AR – 1011 – WASHROOM ACCESSORIES

1.0 DESCRIPTION OF WORK

This work shall cover the provision and installation of all items, articles, equipment and materials for washroom or toilet area as shown in the Drawings and/or as specified and including labour supervision and incidentals required and necessary to complete the system for successful operation.

2.0 REFERENCE STANDARDS

a. Standar Industri Indonesia (SII)

b. Technical Specification AR-0825 - Glass and Glazing.

c. Technical Specification MP-1504 - Plumbing System.

3.0 GENERAL PROCEDURES

3.1 Samples and Technical Data

Samples and technical data of specified washroom accessories shall be submitted to the Engineer for approval, prior to delivery.

Technical data shall show types, dimension, colours and other data required for installation.

3.2 Shop Drawing

Prior to installation, Contractor shall submit Shop Drawing which shall consist of detail of layout, fastening, installation, dimension, and other necessary details, to the Engineer for approval.

3.3 Handling and Storage

The washroom accessories and fittings shall be stored in a clean dry place and protected from damage prior to and after installation.

4.0 MATERIALS

4.1 Water Closets

WC shall be close-coupled siphon jet, in colour as specified later.

Entire unit shall be supplied with all necessary fittings and fixtures.

Each WC pan shall have a closed front seat and cover.

Fittings shall be chrome plated brass.

Squatting toilet shall be as approved by the Engineer in colour as specified later.

4.2 Urinals

Urinals shall be of the single unit wall mounted type with San-Ei V92 fittings, in colour as specified later.

4.3 Lavatory Basins

Lavatory basins shall be of wall mounted type, in colour as specified.

They shall be supplied with a chromium plated and screwed outlet and trap with requisite connector sleeve for the joint.

Each basin shall have provision for one cold water faucet and have liquid dispenser soap deck type, such as W12 of San-Ei or approved equal.

White enamelled support brackets and one chrome plated chained rubber plug shall be provided per unit.

4.4 Kitchen Sink

Kitchen sink shall be stainless steel and consist of 2 (two) sinks/bowls with a drip pan, and air trap with clean-out plug shall also be provided to the sink.

4.5 Water Faucets

Faucets for wall mounted shall be of San-Ei Y20C type or approved equal.

Faucets for lavatory basins shall be of San-Ei Y51C type or approved equal.

Faucets for kitchen sink shall be of San-Ei A10C type or approved equal.

Faucets for garden use shall be of San-Ei Y30C type or approved equal.

4.6 Floor Drain

Floor drain cover shall be chrome plated brass strainer, grid cover of 10 cm or 4 inch diameter and shall be recessed 10 mm into the floor and equipment with air trap, such as San-Ei H-510 type or approved equal.

4.7 Clean Out Cover

Clean out cover shall be chrome plated brass of 10 cm diameter, such as San-Ei H-58 or approved equal.

4.8 Shower Accessories

Shower accessories shall consist of wall shower San-Ei S13 or equal and shower valve San-Ei V10T or equal.

4.9 Accessories

Accessories shall be as follows or approved equal :

- Soap dispenser : San Ei W12
- Paper/tissue holder : San-Ei W30
- Towel holder : San-Ei W565.

All the above accessories shall be of colour as specified later.

4.10 Mirror

Mirror shall be as specified in Technical Specification AR-0825, in thickness and sizes as indicated in the Drawings.

5.0 CONSTRUCTION REQUIREMENTS

5.1 General

All equipment shall be installed in strict accordance with manufacturer's recommendation and this Specification unless otherwise approved in writing.

Vertical and horizontal dimensions to all fixtures and quantities of each item shall be as indicated on the Drawings.

Unless otherwise specified, fixing shall be in accordance with manufacturer's instruction, fitting and details.

5.2 Installation

All joints shall be water and gas tight. Caulking of threaded connections or apertures will not be permitted.

Paint, varnish, putty and others will not be permitted on meeting faces of joints until joints are set tight and tested.

Exposed traps and supply pipes for all fixtures and equipment shall be connected to rough pipe at wall with requisite adapter connection unless otherwise specified.

Water connections to individual fixtures shall be not less than as specified on the Drawings.

Lavatory basins and sinks shall be fixed so that the top of the outer rim is 800 mm above finished floor level.

Urinals shall be fixed so that the top of the front rim of the basin is 530 mm above finished floor level.

Mirror shall be hung at elevation as indicated in the Drawings, and shall be installed in accordance with the requirements of Technical Specification AR-0825.

Support and hang-up system shall be in accordance with recommendation of the manufacturer or as approved by the Engineer.

5.3 Protection and Cleaning

The Contractor shall provide and maintain adequate protection for all sanitary fixture until completion of whole work or as directed by the Engineer. All damage sanitary fixture shall be replaced at the expense of the Contractor.

Before handling over or when directed by the Engineer, all sanitary fixture shall be cleaned to satisfaction of the Engineer.

MP – 1504 – PLUMBING SYSTEM

1.0 DESCRIPTION OF WORK

This work shall cover the providing of all materials, labour, equipment and installation of a complete plumbing system as specified herein and/or as shown in the Drawings.

This system shall include an internal distribution piping system for plant water, sanitary piping, as well as testing, balancing and all other incidentals required so as to make all the system perfect in every respect and ready for operation.

This work shall also include connection to distribution piping as shown by the Drawings.

2.0 REFERENCE STANDARDS

a. American Society for Testing and Materials (ASTM)

b. British Standard (BS)

c. Standar Industri Indonesia (SII)

d. Pedoman Plambing Indonesia

e. Japanese Industrial Standard (JIS)

f. Technical Specification AR-0914 – Paintings

g. Technical Specification AR-1011 - Washroom Accessories.

h. TS 2 Earthworks.

3.0 GENERAL PROCEDURES

3.1 Samples and Technical Data

Contractor shall submit samples and technical data and/or brochures of all materials to be used to the Engineer for approval, prior to delivery.

All the costs of samples shall be the Contractor's responsibility.

If the submittals differ from the requirements of the contract documents, the Contractor shall make specific mention of such difference in a letter, with a request for substitution, together with his reason for this, in order that, if acceptable, suitable action may be taken for proper adjustment. Otherwise, the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract Drawings.

3.2 Shop Drawing

The Contractor shall prepare and submit detailed Shop Drawings for the piping work described herein which is complex in nature, or which requires close co-ordination with other trades on the job.

The Drawings are diagrammatic and indicate generally the location of materials and equipment. These Drawings shall be followed as closely as possible. The architectural, structural and other Drawings of related trades, and all elements thereby constructed shall be checked for dimensions and clearance before installation of any work.

