THE PROJECT
FOR
CONSTRUCTION OF
MULTI-PURPOSE BUILDING
AND
ISLAND OFFICE
WITH SOLAR POWER SYSTEM
IN
LAAMU ATOLL

Tender Documents (Technical Specifications)

VOLUME-II SPECIFICATIONS

PART-A GENERAL SPECIFICATIONS

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TABLE OF CONTENTS

SECTION 1. SCOPE OF WORK

1.1 Outline of the Project

The Project is to construct one lot of Multi-Purpose Building and Island Office together with Solar Power Systems with incidental building facilities in Thundi, Gan island and Fonadhoo island respectively in Laamu Atoll under the Japan's Grant Aid.

1.2 Scope of the Work

The work and services to be performed under the Project covers, but not limited to, site survey, furnishing and construction of temporary and permanent works as well as design, manufacturing, installation, test and commissioning of equipment and materials, transportation and delivery including site construction and erection of all other incidental works required in and for the Project implementation in due conformity with the Contract Documents, which mainly consist of the following components:

Item	Multi-Purpose Building	Island Office
1. Building Size		
• Site area	Approx. 5,000m^2	Approx. 2,301m^2
• Foundation	Direct Foundation	Direct Foundation
• Structure	Reinforced concrete	Reinforced concrete
• Stories	2 stories	2 stories
• Ground Floor Area	Approx. 715m^2	Approx. 254m^2
• 1st Floor Area	Approx. 770m^2	Approx. 358m^2
• Roof	Steel Structure	Steel Structure
• Sewerage system	1 set	1 set
• External work	1 set	1 set
• Electric and water supply	1 set	1 set
• Furniture	1 set	1 set
2. Solar Power System		
• Solar Module	10kW (60pcs)	5kW (30pcs)
• Mounting structure for solar module	1 unit	1 unit
• Junction Box	1 unit	1 unit
• Grid back-up board	1 unit	1 unit
• Power conditioner	1 unit	1 unit
• Tie Transformer	2 units	2 units
• Storage battery	144 pcs	48 pcs

The Work shall also include site survey, designs for the temporary works and shop drawings, testing, transportation, insurance, delivery, and all other things required for the project implementation in due conformity with the Tender Documents.

SECTION 2. GENERAL INFORMATION

2.1 Description

The following general information gives some indication of the Site conditions, which might be useful for the Contractor in formulating his construction programs, but shall not relieve the Contractor in any way from the obligation to consult all available data.

The Employer will not take responsibility whatsoever for the accuracy of the information.

2.2 Natural Characteristics

(1) Geological Condition

The Maldives is a chain of Indian Ocean islands spread over a distance of 900 kilometers and forms an archipelagic country, located between northern latitude 4 to slight south of the equator. The country has 1,190 islands, of which 198 were inhabited prior to tsunami. Of these islands, only 28 have a land area greater than one square kilometer. The average elevation is 1.5 meters above mean sea level.

All islands are situated on the densely condensed coral rocks on which some area form vegetation, grass, bushes and trees. Since the coral rock may have considerable compression strength itself, all structures in this country are constructed on such stable coral rock.

(2) Meteorological Condition

The Climate of southern Maldives is characterized by tropical weather under the equator. There are two seasons which are the rainy from May to October and the dry from December to March. The yearly average is 25.1℃ in Southern Gan Island.

Mean Monthly Temperature in Southern Gan Island (2003)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Temp.(℃)	25.0	25.9	25.2	24.8	25.0	24.4	25.0	25.2	25.0	25.9	25.1	24.7

Source: Department of Meteorology in Maldives

Monthly Precipitation in Southern Gan Island (2003)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	103.5	11.3	148.4	325.7	137.6	204.2	97.4	140.6	176.0	36.0	129.0	377.3

Source: Department of Meteorology in Maldives

2.3 Infrastructure Conditions

Laamu Atoll Island has a 24 hours power plant that provides the necessary electric power supply for the Island needs. Operating Voltage is 220-240V. The Island has a telephone link connecting to all international destinations. To get access to a line an application has to forward to the service provider. The Island has no central water supply network presently. The Contractor shall provide water supply and drainage systems necessary for the construction either by collection of rain water or desalination plant at his own cost.

SECTION 3. GENERAL PROVISIONS

3.1 Undertakings by End-User

The assistance of the Republic of Maldives is to be extent on the following matters prior to and during the execution of the Work. In accordance with the provision in the Exchange of Notes between the Republic of Maldives and the Government of Japan, the Republic of Maldives will take necessary measures:

(1) to secure lands necessary for construction of facilities;

(2) to ensure prompt unloading and customs clearance at ports of disembarkation in the Republic of Maldives and internal transportation therein of the products purchased under the Grant.

(3) to accord Foreign nationals whose services may be required in connection with the supply of the products and services under the Contract such facilities as may be necessary for their entry into the Republic of Maldives and stay therein for the performance of the work.

(4) to ensure that the facilities constructed and the products purchased under the Grant be maintained and used properly and effectively for the execution of the Project; and

(5) to bear all the expenses, other than those covered by the Grant, necessary for the execution of the Project.

3.2 Contractor's Responsibility for the Work

(1) The Contractor shall conduct the followings:

1) To prepare time-time working and shop drawings, progress schedule and other technical documents and submit to the Employer.

2) To submit monthly progress photographs showing the actual physical progress of the Project site.

3) To submit to the Employer As-built Drawings at the completion of the Work.

(2) Even though approved by the Employer under the Specifications, the Contractor shall be responsible for construction methods, techniques, sequence and procedure, or for safety precautions and programs in connection with the Work, and for his failure if any to carry out the Work.

(3) The Contractor shall furnish one resident representative with sufficient power and good command of English for executing the Work smoothly.

(4) The Contractor shall, at his own expense, take necessary measures, in accordance with the Contract Documents and relevant laws, ordinances and regulations, to prevent damage to the Work, construction materials, adjacent structures or a third party, until the completion of the Work.

(5) The Contractor shall be responsible for making necessary arrangement in the Republic of Maldives with manufacturers and/or handling agents to safety-guard against uninterrupted supply of materials required in the Work.

(6) The Contractor shall be responsible for security and safety measures being taken throughout the construction period as specifically referred to under Sub-section 3.18 of these Specifications.

3.3 Ambiguity and Discrepancy

The Contractor shall notify in writing the Employer when he found any doubts and discrepancy among the Contract Documents for their clarification before or after contract awarding. If the Drawings do not contain particular materials and works which are obviously necessary for proper completion of the Work, all such materials and works shall be deemed to be included in the appropriate items of the Contract.

3.4 Subcontractors and Suppliers

The Contractor shall not subcontract the whole of the Work. Prior consent of the Employer shall be obtained to proposed Subcontractor and Suppliers except for them who are named in the Contract. The Contractor shall submit to the Employer complete documents such as name, proposed works, countries and location, past work experiences, organization, financial status etc. of the proposed Subcontractors and Suppliers.

3.5 Procurement

(1) Labor Force

All construction related labor as common labors, foremen, mechanics, and machine operators shall be procured in Maldives or in other countries depending on individual competency by the Contractor. However, since the competency varies considerably, the Contractor shall test them for skilled workmen on important jobs before employment.

(2) Construction Materials and Equipment

All construction materials and construction equipment are available in the local market although they were imported and in the neighboring countries. Materials for building service equipment are also in the same condition as above. In any case, the materials to be used for construction shall be qualified by the Employer prior to procurement. The Contractor shall submit Master List of those construction materials and equipment to the Employer prior to procurement.

3.6 Materials

Unless otherwise specifically noted, the quality of materials, equipment and workmanship shall comply with JIS, JAS, ASTM or other equivalent international standards as specified in the Specifications and approved by the Employer. The Contractor shall, before placing any order to procure materials or manufactured articles for the permanent works, submit to the Employer for his approval a complete description of such items along with the name of the suppliers. When so instructed by the Employer, the Contractor shall submit samples and certificates for his approval.

3.7 Testing

When instructed by the Employer, the Contractor shall submit test data of materials to be incorporated in the Work, or shall be tested at the laboratory approved by the Employer. Cost of such tests shall be born by the Contractor.

3.8 Coordination, Security and Safety Measures

(1) The Contractor shall be responsible for his construction activities on the Site, and shall co-ordinate his own activities with those of other contractors in order to implement smooth construction works.

(2) The Contractor shall be responsible for keeping off the unauthorized persons off the construction Site. Authorized persons shall be Contractor's personnel and the Employer's personnel and any other personnel notified by the Employer. The Contractor shall keep his equipment and his personnel within the Site and any additional working area approved by the Employer.

(3) The Contractor shall take all necessary precaution against risks whatsoever kind to any his personnel, the Employer's employee or any other third party having good and sufficient reasons to be around the Work and to this end he shall properly carry out safety measures in/around the Site. The Contractor shall also take precautions against any damage to the property of them or of any other third party located at or next to the Site inclusive of public utilities. If any damage has been caused to a third party by the execution of the Work, the Contractor shall compensate the third party for such damage.

(4) Temporary fencing or other means to keep pedestrians' safe shall be provided around the Site in a manner and materials accepted by the Employer.

(5) The Contractor shall at all times comply with local safety regulations published by the Republic of Maldives.

3.9 Reports and Records

(1) Work Progress Reports

The Contractor shall submit to the Employer a Monthly Progress Report including actual status of progress of all items and next month schedule with progress photographs.

(2) Daily Reports

The Contractor shall submit daily reports by each work item to the Employer. This will be materials for weekly meeting between the Employer and Contractor. Daily Report shall contain, but not necessarily be limited to, the following:

- Weather conditions
- Staff and labor force employed in the Work
- Materials at Site
- Equipment at Site and the condition of such equipment
- Work items in progress or in preparation
- Accidents and other information relevant to the progress of the Work

(3) Technical Work Records

The Contractor shall prepare and submit his technical work records to the Employer.

3.10 Works to be kept Clean

The Contractor shall keep the works well drained of water until completion of the Work, and shall ensure that as far as it is practicable in the opinion of the Employer all works shall be carried out in dry condition. Excavated areas shall be properly drained and kept free from standing water after the excavation works are over.

3.11 Construction Schedule

Within fourteen (14) days after the date of signing the Contract, the Contractor shall submit to the Employer for his approval a Construction Schedule in accordance with the work program stipulated in the Contract Documents, showing in detail the order of procedures and methods by which of his proposes to perform the Work, and shall submitted particulars in writing of his arrangements for performing the Work and of the construction plant and temporary works he intend to furnish, use, or construct.

3.12 Quality Control

In order to ensure satisfactory work performance, a quality control system shall be instituted by the Contractor before commencement of the Work. The Contractor shall submit the proposed system to the Employer for his consent, to which compliance shall not relieve the Contractor of any of his duty, obligation under the Contract.

3.13 Drawings and Documents to be prepared by the Contractor

(1) Shop Drawings

The Contractor shall prepare the Shop Drawings for his works before starting each work item. The Shop Drawings shall show necessary complete details needed for actual construction or installation of the various works according to the Specifications or as directed by the Employer. The Shop Drawings shall be submitted initially in 3 sets of prints accompanied by a letter of transmittal. Additional prints shall be submitted to the Employer after his approval of which number shall be instructed by the Employer.

(2) As-Built Drawings

At the completion of the Work, the Contractor shall prepare and submit 1 set of original and 4

sets of photocopies of the "As-Built Drawings" for the Employer's approval. The former will be kept by the Employer and latter will be submitted with the following manner.

1) Dark navy blue paper covers with gold letter printing: 2 sets
2) Bound in folded form with sealed book: 2 sets

3.14 Progress and Completion Photographs

High lighted various stage of the construction works shall be photographed in the course of their execution based on the consultation with the Employer. The Contractor shall submit filed copies with complete explanation on each photograph.

Upon completion of the Work, the Contractor shall hire some professional photographer to take the following completion photographs under instruction by the Employer. Colored photographs shall be submitted to the Employer in an album form with title together with one set of colored slides. Size of photograph shall be in cabinet-size with the following details:

- Building Work: Exterior 10 shots, Interior 20 shots (Submit 5 copies)
- Ventilation Facility Works: Exterior 5 shots, Interior 5 shots (Submit 5 copies)
- Water Supply, Drainage and Sanitary Facility Works: Exterior 5 shots, Interior 5 shots (Submit 5 copies)
- Electrical Facility Works: Exterior 5 shots, Interior 5 shots (Submit 5 copies)

3.15 Joint Inspection

Joint inspection shall be carried out by the Employer and Contractor for the following major items in addition to the routine inspection:

(1) Building Works

1) Staking out after confirmation of property lines, and establishment of bench marks
2) Upon completion of excavation
3) Soil Bearing Test
4) Full scale profile of structural steel at the work shop
5) Upon completion of field welding and high strength bolting work on structural steel
6) After fabrication of temporary fabrication of doors and windows at the factory
7) Upon completion of reinforcement bars construction for foundation and each floor levels
8) Upon completion of form work for each concrete members
9) During concrete placing
10) During brick and concrete block laying
11) During rafter installation
12) At the every concrete compressive testing at the laboratory

(2) Ventilation Works

1) Upon completion of equipment installation, piping and ducting
2) Performance, adjustment and measurement of all motor drive machines
3) Adjustment and measurement of ventilation air
4) Temperature and humidity adjustment
5) Noise level adjustment and measurement

(3) Water Supply, Drainage and Sanitary Works

1) Upon completion of all piping, sanitary fixtures etc.

2) Performance, adjustment and measurement of all motor drive machines

3) Water pressure adjustment and measurement

4) Noise level adjustment and measurement

(4) Electrical Facility Works

1) Upon completion of all electrical fixtures and wiring

2) Performance, adjustment and measurement of all equipments

3) Insulation. Illumination measurement

4) Noise level adjustment and measurement

(5) Common Items to All Section of Works

1) Production inspection

2) Finish Works inspection

3) Intermediate Inspection

4) Completion Inspection

In case the Building Authority and/or representatives from other competent authorities who request to participate in the joint inspection, the Contractor shall made prior consultation with the Employer.

Works, of which inspection is unable to perform after their completion, shall be inspected jointly at optimum times during the progress of such works. Photographs shall be taken and filed by the Contractor.

3.16 Final Inspection and Completion Documents

In case the Work reached their completion, the Contractor shall submit the request for substantial completion to the Employer on the date designated. The final inspection shall be made jointly by the representatives from the Employer and Contractor. The Contractor shall complete all remedial works before execution of final inspection. Upon acceptance of the results of the final inspection, the Contractor shall submit the following documents to the Employer and deliver the Work to the Employer together with complete set of the keys. All fees for the inspection and preparation of documents shall be born by the Contractor.

1) Completion Report

2) As-Built Drawings (3 sets of photocopies)

3) Permit and Approval Certificates from various competent authorities

4) Maintenance Manual of the Buildings and Equipments

5) List of Materials/Equipment together with the details of their After Sales Service Companies

6) Guarantee Certificates of some Materials Suppliers concerned

7) Two sets of the complete Key and List

8) Two sets of the Completion Photographs

3.17 Protection of Environment and Dispute

The Contractor shall take all necessary precaution to protect people and property on/off the Site from any damages and nuisance resulting from pollution, noise and vibrations results of his construction operation whether there are any environmental regulations against these or not. In the event of dispute arisen in this concern, such dispute shall be settled by the Contractor.

3.18 Insurance

(1) General

The Contractor shall, at his own expenses, take necessary and adequate measures on the Work, in accordance with the Contract Documents and relevant laws, ordinances and regulation in the Republic of Maldives, in order to prevent damages to the Work, construction materials, adjacent structures or to any third party, from the commencement his field operation to the completion and delivery of the Work.

The Contractor shall, whenever he considers it necessary for prevention of accidents, he shall consult in advance the opinion of the Employer and comply therewith.

(2) Damage to the Third Party

If any damage has been caused to a third party by the execution of the Work, the Contractor shall compensate the third party for such damages to which the Contractor shall provide insurance adequate to cover damage of the third party under the name of the Contractor and the Employer.

