practices and in accordance with applicable codes and safety precautions.

D. Requirements under this section shall be coordinated with the Local CATV Provider.

1.2 QUALITY ASSURANCE

A. Comply with relevant portions of the PEC as applicable to Cable TV systems.

B. Other requirements shall be coordinated with the CATV Provider.

1.3 SUBMITTALS

A. Submit manufacturer's technical literature, and samples, for all cables and components that will comprise the Cable TV system.

B. Submit shop drawings indicating the following

1. Cable routes
2. Cable installation details
3. Outlet mounting details

C. Submit as-built drawings to include the following:

1. Floor plan layouts, sectional view and installation details.
2. List of major components and their place in the system

1.4 ACCEPTABLE MANUFACTURERS

A. Cable TV System shall be from one of the following manufacturers.

1. As recommended by the Local CATV Provider

2 – PRODUCTS

2.1 CABLES (BY CATV PROVIDER)

A. 75-ohm impedance coaxial copper cable specially designed for transmitting (UHF and VHF) signal shall be used.

B. The attenuation loss of the coaxial cable shall not exceed 6dB/100m for main drops and 12dB/100m for secondary runs.

C. The cable shall have polyethylene dielectric with single plain copper wire conductor and copper braid screen and outer PVC sheath for protection.

2.2 COAXIAL CABLE TV OUTLET (BY CATV PROVIDER)

A. Coaxial cable TV outlet shall either be wall, floor, or ceiling mounted type depending on what is indicated on the plans.

B. Plates color and material shall match the interior design of the area and shall be subject to Architect's approval.

C. Plate shall be in standard size and shall fits in standard size single gang electrical box.

D. It shall be capable to withstand abusive environments.

E. When floor-mounted, coaxial cable TV outlet shall be "pop-up" type, metal finished.

F. Co-axial cable TV outlet shall be 9.6mm knockout hole in F-type connector pattern.

2.3 RACEWAY

A. Cable raceway shall include both metal wireways and metallic conduit.

B. Refer to Section *"Raceways and Boxes"*, for details of these materials.

3 – EXECUTION

3.1 INSTALLATION

A. Install the system in accordance with the plans and specification, all national and local applicable codes, DEC wiring criteria and the manufacturer's recommendation.

B. All wiring shall be run in PVC conduit, minimum size to be used shall be 25mm diameter.

C. All conduits in risers and above false ceilings shall be surface mounted. Conduits installed in public areas shall be concealed.

D. Coaxial cable shall not be bent to a radius smaller than 15 times the diameter of the cable. Joints in cable runs and looping of cables of outlet terminals shall not be allowed.

E. Installation of equipment and devices that pertain to other work in the Contract shall be closely coordinated with the appropriate Contractor(s).

F. Any tools or equipment required for the installation shall be provided free of charge by the Contractor and shall remain his property.

3.2 TESTING AND COMMISSIONING

A. The Contractor together with the Cable TV Signal Provider shall carry out an output level measurement at each and every outlet. The exact method of measurement shall be proposed by the Cable TV Signal Provider and agreed with the Consultant. All tests shall be witnessed by the Project Manager and Consultant and copies of the test results submitted for record.

B. In the event of the component units and/or cables failure in such tests and/or system proposed cannot meet the requirements specified herein due to the usage of the inconsistent component units or cables, the Contractor shall re-design the system or replace with proper component units or cables and re-submit to the Project Manager for final approval before the installation is commenced. Any extra costs incurred by such re-design or replacement of component units and cables shall be borne by the Contractor with no charge to the Owner.