All Shop Drawings shall be submitted sufficiently in advance of field requirements to allow ample time for checking, and no claim for extension of

the contract time will be granted to this Contractor by reason of his failure in this respect.

All submittals shall be complete and shall contain all required and detailed information.

The Contractor shall obtain, at his expense, all necessary permits and arrange for all inspection that may be required in connection with the plumbing system specified herein.

3.3 Handling and Storage

Each length of pipe, fittings, trap, fixtures and device used in the piping system shall have cast, stamped or indelibly marked on it the manufacturer's name and the classes of products when so required by the standard mentioned.

All materials shall be stored at a proper place and shall be protected from damage.

3.4 Non Conformity

The Contractor shall carefully check the Contract Drawings towards the possibility of mistakes in dimensions, capacities, quantities, installation and others.

All plumbing fixtures and fittings delivered or installed without any trade mark shall be removed and replaced with properly marked fixtures and fitting, without any extra cost to the Owner.

3.5 Guarantee

The Contractor shall furnish to the Owner a written guarantee covering the satisfactory operation of the plumbing installation in all its parts for a period of one year after date of final acceptance. During this period the Contractor shall repair or replace any defective work and pay any repair or replacement costs.

4.0 MATERIALS

4.1 General

All materials, equipment and accessories furnished shall be brand new and of acceptable quality.

4.2 Water Supply System

Pipes

Pipes for water supply shall be PVC complying with the relevant JIS Standard.

Fittings

All pipe's fittings such as socket, elbow, reducer, knee, nipple, tee and others shall be made from PVC complying with the relevant JIS Standard.

4.3 Sewer System and Vent Pipe

Pipes

Pipes for sewer system and vent shall be PVC pipe which comply with JIS standard with a working pressure 10 kg/cm^2 such as Pralon or Rucika or equal.

Length and diameter of pipes shall be as specified in the Drawings.

Fitting

PVC pipe's fittings such as elbow, reducer, knee, tee and others shall be made from the same material and class as the pipes and shall be from a good quality product.

Adhesive

Adhesive for PVC's pipes and fittings shall be as recommended by the PVC's manufacturer.

4.4 Roof Tank

Where applicable a roof tank of the capacity and material shown on the drawings shall be furnished. The make shall be subject to the Engineer's approval

4.5 Pump and Accessories

Where applicable, pump pressure system shall be furnished in accordance with the Drawings and the directions of the Engineer.

Where applicable pump for supplying header tank shall be of self-priming centrifugal type with capacity, head and working voltage as indicated in the Drawings, and of GAE, Torishima product or approved equal.

Where applicable, the pump for supplying water to a header tank. shall be provided with water level control (WLC) in capacity as specified in the Drawings.

Wiring diagram shall be as indicated in the Electrical Drawings and electrical system shall be according to Technical Specification EL-1601.

4.6 Sanitation Fixtures.

Sanitation fixtures such as closets, sinks, faucets, floor drain and others required shall be in accordance with Technical Specification AR-1011.

5.0 CONSTRUCTION REQUIREMENTS

5.1 General

All labour shall be neat and workmanlike and be qualified and experienced tradesman as approved by the Engineer.

All dimensional locations of fixtures, equipment, floor and drains, risers and pipe shall be verified on the Architectural Drawings and manufacturer's catalogues.

All items, whether specifically mentioned or not, or indicated in the Drawings, shall be furnished and installed if necessary to complete the system in accordance with the best practices of the plumbing trade and to the satisfaction of the Engineer.

5.2 Installation

All plumbing systems to be installed in this building shall be kept clean, and in working order through periodic testing by Contractor until the building has been turned over and accepted by the Owner.

All pipes shall be installed to the defined co-ordinate outside of the buildings.

The Contractor shall be responsible for providing those portions of fittings which are not provided with the fittings required for the complete installation. All fittings shall be carefully checked to determine the portions which to be provided to complete the installation.

The pipes shall be used in full length pipe wherever possible.

All changes in pipe size shall be made with reducing fittings or reducers.

Valves provided as specified for proper control system shall be placed in accessible location with the ample room for full opening, re-packing, replacement of internal part with operating stem horizontally or vertically upward.

Vent pipe shall extend 30 cm above the roof and shall be flashed with lead. The lead flashing shall be returned on the inside of the vent and finished in a neat manner as detailed in the Drawings.

Sewer piping shall run a minimum grade of 1 cm per 100 cm length of pipe unless otherwise noted in the Drawings. Before any waste piping is installed, the Contractor shall field-check all proposed waste piping to verify the piping system so that the said piping can be installed at the required grade.

All plumbing fixtures including floor equipment connected to the sanitary drainage system of floor drain shall be equipped with a trap, as indicated in the Drawings.

Each fixture shall be provided with shut-off valves for water as positioned in the Drawings, so that any fixture may be separately controlled without effecting any other fixtures supplied.

Traps specified here are to be supplied with the fixtures exposed or accessible traps shall be fitted with a thumb screw clean-out plug at the bottom of trap diameter.

Piping work which shall need excavation and backfilling, shall be carried along in accordance with Technical Specification TS 2.

Pump shall be connected to water supply distribution pipe in a manner as shown in the Drawings and in accordance with the manufacturer's installation instruction.

5.3 Supports and Fastenings.

All pipes, fittings and equipment shall be supported and fastened in a safe and durable manner.

Pipes' support shall be installed in such a way that pipes direction and slope can be kept in place and strong enough to hold the pipes and expansion caused by heat exchange.

Inserts shall be safely anchored and the anchors shall be installed flush with the finished wall and shall be completely concealed when the fixtures are installed.

5.4 Roughing-In

Roughing-in for pipes and fittings shall be carried along with building construction, and shall be co-ordinated between Engineer and Contractor.

Correctly located openings of proper sizes for the passage of pipes shall be provided when required. Locations shall be established on Drawings, co-ordination of final positions shall be consulted with the Engineer.

All items such as gutter straps and like appurtenances to be embedded in concrete or masonry shall be thoroughly cleared free from all rust, scale and paint.

5.5 Cleaning and Adjusting

During construction, the Contractor shall properly cap all lines, so as to prevent entrance of sand, dirt and others. Each system of piping shall be blown through with air after completion for as long a time as necessary to thoroughly clean the systems.

After the entire installation has been completed, Contractor shall operate the equipment under normal conditions making all necessary adjustments to balancing valves, automatic pressure controls and others, until all performance requirements are met.