(3) Insurance of the Work

During the execution of the Work, the Contractor shall insure in the joint names of the Employer and the Contractor against all loss or damage on the works and construction plant, etc., as follows from whatever cause arising, other than the damages by Force Majeure.

1) The Work for the time being executed to the estimated current contract value thereof, together with the materials for incorporation in the Work at their replacement value.

2) The construction plant and other things brought on to the Project Site by the Contractor to the replacement value of such construction plant and other things.

Such insurance shall be effected with an insurer and in terms approved by the Employer, which shall not be unreasonably withheld, and the Contractor shall, whenever required, produce to the Employer or the Employer's representative the policy or policies of insurance and the receipt for payments of the current premiums.

(4) Insurance against Accident or Injury to Workmen

1) The Contractor before starting the Work secures and maintains such insurance from an insurance company approved by the Employer as will protect himself, his subcontractors, and the Employer for claims for bodily injury, death insurance and property damage which may arise from operation under this Contract. Bodily injury and death insurance shall provide coverage for all persons of any age.

2) The Employer shall not be liable for any damages or compensation payable under law as a consequence of any accident or injury to any workmen or other person in the employment of the Contractor or to any subcontractor, except accidents or injuries resulting from any act or default of the Employer against all such damages and compensation and against all claims, demands, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

PART-B TECHNICAL SPECIFICATIONS

CHAPTER-1 BUILDING WORKS

CHAPTER-1 BUILDING WORKS

TABLE OF CONTENTS

SECTION 1. GENERAL REQUIREMENT

1.1 General

(1) Detailed Construction Schedule

Within fourteen (14) days after the date of signing the Contract, the Contractor shall submit to the Employer for his approval a Construction Schedule in accordance with the implementation schedule of Schedule-III proposed in the Contract Documents, showing in detail of the order of procedures and methods by which he proposes to perform the Work and of the construction plant and temporary works he intends to furnish, use or construct. However, the structure and buildings located on the reclaimed land by the Project shall not be allowed to commence any work during monitoring period of land settlement.

(2) Materials and works

The Contractor shall supply all materials and works required for completion of the Work in accordance with these Specifications.

If the Drawings do not contain particular materials and works which are obviously necessary for proper completion of the Work, all such materials and works shall be included in the appropriate items in the Contract of the building construction works.

Unless otherwise specified, all materials and equipment which will become a part of the permanent works shall be new and of good quality, and shall be subject to inspection, examination and/or test according to the proper industrial standards as specified.

The Contractor shall, before placing any order to procure materials or manufactured article for the permanent works, submit to the Employer for his approval a complete description of such items along with the name of the suppliers. When so instructed by the Employer, the Contractor shall submit samples and certificates for his approval.

(3) Standards

Unless otherwise specifically provided, the quality of materials, equipment and workmanship shall comply with JIS, ASTM or other equivalent international standards as specified hereinafter and as approved by the Employer.

(4) Working drawings and samples

Working drawings, shop drawings or full size drawings shall be prepared and submitted by the Contractor to the Employer for his approval as specified herein at no extra cost. The Contractor shall also submit samples or catalogues of construction materials for approval as specified without extra cost. The Employer will check such samples or catalogues for assurance of compliance with the design concept and the Specifications.

(5) Safety Precaution

For prevention of accidents, fire, pollution, damage caused by storm and flood, etc., all adequate precautions and measures shall be exercised by the Contractor during the execution of the Work in accordance with the requirements of the appropriate Codes, Fire Prevention, Pollution Control, Labor Safety, Sanitation Laws and other regulations.

(6) Cleaning

The Contractor shall from time to time remove all dirt and rubbish caused by the Work from the construction site. At the completion of the Work, the Contractor shall thoroughly clean the interior and exterior of the buildings. Before the completion of the Work, all temporary facilities shall be removed and the area shall be recovered, cleaned and graded as required.

SECTION 2. PREPARATION AND TEMPORARY WORKS

2.1 General

The works under this Section shall cover the supply of all labor, materials and plant and the performance of all works required for the preparation and temporary works for the buildings and facilities as shown on the Drawings or as directed by the Employer.

2.2 Preliminary Survey and Setting -Out

(1) Property and Boundary lines of the Site

Property and boundary lines of the Site shall be confirmed in the presence of the Employer and other person concerned of which record shall be filed. Representatives of the Employer shall be requested in case instructions are needed.

The Contractor shall investigate the current conditions of the Site and recorded the result thereof to the following items: boundary lines, ground elevation, conditions of adjacent lots and structures, underground utilities such as water supply, sewer, electric and communication lines as well as overhead lines. In case some of them are related to the Work, they shall be mutually settled by the attendants.

(2) Preliminary Survey

The Contractor shall, before commencing any of his works, perform survey work to confirm the level of the ground and prepare survey drawings and submit these to the Employer. The level shall be taken at maximum 10 meters spacing and contours at every 20 centimeters. The cost for these shall be included in the Contract. If, in the opinion of the Employer, further grading work is necessary, the Employer may order the Contractor to perform grading works at a suitable time taking into account of the smooth progress of the Work.

(3) Setting-Out

Prior to commencement of the setting-out, the Contractor shall thoroughly study the corresponding drawings and shall responsible the measurements as well as proper setting out of the facilities or building.

The batter boards shall be set out at the required positions to indicate accurate lines and level of the building and shall be periodically checked thereafter as the need arises since they are quite vulnerable to displacement. The reference points shall be offset to a given distant points in convenience for rechecking.

Upon completion of setting-out, the Contractor shall request to the Employer the verification of the results.

2.3 Temporary Construction and Facilities

Prior to commencement of the Work, a schedule of the temporary work shall be prepared and submitted by the Contractor to the Employer for his approval. The Contractor shall provide and maintain all temporary constructions and facilities necessary to complete the Work. Before completion of the Work, the Contractor shall remove all such temporary facilities by his own cost.

2.4 Material Storage

The Contractor shall erect temporary sheds in order to store and protect construction materials. All storage shall be structurally sound and have suitable dimensions. Cement storage shall of suitably waterproofed construction. Paints, oil and other inflammable materials shall be stored in a fireproofed structure at a suitable location.

2.5 Scaffoldings and Staging

The Contractor shall furnish, erect and maintain during the work as required all scaffoldings, runways, guard rails, and all other temporary constructions as may be necessary for the

construction of works.

Scaffoldings and stagings shall be rigidly installed for assuring safety and for convenience of construction works and inspection, by using methods and materials appropriate for the type, scale, location, construction period, etc. Care shall be taken to maintain them in the best condition and they shall be carefully inspected at all times to ensure safety.

Prior to commencement of the erection of scaffolding, the Contractor shall prepare the detailed drawings including connection methods, erection system, etc., and shall submit to the Employer for his approval.

2.6 Lavatory for Laborers

The Contractor shall provide lavatories for labors in the Site in accordance with the related regulations. These lavatories shall be maintained in a sufficiently clean, safe condition and shall not cause damage to third parties.

2.7 Quality Control and Instrument for the Employer

The Contractor shall provide all instruments necessary for checking of the various constructions by the Employer. The instruments shall be of modern type and shall be maintained by the Contractor at all times.

The Contractor shall manage and operate the laboratory tests for performance of all the standard tests required by the Specifications. Some specific tests shall be performed in the authorized laboratory in Mare. The Contractor shall hand in daily report dealing with quality control of concrete and fill materials.

SECTION 3. EARTHWORK AND RUBBLE STONE WORKS

3.1 General

This Section shall apply to all earthworks and rubble or stone works required in the Work. The Earthwork shall includes examination, filling or backfilling, compacting, forming sub-grade for any type of foundation works and disposing of any excess or rejected materials as required in the Work.

The Rubble Stone Work includes all rubble stone works required to complete the rubble stone foundation and any other rubble stone works required in the Work.

3.2 Work Plan

Prior to commencement of the earth works, the Contractor shall submit the following detailed plan to the Employer for his approval.

Work schedule showing the sequence, extent, depth of the excavation, methods and procedures of filling, and disposal of excess materials in consideration of soil properties, geographical features, weather conditions and related work.

Schedule of plant and equipment operation shall describe the type, classification, capacity and time of operation together with Drainage Plan describing all necessary measures to be taken in case of stormy weather or flooding.

3.3 Excavation

(1) Construction Equipment

The Contractor shall select the most suitable construction equipment for excavation, filling, hauling, leveling, compaction, etc. A list of this equipment showing types, capacities, numbers, and other information shall be submitted to the Employer for his approval.

(2) Borrow Pits

If there is an insufficiency of soil suitable for use of backfilling and embanking, the Contractor shall make his own arrangement to obtain good soil from borrow pits for this purpose. When necessary, the Contractor shall ascertain by conducting surveys and tests that adequate supplies of suitable materials can be obtained for the work. The cost for this work shall be included in the Contract price.

(3) Safeguarding Excavations

The Contractor shall be responsible for the safety of all excavations, for the prevention of injury to workmen, for damage to the adjoining works, and property and for the maintenance of all slopes and excavations.

The Contractor shall provide, fix and remove all necessary open or close timbering, strutting and shoring wherever excavation require temporary support. The Employer may order such temporary support to be strengthened or altered if he considers it necessary in the interest of the Work as a safeguard against accidents to the workmen, but this shall not relieve the Contractor of any of his responsibilities under the Contract.

(4) Excavation

The excavation to form a foundation for building, equipment or the like shall be made to be dimension and elevations indicated on the Drawings and the Specifications or directed by the Employer.

The excavation shall extend a sufficient distance from walls and footing to allow for installation of forms, services and of inspection. Bottoms of excavation shall be level, free from loose materials, and brought to the indicated or required levels in undisturbed earth or compacted fill. When excavation is complete, the Contractor shall request approval of the Employer as to the character and suitability of the foundation materials. The foundation shall

be set on the firm soil of uniform density throughout its length and width.

Excavation shall be carried out at all times in a manner which will not disturb adjacent unexcavated ground.

If the Contractor excavates more materials than it called for on the Drawings or instructed by the Employer, he shall refill the area to the correct level to the approval of the Employer. Under and around the foundations of structures in particular, such filling material shall be well compacted.

(5) Excavation for Pipes and Trench

Excavation for pipes of water, sewage, waste water and electric cable services shall be carried out to a depth lower than the bottom of pipe orifice by 100mm for constructing the sand base as specified hereafter.

3.4 Backfilling and Filling

Prior commencement of backfilling and filling, the places shall be cleaned of all temporary facilities, concrete forms, refuse, debris or any other deleterious matters and all embedded structures, pipes, cables and the like shall be inspected and approved by the Employer.

Soil to be used for backfill and filling may, in principle, be excavated soil so far as it does not contain any vegetation, organic matter, large fragments of rock, metallic or harmful refuse.

The soil shall be placed in not more than 200mm layers evenly spread and each layer shall be well compacted to attain a dry density of at least 90% of the maximum dry density. The soil shall be dried or watered as required to have optimum moisture content to attain the required consolidation.

The surface of backfilling after compaction shall have a slightly cambered surface where required to facilitate drainage. For other area, the surface of the finished fill shall be flat and level and shall have correct elevation as specified. After finishing the filling work, its level and elevation shall be inspected jointly and the Contractor shall obtain the Employer's approval.

Care shall be exercised on the places adjacent to the structure not to cause damages to them. Compaction on such places shall be carried out by approved hand tools. Unless otherwise instructed by the Employer, backfilling or filling material shall not be placed and compaction shall not be permitted adjacent to the concrete for seven (7) days after the placing thereof. Where residual settlement can be reasonably expected after backfilling, extra filling shall be provided as instructed by the Employer.

3.5 Disposal of Surplus Soil and Refuse

The Contractor shall removed surplus soil from excavations of the Site and deposit these at dumping points approved by the Employer. The dumping point shall be selected in or out of the Site not further than 10km away from the boundary lines of the Site.

The Contractor shall keep at all times the dumped soil in a tidy and self-draining state. The Contractor shall not deposit any refuse inside the Site and shall selected dumping points for these at his sole responsibility and expense.

3.6 Rubble Stone Foundation

For concrete structures of building, equipment foundations, tanks or the like, a rubble stone foundation course shall be constructed on the excavated or filled ground where shown on the Drawings or directed by the Employer.

The rubble foundation shall be made of approved rubble or crashed stone having a nominal size of larger than 65mm to a total thickness of 100mm or 150mm as shown on the Drawing. The rubble or crushed stone shall be well compacted with jumping rammer, vibrating soil compactor or roller depending on the place to the satisfaction of the Employer. Top surfaces of the rubble stone shall be filled up with gravel or crushed-run of suitable size and made

smooth while compaction work proceeds.

SECTION 4. CONCRETE AND FORM WORKS

4.1 General

The work under this Section shall comprise the supply of all labor, materials and plant and the performance of all work required for the concrete and form works for the buildings as shown on the Drawings or as directed by the Employer and as specified herein.

All materials and workmanship for concrete, formwork and reinforcement shall be in accordance with JIS, ASTM and ACI in so far as they do not conflict, or are not inconsistent with the Specifications provided hereinafter.

4.2 Materials

(1) Cement

Cement to be used for building shall be obtained from an approved manufacturer and shall conform to JIS R5210, ASTM C150 Portland Cement, or equivalent approved. Particular attention shall be drawn to that for the structural members of the building which come in contact with ground soil, type V cement (sulfate resistant type) shall be used. The structural members above mentioned shall be foundations, foundation beams and floor slabs.

The cement shall be delivered to the Site in sealed kraft bags which shall be clearly marked with the name of manufacturer, place of production, the type of cement, the year and month produced and the weight contained. No cement shall be allowed to be used without approval of the Employer. The Contractor shall submit a complete factory test report of the cement to the Employer for his approval.

The minimum weight of cement to be used for the concrete shall be 270kg/m3 per cubic meter of concrete in order to achieve appropriate consistency of the concrete.

(2) Storage of Cement on the work

Immediately upon receipt at the Site, cement shall be stored in a dry, weather tight, properly ventilated store, with adequate prevention of moisture absorption. Not more than thirteen (13) bags of cement shall be piled up and this number shall be limited to seven (7) bags when the storage is expected to be longer than two (2) months.

(3) Imported Cement

Imported cement shall be tested as may be required by the Employer prior to their incorporation in the work notwithstanding that the cement may have been tested prior to delivery to the Site. The Employer may reject any cement not meeting these Specifications of which rejected cement shall be immediately removed from the Site. Cement held for more than ninety (90) days after manufacture shall be tested prior to use in accordance with ASTM C-114.

(4) Aggregates

All aggregates shall be free from earth, clay, chalk, lime, peat, loam, soft clay of shale or decomposed stone, vegetable and organic matter and other impurities. The aggregate shall be hard and dense, spherical or cubical in shape.

1) Coarse Aggregates

Coarse aggregate shall consist of gravel, crushed stone, or other inert materials with similar characteristics, or combination thereof.

Unless otherwise approved or directed by the Employer, the maximum nominal size of the coarse aggregate shall be 25mm. The coarse aggregate shall be well graded and shall conform to the following standard grading.

Grading of Coarse Aggregate

Designated size (mm)	50	40	30	25	20	15	10	5	2.5
25-5			100	90-100	-	25-60	-	0-10	0-5
15-5					100	90-100	40-70	0-15	0-5

Deleterious materials in the coarse aggregate shall not exceed the following limits.

Materials	Percentage by weight
Clay lump	0.25
Soft Particles	5.0
Particle which have a specific Gravity of not less than 2.0	1.0

2) Fine Aggregates

Fine sand shall consist of river sand having clean, hard, durable, uncoated grains, free from deleterious substances and the particles of these shall be generally spherical or cubical in shape. Grading of the fine aggregate shall conform to the following standard grading.

Grading of Fine Aggregate

Sieve Designation	Cumulative percentage by weight passing sieve
9.5 mm	100
4.8	95 to 100
2.4	80 to 100
1.2	50 to 85
0.6	25 to 60
0.3	10 to 30
0.15	0 to 10

In addition, the fine aggregate, as delivered to the mixer shall have a fineness modulus of not less than 2.3 nor more than 3.1.

