SECTION 6600 ARCHITECTURAL FINISHING

6601 General

(1) General

This Section shall covers all architectural finishing works in the building.

(2) Scope of Works

The Contractor's scope of work shall include design, manufacture, delivery to Site and installation required for the Architectural finishing which should include but not be limited to the following:

a. Doors, windows and louvers
b. Floor finish
c. Roof waterproofing and insulation
d. Ceiling
e. Building appliances
f. Interior and exterior walls finishes

(3) Applicable Codes and Standards

The Contractor shall comply with applicable Codes and Standards. The codes and standards of the following are specifically applicable to the design, manufacture and testing of the work included in this Specification:

AA	Aluminum Association, U.S.A
AAMA	Architectural Aluminum Manufacturers Association, U.S.A.
ACI	American Concrete Institute
AMCA	Air Movement and Control Association, Inc. U.S.A.
ANSI	American National Standards Institute Inc.
ASTM	American Society for Testing Materials
NFPA	National Fire Protection Association, U.S.A
BS	British Standards

6602 Submittals

The Contractor shall submit the following to the Engineer for written approval before ordering materials and commencement for the relevant item of finishing work:

a. Manufacturer's literature, giving a materials description, color charts, details of fixings, preparation of the background and range of accessories together with recommendations for good workmanship practice.
b. Samples of each type of finish and materials from the manufacturers or Contractor produced range as requested by the Engineer to enable the selection of quality, color, pattern and the like.

c. Engineering calculations supporting the design in conformity with this specification.
d. Certification of test results and label of materials conforming to cited requirements and standards.
e. Shop drawings shall provide all information required at site for construction and shall include full details regarding dimensions, recesses, openings, embedded parts, reinforcements, etc.
f. Shop drawings, showing complete details or fabrication of panels, supports, frames and accessories including elevations, plan views, full size details and fastening methods for this complete scope of the works. The shop drawings shall be prepared in conformity with the best modern practice and with due regard to practicability and economy in fabrication and erection.
g. As-built drawings shall be submitted with soft copy as required by the Engineer.

6603 Doors

(1) Design Load

All doors shall be designed and provided by the Contractor and meet the following minimum requirements:

(a) Wind Load:
Exterior doors shall be designed to withstand a minimum wind pressure of 80 kg/m^2 and interior doors 40 kg/m^2, uniformly applied over the entire area of the door. The maximum deflection of the door under wind pressure loading shall be l/120 of the width span.

(b) Operating Load:
All exterior doors shall be designed to operate under a minimum of 50 kg/m^2 load uniformly applied over the entire area of the door.

(2) Swing Hollow Metal Doors

(a) Hollow Metal Door Usage
(i) Exterior Doors:
Seamless hollow steel construction, with 1.6 mm face sheets and additional tubular reinforcement at head, hinged jamb and lockets or push-pulls and prepared for surface hinges and through bolted to door, unless otherwise indicated.
(ii) Interior Doors:
Seamless hollow steel construction, with 1.27 mm face sheets and additional channel reinforcement at head and prepared for mortised hinges, unless otherwise indicated. Class II doors shall be used for all interior door locations. Class I door shall be used for all exterior door locations. Class I doors shall also be used for interior doors that are exposed to heavy traffic areas, doors that are exposed to abusive usage or doors that are exposed to extreme difference in room pressure.

(b) Hollow Metal Door Type

The doors shall be flush types. Vision light shall be used when desired for a safety reason or required for a plant operating reason i.e. to view what is on the opposite side of the door when the door is in the closed position.

(c) Materials

Face sheets shall be roller-leveled or stretcher-leveled prime quality cold-rolled carbon steel. Stiffeners, reinforcing and other accessories shall be prime quality carbon steel. Glazing shall be as follows.

a. Glazing shall conform to the applicable requirements of ANSI Z 97.1.
b. Normal door glass shall consist of minimum 6 mm thick clear polished wire glass.
c. Glazing compound shall be in accordance with manufacturer recommendations.
d. Setting blocks and spacer shims shall be made of neoprene rubber and shall be provided as recommended by the glass manufacturer

The door frames for hollow metal doors shall be steel channel frames (ASTM A36) or pressed metal frames (prime quality cold rolled carbon steel). Where a fire rated frame is required the frame construction shall be used. Hardware for the door shall include locks, butts, closures, holders, panic devices etc. The fasteners shall be type 304 stainless steel for doors. Brass fastener may be used for interior doors when approved by the Engineer. All hardware shall meet the Engineer's prior approval.

(d) Door Construction Details

(i) General Provision:

a. All doors shall be seamless hollow steel construction conforming to ANSI A123.1, with each door formed from two face sheets of steel. No seam shall occur on the door faces or sides. The top and bottom of the door shall be closed and the internal construction shall consist of steel rib stiffeners.
b. All doors provided in the air-conditioned room should be insulated with fibrous glass or mineral wool of 48.00 kg per cubic meter density, having Underwriters Laboratories certification for the service.