5.6 Sewer System Test

The entire sewer and vent system shall be supplied with all incidental appurtenances to permit plugging as necessary to enable the entire system specified herein, to be filled with water to the level of the highest vent stack and/or vent stack above the roof.

The system shall hold water for a full 30 minutes during which time there shall be no drop in the water's level.

In the event that the Engineer decides that additional tests are needed, such as an air smoke test on the drainage system, the Contractor shall perform such tests without any additional cost to the Owner.

5.7 Pressurised System Test

Upon completion of the plumbing installation and of the roughing-in and before setting fixtures, the entire piping system shall be tested at a hydrostatic pressure one and a half times the nominal working pressure in the system in operation, and proved tight at this pressure for at least 8 hours. The nominal working pressure is 10 bar.

Where a portion of the piping system is to be concealed before completion, this portion shall be tested separately at a pressure similar to that described for the entire system and in the presence of the Engineer.

5.8 Manholes

Where applicable manhole shall be constructed from concrete in accordance to the line and grade shown in the Drawing.

Concrete work shall be formed, places and cured in accordance with Technical Specification TS 3. The steps shall be placed and embedded as indicated by the Drawing.

Clean out shall be installed for the sewer system smaller than 150 mm dia., for each plate easily to be stacked.

Where the pipe cannot be laid through the manhole, the base shall be carefully formed so as to make invert channels for the sewers.

After Installation, any manhole cover or inlet lid or grate which is not firmly seated and rocks in the frame, shall be replaced at the Contractors expense.

MP – 1515 – VENTILATION AND AIR CONDITIONING SYSTEM

1.0 DESCRIPTION OF WORK

This work shall cover the delivery, furnishing and installation conditioning system equipment as shown in the Drawings.

The work shall include installation, adjustment and commissioning.

2.0 REFERENCE STANDARDS

a. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

b. Japanese Industrial Standard (JIS)

c. Peraturan Umum Instalasi Listrik (PUIL)

d. Technical Specification AR-0914 – Painting

e. TS 3 Concrete Work

f. Technical Specification EL-1601 - Electrical Works.

3.0 GENERAL PROCEDURES

3.1 Technical Data

Contractor shall submit all required technical data concerning this work to the Engineer for approval prior to delivery. Technical data shall contain descriptions, characteristics, and installation and maintenance instructions.

3.2 Shop Drawing

Prior to installation, the Contractor shall prepare and submit Shop Drawings to the Engineer for approval.

The Contractor shall check all dimensions from the Drawings with the site condition. No claims will be allowed arising from the slight discrepancies between Drawings of other disciplines and/or measurements taken at the site of the project.

Shop Drawing shall include the following :

- Dimensions, sizes and layouts.
- Installation methods.
- Wiring diagram for each installation.

All documents shall be drawn up in accordance with models submitted to and approved by the Engineer.

4.0 Main Equipment

Split System Air Conditioning

Split system air conditioning units shall be of equipment which are factory assembled (provided with factory certificate) and shall consist of casing, coil condensate drain, fan and motor, cleanable filter, unit control, expansion valve, compressors, air cooled condenser, condenser fan and motor, pressure and capacity control.

The capacity and number of the unit shall be not less than as specified in the Drawings.

The air conditioning units shall be of Daikin product or approved equal.

Exhaust Fan

Exhaust fan shall be of wall mounted type or ceiling mounted type such as Sanyo or equal, with capacity and number as indicated in the Drawings.

5.0 CONSTRUCTION REQUIREMENTS

5.1 General

Prior to installation, the Contractor shall consult the Engineer or Drawings of other disciplines in order to determine the exact locations for installation.

The Contractor shall obtain this information from the Engineer before proceeding with any installation.

The Contractor shall carefully check space requirements with other Contractors to ensure that all equipment, pipes and others can be installed in the spaces allowed for them.

All required devices, controls and others under local regulations shall be furnished by the Contractor.

5.2 Mounting

Internal and external components of split units shall be mounted in accordance with the manufacturer's recommends in locations and in a manner approval by the Engineer.

5.3 Pipe Work

Location, arrangement and size of pipe shall be as specified by the air conditioning equipment manufacturer or as indicated in the Drawings.

Pipe work shall be constructed and installed in accordance with the manufacturer's instruction and the specified Drawings.

Pipe insulation shall be installed in accordance with the manufacturer's installation instruction.

Variation in size and location of pipe are not permitted without Engineer's approval.

5.4 Vibration Insulation/Absorption

All air conditioning units, exhaust fans and others which generate vibration must be fitted with a vibration insulation in accordance with the recommendations of the manufacturer.

The maximum vibrational peak speed shall not exceed 0.4 mm/set measured following a vertical axis.

5.5 Refrigerant Pipe Supports

Above ground refrigerant piping systems within buildings shall have hangers and supports as required by a applicable plumbing codes.

The necessary hangers and supports, including clamps, rod, angles and plates shall be in accordance with recommendation of the manufacturer or as approved by the Engineer.

Wood plugs will not be allowed.

5.6 Electrical Work

All electrical system such as cable, wiring diagram and others which shall needed in this works shall be installed in accordance with Technical Specification EL-1601.

5.7 Testing

On-site testing and balancing of the equipment is to be conducted in accordance with the best standard approved by the Engineer.

All the test requested will be made at the expenses of the Contractor who shall have to provide all the necessary materials and equipment for testing.

Each system shall be completely tested and balanced checking of :

a. Unit capacity

b. Air flow

c. Air temperature

d. Humidity

e. Noise and vibration level

f. Temperature control.

Test shall be conducted at approaching design full load.

All equipment shall be tested for electrical safety.

EL – 1601 – ELECTRICAL WORKS

1.0 DESCRIPTION OF WORK

The work shall cover all delivery, materials, labour, equipment, tools for the installation and satisfactory operation of all electrical works as shown in the Drawings and/or as specified herein for the Hydropower Station, Garage Guard House, Gallery and Dam Crest Lighting. This work shall include but not be limited to the following :

- Distribution panels and lighting panels at places as indicated in the Drawings.
- Installation of all lighting, socket outlets and accessories inside and outside the buildings.
- Cable feeder from the main distribution panel in the administration building in the Dam Management Complex (constructed under package 2) to the gallery panel.

Electrical installation for the generating equipment is specified elsewhere.