Deleterious materials in the fine aggregate shall not exceed the following limits:

Materials	Percentage by weight
Clay lump	1.0
Materials retained in 0.3mm sieve which have a specific gravity of less than 2.0	0.5
Chlorides (as NaCL)	0.01
Other Deleterious Materials	2.0

Fine and coarse aggregates shall be stockpiled separately in such a manner as to avoid

contamination and have an appropriate drainage facilities and covers to ensure uniform and stable moisture content.

(5) Mixing Water

Water for mixing concrete shall be clean, fresh and free from oil, acid, alkali, sugar and vegetable substances, and any other substances that may impair strength, appearance or durability of concrete. If required by the Employer, the Contractor shall test the water to substantiate that the water is acceptable for concrete mixing at no extra cost.

4.3 Concrete Mixing

(1) Type of Concrete

The table below gives the different types of concrete to be used in principal in the various structures, with each minimum design compressive strength at a 28 days age and the maximum sizes of aggregates.

Type of concrete	Minimum design compressive strength at a 28 day age	Maximum size of aggregate
	(kg/cm^2)	(mm)
A	210	25
B	180	25
C	150	25

Each type of concrete shall in principle be used in the various structures specified below and as indicated on the Drawings.

Description	Concrete Type
Reinforced concrete for building structures, Equipment foundations and the like	A
Reinforced concrete for pits, ducts, passageway	B
Plain concrete for leveling concrete or other various purposes	C

(2) Water/Cement Ratio

Water cement ratio to be applied for building construction shall be 65% or lower as directed by the Employer. However the value of the water/cement shall preferably be lowered in order to achieve workability, durability and density of the concrete.

(3) Standard Slumps

The slumps of concrete to be used for building, equipment foundation shall be approximately as follows and subject to the Employer's instructions.

Description	Standard Slump (cm)
Reinforced concrete for building framings	10~15
Building and equipment foundation	7.5~12.5

(4) Admixture

No admixture shall be permitted to use in the concrete without approval of the Employer. When the admixture is employed, appropriate tests shall be carried out by the Contractor to show that the density has not been reduced by more than 5% by using them.

(5) Mix Proportion

In order to determined the optimum mix proportion of the concrete, the Contractor shall carry out analysis and tests to obtain a concrete of maximum density, workability, consistency and required strength with the minimum water/cement ratio by taking into account of the actual grading of coarse and fine aggregates at no extra cost.

The target compressive strength shall be determined by the following formula:

$$F = (Fo + t) + \sigma$$

where: F = Target compressive strength (kg/cm2)
F0=Design compressive strength (")
σ =Standard deviation factor (")
t =Temperature compensation factor (")

Unless otherwise approved by the Employer, " σ " shall be 30 kg/cm2 and "t" shall be made 20 kg/cm2 when the atmospheric temperature is expected to be lower than 10℃ at the time of concrete pouring.

Only minimum water shall be added during concrete mixing considering the moisture contents of the aggregates to ensure proper hydration of the cement and to produce an optimum consistency of the concrete.

(6) Batching

The Contractor shall obtain the approval of the Employer on his batching equipment. The accuracy of the batching equipment in feeding and measuring of the materials shall not exceed the following limit.

Water and cement	1.5 per cent
Admixtures	1.0 per cent
Aggregate	3.0 per cent

The Contractor shall also provide standard test weights and any other auxiliary equipment required for checking the operation of each scale or other measuring devices, and shall make periodic tests over the range of measurements involved in the batching operation.

The amount of each material comprising the concrete shall be determined by weight, except the amount of the water which may be measured by volume; however such materials may be measured by volume, if approved by the Employer.

The mixing time for each batch shall not be less than one (1) minute and shall not exceed three (3) minutes, and shall be constant for a series of batches for the structure.

4.4 Trial Mix

Immediately after commencement of the construction, the Contractor shall make trial mixes, under the approved mix proportion of the concrete, to ensure that the concrete could sufficiently achieve the deign strength, workability and segregation of the mix during transportation and placing does not occur.

4.5 Placing Concrete

Concrete shall be placed and compacted within one (2) hour after being mixed and no partially set material shall be used in the work.

The concrete shall be not placed from a height more than 1.5m in order to avoid segregation of the materials. Immediately before placing succeeding concrete onto those previously executed and set, of which surfaces shall be carefully cleaned by removing the laitance and covered with fresh cement mortar 10mm thick onto the surface.

Placing concrete in individual members shall be continued without stoppage up to an approved prearranged construction joint or until the member is completed.

4.6 Construction Joints

The construction joints of the concrete shall be provided as near possible to a point of minimum shear-near the center of a slab, beam, or girder (ACI code). The location and details of construction joints shall be subject to the instruction of the Employer and shall be so arranged as to minimize the possibility of the occurrence of shrinkage cracks.

The Contractor shall prepare and submit bay layout drawings and concreting schedules for the approval of the Employer in adequate time prior to preparation of concreting to enable any changes by the Employer who may consider necessary to be made.

Immediately before placing fresh concrete against faces of previously placed and hardened concrete, the surfaces of construction joint shall be thoroughly cleaned and wetted.

4.7 Compaction and Curing

Where concrete vibrators are employed, they shall be in general of type approved by the Employer. The vibrator shall not be used more than 5~15 second at a place in order to avoid segregation of concrete. The vibrating head shall be withdrawn slowly to ensure complete closure of the hole in the concrete which has formed. Care shall be taken to avoid contact with the reinforcement and surfaces of the forms and to avoid excessive local vibration.

The Contractor shall take adequate measures to cure the concrete. These shall include covering the concrete with burlap matting, gunny bag matting or other effective means which shall be kept damp continuously for a minimum period of three days after placing of the concrete. After removal of this covering, the concrete shall be sprayed with water for a minimum period of further seven days.

4.8 Finishes

Where the concrete surface is required to be "exposed concrete", it shall be rubbed smoothly with carborundum brick or other tools immediately after removal of the forms and while the concrete is green and all small holes shall be stopped with cement mortar of such a mix as to render the stopping invisible.

4.9 Concrete Testing

A preliminary test shall be carried out for each class of concrete consisting of taking 6 cubes for each in sufficient time before concreting to allow 7 and 28 days results to be obtained for the purpose of Subsection 4.3 Concrete Mixing hereinbefore.

During the progress of concrete works, test shall be carried out consisting of taking 6 cubes of each class of concrete being cast at every volumes or portion instructed by the Employer. Of the 6 cubes, 3 shall be tested at 7 days and the rest shall be tested at 28 days for compressive strength.

The cube shall be 15 cm cubes made and tested according to ASTM C172and C39. The compression test shall be performed at an authorized laboratory in Male or with testing equipment delivered to the Site by the Contractor subject to approval of the Employer. The cost of all such sampling and tests shall be included in the Contract prices.

4.10 Test Failures

For acceptance, average strength of the cubes and the strength of two third of them shall

exceed the specified strength. If two third of the cubes fails to attain the specified strength, the Contractor shall immediately report it to the Employer and examine the work to find the cause of the failure. Any improper materials, mixing, placing and curing found on examination shall be corrected. If the failure, in the opinion of the Employer, is serious, the Contractor shall drill out one or more test cylinders from the suspected concrete and test in accordance with ASTM C42 as instructed by the Employer. According to the result of these tests, the Employer may order the suspected concrete to be cut out and replaced with sound concrete. The cost for these tests, cutting out and replacing of inferior concrete shall be born by the Contractor.

4.11 Form Work

(1) General

The materials for form shall be of wood, steel or aluminum, sufficiently strong and shall produce the specified shapes, lines and dimensions as shown on the Drawings. In case of wood form to be used, the form shall either be of waterproofed type plywood 12mm thick or of planks lined waterproofed type plywood 4mm inside except for the concrete faces which comes in contact with soil permanently.

Forms shall be braced and strutted to withstand the pressure resulting from placing and vibrating the concrete, construction loads, wind and other forces without appreciable deformation.

The surfaces of the forms in contact with concrete shall be free from foreign matters and any defects. The forms shall be carefully joined and so arranged to allow swell and shrink under the influence of humidity of the concrete without causing any deformation to the forms. Interstices of the forms shall be filled up with putty or other means to prevent escape of cement paste. Surfaces in contact with concrete shall be treated with an approved non-staining lubricant.

When forms have been erected and ready for inspection, the Contractor shall submit request for inspection on the forms to the Employer at least 24 hours in advance.

(2) Removal of Forms

The Contractor shall take full responsibility for the removal of forms. In order to attain sufficient strength before forms are removed, the forms shall be left in place until the minimum time has elapsed depending on the various factors as shown on the following list.

Minimum time before removal of forms and Supports

Location		Forms		Supports	
		Foundation, Side of Beam, Column, Wall	Under Slab, Under Beam	Under Slab	Under Beam
Do not remove until site-cured test cylinders develop		50% of 28-days strength	Until Removal of Supports	85%of 28-day strength	100%of28-day strength
Minimum days left in place at an average Temperature (℃)	>15	3		17	28
	> 5	5		25	
	> 0	8		28	

After removal of forms, the surface of all concrete shall be brought true to line; all defective portions of the face filled up and any projection cut off. Honeycombed portions shall be cut out to a depth and shape required by the Employer and filled up with fine concrete of equal quality.

4.12 Construction Tolerances

Variation in alignment, grade and dimensions of the structures from the specified alignment shown on the Drawings shall be within the tolerances specified in the following tables. Excess deviation from the tolerance limits specified herein may be required by the Employer

to be remedied or removed and replaced by the Contractor at no his extra cost.

Construction Tolerances for Reinforced Concrete Construction

1. Variation from Vertical		
-In the line and surfaces of columns, piers, walls in general	In 3 meters In 6 meters maximum In 12 meters or more	6mm 9mm 18mm
-For exposed columns, walls control joint grooves and other conspicuous lines	In 6 meters maximum In 12 meters or more	6mm 12mm
2. Variation from the level or from the grades indicated on the Drawings	In 3 meters In any bay or 6 meters max.	6mm 9mm
-In floors, inverts, ceilings and beam soffits	In 12 meters or more	18mm
3. Variation of the linear structure lines from specified position in plan and columns and partitions	In every bay or 6 meters max. In 12 meters or more	12mm 25mm
4. Variation in locations of sleeves and sizes and location of floor and wall openings		6mm
5. Variation of cross-sectional dimensions of columns, beams, foundations and thickness of slabs and walls	Minus Plus	6mm 12mm
6. Variation in steps:		
-In a flight of stairs	Riser Tread	3mm 5mm
-In consecutive steps	Riser Tread	2mm 3mm

4.13 Reinforcement Steel

(1) Materials

Materials of steel reinforcement shall comply with the following standards or equivalent approved by the Employer:

ASTM A15 "Billet steel bars for concrete reinforcement" or

JIS G3112 "Steel bars for concrete reinforcement"

The design Drawing prepared have been based upon the following allowable design stress of deformed reinforcement bars:

Allowable tensile stress : 1600 kg/cm2

(2) Bending Schedule

The Contractor shall prepare bending schedule showing shapes, diameters, lengths, location of laps and splices and quantity of steel reinforcement and submitted in duplicate copy to the Employer for approval six week before production is to commence. No reinforcement shall be bent until such approval has been received.

Unless otherwise approved by the Employer all laps and spices shall be located as indicated on the Drawings and in slabs, beams, and girders, splices of reinforcement at a point of maximum

stress shall be avoided wherever possible.

(3) Fabrication and Concrete Coverage

Bends, cranks or other works on reinforcement bars shall be carefully formed in accordance with the Drawings. The bars shall be bent cold in a manner which will not injure the materials. The number, size, form and position of all steel bars, ties, links, stirrups and other parts of the reinforcement shall be in accordance with the requirements shown in the Drawings and specified herein.

(4) Placing

The reinforcing bars shall be accurately placed and adequately secured in position by metal chairs or spacers. The clear distance between parallel bars, except in columns, shall be not less than 2.5 times of the nominal diameter of the bars, the required coverage to avoid displacement of bars during compacting of the concrete in place. The minimum concrete coverage to reinforcement bars in the part of structure shall be as follows:

Minimum Concrete Coverage

Portions	Minimum Concrete Coverage
• Slabs, walls	2cm
• Columns, beams	3cm
• Walls, columns and beams contact with soil	4cm
• Foundations	6cm

Bars shall be bound together with best black annealed soft-iron wire twisting at its end tightly. Before embedding any reinforcement bars in the concrete all loose mill scale, loose rust and any oil, grease, mud or other deleterious matter shall be removed. Partially set concrete which may adhere to the exposed bars during concreting operation shall likewise be removed.

(5) Inspection

When reinforcement has been placed and is ready for concreting, it shall be inspected and approved by the Employer. The Contractor shall inform the Employer at least 24 hours in advance, of his intention to have the reinforcement ready for inspection.

SECTION 5. STRUCTURAL STEEL WORKS

5.1 General

The work under this Section shall comprise supply of all labor, materials and plant and the performance of all works necessary for completion of structural steel works fro the buildings, in every respect as shown on the Drawings or as directed by the Employer and as specified herein.

5.2 Materials

All materials furnished by the Contractor shall be new and shall have the best quality of their respective kinds and shall conform to the applicable, ASTM (American Society for Testing and Materials), JIS (Japan Industrial Standard) set out below or equivalent approved.

	JIS	ASTM
Structural steel	JIS G3101 (SS400)	ASTM A36
Light Gauge Structural Steel	JIS G3350 (SSC400)	ASTM A36
Steel tube and pipe	JIS G3444 (Class 2)	
Steel bolt, nut and washer	JIS G3101 (SS400), B1180 B1181, G1256	ASTM A307
High tensile bolt, nut and washer	JIS B1186 (Class 2)	ASTM A325
Welding rod	JIS Z 3211, 3212	

All steel members to be used for roof structure shall be of galvanized steel and their welded portions shall be carefully retouched by two coats of approved zinc paint after completion of erection.

5.3 Working Drawings

Prior to starting the work, the Contractor shall prepare working drawings and submit them to the Employer for his approval. The working drawings shall show the position, size and dimensions of all members, details of joints, diameters, size, level of embedded anchor bolts as well as details of welded joints including root opening, groove angle and groove depth of butt weld together with size of fillet weld and all other information associated with the work. The Contractor shall submit to the Employer two complete sets of working drawings of which one copy will be returned to the Contractor for his action.

5.4 Workmanship and Fabrication

The first class workmanship and equal to the latest practice in modern fabrication and machine shops shall be achieved in the work. Before laying out, cutting or fabricating the work in any way, the materials shall be thoroughly straightened by method that will not result in injury. Finished members shall be free from kinks, bends, or winds.

All structural steel work shall be fabricated strictly compliance with the approved working drawings and these Specifications. The Contractor shall provide reinforcements members and holes necessary for other works where indicate or provided in the other documents. The shearing shall be accurately and neatly finished. Corners shall be square and true unless otherwise shown on the Drawings. Bends, except for minor details, shall be made by bending rollers. Where heating is required, precautions shall be taken to avoid overheating the materials.

Unless otherwise specifically authorized, deviations of the major dimensions of any structure fabricated of structural steel shall be within 3mm of the dimensions shown on the drawings.

The overhanged eaves portions shall be adequately reinforced by providing additional members to withstand against blow up loads caused by possible storms in the area.

The materials shall be carefully handled so that no part will be bent, broken or otherwise damaged. Hammering that may damage or distort the members shall not be permitted. Bearing surfaces to be in permanent contact shall be carefully cleaned prior to their assembly.

5.5 Welding

Welding shall be carried out only under the direction of an experienced and competent supervisor. Unless otherwise agreed by the Employer a record shall be kept to enable major butt welds to be identified with the welders responsible for the work, but finished work shall not be marked by hard stamping for this purpose. Unless otherwise described in the Drawings, all welding shall comply with AWS (American Welding Society) standards.

Harmful defects such as poor fusion, poor penetration, slag inclusion, pits, blow holes shall be removed and rewelded to the satisfaction of the Employer.