2.0 REFERENCE STANDARDS

a. Peraturan Umum Instalasi Listrik (PUIL-1987)

b. Peraturan Umum Instalasi Penangkal Petir (PUIPP-1983)

c. International Electrotechnical Commission (IEC)

d. Verband Deutscher Electrotechniker (VDE)

e. Japanese Industrial Standard (JIS)

f. Standar Industri Indonesia (SII)

g. British Standard (BS)

h. Section 3: Surface Earthworks.

3.0 GENERAL PROCEDURES

3.1 Samples, Technical Data and Material Lists

Prior to delivery, all samples and technical data/brochures of materials and equipment for this work shall be submitted to the Engineer for review and approval.

Contractor shall make a list of materials and equipment to be used and shall submit all those to the Engineer for approval.

3.2 Shop Drawings

The Contractor shall prepare and submit Shop Drawings of the electrical work to the Engineer for approval.

All Drawings shall be submitted sufficiently in advance of field requirements to allow ample time for checking and no claim for extension of the contract time will be granted to the Contractor by reason of his failure in this respect.

All submittals shall be complete and shall contain all required and detailed information.

In the event of any discrepancy between one Drawing and another or between the Drawings and this Specification, The Contractor shall bring such a discrepancy to the attention of the Engineer for resolution.

The Electrical Drawings generally indicate the location of materials and equipment, cable lane and connections.

These Drawings shall be followed as closely as possible. The Architectural, Structural and other Drawings of related trades, as well as all elements shall be checked for dimensions and clearances in preparing Shop Drawings.

The Contractor shall carefully check space requirements with other Contractors which might work at the same location to ensure that all equipment can be installed in the spaces allocated for them.

3.3 Delivery and Storage

All materials and equipment to be delivered shall be in good condition, new, free from any defect, and shall be completed with labels, technical data and other data required as specified.

All materials and equipment shall be orderly kept in their packages and shall be kept free from damage and humidity.

3.4 Non Conformity

The Engineer has the right to reject any material delivered or installed which does not comply with the specified Drawings and/or Specification.

The Contractor shall immediately correct and/or replace any work deemed inferior by the Engineer without any cost to the Owner.

If the submittals differ from the requirements of the Contract Documents, the Contractor shall make specific mention of such difference in a letter, with a request for substitution, together with its reason for same, in order that, if acceptable, suitable action may be taken for proper adjustment. Otherwise, the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract Drawings.

3.5 Other Requirements

The Contractor shall employ the necessary supervisors, electrical workers and labourers to complete the work in a timely manner and shall certify to their competency, if requested.

All materials, equipment and systems shall be installed in a workmanlike manner by skilled workman under the supervision of competent foremen who are thoroughly experienced in the class of construction work specified herein. The Contractor shall immediately correct any work deemed inferior by the Engineer.

The Contractor shall provide all tools, construction equipment, test equipment and make tests and keep records as specified herein.

To conduit the works, the Contractor must have installation passes (C class minimum), issued by PLN.

4.0 MATERIALS

4.1 Panels

All sub-panel frames and bodies shall be made from galvanized steel sheet in 1.6 mm thickness with dimensions as indicated in the Drawings.

Cubicle panel shall be of free standing-indoor type and wall mounted type made of steel sheet in 2 mm thickness with dimensions as indicated in the Drawings.

All panels shall have oven-baked coating with colour as specified in Colour Scheme.

Enclosure shall be gasketted for use in an industrial atmosphere. Hinged doors shall have keyed-alike flush type cylinder locks.

All components for all panels shall be of Telemecanique, Merlin Gerin, Siemens or approved equal.

Circuit breakers shall be of the mini circuit breaker and moulded case circuit breaker type unless otherwise noted in the Drawings.

Type and capacities of components shall be as specified and indicated in the Drawings and shall be suitable with the type of equipment to be installed.

Every panel shall be provided with power indicator lamps for every phase.

4.2 Cables

Cable feeder or multi-conductor cable for direct burial application at 600 V or higher shall be as indicated in the Drawings such as Kabelindo, Supreme or others equal.

Sizes shall be as indicated in the Drawings.

All single conductor cable for power, lighting and control circuits installed in conduit for operation at 600 V or below shall be NYY or NYM.

Sizes shall be as indicated in the Drawings.

Minimum cable cross section shall be 2.5 mm², except when otherwise indicated by the Drawings.

Cable colour code shall be as follow :

- Neutral : Blue
- Ground : Yellow with green stripe
- Phase : Red, Black, Yellow.

Cable splicing/terminating shall be from a good product such as 3M or Raychem, Supreme and shall be from the type suitable with the cable type to be spliced/terminated.

4.3 Raceways

Conduits

Cables leading to sockets, switches and lights shall be installed in a conduit of high impact heavy duty PVC type such as Ega, Clipsal, or approved equal and shall comply with BS 6099, with minimum diameter of 20 mm unless otherwise noted in the Drawings.

Conduits which shall be installed under floor up to 1.50 m outside the buildings shall be from PVC pipes of 5 kg/cm² working pressure and shall comply with JIS standard such as Pralon, Rucika or approved equal.

Diameter shall be as indicated by the Drawings.

Conduits which shall be installed underground across the road shall be of galvanized steel pipe class medium and shall comply with BS-1387 or SII-0161 standard, with diameter as indicated by the Drawings.

Flexible/corrugated conduit shall be of high impact PVC such as Ega, Clipsal or approved equal, and shall comply with BS 6099.

Flexible conduit shall be suitable for tropical climate, and shall be hard to break, dustproof and waterproof.

Cable Trays

Cable trays shall be made of galvanized perforated steel in shape, type and size as indicated in the Drawings. Cable trays shall be from an approved product, such as Nobi or equal.

Flush Floor Trunking

Flush floor trunking shall be constructed from 1.6 mm and 2.5 mm thick galvanized sheet steel, such as FXT 280/2 type by Ega or approved equal. This flush floor trunking shall be provided with suitable accessories recommended by the same manufacturer.

Wall Trunking

Wall trunking shall be used to distribute power, data and telecommunication services around and through buildings from power source to service outlet. Wall trunking shall be made from uPVC, such as Assembly E type by Ega or approved equal.

4.4 Outdoor Lighting

HRC 511 luminaire for HPL-N 80 W lamp including ballast and capacitor with power factor 0.85, shall be manufactured by Philips or approved equal

Lighting poles shall be made from galvanized steel pipe such as TSL 10S type by PPI or approved equal.

4.5 Indoor Lighting

The Electrical Drawing indicates the types of lamps used for different way of mounting:

Surface Mounting:

TL'D 1 x 36 W, which shall include all component such as ballast, starter and capacitor, which capacity shall be sufficiently high to obtain the power factor of 0.85 - 0.95. The lamps shall be manufactured of Philips or approved equal.

Downlight SL 18 W shall be of Philips product or approved equal. Colour of downlight fixture shall be in general white, except differently specified by the Engineer.

Baret Type TL'D 36 W shall be of circular type, manufactured by Philips, or Artolite or approved equal.

These ceiling lights shall be provided with suitable ring, made by the same manufacturer in colour as specified by the Engineer.

Incandescent fixture 60 W lamps shall be of rectangular type, provided with acrylic cover and lamp holder.

The armature shall be the product of Philips, or Artolite, or approved equal.

Spot Light 100 W shall be of incandescent type, and manufactured by Philips or approved equal.

Colour of fixture shall be in general white, except differently specified by the Engineer.

Recessed Mounting

Recessed lamps shall be product of Phillips or approved equal.

Suspended Mounting

Suspended Lamps shall be product of Philips or approved equal.

4.6 Exit/Emergency Lamp

Exit/emergency lamps shall have the following specifications :

- 2 x 8 W fluorescent lamps,
- Battery 2.4 V 4AH high temperature nickel-cadmium,
- Single rate constant current,
- 2 hours duration,
- Surface mounting direct to wall or ceiling,
- A test switch to simulate mains failure,
- Having a red light emitting diode indicates supply healthy and charging is on, as monitoring, such as TEJ 208 by PNE or approved equal.

4.7 Sockets, Switches and Plug

Socket outlets with side earthing contacts, shall be of flush mounting type (complete with box) and shall comply with CEE 7 standard, such as MK, Clipsal, Legrand product or approved equal.

Minimum capacity of each socket shall be 250 V 10A/16A.

Sockets which shall be placed at 30 cm from floor shall be provided with cover and shall be of waterproof type.

Switches shall be of flush mounting type (complete with box) with minimum capacity of 10 A and shall comply with BS3676, such as MK, Clipsal, Legrand or approved equal.

Switches shall be placed 150 cm above floor, unless otherwise indicated in the Drawings.

Unless otherwise noted, all sockets, switches and plugs shall be of white colour.

4.8 Supports

All necessary supports for equipment installed under this Specification shall be provided.

Supports shall consist of steel frames, plates, brackets, racks and other shapes of adequate size and shall be fastened with bolts, screws or by welding, to rigid supports.

5.0 CONSTRUCTION REQUIREMENTS

5.1 General

Power Supply

Distribution of power supply shall be radial system, 220 V and 50 Hz.

Power shall be distributed the interfaces with PLN as shown on the Drawings.

Protection

Electrical system shall be provided with protection device against short circuit, at lighting panels; protection device against overload and short circuit,

at main distribution panels and power panel, except otherwise indicated in the Drawings.

All non-current carrying metal parts of electrical equipment and installations shall be connected to the ground loop as required by the Drawings.

These will include, but not necessarily be limited to building structural columns, track, lightning arresters, raceways, electrical equipment enclosures, ground bus, transformers, motor frames and others.

Grounding system shall be in accordance with Peraturan Umum Instalasi Penangkal Petir (PUIPP) and Technical Specification EL-1652.

5.2 Panels and Components

Prior to fabrication of panels, Contractor shall submit detailed Shop Drawing to the Engineer for approval

Panels shall be fabricated and installed to places as indicated in the Drawings.

All circuit breakers, overload devices, protective relays and timer shall be set in accordance with notations in the Drawings and/or Engineer's instruction.

All cabinets of control panel, power panel, circuits breaker, safety switches and other electrical equipment, if not identified by factory, shall be furnished and attached with nameplates for identification.

The name plate/directory at each panel board shall be neatly marked showing the destination of each circuit installed. Name plate shall be made of metal plates with embossed letters. Name plates shall be sized of 1,5" (3,81 cm) height with necessary width. Letter heights shall be of 1,0" (2,54 cm).

Name plate thickness shall be 3 mm minimum. Name plates shall be installed in such a way that they remain strongly in place.

Labels shall have to be written in Bahasa Indonesia.

Pullboxes and cabinets shall be inspected for size and number of conduits, conductors and conductor configuration.

Each panel shall be grounded with maximum 2 ohms. Grounding system is PNP, complying with PUIL-1987.

Each panel shall be provided with wiring diagram and directory card which shall be mounted on the inside of the door panel.

The card shall be completely filled out by the Contractor, listing all connected loads.

Each panel of each door shall be connected with grounding cable to the panel enclosure.

At all entrances to panel boards, pull boxes, or outlet boxes without threaded hubs or based, conduit runs shall be secured in place with galvanized lock nuts outside the box and lock nuts and bushings on the inside. Bushings shall be of the insulating type.

Each panel shall be provided with surge arrester lightning protection and installed at places as indicated in the Drawings.

5.3 Cable Installation, Outdoor and Indoor

Outdoor

Installation of cables underground shall be carried out in such a way that the cables are protected against mechanical and chemical damage which might happen where the cables are to be buried.

Cables shall be buried in accordance with the Drawings.

Cables which shall be buried across the road shall be placed in a galvanized steel pipe as specified in point 4.3. of this Specification.

Installation shall be in accordance with the Drawings.

All excavation, trenching and backfilling work shall be carried out in accordance with Technical Specification TS 3.

All disturbed surfaces shall be restored to original condition, and properly installed to eliminate any settlement.

Position of buried cables shall be marked with strong signed poles from steel plate and support.

Each cable feeder which shall need to be spliced shall be furnished with a suitable splicing kit.

Indoor

A conduit system shall be furnished and installed as required by the Drawings. This system shall connect all outlet boxes (including sockets and switches), junction boxes, lighting fixtures, panel boards, cabinets and others as indicated in the Drawings.

Field bends and offsets shall be uniform and symmetrical, without conduit flattening or finish scarring.

Field bends shall be made with standard tools and equipment manufactured specifically for conduit.

Cables leading to sockets, switches, lamp points and equipment, whether on the walls or over the ceilings, shall be placed in a conduit as specified in this Specification.

Wherever conduits are run on the walls they shall be spaced out, not mounted directly on the surface, except otherwise specified in the Drawings.

All horizontal conduits shall drain toward the vertical conduit to which they are connected.

All conduits installed in floor slabs shall be PVC pipes, except otherwise as indicated in the Drawings. Types of PVC pipes shall be as specified in this Specification.

Conduits installed in floor slabs shall have a minimum cover of 50 mm.

All splices and/or taps shall be made only in approved junction or terminal boxes.