5.6 Erection

The Contractor shall erect the steel structure to the dimensions and elevations shown on the Drawings. The steel shall be carried up true and plumb and temporary bracing and support shall be introduced whenever necessary to secure of all alignment and loads to which the structure may be subject. Such bracing shall be left in place as long as may be required for safety.

Temporary supports may be employed for erection and field assembling of the steel members. When all steel structures have been properly aligned, the Contractor shall request the Employer to inspect thereon. As erection progresses, the structure shall be securely welded to care of all dead load and erection stresses. Connection of members shall be carefully carried out so that no part will be bent, broken or otherwise damaged.

The Contractor shall take necessary safety measures to protect the steels, workmen, equipment, and property of not only his but other parties to the satisfaction of the Employer.

5.7 Correction of Errors and Deformations

Any deformation resulting from improper handling by the Contractor that prevent the proper assembling and fitting-up of parts shall be corrected in the field as approved by the Employer. Field corrections that are required because of incorrect fabrication shall be made as directed by the Employer. Any misalignment of members shall be brought to the attention of the Employer for approval of corrective measures and all remedial work shall be performed at the Contractor's expense.

SECTION 6. MASONRY WORKS

6.1 General

The work under this Section shall comprise the supply of all labor, materials and plant and the performance of all work required for the masonry works for the buildings as shown on the Drawings or as directed by the Employer and as specified herein.

6.2 Sample and Test

The Contractor shall submit sample of concrete hollow blocks (hereinafter call as CHB) to the Employer for approval. One sample of CHB wall conforming to the requirement of under this Section shall be constructed by the Contractor in the place directed at Site. The size shall be approximately 2000mm long and 800mm high and shall be properly maintained during the construction period.

The certificate of test result for proposed CHB shall be submitted to the Employer for approval. Otherwise the Contractor shall carry out testing for CHB at an authorized laboratory approved and submit the results to the Employer for his approval.

6.3 Materials

(1) Concrete Hollow Block

Concrete hollow block to be used for the construction shall be of hollow core load-bearing concrete blocks and hard, even in shape, square with true arises, well matured and dense, well consolidated mixture having exterior dimensions of 390x 190. The thickness of the block shall be 100, 150 and 200mm as shown and directed by the Employer. The concrete hollow block shall have a compressive strength of not less than 40kg/cm2 and apparent specific gravity, air dried of not les than 1.7 conform to JIS A5406, ASTM C90-66T or equivalent approved by the Employer.

(2) Cement and Sand

The quality of cement and sand required for block masonry shall conform to the requirement of Subsection 4.2 under Section 4 hereinbefore.

6.4 Laying

(1) Concrete Hollow Block

The concrete hollow block shall be laid in struck bond masonry with joints approximately 10mm thick of which mortar shall have one part of cement and three part of sand (1:3). All horizontal and vertical joints shall be struck off flush with the wall as each block laid.

The concrete block walls shall be reinforced with reinforcing bars: two horizontal coursesin the total height of walls and every 800mm vertical course providing 10mm dia. reinforcing bars for both courses. Lintels having 100mm high by thickness of block walls shall be provided as specified hereinafter having two 10mm dia. reinforcing bars which shall be spliced with steel anchor bars to be preinstalled in the adjacent columns, beams and studs. The intermediate lintels shall be provided as required at least one layer for maximum 3000mmm height of block wall. Laying of concrete hollow block shall not exceed 1200mm in height per day.

(2) Lintels and Caulking

Where required to installed doors, windows and any other openings in the concrete hollow block walls, reinforced lintels shall be provided over all openings. The lintels shall rest on both sides of adjacent block walls for more than 200mm long. The lintels shall have 200mm high by thickness of concrete block walls with two or four 10mm dia. reinforcing bars and 6mm dia. stirrups at 150mm maximum spacing. All free end of the top of concrete hollow block walls shall be provided with concrete lintels having 150mm high by thickness of walls. The Contractor shall design the lintels and obtain Employer's approval.

SECTION 7. WATERPROOFING AND DAMP PROOFING WORKS

7.1 General

The work under this Section shall comprise the supply of all labor, materials and plant and the performance of all work required for waterproofing and dampproofing works for the building as shown on the Drawings or as directed by the Employer and as specified herein.

7.2 Materials

All materials shall be best quality and shall comply with the applicable standards. The Contractor shall submit samples or catalogues of the waterproofing and damproofing materials to the Employer for his approval.

(1) Caulking Compounds

The caulking compound shall be polysulfide sealing compound and shall conform to JIS 5758 or equivalent approved.

(2) Damp proofing

The damp proofing shall be of moisture protection consisting of polyethylene film having 0.08mm thick and provided underside of the footings or other area as shown in the Drawings in order to protect moisture from the ground soil.

7.3 Application

(1) Caulking Compounds

Caulking compounds shall be used for sealing around the perimeter of windows and doors as well as any joints between concrete hollow block walls and concrete structures to obtain a watertight structure. The size of caulking pits shall be approximately 10mm by 10mm or 10mm by 15mm depending on their location and thoroughly cleaned before starting caulking. Caulking shall generally be done by an experienced workman using a special caulking gun. When finished, the surface shall have a uniform appearance throughout.

(2) Damp proofing

The polyethylene film shall be laid onto 30mm thick leveling concrete placed on the well compacted backfill with not less than 150mm side and end laps.

SECTION 8. TILE WORKS

8.1 General

The work under this Section shall cover the supply of all labor, materials and plant and the performance of all work required for the various tile works in the building. The work shall be performed as shown on the approved working drawings and as specified herein.

The Contractor shall submit samples of tiles and catalogues for the approval of the Employer prior to delivery. The materials, colors and patterns shall be instructed by the Employer. The Contractor shall submit tile arrangement drawings for Employer's approval.

Only first quality tiles shall be used in the works. The quality of the tiles shall comply with JIS or ASTM or equivalent approved.

8.2 Materials

(1) Porcelain Tile to Floor

Porcelain tile to floor shall be approximately 200 x 200 x 8 and 300 x 300 x 8 in size and shall have an unglazed surface. Colors and patterns shall be selected by the Employer. The porcelain tile for Staircase and Terraces shall be non-slip type.

(2) Ceramic Tile to Walls

Ceramic toile to interior walls for toilets shall be approximately 200mm x 200mm in size and shall have semi-glazed surfaces. The pattern shall be selected by the Employer.

(3) Ceramic Tile to Skirting

The size of skirting ceramic tile shall be approximately 300mm x 120mm x 9mm with the round cushion at the top and have unglazed surfaces.

(4) Non-Slip Stair Nosing

The non-slip stair nosing tile shall have the nosing at its one end and have the non-slip grooves. The nosing tile shall be 70mm wide and unglazed surfaces to match with the floor tiles.

8.3 Tile Setting

Floor tile installation shall not be started before completion of wall tiling in the area. Surfaces to receive floor tile shall be clean and free from dirt, dust, oil, grease and other foreign matter. The tiles shall be set with 1:3 cement to a level and slope specified and as shown on the Drawings.

Wall and skirting tiles shall be commenced before application of floor tiles in the respected area. Concrete and/or block surfaces to receive the tiles and skirting shall be cleaned and free from dirt, oil, grease and other deleterious substances and soaked with clean water prior to application of the rendering cement mortar base. The rendering cement mortar base for the tiles works shall be specified in Section 9.2 (3) hereinafter.

The joints of porcelain tile 300 mm x 300mm to floor and nosing tile shall be 6 mm wide, uniform and true to line and grouted flush with cement paste. The joints of porcelain tile 200 x 200 mm to toilet floor shall be 2 mm wide and grouted with white cement paste. The joint of ceramic tile to toilet walls shall be 2 mm wide and grouted with white cement paste.

After completion of setting, the tile surfaces shall be washed down to clean with plain water or muriatic acid according to the manufacturer's instruction.

Plumbing fixtures and any others to be built in the tile surfaces shall be installed to suit tiling works. Damage or defective tiles shall be replaced by the Contractor at his own expenses.

SECTION 9. PLASTERING WORK

9.1 General

The work under this Section shall comprise the supply of all labor, materials and plant and the performance of all work for the plastering works to floors, walls, ceilings in the building. The work shall be performed as shown on the Drawings or as directed by the Employer and as specified herein.

9.2 Cement Mortar Plaster

(1) Cement Mortar

The sand to be used in the cement mortar shall be clean, hard, solid and durable and shall not contain harmful amounts of dust, mud, organic materials or other objectionable matter. The grading of the sand shall be within the following limits:

Classification	Screen Designation	Percentage by Weight Passing Screen
Rendering Coat	5 mm	100%
	0.15 mm	10% or under
Finishing Coat	2.5 mm	100%
	0.15 mm	10% or under

The mix proportions of the cement mortar by volume shall be as follows:

Applying Bed	Place of Application	Rendering Coat Cement : Sand	Finish Coat, Cement : Sand or Cement : Sand : Lime
Concrete	Floor		1 : 2
	Interior wall	1 : 2	1 : 3 : 0.3
	Ceiling	1 : 2	1 : 3 : 0.3
	Exterior wall	1 : 2	1 : 3
Block Masonry	Interior wall	1 : 3	1 : 3 : 0.3
	Exterior wall	1 : 3	1 : 3

(2) Surface Preparation

The surface which are to receive a rendering coat shall be roughened, brushed or washed clean, free from all laitance, scum, loose carbonate scale, loose aggregate, dirt and other foreign matter. Smooth concrete surfaces shall be treated with a suitable bonding coat or well hacked to form a plaster key, all to the approval of the Employer.

Concrete surfaces shall be kept thoroughly wet for 2 hours prior to application of plaster to ensure satisfactory bond. In case of block, their surfaces shall be sufficiently and uniformly dampened immediately before application of cement mortar.

At all flush junctions between dissimilar materials to receive plaster or rendering coat, a strip of galvanized expanded metal lathing minimum 150 mm wide shall be securely pinned to the wall bridging the joint to prevent cracking of rendering due to differential movement of backing materials.

(3) Application

The Contractor shall apply three-coat cement mortar plaster where shown on the Drawings

and as directed by the Employer. Three-coat cement mortar plaster consisting of a screed coat, a rendering coat and a finish coat shall be applied to all walls.

The rendering coat for tile work shall be made 18 mm thick and its surface shall be cross scratched. The rendering for an interior wall tile in the toilets and shower rooms as well as an exterior wall tile shall be mixed with water proofing admixtures approved by the Employer. In case of cement mortar finish, the total thickness of rendering and finish coat shall be 40 mm for the floors, and 20 mm for interior walls and 25 mm for exterior walls. When the finishing coat is applied, the entire surfaces of walls and ceiling shall be finished in one operation in order to minimize joint marks.

Where expansion and control joints exist in the base structure, provision shall be made to prevent cracking of the cement mortar by inserting galvanized steel expansion beads within the coating thickness in a manner approved by the Employer. The finished surface shall be perfectly plumb or level as the case may be without any bulging, runs, bruises or stains.

After application of the finishing coat, the surfaces shall be kept continuously damp for not less than 48 hours and then allowed to become thoroughly dry. Moistening shall be started as soon as the surface has hardened sufficiently to prevent displacement or damage.

9.3 Waterproof Cement Mortar

Waterproof cement mortar shall be applied to canopies, eaves, terraces and other places required as shown on the Drawing or as directed by the Employer. Cement mortar shall conform to the Specifications as provided for in this Section. Waterproof admixture shall be used in the cement mortar in accordance with the manufacturer's recommendations to effect waterproofing. Catalogues of waterproofing admixture shall be submitted to the Employer for his approval.

The rendering mortar for tile work at toilets, terraces and other places shall be of waterproof cement mortar as specified in the foregoing Subsection9.3.

SECTION 10. DOOR AND WINDOW WORKS

10.1 General

The work under this Section shall comprise the supply of all labor, materials, plant and the performance of all works necessary for fabrication and installation of doors and windows in the buildings required at the locations indicated on the Drawings and as specified herein

(1) Samples and Shop Drawings

Before manufacturing doors and windows, the Contractor shall submit samples of each materials and shop drawings showing complete details in accordance with these Specifications to the Employer for his approval.

(2) Delivery and Storage

Materials shall be delivered, stored, handled and installed in a manner to protect them from warping and other damages before installation of the materials.

(3) Materials in General

Aluminum materials shall conform to JIS, ASTM or equivalent standard approved. Aluminum surfaces shall have anodized to a color which shall conform to the same standards. The color shall be approved by the Employer.

Steel materials shall conform to JIS, ASTM or equivalent standard approved.

Wooden materials shall be thoroughly seasoned and matured, sound, straight, free from warp, sapwood, sign of rot, large and loose knots, worm holes, wanes, cracks and other defects.

All door frames shall be provided with rubber bumpers at the meeting point with door to lessen the door strike. All perimeter doors frames shall have approved sponge cushion to the gaps all around the doors. The Contractor shall submit samples for these for approval.

10.2 Wooden Door Leaves and Frames

(1) General

Wooden door leaves shall be flush and assorted panel types with 40 mm in total thickness, installing panes, wood louvers and panels as shown on the Drawings. Door frames shall be of hardwood to durable to withstand the weight of door leaves and operation having 100mm in depth.

All wood surfaces shall be sanded and putty applied to smooth surfaces to receive painting. The plywood shall be covered with teak laminated, and vanished. Panes or louvers, if provided, shall be fixed with adequate beads.

(2) Hardware

The Contractor shall supply and install the hardware for the wooden doors as listed in the Drawings. The Contractor shall submit catalogues or samples of the hardware to the Employer for his approval.

The hardware shall comply with the following requirements:

Butt Hinges:	Bronze or stainless steel, 13cm in approx. size, 3 hinges for each door leaf
Knobs:	Stainless steel
Lock Sets:	Bronze, cylindrical lock, 3sets of key to be furnished
Door Closer:	Die-cast aluminum body, oil and spring activated with 90 degree stop device
Push and pull:	For toilet door, plastic made 15cm x 25cm in handle size.

10.3 Steel Door Leaves and Frames

(1) General

All steel doors, frames and hardware shall be of first-class quality. Materials for all doors, frames and hardware shall be free from defects impairing their strength, durability or appearance and the best of their respective kinds. They shall be made to sustain safely strains or stresses to which they normally may be subjected. The work shall be true and straight, accurately fitted with tight joints and intersections. The trim shall be neatly and accurately mitered. Welded joints shall be dressed clean and ground smooth.

(2) Hollow Steel Door Leaves

Hollow steel door leaves shall be fabricated of cold rolled steel sheet. The sheet thickness shall be as follows:

Panel	1.6 mm
Stiffener plate and anchor plate	2.3 mm

The door leaves shall be full flushed seamless panel type, 40 mm thick unless otherwise specified. All four edges shall be sealed and ground smooth. Panels shall be complete with 1.6 mm cold rolled steel sheet welded to an astragal and all fastenings shall be hidden.

Door frames shall be formed of cold rolled steel sheet having 100mm in depth. The sheet thickness shall be as follows unless otherwise specified.

Frame	1.6 mm
Architrave	1.2 mm
Threshold	2.3 mm

Door frames shall be profiled accurately to the details and dimensions as shown on the shop drawings approved by the Employer. The door frames shall be reinforced, drilled and tapped to receive hardware and all frames shall be provided with rubber bumpers. Door frames shall be provided with adjustable anchors as required. Perimeters of door frames facing outdoors shall be securely caulked with approved caulking materials.

(3) Hardware

Hardware for the steel door shall comply with the requirements specified in the list of door on the Drawings. The Contractor shall submit catalogues and samples to the Employer for his approval. Each door shall be provided with the following hardware:

Butt Hinges: Bronze or stainless steel, 130 mm approx. 3 or 4 sets as required for each door leaf

Knob: Stainless steel hair line finish

Lock sets: Bronze, Cylindrical lock, 3sets of keys to be furnished

Door Bolts: Bronze, surface or flush type

Door Closer: Diet-cast aluminum body, oil and spring activated with 90 degree stop device

10.4 Steel Rolling Door

Steel rolling door shall be manual operative type door which composed of slats, guide rails, rolling drum, cover case, bottom bar, with chain operating device, safety switch for preventing falling, lock and complete with other accessories approved by the Employer.