Cable connection at busbar terminal shall be furnished with cable lug,

5.4 Testing, Commissioning and Inspection.

The contractor shall, upon completion of the works and before acceptance, perform complete functional operating tests of all systems governed by this section in the presence of the Engineer.

All systems and equipment shall be demonstrated to function in accordance with their intent and the requirement of this specification.

The contractor shall furnish all required instruments and personnel for the tests and maintain the test equipment and apparatus in an approved condition at all times during the tests.

Test records shall be maintained by the contractor and formally transmitted to the Engineer prior to final acceptance of the facility,

Testing and commissioning shall be determined by the Engineer.

Test (except high-potential tests) shall be completed with all switchboards, panel boards, fuse holders, switches, fuses and overcurrent devices in place.

All circuits shall be tested and operated to demonstrate the followings:

- Proper phase sequences and correct motor rotation.
- Circuit continuity and intended operation.
- To be free of grounds.
- To be free from shorts.

All equipment shall pass functional test.

Insulation resistance of all major electrical equipment such as rotating equipment, transformers, circuit breakers, switchgear and control centres shall meet or exceed minimum acceptable standards as specified for the equipment tested.

The contractor shall be responsible for replacement of any damaged or defective fixture, including glassware, plastics or diffusers up to the time of final inspection and acceptance by the Engineer.

Contractor shall submit to the Engineer all equipment's original manual operation and maintenance book, in English and Indonesian, which will be forwarded to the Owner.

5.5 Cleaning Up

The Contractor shall at all times keep the premises free from accumulation of waste material or rubbish caused by his employees or work. At the completion of work, he shall remove all his rubbish, tools, scaffolds and surplus materials from and about the site, leaving his work clean and the areas ready for occupancy.

EL – 1652 – LIGHTNING PROTECTION AND GROUNDING SYSTEM

1.0 DESCRIPTION OF WORK

The work shall cover the furnishing and installation of lightning protection and grounding system as shown in the Drawings and/or as specified herein.

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

- Lightning rod
- Base and supports
- Copper conductor
- Earthing box
- Grounding rod
- Conduits
- Lightning Arrestors
- Potential Equalisation Bars

2.0 REFERENCE STANDARDS

a. Peraturan Umum Instalasi Listrik (PUIL-1987)

b. Peraturan Umum Instalasi Penangkal Petir (PUIPP)

c. British Standard (BS)

d. Japanese Industrial Standard (JIS)

e. International Electrotechnical Commission (IEC).

3.0 GENERAL PROCEDURES

3.1 Sample and Technical Data

Prior to delivery, all samples and technical data/brochures of materials and equipment for this work shall be submitted to the Engineer for review and approval.

If the submittals differ from the requirements, the Contractor shall make specific mention of such difference in a letter, with a request for substitution, together with its reason for this, in order that, if acceptable, suitable action may be taken for proper adjustment.

Otherwise, the Contractor will not be relieved of the responsibility for executing the work in accordance with the Drawings.

3.2 Shop Drawing

The Contractor shall prepare and submit Shop Drawings of the electrical work to the Engineer for approval.

All Drawings shall be submitted sufficiently in advance of field requirements to allow ample time for checking and no claim for extension of the contract time will be granted to the Contractor by reason of his failure in this respect.

All submittals shall be complete and shall contain all required and detailed information.

In the event of any discrepancy between one Drawing and another or between the Drawings and this Specification, The Contractor shall bring such discrepancy to the attention of the Engineer for resolution.

The Drawings generally indicate the location of materials and equipment, cable lane and connections.

These drawings shall be followed as closely as possible. The Architectural, Structural and other Drawings of relates trades, and all elements shall be checked for dimensions and clearances in preparing Shop Drawings.

3.3 Delivery and Storage

All materials to be delivered shall be in good condition, new, free from any defect, and shall be completed with labels, technical data and other data required as specified all materials shall be orderly kept in their packages and shall be kept free from damage and humidity.

3.4 Non Conformity

The Engineer has the right to reject any material delivered or installed which does not comply with the specified Drawings and/or Specification.

The Contractor shall immediately correct and/or replace any work deemed inferior by the Engineer without any cost to the Owner.

4.0 MATERIALS

Refer to section 5.0. of this Specification.

5.0 CONSTRUCTION REQUIREMENTS

5.1 System

The system to be applied is the cable on ridge (primary protection) and secondary protection systems.

The Contractor shall complete all necessary equipment and fixtures, in order to get the best and complete system.

5.2 Primary (External) Lightning Protection System

The lightning spikes/rod shall be made from copper material connected to 2.5 cm diameter galvanizing pipe fastened with bolt and nut.

Lightning rod which are located due to the Drawing shall be grounded with 50 mm^2 bare copper conductor and grounded in grounding boxes.

The joints between copper conductors shall be a copper clamp screw type, and shall have minimum resistance.

5.3 Grounding and Bonding

The grounding rod of minimum diameter 2 cm with length as shown on the Drawing shall be made of galvanised steel pipe class medium of BS-1387/SII-0161 standard and/or PVC pipe of 5 kg/cm^2 working pressure, and shall be furnished with copper, or steel plated by 2.5 mm copper grounding electrode.

The grounding rod complete with grounding electrode shall be buried underground, as shown on the Drawing.

The ground resistance at grounding box shall be less than 2 ohm measured on dry condition or after 2 days without rain.

The grounding system shall have a hand hole (test point) for measuring purposes as indicated in the Drawings.

A perimeter grounding around the building shall be constructed as indicated in the Drawings.

Hand hole shall be constructed of masonry with a concrete plate cover in sizes as indicated by the Drawings.

At the bottom of the hole shall be placed a sand layer of minimum thickness 15 cm or as specified in the Drawings.

The building steel construction and the electrical system grounding shall be connected with the lightning grounding as indicated in the Drawings.

Connection of grounding wires shall be made completely both electrically and mechanically.

Down conductor which going down shall be clamped as specified in the Drawings.

All non-current carrying metallic bodies, such as pipe stacks, air handling equipment, pumps, etc. shall be bonded and grounded to the ground loop or to nearest grounding bus in the equipment room.

5.4 Testing and Inspection.

The whole installation must be inspected mechanically and electrically.

Each grounding box shall reach 2 ohms earthing resistance in dry soil condition.

CS – 0304 – PRECAST CONCRETE

1.0 DESCRIPTION OF WORK

The work shall consist of constructing and placing of precast concrete material of dimension and shape in accordance with the Drawings.

It shall include but not be limited to the following :

- Supply of material, labour, equipment and tools,
- Excavation and backfilling to the acceptance of the Engineer.