Specifications for the various components shall be as follows:

Slats: Flat type, steel plates 1.5 mm thick, designed against a wind velocity of not less than 25 m/sec

Guide rail: 2.3mm thick formed stainless steel plates, depth 60 mm, with safety stop at a height of 2200mm above the floor

Cover case: 1.6mm thick steel panel with adequate reinforcement and inspection door

The manual operating device shall be allowed to suitably operate by one person.

10.5 Aluminum Doors, Windows, Louvers and Frames

(1) General

Aluminum doors, windows, and louvers shall be furnished and installed complete with door, window frames, fixing lugs and glazing beads. Aluminum windows are composed of sliding windows, framed louver windows and casement windows as shown on the Drawings.

Aluminum doors and windows shall conform to JIS, ASTM or equivalent standard approved. Aluminum window and door frames shall be of extruded aluminum shape with anodized to a color having 100mm in depth. Before delivery they shall be protected with strippable plastic. The plastic shall be removed after the major construction works has been completed.

(2) Materials and Workmanship

Doors, windows, and louvers shall be furnished and installed complete with door and window frames, fixing lugs and glazing beads. Fixing lugs attached to the frames shall be firmly secured into the openings so that glazing surfaces are vertical.

Prior to installation of doors, windows and louvers, the Contractor shall ensure that the surface of the concrete to receive the frames are free from all loose and foreign materials. All surfaces of the aluminum in contact with cement mortar, concrete or dissimilar metals shall be coated with bituminous paint or provide polyethylene film. The frames shall be installed in vertical planes without warping and shall be adjusted before glazing is commenced. Spaces between the frames and the surrounding concrete shall be grouted with cement mortar and all outdoor perimeters of frames shall be sealed with caulking materials.

Insect screen shall be provided to all perimeter openings and where directed by the Employer. The insect screen shall be fabricated with extruded aluminum frames and wire secured in frames to the inner side of windows and louvers by means of spline or galvanized screw. Screen unit shall be removable and rewirable. Screen wire shall be of aluminum mesh, stainless mesh or other approved wire. The Contractor shall submit catalogues or samples of the hardware to the Employer for his approval.

The hardware shall comply with the following requirements:

Floor Hinge:	Cast iron body with stainless steel cover, oil and spring activated with 90 degree stop device
Push and Pull Handle:	For entrance door, stainless steel, 200 x 200 mm in size
Hinge:	Bronze or stainless steel, approx.130mm in size, 3 hinges to each door leaf (less than 2.1m high door)
Knob:	Stainless steel
Lock Set:	Bronze, cylindrical lock, 3 sets of key to be furnished
Door Closer:	Die-cast aluminum body, oil and spring activated with 90 degree stop device
Door Bolt:	Bronze, surface or flush type
Sash Fastener:	Die-cast aluminum

10.6 Glazing

All glass and glazing shall comply with JIS, ASTM or equivalent approved by the Employer. The size of glass shown on the Drawings shall be provisional and the actual size shall be determined by measuring the frames to receive the glass. The doors and windows shall not be operated until glazing compound has set.

Glasses shall be the best of its respective kind and shall be free from internal and external surface and edge defects. Glasses to be installed in the doors and windows shall be as

follows:

a) Plate glass-8mm thick

b) Plate glass-5mm thick

c) Plate glass-3mm thick

d) Figured glass-5mm thick

e) Heat absorbing figured wire glass 6.8mm thick

f) Wired glass-6.8mm thick

g) Figured wire glass-6.8mm thick

h) Tempered glass (for tempered glass doors)-12mm thick

The brand and quality shall be subject to the approval of the Employer.

All glass shall be accurately cut to fit in the frames with 3mm clearance all around. Glass in windows or door leaves shall be set in glazing mastic applied on all four sides for the full length by using spacer shims and vinyl splined glazing bead as recommended by the manufacturer. Glasses for wooden frames shall be fixed with wood stops. Wired glass to be fixed in the opening facing outdoor shall be protected from rusting of wire by using paint or tape applied on bottom edge and lower parts of side edge.

All door and window glasses shall be cleaned and polished when the building work is completed.

SECTION 11. PAINTING WORKS

11.1 General

The work under this Section shall comprise the supply of labor, materials and plant and performance of all work necessary for applying painting finishes to the interior and exterior surfaces of the buildings and facilities. The work shall be performed as shown on the Drawings or as directed by the Employer and as specified herein.

Paints shall be of the best quality of its kind. The Contractor shall submit catalogues and specifications of all paints to be used to the Employer for his approval.

11.2 Preparation

(1) General

All metal components other than galvanized steel shall be prepared and primed in the shop and finish painted after erection.

Painting work shall not be done in rain, fog or mist, or at any other time considered to be unsuitable by the Employer.

All painting work shall basically conform to the manufacturer's specifications and instruction.

All surrounding works shall be protected in a suitable means from paint drops and overspray. All smeared and damaged surfaces shall be cleaned or repainted to the Employer's satisfaction.

Color shall be selected by the Employer. Prior to starting painting works, the Contractor shall provide trial painting in a manner as instructed by the Employer for his approval.

(2) Metal surfaces shall be cleaned with mechanical methods by metal scrapers and wire blush to remove all mill scale, weld spatter, rust and any other deleterious materials. Oil and grease shall be removed by an approved solvent. The surfaces shall be wiped clean of any dust prior to priming. Priming shall be done immediately after cleaning to prevent new rust. Any primed surfaces that shown rusting, flaking, powdering or peeling shall be recleaned and repainted

(3) All wood surfaces to receive paint shall be cleaned of all dirt, grease, dust or any other deleterious matters. All surfaces shall be thoroughly sanded and all nail holes, cracks and any other defects shall be puttied, re-sanded to a smooth and flush finish. The painted surfaces shall show a smooth, level and uniform finish, free from any stains and shall be uniform in color and shade.

(4) Concrete and plastering surfaces to be painted shall be treated with a thin cement plaster to smoothen the surfaces. Any flaws, holes shall be filled up with cement plaster and left for about 3 weeks. After hardening, the surfaces shall be rubbed with a hard wood block and dusted.

11.3 Application

The following surfaces shall be given the number of coats and kinds of paints as described herein, or as indicated in the color schedule:

(1) External and internal ferrous metal surfaces other than galvanized surfaces shall be primed with two coats of red lead primer. Two coats of synthetic resin alkyd paint (SOP) or similar approved shall be applied.

(2) Internal Wood surfaces shall be knotted, stopped and primed with one coat of primer paint, one coat of undercoat, and one coat of finish semi-gloss synthetic resin alkyd paint (OP).

(3) External surfaces of concrete or cement plastering shall be thoroughly dried out and cured for 20 days before being given one coat of primer and two coats of exterior quality semi-gloss acrylic resin emulsion paint (AEP for outdoor quality) or similar approved. Apply

zinc-sulfate solution before prime coat. Minimum 12hours shall be allowed before application of each successive coat.

(4) Internal surfaces of concrete or cement plastering shall be thoroughly dried out and cured for 20days before being given coat of primer, one coat of undercoat and one coat of synthetic resin emulsion paint (EP). Apply zinc-sulfate solution before prime coat.

(5) Internal gypsum board surfaces shall be puttied to remove any flaws and gaps and rubbed down with fine sand paper to a smooth surface. An acrylic resin primer coat shall then be applied. For finishing, one coat of undercoat and one finish coat of acrylic resin emulsion paint shall be applied (AEP). Minimum 12 hours shall be allowed before application of each successive coat.

(6) Structural steel members shall be grit blasted and cleaned with mechanical methods by metal scrapers and wire brush to remove all mill scale, rust and any other deleterious materials. Two coats of lead red primer and one coat of epoxy resin paint shall be applied on the surface at factory. The top coat of epoxy resin paint shall be applied only after completion of erection of the structural steel. All damaged coats shall be carefully retouched.

(7) Galvanized surfaces shall be firstly etched with 5% acetic acid and washed clean before priming. One zinc chromate primer shall be applied on the galvanized surfaces. Oil grease shall be removed by washing with turpentine or mineral spirits approximately 30 minutes prior to the application of those. Two coats of synthetic resin alkyd paint (SOP) shall be applied as a top coat. Sufficient time shall be allowed for drying between each new coat.

(8) Clear Lacquer and Vanish finish

Wood surfaces shall be smoothened by applying abrasive papers carefully. Clear lacquer shall be applied in 3 coats to a clear and uniform finish in shape and to reveal the grain of the wood. Vanish finish shall be applied to wooden surfaces in the same manner as clear lacquer.

(9) Textured Spray Paint (Epoxy Resin Spray Tile)

Textured spray paint shall be epoxy resin spray tile which is waterproof spray coating to be used on exterior walls and soffits. The spray tile shall consist of the emulsion type epoxy resin coating which hardens by polymerization after spraying and the top coat of acrylic resin. The epoxy resin and acrylic resin shall be applied with a spray gun to produce the approved texture.

Application of the epoxy resin spray tile shall be performed by skilled workmen in this trade under the supervision of the instructor of the manufacturer. Specifications and samples of the spray tile shall be submitted for approval of the Employer.

(10) Vinyl Emulsion Paint (VP)

External waterproofed ceiling board shall be puttied to remove any flaws and gaps and rubbed down with fine sand paper to a smooth surface. After removal of remaining dust, three layers of polyvinyl resin emulsion paint shall be applied. Minimum 12 hours shall be allowed before application of each successive coat.

SECTION 12. CARPENTRY AND JOINERY WORKS

12.1 General

The work under this Section shall comprise the supply of all labor, materials, and plant, and the performance of all work necessary for the fabrication and fixing of carpentry and joinery works in the building. The work shall be performed as shown on the Drawings or as directed by the Employer and as specified herein.

The Contractor shall submit samples of each material for approval of the Employer prior to delivery of the materials to the Site. The Contractor shall submit working drawings for respective work items in this Section to the Employer for approval. Shop drawings shall cover of all sections, joints and details covering all items of the work required.

12.2 Materials and Workmanship

(1) General

Timbers shall be of suitable kinds to be used for respective purposes and the best grade of each kind available locally. Selection of timber shall be subject to the approval of the Employer.

All timber shall be well-seasoned and shall be free from large knots, flaws, shakes or blemishes of any kind. Timber with loose, rotten or dead knots will not be accepted. Sawn timber shall have the shape and size shown on the Drawings and twisted or warped materials shall not be used.

All wooden members shall be brought and fixed exactly as shown on the Drawings and planed wherever exposed to view. Wood members not to be painted and having direct contact with concrete shall receive a coat of creosote or other preservatives approved prior to fixing. Wood members to be painted or exposed to view shall be painted with an approved clear type preservative. All wood members not to be exposed shall receive approved termite resistive chemicals.

(2) Wooden Door Frames

All wooden door frames shall be made of hard wood and fabricated with mortise joint. The frames shall be molded as shown on the Drawings or as directed by the Employer. The frames shall be securely fixed to the walls by using galvanized steel lugs. The frames shall be puttied and sanded to a smooth surface and finished with varnish paint.

(3) Reception Counters

Reception counter shall consist of visitor's counter top, receptionist desk with drawers and adjacent windows in combination with these counters as shown on the Drawings. The top of counter and desk shall be wooden fabrication finished with melamine or polyester resin sheets glued onto a laminated wood core which shall be securely supported by steel arms on both end. The brim of counter shall be protected by hardwood section. The drawers shall be guided by plastic rails to ensure their smooth operation. Combination large glass windows shall be rested on the wall and fixed into the wood studs by using suitable aluminum beads and rubber cushion. Prior to fabrication, the Contractor shall prepare and submit shop drawing to the Employer for his approval. All wood exposed to view shall be puttied and sanded to a smooth surfaces and finished with varnished paint.

(4) Eaves Fascia

Eaves fascia shall be of wood construction fabricated to a dimension as shown on the Drawings. The materials shall be well seasoned timbers recommended by the Employer. The eaves fascia boards shall supported by the galvanized steel flat bars having 5mm x 30mm at 500mm spacing. All surfaces to exposed view shall be painted as specified under Subsection 11.3 hereinbefore.

SECTION 13. INTERIOR FINISHING WORKS

13.1 General

The work under this Section shall comprise the supply of all labor, materials and plant, and the performance of all works necessary for construction of the interior finishing works in the buildings. The work shall be performed as shown on the Drawings or as directed by the Employer and as specified herein.

(1) Samples

The Contractor shall submit samples of each material to be used for this works to the Employer for his approval.

(2) Shop Drawings

The Contractor shall submit shop drawings for respective work items in this Section to the Employer for approval. Shop drawings shall include ceiling panel arrangement, wall elevations with complete details required.

All materials for interior finishing works shall be of the best quality of their respective kind and shall comply with applicable standards and the following requirements.

13.2 Materials

(1) Mineral Fiber Acoustical Tile Suspension Systems

Mineral fiber acoustical tile shall be of a product of plaster rockwool having a fissured surface simulating travertine stone with a white paint finish, and shall be approximately 600 x 1200 x 15 mm in size or other dimension approved.

(2) Gypsum Board Suspension System

Gypsum board shall be of a plastered board laminated with craft papers on both sides with a dimension approximately 600 x 1200 x 12mm in size. The tiles to be used for designated ceilings as shown on the Drawings. All tiles shall be of moisture resistant type.

(3) Waterproofed Ceiling Suspension Systems

Waterproofed Ceiling board shall be of a compressed cement fiber reinforced board produced with silicic calcium fiber mixed with cement paste having a dimension approximately 600 x 1200 x 5mm in size.

(4) Ceiling Trim (Cornice)

At all meeting corners of ceiling and walls even beams, the preformed ceiling trims (Cornice) shall be provided. The ceiling trims shall be of decorated fiber reinforced plaster trims or wood trims and fixed to walls with stainless screws or other means approved. The Contractor shall submit samples to the Employer for his approval.

(5) Ceiling Access Holes

Ceiling access holes shall be provided at each room as directed by the Employer. The surface of access hole covers shall match the surrounding ceiling and uniform to the ceiling patterns. The access hole shall be fabricated with aluminum framing having dimension approximately 450mm square removable type.

13.3 Installation

(1) Mineral Fiber Acoustical Tile Suspension System

Ceiling suspension system shall be constructed with hot-dipped galvanized steel, exposed grid type suspension system complete with anchors, hanger wires, clips, main runners, cross-T, wall angles and other accessories required.

Main runner shall be provided at an interval of approximately 600mm, installed with

allowance for adequate cambers. They shall be designed against ceiling loads of 70kg/m2. Cross T bars and adjustable suspension rod shall be provided at a distance recommended by the manufacturer's specification. Acoustical tiles shall be installed on the main runner and cross T true to line and level.

(2) Gypsum and Waterproofed Boards Suspension Systems

Gypsum board and waterproofed board ceiling suspension systems shall be constructed in the same alignment of the framing as in the acoustical tile systems and in accordance with manufacturer's instruction. The boards shall be constructed with open joint having 4mm in width, straight and uniform and the bottom of joints shall be colored taped. The surface of the board shall be painted with vinyl paint as specified hereinbefore.

The eaves ceiling shall be finished with waterproofed ceiling board having ventilation holes with insect screen partially of which dimension will be instructed by the Employer. The eaves ceiling board shall be securely fixed on the bed with stainless screws at an interval recommended by the Employer.

(3) Ceiling Bed Reinforcement

Appropriate reinforcing metal framings shall be provided for mounting the lighting fixtures and around the ceiling access holes which are specified in the Subsection 13.2 hereinbefore.

The ceiling suspension system for waterproofed ceiling board to be installed at terraces or canopies shall be adequately reinforced to provide additional bars to withstand against pushing up load caused by possible local storms around the proposed Site.

SECTION 14. MISCELLANEOUS METAL WORKS

14.1 General

The work under this Section shall comprise the supply of all labor, materials and plant and the performance of all works necessary to installed miscellaneous metal work in the buildings. The work shall be performed as shown on the Drawings or directed by the Employer and as specified herein.

All materials to be furnished under this works shall be of the best of their kind. Catalogues of the materials shall be submitted to the Employer for his approval.

The Contractor shall prepare and submit shop drawings showing complete details of all miscellaneous steel parts, assemblies, component, supports and connections to the Employer for his approval. The work shall be shop fitted and shop assembled where possible.

Wherever necessary, metals shall be insulated to prevent electrolysis due to contact with dissimilar metals. Insulation shall be made by means of bituminous paint or other approved means.

14.2 Materials and Installation

(1) Stainless Steel Handrails

Stainless steel handrails shall be provided for the staircase, terraces, and slopes. The handrails shall be fabricated with stainless steel pipes with the members and manners as shown on the Drawings. Embedded feet of balustrades shall be securely welded to the reinforcement bars in the structures. All stainless members shall be true to line and the welded joints shall be ground smooth. The feet of the balustrades shall be caulked all around.

(2) Eaves Gutters

Eaves gutters shall be fabricated with galvanized steel plated with thickness of 0.5mm to a shape and slope as shown on the Drawings. The gutters shall be approximately 150mm x 120mm in size and supported by galvanized steel straps having 30 x 5 mm at less than 1200mm intervals. The work shall include the flashing plates having 0.5mm thick to cover the gaps between gutters and fascia boards as well as sunshade roofs. All connections associated with these works shall be completely sealed with approved caulking compound.

(3) Steel Roofing

Steel Roofing shall be Colourbond profile roofing metal sheet or approved equivalent. The steel roofing shall be of a formed steel roofing systems consisting of fixing clips, ridge capping, barge capping, fascia capping, ridge covers, valley gutters, flashings, and all other related accessories.

The roofing shall be pre-painted and organic film laminated galvanized steel sheet with approximately 0.5mm total coated thickness. The roofing shall be of rollformed steel roofing with formed side hems to conform to ASTM A792 M or equivalent approved.

The roofing shall be placed on the supporting steel purlines and bed provided at approximately 1500mm intervals and adjusted to proper alignment. The method of installation shall strictly comply with the manufacturer's specifications. All fixing shall be adequately reinforced to withstand against uplift load by possible storms around the area.

(4) Fittings for the Handicapped

The toile for handicapped shall be provided with stainless steel pipes of fixed or movable handrails, grip bars, inclinable mirror, emergency call button and other complete accessories in accordance with the appropriate regulations and the Drawings and as specified herein. The Contractor shall submit catalogues and plans of fittings to the Employer for his approval.

(5) Canopy Ridge Ornaments

Both the Multi-purpose building and Island office shall be provided with canopy ridge ornaments on its front roof ridge. The ornaments shall consist of stainless rings, plates, supporting columns, and other accessories to be fabricated in accordance with the Drawings and directed by the Employer or specified herein. At the foot of supporting column shall be caulked completely.

(6) Steel Grilles

Steel grilles shall be provided at internal surfaces of windows at the Cells in the Police Office on the first floor in the Multi-purpose building. Steel grilles consist of steel angle framing and 16 mm dia. reinforcing bars as grilles. The grilles shall be vertical and welded at approximately 100mm intervals. The welded surface shall be faced outward supporting by fixing lugs embedded into the wall. All surfaces shall be painted in a manner as specified hereinbefore.

(7) Main and Sub Entrance Gate Doors

Main and Sub Entrance gate doors shall be provided in the location as shown on the Drawings. The gate doors shall be constructed with stainless steel materials and shall consist of 60mm dia. main frames, 180mm x 4.5mm medium plates, 27mm dia. balusters at approx. 150mm intervals, with accessories such as rollers, rails, heavy duty hinges and padlocks. The main gate door shall have 3000mm width and sub gate shall have 1000mm width and the both have 1500mm in height. Door leaves shall be securely fixed into the concrete columns to be constructed both side of the gate doors through hinges. The Contractor shall prepare and submit shop drawings to the Employer for his approval.

SECTION 15. MISCELLANEOUS WORKS

15.1 General

The work under this Section shall comprise the supply of all labor, materials and plant, and the performance of all works necessary for the fabrication and installation of miscellaneous works in the buildings. The work shall be performed as shown on the Drawings or directed by the Employer and as specified herein.

(1) General Requirement

All materials to be furnished under this Section shall be of the best quality of their respective kind. Catalogues and samples shall be submitted to the Employer for his approval.

(2) Shop Drawings

The Contractor shall prepare and submit shop drawings for all items under this Section to the Employer for approval. Shop drawings shall show complete details of all miscellaneous works and erection including catalogues and brochures.

15.2 Materials and Installation

The work shall be fitted and assembled in the shop as much as possible. The work shall be erected true and straight, accurately fitted with tight joints and intersections. All works shall be reinforced where required. The rims shall be neatly and accurately mitered. Where screws are used, the heads shall be concealed.

(1) Downspouts

Downspouts shall be polyvinyl chloride heavy duty pipes with adaptable fitting accessories. The downspouts shall be securely fixed to the walls or columns with galvanized steel supports at approximate 1500mm intervals. All surfaces exposed to view shall be painted in accordance with the Specifications hereinbefore.

(2) Room and Facility Name Plates

Room name plates shall be provided on the wall just beside the entrance door in each room designated by fixing with stainless screws. The plates shall be made of stainless steel plates on which room names shall be printed by silkscreen in English and Dhivehi as directed by the Employer. The size of plates shall be approximately 200 x 400 x 2.0 in millimeters.

The facility name plates shall be provided on the boundary walls as specified Subsection 16.2 hereinafter provided. The name plate shall be made of stainless plates on which facility name shall be in English and Dhivehi and painted by silk screen as shown on the Drawings. The size of plates shall be approximately 300 x 500 x 2.0 in millimeters.

The toilet signboards shall be provided on the wall just beside the entrance of the toilets. The sign board shall be made of acrylic resin plates having 100 x 200 x 2.0 in millimeters in size and fixed on the walls with stainless screws on which pictogram sign for Gentlemen or Ladies shall be provided.

(3) Heat Insulation

The heat insulation shall be laid onto the entire ceiling except for that in outdoor corridors. The insulation materials shall be of 75mm thick Glass fiber board laminated by aluminum foil on both sides and completely packed by glass fiber net. The end and side laps shall be approximately 150mm and the joint of each others shall be sealed by aluminum foil tapes completely.

(4) Mirrors

Mirrors to be furnished under the building works shall be of 6mm thick polished second silvered glass and shall have a dimension approximately 450mm x 550mm in size to be provided in the places as shown on the Drawings. The mirror shall be set by decorated stainless bolts with cushion around the holes on the walls at height as shown on the Drawings.

All part shall be smooth and true.

(5) Foundations for Water Storage Tanks

The foundations for water storage tanks shall be constructed in the storage rooms on the ground floor. The foundation shall be constructed by reinforced concrete to a dimension as shown on the Drawings or as directed by the Employer. Blockouts for anchors shall be provided on the foundations so as to meet with the location of anchors of the tanks.

(6) Foundation for Solar Cells

The foundation for solar cells to be installed on the roof shall be constructed in a manner as recommended by the detailed documents for solar cells. The materials for foundations shall be durable against local intense climatic conditions. The foundations shall be separated from any dissimilar metals and sealed completely where penetrate through roof covering materials. The Contractor shall prepare and submit the shop drawings to the Employer for his approval.

(7) Kitchen Sink Units

Kitchen sink unit shall consist of a sink and a table unit having dimensions as shown on the Drawings. The sink and table shall be made of stainless steel plate not less than 1.2mm thick. The remaining portions including the cabinet provided under the sink shall be made of wooden fabrication finished with melamine or polyester resin. Metal flashings shall be of stainless steel sheet 1.0mm thick and provided at the back of kitchen sink and tables to be fixed to the walls securely. Caulking shall be applied to the joint of flashing and wall finish. The door leaves shall have appropriate ventilation holes with fine insect screens.

(8) Cupboard Units

Cupboards shall be provided just above the Kitchen sink units to a full length of them. Cupboard shall be of wooden fabrication finished with melamine or polyester resin at the front side and having chromium-plated hardware. The cupboard shall have a shelf inside and swing doors at the front and securely fixed on the walls by approved means. The door leaves shall have appropriate ventilation holes with fine insect screens.

(9) Window Flashings

Window flashing shall be provided at the outdoor bottom of all perimeter window openings. The flashing shall be constructed with cement mortar and extended to slightly over the full length of the openings. The Contractor shall prepare the shop drawings and submit it to the Employer for his approval.

SECTION 16. OUTDOOR WORKS

16.1 General

The work under this Section comprise the supply of all labor, materials and plant, and the performance of all work necessary for construction of the outdoor works as shown on the Drawings and as directed by the Employer and as specified herein.

16.2 Materials and Installation

(1) Boundary Wall

Along the entire perimeter of the Site, the boundary walls shall be constructed as shown on the Drawings. The wall shall be constructed with concrete hollow block having 150mm thickness and 1500mm in height. The wall shall have the cement mortar coping at top and 300mm skirting and walls. All of which shall be finished with sprayed texture paint on cement plaster. On the wall just beside the main entrance the facility name plate shall be fixed by stainless screws, of which details is specified under Subsection 15.2 herein before.

(2) Flag Poles

The three combination flag poles shall be constructed in front of the building having 6000mm in height from the ground level as shown on the Drawings. The flag pole shall consist of tapered aluminum poles, rope pulleys at the top, rope hooks, caps of pole, ropes and a foundation. The poles shall be securely embedded into the foundation so as to withstand against possible storms in the area. All other parts shall also be tightly fixed on the pole in a manner to intact with pole. The Contractor shall prepared and submit shop drawing to the Employer for his approval.

(3) Landscaping

The Premises of the buildings shall be provided with the following landscapes as shown on the Drawings and as directed by the Employer or specified herein.

1) Approach pass: From the Main entrance door to the building shall be paved with the interlocking pavement blocks with 3000mm wide and 100mm high from the adjacent ground. The thickness of pavement blocks shall be 80mm of which pattern shall be instructed by the Employer.

2) General area: except for the approach pass and facility area shall be finished with natural sandy pavement. The area shall have gentle gradient so as to avoid producing rainwater ponds.

3) Tree planting: 6 young coconut trees and 4 young broadleaf trees shall be planted in both Multi-purpose Building and Island Office. The location of planting and kind of species shall be instructed by the Employer.

The planting shall be properly made by most appropriate manners suitable for local conditions. The Contractor shall be full responsibility to maintain the plants until these are successfully rooted.

SECTION 17. FURNITURE

17.1 Application

This chapter sets forth requirement for design, fabrication, transportation, layout at each room of Furniture to be supplied under this contract.

17.2 Work

The scope of work of the Contractor shall be to supply Furniture listed in the 17.8 in this section, and include the following related works:

(1) Fabrication design

(2) Fabrication water content of all timber for furniture fabrication shall be below 15% with kiln drying

(3) Transportation to the sites

(4) Layout in the rooms

(5) After sales services

17.3 Shop Drawings

The Contractor shall examine all of the Drawings, Specifications and site measurement and prepare necessary shop drawings. Shop drawings shall include all information necessary for installation of the furniture such as size and weight, fixing method, layout, lists of material, fixtures, and accessories to be incorporated in the relevant work.

Shop drawings shall be prepared for all items of furniture and submitted in triplicate to the Employer for his approval. No work shall be commenced without the approval there of by the Employer.

17.4 Japanese National Flag sticker.

A label or sticker of Japanese national flag, descried in 6.Chapter-7, PART-I, Volume-I, shall be furnished to each furniture and equipment provided.

17.5 Handover Inspection

1) Pre-Inspection by the Contractor

The Contractor shall check each item of furniture regarding the quantity, the appearance, and submit a check report to the Employer before asking the inspection by the Employer.

2) Immediate Restoration of defect

Should any defect be found during the inspection above, the Contractor shall, without undue delay, take necessary arrangement for restoring the said imperfection before the Employer's inspection.

3) Responsibility after Handover Inspection

The Contractor shall be responsible for the proper storage of furniture until handover.

17.6 Guarantee

1) Guarantee Period

The Contractor shall be responsible for the correct performance of all items of furniture under the contract during a period of 12 months after handing over.

2) Defect

If any defect or imperfection arises in furniture during the period above, the contractor shall rectify or replace the defective parts, components, or whole of said item without any cost on the Employer. If the cause of defect is certified to be due to inferior products supplied by the Contractor.

17.7 After Sales Service

1) Contractor's Responsibility

The after sales services are to ensure the stock of spare parts and additional number, and repair for the supplied furniture, which the Employer may time to time require. The Contractor shall be responsible for providing the Employer with proper after sales service for a period of at least years after the handing over.

2) Service Organization

The Contractor shall appoint a local agent in Maldives who shall be in charge of the after sales service on behalf of the Contractor and submit to the Employer a letter of appointment of

agent with the name, address, telephone and facsimile number which shall be continuously updated.

17.8 The List of Furniture

A. MULTI-PURPOSE BUILDING

No.	Desc	Particular	Size	Island Office	Police Station	Post Office	Banking Booth	Island Court	Community Hall	Remarks
C1	Chair	General Clark		*33	11	8	5	21	0	*33=31+2(Gd.FL)
C2	"	Senior Officer	w/arm rest	28	6	7	6	16	12	
C3	"	Executive	"	3	0	0	1	3	0	
S1	Sofa	Sofa (Individual)		6	0	0	0	4	0	
S2	"	Sofa (Long)		1	0	0	0	1	0	
D1	Desk	General Clark	0.7x 1.2	9	0	0	0	0	0	
D2	"	Senior Clark	0.7x 1.2	2	0	5	3	6	0	
D3	"	Investigation	0.75x1.4	0	1	0	0	0	0	
D4	"	Executive	0.75x1.4	1	0	0	0	3	0	
D5	"	General Officer	0.7x1.8	0	2	0	0	0	0	
T1	Table	Meeting Room(long	1.2x2.4	4	0	0	0	1	2	
T2	"	Do. (short)	1.2x1.2	1	0	0	0	1	0	
T3	"	Tea Corner	0.6x1.2	1	1	1	0	1	0	
T4	"	Reception	0.4x1.0	1	0	0	0	1	0	
T5	"	Do.	0.4x0.6	2	0	0	0	1	0	
T6	"	Side Table	0.6x0.8	0	0	0	0	0	0	
T7	"	Night Table	0.35x0.5	0	0	0	0	0	0	
T8	"	Tea Corner	0.6x0.6	0	0	0	1	0	0	
B1	Bed	for Cells	0.8x1.8	0	2	0	0	0	0	
B2	"	Guest Room	0.95x1.9	0	0	0	0	0	0	
K1	Sink	Tea Corner	0.5x1.0	0	0	0	0	0	0	
K2	"	Do.	0.6x1.2	1	1	1	1	1	0	
SLF1	Shelf	Filing Cabinet	0.35x1.7	0	0	0	0	0	0	
SLF2	"	"	0.35x1.0	0	0	0	0	0	0	

B. ISLAND OFFICE

No.	Desc	Particular	Size	Guest Room	Island Chief	Assist Island Chief	Administration	Photcopy/Radio	Waiting	Committee Room	Conference Room	Filing Room	Tea Corner
C1	Chair	General Clark		0	2	4	7	1	8	0	0	0	4
C2	"	Senior Officer	arm rest	2	0	2	0	0	0	12	13	0	0
C3	"	Executive	"	0	1	0	0	0	0	0	0	0	0
S1	Sofa	Sofa (Individual)		0	2	2	0	0	0	0	0	0	0
S2	"	Sofa (Long)		0	1	0	0	0	0	0	0	0	0
D1	Desk	General Clark	0.7x 1.2	2	0	0	5	1	0	0	0	0	0
D2	"	Senior Clark	0.7x 1.2	0	0	2	0	0	0	0	0	0	0
D3	"	Investigation	0.75x1.4	0	0	0	0	0	0	0	0	0	0
D4	"	Executive	0.75x1.4	0	1	0	0	0	0	0	0	0	0
D5	"	General Officer	0.7x1.8	0	0	0	0	0	0	0	0	0	0
T1	Table	Meeting Room(long	1.2x2.4	0	0	0	0	0	0	2	2	0	0
T2	"	Do. (short)	1.2x1.2	0	0	0	0	0	0	0	0	0	0
T3	"	Tea Corner	0.6x1.2	0	0	0	0	0	0	0	0	0	1
T4	"	Reception	0.4x1.0	0	1	0	0	0	0	0	0	0	0
T5	"	Do.	0.4x0.6	0	0	1	0	0	0	0	0	0	0
T6	"	Side Table	0.6x0.8	2	0	0	0	0	0	0	0	0	0
T7	"	Night Table	0.35x0.5	2	0	0	0	0	0	0	0	0	0
T8	"	Tea Corner	0.6x0.6	0	0	0	0	0	0	0	0	0	0
B1	Bed	for Cells	0.8x1.8	0	0	0	0	0	0	0	0	0	0
B2	"	Guest Room	0.95x1.9	4	0	0	0	0	0	0	0	0	0
K1	Sink	Tea Corner	0.5x1.0	0	0	0	0	0	0	0	0	0	1
K2	"	Do.	0.6x1.2	0	0	0	0	0	0	0	0	0	0
SLF1	Shelf	Filing Cabinet	0.35x1.7	0	0	0	0	0	0	0	0	1	0
SLF2	"	"	0.35x1.0	0	0	0	0	0	0	0	0	1	0

CHAPTER-2 PLUMBING WORKS

CHAPTER-2 PLUMBING WORKS

TABLE OF CONTENTS

SECTION 1. GENERAL DESCRIPTION

The Contractor shall furnish and install complete the plumbing and sanitary systems indicated on the drawings and as specified herein.