2.0 REFERENCE STANDARDS

a. Peraturan Beton Bertulang Indonesia (NI-2, 1971).

b. Persyaratan Umum Bahan Bangunan di Indonesia (PUBI).

c. Standar Industri Indonesia (SII).

d. TS 2 Earthworks

e. TS 3 Concrete Works

f. TS 8 Handling and Erection of Precast Concrete Units.

g. Technical Specification AR-0404 - Cement Mortar.

3.0 GENERAL PROCEDURES

3.1 Technical Data.

Technical data of specified materials shall be submitted to the Engineer for approval, prior to delivery and installation.

Technical data shall show type/shape, dimension, manufacturer's installation instruction and all information required for installation and erection.

3.2 Shop Drawing.

The Contractor shall submit Shop Drawings which shall show details, placing diagrams, instructions and notes on materials, finish and others in accordance to the lines, elevations of the Drawings and shall be approved by the Engineer.

4.0 MATERIALS

All precast concrete materials shall be of concrete with minimum quality of K-250.

All reinforcing steel shall be deformed bars as specified in Technical Specification TS 3.

Cement mortar for sealing joint shall comply with Technical Specification AR-0404.

5.0 CONSTRUCTION REQUIREMENTS

5.1 General.

All excavation shall be made to the required depth and dimensions as shown by the Drawings.

The foundation where the precast concrete materials will be set or located shall be properly tamped and layered with sand blinding layer.

Prior to placing of the precast concrete, all the requirements in the Drawings shall be followed.

Compaction procedures shall be in accordance with TS 2 Earthworks.

5.2 Drainage Installation

The forms shall be set so that the drain is inverted and top of walls shall conformed to the desired lines and grades.

All weep holes and inserts shall be formed or block out as shown by the Drawings or as directed by the Engineer.

Both side walls shall be brought to the level of the back of shoulder, except where it shall be reduced in height to accommodate a cover slab and/or where the side wall adjacent to shoulder is raised to form a curb.

Backfill shall be immediately placed after the placing of precast concrete drain and shall be tamped to the level of the top of the drain.

The distance of the backfill from the edge of drain wall shall be in accordance to the direction of the Engineer.

All precast concrete drain shall be placed at designated interval as shown in the Drawings.

All joints shall be 2 cm spaced and sealed tightly with 1 : 3 mix of cement mortar and/or as directed by the Engineer.

All cover slabs shall be furnished at particular locations as determined by the Engineer.

EO – 1 ENGINEER'S OFFICE AND FACILITIES

1.0 GENERAL

This specification covers the requirements for the Engineer's office and facilities described in Sub-Clause 1.9.7 of the Specification.

Standards for materials and workmanship shall be in accordance with the relevant clauses of applicable sections in divisions B and C of the Specification.

The layout, design and details of all facilities to be provided in accordance with Sub-Clause 1.9.7 shall be subject to the Engineer's approval.

At the sole discretion of the Engineer, alternative designs and specifications may be considered. Proposals for alternative designs shall not be of a lesser quality then specified hereunder and shall be based on the principle of providing high quality facilities for the duration of the Contract.

All linear dimensions in this specification are in mm unless otherwise noted.

2.0 GENERAL REQUIREMENTS FOR BUILDINGS

2.1 Structural Design

Unless otherwise specified for individual buildings, the following requirements shall be considered for the design and construction of buildings.

2.1.1 Foundation

Continuous inverted T-type reinforced concrete footing, 150 mm thick stem with variable height, stem embedded portion 10 cm below ground level, 450 mm wide × 200 mm thick slab; 100 mm thick cobblestone base with 50 mm thick levelling concrete provided beneath slab; top elevation of stem same as the finished floor level.

2.1.2 Floor Slab

h. Before placing the floor slab the foundation shall be excavated, trimmed and thoroughly compacted. The floor slab shall consist of a 70 mm thick concrete slab, single steel wire mesh reinforcement 4.5 mm diameter, 100 mm × 100 mm mesh spacing, 150 mm compacted sand layer, polyethylene damp-proof sheet on compacted ground surface, total thickness 220 mm.

i. Outside concrete slab around buildings shall conform with the requirements of the floor slab except that the damp-proof sheeting shall be ommitted.

2.1.3 Wall and Partition Wall

a. Timber-frame construction in general. Light steel angle construction where particularly requested.

b. Outside wall, furring, cement sheet 6 mm with watertight joints, vinyl emulsion paint finish.

c. Inside wall panel for dry places shall be water proof plywood 8 mm thick, oil paint mat finish.

d. Wall panel for toilet room, shower room, kitchen shall be cement sheet, 6 mm thick, vinyl emulsion paint finish.

e. Toilet booth shall be plastic laminated plywood.

f. Shower booth shall be water proof plywood sheathing, building paper, lathe board, cement plaster, ceramic tile finish.

2.1.4 Roof

a. Corrugated cement sheet, with timber gable board, facia board and waterproof plywood plancier, oil paint mat finish.

b. Projection of gable shall be not less than 900 mm and the projection of eave not less than 1000 mm.

2.1.5 Ceiling

a. Ceilings for offices and meeting rooms shall be acoustic rockwool tile.

b. Ceiling for pantry kitchen, toilets, and ablution areas shall be plywood sheathing 6 mm thick, vinyl emulsion paint finish.

c. All other ceilings for corridors and lobbies shall be semi-hard fancy fiber board.

2.2 Doors

2.2.1 General

a. Except as otherwise specified, all doors shall be wooden doors with both sides flush with weather-proof plywood having lacquer paint finish and furnished complete with all accessories. Door closers and fly screens will be fitted as directed.

b. Doors shall be located as required in consultation with the Engineer shall comprise double swinging or double leaf acting doors, 1,600 W × 2,100 H; single swinging doors, 900 W × 2,100 H for kitchen, toilets and shower rooms only.

2.2.2 Special Doors

Waterproof plastic laminated plywood shall be used for toilet booth door as follows:

a. single swinging for toilet booth, Asian commode, 700 W × 2,100 H; and

b. single swinging for toilet booth, European commode, 700 W × 2,100 H.

2.3 Windows

2.3.1 General

Windows shall be furnished with aluminium sash (casement window), sliding (double sliding) with clear or frosted sheet glass 5 mm thick, fastener and fly screen. Safety steel grill shall be installed as directed.