SECTION 2. CODE AND STANDARD

All works performed under this Chapter shall be completed with all equipment for its satisfactory operation, control, maintenance and safety under all normal conditions of service and shall comply in all respects with the rules and regulations or by-laws of:

(1) All local authorities having jurisdiction over the installation of equipment in the locality.

(2) JIS (Japanese Industrial Standards)

(3) HASS (Heat, Air-Conditioning and Sanitary Standard)

Other applicable standards or codes may be acceptable provided the approval by the Employer.

SECTION 3. SUBMITTAL DOCUMENTS

3.1 Before commencement of works

The following are to be submitted to the Employer for his approval

(1) Catalogues, product data and test reports

(2) Installation Instructions

(3) Samples

(4) Shop Drawings

(5) List of spare parts

3.2 After Completion of works

The following are to be submitted to the Employer after the completion of work;

(1) Maintenance and operation manuals

(2) Certificates of warranty

(3) Spare parts and tools

(4) Construction photos

SECTION 4. TEST AND INSPECTIONS

4.1 The Contractor shall carry out the following tests and inspections at each phase of construction to confirm that the requirements for the quality, capacity, performance and other items indicated in the Drawings and the Specifications with regard to the materials, goods and workmanship are met satisfactorily. The Contractor shall record the results of each test and inspection, and submit them to the Employer.

The tests shall include, but not be limited to, the following;

(1) Water pressure test

Piping	Minimum Pressure	Minimum Duration
Water supply	10 kg/cm²	one hour

(2) Water filling test

Piping	Minimum Pressure	Minimum Duration
Drainage	0.3 kg/cm²	one hour
Sewage	0.3 kg/cm²	one hour

(3) If the materials, equipment and workmanship are judged unsatisfactory or unacceptable, as the result of such tests and inspections, they shall be made good to the Employer's satisfaction.

(4) The Contractor shall, in advance, confirm to the Employer as to the program, schedule and items of tests and inspections to comply with the Employer's instructions.

(5) Submission of the Documents

The Contractor shall submit the Results to the Employer upon completion the Test and Inspections.

SECTION 5. EQUIPMENT AND MATERIALS

5.1 Pump

The Contractor shall provide pumps necessary for the plumbing works in accordance with the Drawings.

5.2 Tanks

The Contractor shall provide tanks necessary for the plumbing works in accordance with the Drawings.

5.3 Plumbing Fixtures

(1) All plumbing fixtures shall be sanitary vitreous porcelain conforming to JIS A5207 or equivalent. The fittings shall conform to JIS A5514 or equivalent.

(2) The fittings shall conform to JIS A5514 or equivalents.

(3) Faucets shall be of bronze, chrome-plated type conforming to JIS B2061 or equivalent. Faucets shall pass a pressure test at hydrostatic pressure of 17.5 kg/cm² gauge.

(4) Water closet shall have a discharge water bore of 32 mm, which shall be made of bronze casting in accordance with JIS H5111, and shall have been tested at hydrostatic pressure of 10.0 kg/cm². The water closets shall be equipped with vacuum breaker.

5.4 Pipe Materials and Accessories

(1) Pipes and Pipe Fittings

1) Water Supply Piping

Piping and pipe fittings for water supply shall be as listed in Table 5.4.1-A, or

equivalent as approved by Employer.

Table 5.4.1-A Water Supply Piping

Items	Nomenclature
PVC Pipe	Unplasticised polyvinyl chloride (PVC) pipes
Fittings for PVC pipe	Unplasticised polyvinyl chloride pipe fittings for drain

2) Soil, Waste, Drain and Vent Piping

Soil, Waste, drain and vent pipes and pipe fittings shall be a listed in Table 5.4.1-B, or equivalent as approved by Employer.

Table 5.4.1-B Soil, Waste, Drain and Vent Piping

Items	Nomenclature	Remarks
PVC Pipe	Unplasticised polyvinyl chloride (PVC) pipes	VP
Fittings for PVC pipe	Unplasticised polyvinyl chloride pipe fittings for drain	

(2) Valves

Valves shall be as listed in Table 5.4.1-C and 5.4.1-D

Table 5.4.1-C Soil, Waste, Drain and Vent Piping

Items	Size	Nomenclature
Gate Valves	Nominal Dia. 65 and smaller	5 kgf/cm² bronze screwed gate valves
		10 kgf/cm² bronze screwed gate valves
Butterfly valves	Nominal Dia. 80 and larger	5 kgf/cm² cast iron flanged gate valves (outside screw type)
		10 kgf/cm² cast iron flanged gate valves (outside screw type)
Check valves	Nominal Dia. 50 and smaller	10 kgf/cm² bronze screwed swing check valves
		10 kgf/cm² malleable iron screwed lift check valves
	Nominal Dia. 65 and larger	10 kgf/cm² cast iron flanged swing check valves
Sluice valve		Sluice valve for water work

Table 5.4.1-D Valves for Soil, Waste and Drain

Items	Size	Nomenclature
Gate Valves	Nominal Dia. 50 and smaller	5 kgf/cm² bronze screwed gate valves
	Nominal Dia. 65 and larger	5 kgf/cm² cast iron flanged gate valves

(3) Sleeves

Sleeves shall have a diameter of approx. 40 mm larger than the outside diameter of the pipe, in principle. Sleeves for pipes passing through exterior walls, etc., where water tightness is required, shall be of steel pipes with flanged ends, except that where the use of such is not practical, cardboard formed sleeves, etc., may be used, in lieu of , subject to approval of the Employer.

(4) Flexible Joints

Stainless steel flexible joints, 500 mm long, shall be provided at the pipe connections to the pump.

(5) Pipe supports and Hangers

Pipe supports and hangers shall be made of steel adequate to withstand loads, expansion and construction and sway of pipes.

5.5 Drains and Cleanouts

(1) Floor Drains

Floor cleanouts shall consist of cast iron body and nickel-chromes plated brass strainer. Where the floor is waterproofed, the floor drain shall be of waterproof type.

(2) Floor Cleanouts

Floor cleanouts shall consist of nickel-chrome plated brass, non-threaded. Where the floor is to be waterproofed, the floor cleanouts shall be of waterproof type.

(3) Vent caps

Vent caps shall make aluminum.

5.6 Manholes and Manhole Covers

(1) Sewer manhole

Sewer manholes shall be of reinforced concrete construction. Exterior exposed surfaces and all interior surfaces shall be cement mortar finished. Inverts suitable for the diameter of the pipe to be connected shall be provided at the bottom. Manhole covers shall be made of reinforced concrete or steel.

(2) Catch Basin

Catch basins shall be reinforced concrete construction. Exterior exposed surfaces shall be cement mortar finish. Catch basin shall be provided with a cover.

5.7 Sewage Treatment System

The sewage treatment system shall be provided to treat sewage water that methods of returning the partially effluent to the sea.

The sewage treatment system shall be installed as shown on the Drawings.

5.8 Kitchen Equipment

Kitchen equipment shall be provided in accordance with the Drawings

5.9 Painting

Painting shall be selected in accordance with section 11/Chapter-1/Part-B of this Volume.

SECTION 6. INSTALLATION

6.1 Plumbing Fixtures

(1) Fixture Installation

1) Where fixtures are secured to concrete or brick work walls, wall mounted type fixtures shall be fastened with expansion bolts, in principle, and where mood inserts are used, they shall be treated with wood preservative treatment and firmly fitted into the wall.

2) Where fixtures are secured to wood furred wall, lathed wall, or plywood wall, steel angles or hardwood blockings shall be installed in advance.

3) Where fixtures are secured to metal panels or gypsum board walls, steel plates, steel angles, or hardwood blocking shall be installed in advance.

4) Where a part of a fixture is buried into concrete work, a coat of asphalt with a thickness of not less than 3 mm shall be applied where the fixture contacts with concrete or cement mortar.

(2) Water Closet (Western Type or Local Type)

Water closet shall be wash down type with low tank faucet and other accessories. The Contractor shall install water closets true to plane and secure in accurate position.

(3) Lavatory

Wall hung lavatory with single faucet, P-trap and other accessories shall be provided.

(4) Faucet

Type of faucet shall be completed with plumbing fixture schedule on the Drawings.

6.2 Water Supply System

One well water and one rain water supply systems shall be provided in accordance with the Drawings.

(1) Equipment Foundations

1) Foundations shall be reinforced concrete durable to support the weight of the equipment and have enough surface area to support the equipment. Surface shall be cement mortar finish.

2) Equipment shall be securely anchored in place.

(2) Pipe Connections

1) General

a) Pipes shall be cut square. After cutting, pipes shall be reamed and burs shall be removed.

b) Pipes shall be connected with care taken not to adversely affect the water flow nor cause leakage.

c) All pipe connections shall have adequate strength and be protected from corrosion.

d) No union joint shall be permitted.

e) In case of flange connections, gaskets of a proper thickness shall be provided and the bolts shall be tightened evenly.

f) Flange connections shall be provided at about 25 m intervals in the piping to

facilitate removal of equipments and maintenance where necessary.

2) Steel Pipes

a) Pipes 80 mm in nominal diameter and smaller shall have threaded joints, and 100 mm in nominal diameter and large shall have either flanged connections or welded connections.

b) Thread shall be of taper type with an effective length of male thread as shown in the following Table 6.2.2-A.

Table 6.2.2-A Thread of Steel Pipe

Pipe Dia. (mm)	15	20	25	32	40	50	65	80	100
Effective length (mm)	15	17	19	22	22	26	30	35	40

c) At flanged joint, rubber or asbestos cement packing for water work with a diameter suitable for the flanges shall be used.

3) PVC Pipes

Joint shall be made by the cold-jointing method, and the pipe interior shall be no offset at each joint interfering with the flow. Joint adhesive shall be of good quality and shall not be affected by heat and shock.

6.3 Pipe Installation

(1) General

1) Flange connections shall be provided in appropriate locations in the main piping for easy disconnection.

2) Branch lines maybe taken from right to left side of the main line using Tee-branches.

3) When cold water lines are buried in parallel with sewer lines, actual horizontal distance between the two lines shall not be less than 500 mm and the water lines shall not be located lower than the sewer lines. This is also applicable for the situation when the two lines are crossing each other.

(2) Slopes

Horizontal cold water piping shall be sloped upgrade for upflow and downgrade for down-flow. Slopes shall be 1/250, in principle.

(3) Pipe Support Spacing

1) Spacing for horizontal piping shall be in accordance with the following table 6.3.1-A, in principle, except that hangers and supports shall be installed at each change in direction and at each branch, as required. Protection against vibration shall be provided.

2) For vertical piping, one or more supports shall be provided at each floor, except that vertical piping shall be firmly supported to the floor.

Table 6.3.1-A Spacing for Horizontal Piping

Diameter (mm)	20 and smaller	26-40	50-80	100-150	200 & larger
Spacing	1.8 m	2.0 m	3.0 m	4.0 m	5.0 m

(PVC Pipes)

Diameter (mm)	40 and smaller	50	65-125		150 & larger
Spacing	1.8 m	2.0 m	3.0 m	4.0 m	5.0 m

3) Depth of Buried Pipes

Minimum earth cover over buried pipes shall be 300 mm for non-traffic area, and 750 mm minimum for traffic area.

(4) Test

Piping systems shall be filled with water for a period of at least 60 minutes. Pipes cold water supply shall be tested as a pressure of not less than 10.0 kgf/cm².

6.4 Soil, Waste , Drain and Vent Piping

(1) Pipe Connection

1) General

Refer to sub-clause 6.2.2, (2), 1), of this Part.

2) PVC Pipes

Use "solvent cement" joints. Connections shall be made so that the interior of the pipe will be free of unevenness.

(2) Pipe Installation

1) General

a) Branch soil pipes shall be connected to the main pipes using 45_ or less degree wyes. Connections shall be made as horizontally as possible.

b) For PVC pipes crushed gravel or sand shall be placed at the bottom of the trench and compacted. Pipes shall be laid firmly on the bottom of the trench. Backfill material shall be placed along the pipe up to elevation of the center of the pipe to prevent pipe movement off line or grade, and compacted, and the remainder of the trench shall be backfilled as specified.

c) Slopes

For interior horizontal drainage, piping in nominal diameter in 75 mm and smaller shall be sloped 1/50, and piping in nominal diameter of over 75 mm shall be sloped 1/100, in principle.

d) Pipe Support Spacing

Refer to sub-clause 6.3.2, (3), of this Part.

(3) Test

Water tests shall be applied to drainage systems. Upon completion of the fixture Installation, etc., the system shall be filed with water. Water shall be kept for at least 30 minutes.

6.5 Septic Tank

Septic tank shall be of poured-in-place concrete construction. This septic tank shall conform to the local cord and any requirement of related authorities. Details of septic tank shall be submitted to the Employer for his approval before commencement of works.

CHAPTER-3 ELECTRICAL WORKS

CHAPTER-3 ELECTRICAL WORKS

TABLE OF CONTENTS

SECTION 1. GENERAL REQUIREMENT

1.1 General Items

(1) The Contractor shall execute all the necessary electrical work for the Island Office and Multi Purpose Building in accordance with this specifications and Drawings.

(2) The Contractor shall execute all the necessary electrical work for the Island Office and Multi Purpose Building in accordance with this specifications and Drawings.

(3) The Contractor shall submit shop drawings and other drawings required during construction to the Employer for his approval without delay.

1.2 Design Standard and Code

The following standards and codes shall be applied to this section.

(1) JIS (Japanese Industrial Standards)

(2) JEC (Japanese Electro technical Committee)

(3) JEM (Japanese Electrical Manufacturers' Association)

(4) BS (British Standards)

Other applicable standards or codes maybe acceptable provided the approval by the Employer.

1.3 Records of the Tests

The following records of the tests shall be submitted to Employer for his approval.

(1) Withstand voltage test for 400/230 V

(2) Insulation resistant test

(3) Illuminance intensity measurement records

(4) Earthing resistant test

(5) Operation test report of each equipment

SECTION 2. COMMON MATERIALS AND INSTALLATION

2.1 Conductors and Cables

(1) Conductors and Cables

1) Connecting Conductors and Cables

Conductors or cables shall be connected to earth other in the following manner.

a) Conductors shall be connected so as not to increase electrical resistance before connecting.

b) Conductors and cables shall be joined so as not to decrease their mechanical strength by more than 20 percent.

c) No connections shall made within conduits or wiring ducts.

d) Conductors and cables shall be connected by means of suitable connector fittings such as pressure connectors.

e) Where any connections occur, an adhesive vinyl tape shall be wrapped around the joint.

(2) Connections between Conductors and Devise Terminals.

The device terminals shall be firmly fixed so as not to be loose at the connection. If it is likely to become loose, a double nut or a spring washer shall be used to prevent it from coming loose.

(3) Colour Coding of Conductors

Colour coding system for conductors shall be approved by the Employer.

(4) Mounting Equipment

The equipment such as lighting fixtures, tumbler switches and plug sockets shall be mounted strongly on the strong ceilings or walls by suitable bolts or screws so as not to come loose by vibration.

(5) Insulation Resistance

The value of insulation resistance to ground or in between conductors shall be more than 5 M ohms in all electrical circuit as switching points.

2.2 PVC Pipe Work

(1) Conductors

Conductors shall be vinyl-insulated wires unless otherwise specified.

(2) PVC Pipes and Fittings

1) PVC pipes shall be used generally in accordance with the Drawings.

2) Fittings such as outlet boxes, switch boxes, and normal bends shall be suitable for conduit to be connected.

3) Other matters not provided in this section shall conform to sub-clause 3.2.3 of this Part, "Metal Conduit Work".

(3) PVC Pipe Installation

PVC pipe installation shall conform to metal conduit installation and as follows;

1) Specific heating equipment shall be used to bend the pipe. Care shall be taken not to overheat it.

2) The intervals between suspensions of PVC pipes shall be installed within 1.2 meters or less.

(4) Connection of PVC Pipe

PVC Pipe shall be connected in the manner as follows;

1) Couplings shall be used for connection pipes.

2) Coupling shall be closely inserted in the pipe by means of an adhesive and other end inserted loose without the use of adhesive.

3) For connection between pipe and box, connector or hubbed metal box shall be used.

(5) Protection and Cleaning

Protection and cleaning shall conform to sub-clause 3.2.3 of this Part, "Metal Conduit of this Part, "Metal Conduit Work".

(6) Wiring of Conductors

Wiring of conductors shall conform to 3.2.3 of this Part, "Metal Conduit Work".

(7) Earthing

Earthing shall conform to sub-clause 3.3 of this Part, "Earthing Work".

2.3 Metal Conduit Work

(1) Conductors

Conductors shall be vinyl-insulated wires unless otherwise specified in the specifications or the Drawings.

(2) Metal Conduit and Fittings

1) EMT conduit shall be used for exposing piping. But rigid steel conduit shall be used for explosion and or other area, if necessary.

2) Fittings such as outlet boxes, switch boxes, bushing, coupling, and normal bends shall be suitable for conduit to be connected.

3) The size of conduit shall be indicated and specified on the Drawings. The sum of the cross-sectional areas of the individual conductor shall not exceed 40 % of the interior cross-sectional area of the conduit.

(3) Conduit Installation

Conduit shall be installed in the manner as follows;

1) The minimum bending radius shall be six diameters and the maximum bending angle shall be ninety degrees (a right angle). Then the total off all bending angles in any run of conduit between outlet or junction boxes shall not exceed 3 times as much as right angle (270 degrees).

2) Supports for exposed conduit runs shall be installed at maximum of 1.5 meter intervals. And boxes shall be firmly fixed to the building material.

3) Conduit embedded in concrete shall be fixed by iron wires.

4) Conduit installed in damp locations shall not be a U-bend.

5) The ends of all conduits shall be reamed and free from sharp edges.

(4) Connection of Conduit

Conduit shall be connected in the manner as follows;

1) Connection between conduits shall be made using a coupling and screwed in until pipe ends closely butt each other.

2) Where connection between conduits and a box or panel board will not be screwed in, locknuts shall be fitted on both sides of a box or panel board case to tighten the connection and conduit end shall be provided with a bushing.

3) All conditions on both sides of a box shall be bonded to by 3.5 mm earthing conductor to effect electrical integration.

(5) Protection and Cleaning

Conduit shall be protected and cleaned in the manner as follows:

1) All conduits shall be suitably protected by means of end caps to avoid the entry of rain water, dust, etc., into the conduits during installation.

2) All conduits embedded in concrete shall be cleaned up in its inside surface and inspected to pass through wire before wiring.

3) All conduits and fittings shall be given a coating of anti-corrosive insulating paint on the exposed surface.

4) Inside of a box shall be painted by electric insulation paint.

(6) Wiring of Conductors.

Conductors shall be wired into conduits in the manner as follows;

1) Conductors shall be continuous from outlet to outlet. No spices shall be made except within outlet or junction boxes.

2) In case of wiring conductors into conduits, such lubricant as to corrode the insulation materials of conductors shall not be used.

3) Conduits shall be clean and fee from oil and cuttings before inserting conductors.

4) All conduits in which conductors will not be wired shall be provided with a galvanized iron wire.

(6) Earthing

Conductors shall be wired into conduits in the manner as follows;

Earthing shall conform to sub-clause 3.3 of this Part, "Earthing Work".

2.4 Flexible Conduit Work

(1) Conductors

Conductors shall be vinyl-insulated wires unless otherwise specified.

(2) Flexible Conduit and Fittings.

Flexible conduit and fittings shall conform to sub-clause 3.2.3 of this Part, "Metal Conduit Work".

(3) Flexible Conduit Installation

1) Flexible conduit shall be firmly fixed to the building material with saddle.

2) The ends of conduit shall be provided with bushing or connector to protect conductor insulation from damage.

(4) Connection of Conduit

Connection between flexible pipe and box or other metal pipe shall be connected with proper connector.

(5) Protection and Cleaning

Protection and cleaning shall conform to sub-clause 3.2.3 of this Part, "Metal Conduit Work".

(6) Wire of Conductor

Wiring of conductors shall conform to sub-clause 3.2.3 of this Part, "Metal Conduit Work".

(7) Earthing

Earthing shall conform to sub-clause 3.3 of this part, "Earthing Work".

2.5 Cable Work

(1) Cable

The kind of cables and the conductor size shall be indicated and specified on the Drawings.

(2) Installation of cables

Cables shall be installed in the manner as follows.

1) Non-metallic covered cable shall be installed along structural members.

2) When cable shall not be installed along structural members, messenger wires shall be used to support the cables.

3) Cable shall be firmly fixed to structural members using saddles or staples to prevent damage to the cable sheath. Supports for cable runs shall be installed at maximum of 1.5 meter intervals.

4) In case cable will be subject to external damage, it shall be protected in steel conduit of which diameter is larger than 1.5 times of the cable diameter.

5) Bending radius of cable shall exceed 10 times as large as the cable diameter for high-tension use and 5 times for low tension use.

(3) Connection of the Cable

1) Connection of branch of cables shall be made inside a cabinet or a box.

2) The matter not provided for in this chapter shall conform to sub-clause 3.2.1 of this Part, "Conductors and Cables".

2.6 Underground Cable Work

(1) Cable

The kind of cables and the conductor size shall be indicated on the Drawings.

(2) Hand hole

Hand hole shall be of concrete made, capable of withstanding vehicle load or other heavy object

load and shall be so designed as to prevent the entry of water. Hand hole boxes shall be so constructed that water accumulating therein may be drained.

(3) Connection and Bending of Cable

Connection and bending of cables shall conform to sub-clause 3.2.1 of this Part, "Conductors and Cables".

(4) Piping and Wiring

Piping and wiring for underground cable work shall conform to sub-clause 3.2.2 of this Part, "PVC Pipe Work"

SECTION 3. EARTHING WORK

3.1 General

All metallic parts including DEG, Panels, fuel oil tanks, fuel day tank, pumps, etc., shall be earthed effectively in accordance with Japanese Standards and/or regulations.

The Contractor shall determine the earth resistance at site.

3.2 Classification and Earthing Resistance

Classifications and earthing resistance value shall be as follows;

(1) Class 1 method

10 ohms or less

(2) Class 2 method

Required resistance value shall be determined as agreed of Employer.

(3) Class 3 method

100 ohms or less

(4) Special Class 3 method

10 ohms or less

3.3 Electrical Work to be Earthed

(1) Class 1 method

The following electrical works shall be earthed by Class 1 method.

1) Steel bases and external metal boxes of high-tension or extra high-tension equipment of fixtures.
2) Metal conduit accommodating high-tension or extra high-tension cables and metal junction boxes.

(2) Class 2 method

Neutral point of the low tension side of the transformer shall be earthed by class 2 method.

(3) Class 3 method

The following works shall be earthed by Class 3 method.

1) Steel bases and external metal boxes of low-tension equipment or fixes not in excess of 300 volts.
2) Metal conduits, metallic fittings and parts, or metal pull boxes not in excess of 300 volts.
3) Metal conduit to be installed in damp or wet places.
4) Secondary circuit of low tension above 300 volts or high-tension instrument transformer.
5) External boxes of discharge lamp ballasts and metallic parts of discharge lamp fixtures. In case

where maximum circuit voltage to ground will not exceed 150 volts and the equipment is installed in dry place, this provision may be omitted.

(4) Special Class 3 method

The following electrical works shall be earthed by Special Class 3 method:

1) Steel bases and external metal boxes of machinery equipment with power circuit above 300 volts but not over 600 volts.

2) Low-tension wire ways over 300 volts but not exceeding 600 volts installed in metal conduit, metal duct and connection metal boxes.

3) Metallic part of cable protector, metal junction box accommodating over 300 volts interior wire provider where accessible to man.

3.4 Earthing Electrodes

Earthing electrodes shall be copper plate and/or copper rod.

(1) Copper Plate

Thickness shall be more than 1.5 mm. And the surface area shall be more than 0.8 m^2.

(2) Earthing Rod

Joined earthing rod shall be more than 16 mm dia. and 1.5 m length.

3.5 Installation of Earthing

(1) Earthing electrodes or conductors shall be isolated more than 1 meter from others and shall be isolated more than 2 meters from lightning rod.

(2) Earthing electrodes shall be installed in damp but not corrosive place deeper than 0.75 m from ground surface.

(3) Rod support shall be rigidly installed in a manner to resist wind pressure and provide water tightness

(4) Conductor shall be isolated 1 meter or more from power line or gas pipe.

(5) Where section area of structural steel member is more than 300 mm^2, lightning rod and Conductor may be omitted in accordance with the Drawings.

(6) Earthing resistance value of each down conductor shall be less than 10 ohms.

(7) Any other matters not specified in this section shall conform to the direction of the Employer.

(8) Earth junction shall be installed with the Protective covers.

3.6 Earth Marker

(1) Wherever earthing electrodes are buried, earth marker shall be provided.

(2) Earth marker shall clearly indicate location of earthing electrode, depth, date class of ground and ground resistance value.

SECTION 4. DISTRIBUTION BOARD FOR BUILDING

4.1 Distribution board for the building shall be supplied in order to distribute the power source to the building service equipment, the workshop equipment, etc.

4.2 General Requirement of the Distribution Board

(1) Main feeder shall be vinyl-covered wires or copper strips and front part shall be covered with non flammable board with card-holder.

(2) The equipment for a main and branch circuits shall be moulded case circuit breakers, and the rating

shall be indicated on the design drawings.

(3) The distribution board shall be insulated and coloured-finish.

(4) Structure

1) The structure of lighting panel board shall be manufactured to prevent, dust, insect, etc., from penetrating or getting inside. Cable gland and/or ceiling materials shall be used for complete sealing, when cables entries from bottom side.

2) The cabinets for lighting panel boards shall be constructed of sheet steel. The steel thickness shall be selected adequately in consideration of the size, installation method, and easy operation and maintenance of the board.

SECTION 5. INDOOR LIGHTING FIXTURES

5.1 Lighting Fixtures

Lighting fixtures indicated in the specifications consists of incandescent lamps, fluorescent lamps, mercury vapor lamps, other discharge lamps, and ballasts and apparatus for these lamps.

(1) Lighting fixtures shall conform to the Drawings

(2) Shop drawings of lighting fixtures shall be approved by the Employer before manufacturing.

(3) All discharge lamps shall be equipped with a capacitor for improving power factor.

(4) Fluorescent lamp shall be glow starter type. Consideration shall be made on selection of the lamp type so that the lamp can be purchased locally.

5.2 Installation

(1) The locations of lighting fixtures shown on the Drawings are indicative position, where the actual locations may be approved by the Employer.

(2) Shop drawings of lighting fixtures shall be approved by the Employer before manufacturing.

(3) All discharge lamps shall be equipped with a capacitor for improving power factor.

(4) For heavy lighting fixtures or those requiring special installation method, installation drawings shall be prepared and submitted to the Employer for his approval.

SECTION 6. OUTDOOR LIGHTING FIXTURES

Lighting fixtures shall be complete with lamps and following specifications. Bulb for the fixture shall be the ones available in Maldivian market.

(1) Incandescent lamp lighting fixtures of AC 230 V shall be equipped with 60 W lamp (Wall mounted type).

(2) Mercury lighting fixtures of AC 230 V shall be equipped with ballast, mercury lamp (220 W).

(3) Flood light fixture of AC 230 V shall be equipped with ballast, mercury lamp (400 W) and accessories for the installation of fixtures.

(4) Fluorescent lighting fixtures of AC 230 V shall be equipped with 40 W tube light.

(5) Outdoor type fixtures shall be of water-proof type.

(6) Consideration shall be made on selection of the lamp type so that the lamp can be purchased locally.

SECTION 7. INTERPHONE SYSTEM

Interphone system shall be provided for the purpose of communication between each room.

The actual position of interphone hand sets shall be subject to the approval by the Employer.

Necessary equipment and materials for office building such as interphone hand set, cables, conduit pipes, etc., shall be supplied by the Contractor.

SECTION 8. ELECTRICAL SYSTEM

8.1 General

Electrical system applied for building services shall be as follows.

(1) Single-Phase, 2-wire system

Both lighting and single phase motor loads shall be able to be served by this system. The voltage shall be 230 V.

(2) 3-phase, 3-wire system

3-phase motor loads shall be supplied by this system and phase-to-phase voltage shall be 400V.

(3) 3-phase, 4-wire system

This system shall be the most widely used to serve a combination of power and lighting loads. The voltage shall be 400/230 V.

8.2 Power Circuit

(1) General

Power circuit shall be installed at the locations indicated on the Drawings so as to supply electricity to air conditioning, ventilation equipment, etc.

(2) Electrical System

Ceramic toile to interior walls for toilets shall be approximately 200mm x 200mm in size and shall have semi-glazed surfaces. The pattern shall be selected by the Employer.

1) 3-phase, 3-wire system, the voltage shall be 400 V.

2) Single-phase, 2-wire system, the voltage shall be 230 V.

(3) Power Source

Power source of power circuit for building service equipment and workshop equipment shall be the distribution board for building. The single line diagram shall comply with the Drawings.

8.3 Lighting and Convenience Outlet

(1) Wiring System

Single-phase, 2-wire system, the voltage shall be 230 V.

(2) Power Source

The power source for lighting and convenience outlet shall be the distribution board for building. The single line diagrams shall be submitted to the Employer for his approval before commencement of the works.

(3) Electrical Fittings

1) Electrical fittings, such as tumbler switches and convenience outlets, shall conform to the Drawings.

2) Convenience outlets and tumbler switches shall be firmly fixed with suitable screws to resist the external forces caused by plug insertion and withdrawal and manual switching.

SECTION 9. FIRE EXTINGUISHER

9.1 General requirement

(1) The Contractor shall execute all the necessary fire extinguisher work for the power house building.

(2) The Contractor shall submit the specification and drawings to the Employer for his approval.

9.2 Design standard and Code

The following standards and codes shall be applied to this section.

(1) JFSL (Japanese Fire Service Law)

9.3 Installation

(1) Fire extinguisher

The Contractor shall be provided ten(10) sets of 3 kg ABC type fire extinguishers.

(2) Location

The Contractor shall be installed the following rooms.

1) Store Room 1 set
2) Utility Room 1 set
3) Corridor of the 1st Floor 8 sets