2.3.2 Sizes

Window sizes shall comply with the following

a. offices, sitting room, dining room, living room, bed room, kitchen, store, prayer room and ablution area shall be 1,200 – 1,800 W × 1,200 H: and

b. toilet, shower, kitchen/pantry shall be 1,200 W × 500 H.

2.4 Floor Finish

a. Office rooms, meeting room, sitting room, living room, dining room, bedroom, kitchen/pantry room shall be vinyl title;

b. Store, kitchen, corridor, porch, shall be terrazo tile;

c. Toilet, ablution and shower room shall be mosaic tile; and

d. Garage and warehouse, and exposed surfaces of footing concrete shall be cement render.

2.5 Lighting and Socket Outlets

2.5.1 Lighting Levels

The brightness of rooms of buildings as measured 700 mm above the floor shall be as follows:

a. 250 lux : offices and meeting rooms

b. 150 lux : living room, dining room, lobby, sitting rooms

c. 75 lux : bedroom, store, prayer room, kitchen/pantry, bed rooms, lounge room.

d. 50 lux : toilet, shower, ablution, corridor

2.5.2 Lighting Fixtures

a. Indoor lighting fixtures shall be ceiling mounted fluorescent lamp (F.L.) 18 W, 36 W high efficiency tube, without cover except cases as specified elsewhere.

b. The outdoor entrance illumination shall be a wall mounted fluorescent lamp, 1 × 36 W, water proof type.

2.5.3 Socket Outlets

Socket outlet shall be standard Indonesian type, 1 kW rated and shall be earthed.

3.0 REQUIREMENTS FOR PARTICULAR BUILDINGS AND FACILITIES

3.1 Office Building

3.1.1 Ceiling Height

2,900 for office room

2,700 for toilet and kitchen/pantry

3.1.2 Doors

3 – Double swinging, 1,600 W × 2,100 H with fly screen for entrance

2 – Single swinging, 900 W × 2,100 H with fly screen for entrance

5 – Single swinging, 900 W × 2,100 H for rooms

3 – Single swinging, 700 W × 2,100 H for toilet rooms.

Doors to exterior and offices shall be lockable and master keyed

3.1.3 Windows

14 – Sliding, 1,800 W × 1,200 H with fly screen and venetian blind

2 – Sliding, 1,200 W × 1,200 H with fly screen and venetian blind

14 – Hanging, 1,800 W × 1,200 H with fly screen and venetian blind

2 – Sliding, 1,200 W × 500 H with fly screen and venetian blind.

3.1.4 Toilet Room

3 – Commode, western, low cistern,

3 – Urinals

2 – Wash-basins with mirrors and comb racks,

Venetian blinds on all windows

3.1.5 Pantry/Kitchen

Service desk, sink, cabinet.

3.1.6 Air-Conditioners

8 – 1,600 kcal.h – 2,000 kcal.h sized and located as required.

3.1.7 Lighting

As specified in Clause 2.5.

3.1.8 Electric Socket Outlets

24 located in consultation with the Engineer.

3.2 Dormitory

3.2.1 General

The dormitory shall be a building to provide air-conditioned accommodation at the site for 5 persons and shall include the following features:

- 5 bedrooms
- Lounge room
- Toilets
- Bathroom
- Corridor
- Verandah

3.2.2 Ceiling Height

2,700 for private room

2,500 for toilet and shower

3.2.3 Doors

Single swinging, 900 W × 2,100 H with fly screens for entrance and veranda.

Single swinging, 700 × 2,100 H for toilet room.

Doors to exterior and private rooms shall be lockable and shall be master keyed.

3.2.4 Windows

Sliding, 1,200 W × 1,200 H with fly screens, curtain rail with curtain in private rooms.

Sliding, 790 W × 365 H with fly screen for shower room and toilet room.

3.2.5 Toilet Room

Western commode, low cistern, shower tray, shower head, curtain rail with curtain, wash basin with mirror and comb rack. Electric water heater installed outside building.

3.2.6 Electric Water Heater

1 unit of 150 litres.

3.2.7 Electrical Fixtures

a. Private room

1 × 36 W F.L. per room

1 – socket outlet

2 – socket outlet lounge room standard socket outlet

b. Toilet

1 – standard socket outlet

Outlet room

c. electric outlet for water heater: 1 – 3-pin type

3.2.8 Corridor

Minimum width 1,500 mm

3.3 Garage

3.3.1 Floor

The garage room floor shall consist of 200 mm compacted sand and a 100 mm thick concrete slab with reinforcement bars D6 at 150 mm both ways, single layer.

3.3.2 Structure

The structure shall be a timber frame wall construction with light steel or wood roof framing.

3.3.3 Garage Wall

Cement sheet sheathing without inside wall panel on 3 sides only.

3.3.4 Garage Entrance

Non-door, head clearance 2,700.

3.3.5 Electrical Fixtures

a. Pendant Light Fitting

b. 3 socket outlets

3.3.6 Finish

The garage wall shall remain unpainted.

3.4 Warehouse

3.4.1 General

The warehouse shall be a building to provide storage for core logs, general items and equipment handed over by the Contractor under the terms of the Contract. The warehouse shall be complete, lockable and secure and divided by a partition wall into two rooms one of which shall be air-conditioned.

The non-air conditioned room shall be provided with a table 3,000 x 1,000 for core logs and timber shelving.

The air-conditioned room shall be provided with timber shelving for storage of equipment and temperature/humidity-sensitive items.

3.4.2 Construction

General requirement for building construction are specified in Clause 2.0 of this Technical Specification.

3.5 Tennis Court

3.5.1 Size and Type

The tennis court shall be a single standard international-size clay-surfaced tennis court complete with all surface markings and net and maintenance equipment.

3.5.2 Fence

The tennis court shall be surrounded by a 5,000 high chain link fence and shall include a lockable, chain link-clad, gate.

3.6 Volley Ball Court

3.6.1 Size and Type

The volley ball court shall be single standard international-size with a grass-surfaced and shall be complete with a net. No fence is required.

3.6.2 Construction

The court shall be accurately shaped to provide a uniform surface for playing and shall be sloped to surrounding shallow surface earth drains to prevent ponding of water and to ensure rapid drying following rain.

3.7 External Works

3.7.1 Roads

All roads in and around the Engineer's site office and facilities shall be sealed.

3.7.2 Paths

All foot paths in and around the Engineer's site office and facilities shall be sealed.

3.7.3 Drainage and Landscaping

The entire area surrounding the Engineer's site office and facilities shall be graded to shed water to a system of surface drains which shall remove water from the site. No area shall permit water to pond.

Grass, shrubs and trees shall be planted to enhance the area.