(ii) Door Details:

a. Bottom Clearance: Shall be maximum 3 mm between bottom of door and finish floor.
b. For doors with Full Mortise butts: Doors and frames shall be mortised to receive butts.
c. Bottom Drips: Shall be provided on all exterior doors.
d. Straggles: Shall be provided on the active leaf of all double doors.
e. Door Stop Seals: Shall be provided on all doors.
f. Glazing Details: Shall be provided with fixed glass stop on the exterior side and removable glazing bead on the interior side of a door.

(e) Door Treatment

(i) Exterior Doors

Both sides of face sheets, all surfaces of internal stiffeners, reinforcing, etc. and all other

steel accessories forming an integral part of the door shall be hot-dip galvanized in accordance with applicable requirements of ASTM A123, A153, A385, A386 and other applicable ASTM Standard Specifications for hot-dip galvanizing of materials. The minimum weight of galvanizing shall be that for G90. Poorly galvanized work will be rejected.

Alternatively a painting scheme as specified in the Specification S-440 shall be considered.
After fabrication of the door is completed, all exposed surfaces shall be properly cleaned and shall receive primer paint baked on at 150°C for not less than one-half hour.

(ii) Interior Doors

a. Inside surfaces of doors shall be treated, before fabrication, with a rust inhibitor, as approved by the Engineer.
b. Exposed surfaces of doors shall be treated with Bonderite after fabrication.
c. Primer paint shall be applied and baked on at 150°C for not less than one-half hour.

(3) Wooden Doors

(a) General

a. Wooden doors shall be used for office, toilet and light duty interior door.
b. Timber shall be sound, well conditioned, properly seasoned to suit the particular use and free from the fungus.
c. Samples of wood are to be submitted to the Engineer for approval and the timbers used throughout the Works are to be equivalent in all respects to the approved samples having particular regard to consistency of grain and color.

(b) Suitable Timbers

Unless otherwise approved by the Engineer timber shall be used in the locations as follows.

Locations	Timber grade
(1) Door Frames	1st grade hard wood
(2) Internal doors	1st grade hard wood
	1st grade faces of double wood
(3) External doors	1st grade hard wood
(4) Doors to toilet and showers	15mm plastic faced plywood
	(Weisboard or similar approved)

(c) Decorative Plastic Laminate

Decorative laminated plastic sheeting shall be "Formica" brand 1.5 mm thick. Color and type shall be approved by the Engineer.

(d) Pressure Impregnation

The Contractor shall treat cut ends and notches, etc. made on site with a brush applied preservative recommended by the manufacturer. Wood staining and finishing is specified

under Painting and Decoration.

(e) Fixing Materials

All nails, screws, bolts and nuts shall be sufficient size and strength and be adequately spaced to ensure that all lumber works and joinery works shall be carried out in the best possible manner.

(f) Priming

Priming paint shall be provided to protect from weather and damage.

(g) Ironmongery

(i) General

All ironmongery shall be fixed with matching screws and shall be properly fitted and lubricated to ensure proper operation. All ironmongery is to be first class quality to the Engineer's approval. Brass shall be used as approved by the Engineer.

(ii) Hinges

Door hinges shall be 100 m x 75 mm stainless steel. They shall be fixed with 30 mm long stainless steel screws. Hinges for shower and toilet cubicle doors shall be 75 mm x 40 mm heavy pattern stainless steel hinges. They shall be fitted with stainless steel screws.

(iii) Door Closures

Door closures shall be "Yale Concord" or equal. Both items shall be satin aluminum finished. External doors opening outwards shall be fitted with a back check door closer.

(iv) Door Handles

Door Handles shall be stainless steel. They shall be fixed with stainless steel through bolts.

(v) Bolts

Bolts of various types shall be heavy brass pattern with brass shoots and brass plates or sockets; bolts to floor shall have brass sockets slotted into the floor.

6604 Windows

(1) General

All exterior windows shall be either sliding or bottom-hinged, side-hinged or fixed aluminum windows having floated glass glazing.

(2) Design Loads

(a) Wind Loads:

Design wind loads shall be 100 kg/m^2.

(b) Wind Load Design:

Unless otherwise indicated, all windows and window frames in exterior walls, including mullions, connections, fasteners and other accessories, shall be designed to withstand the specified wind loads over the entire area of each window, without permanent distortion and without exceeding allowable unit stresses and allowable deflections. Allowable unit stresses shall conform to the applicable requirements of AA Specifications for Aluminum Structures. Allowable deflections shall be 20 mm maximum.

(3) Hollow Metal Window

(a) Height and Length

Height and length of any windows shall be determined from lighting and ventilation point of view, but not to exceed 1.5 m in height and 0.8 m in length for a single continuous window unless otherwise indicated. Sizes of windows shall be designed and standardized based on the approved shop drawings.

(b) Vents

Entire area of each window shall be operable and shall open out to an angle of 45 degrees to provide a free-air opening of approximately 75%, except where windows are indicated to be fixed.

(c) Window Components

The minimum thickness of any structural component of the window framing, vents, etc. shall be not less than 3 mm.

(d) Window Framing and Hinge Material

Extruded aluminum, Alloy 6063 or approved equal, with T-temper as required for the service and with anodized finish.

(e) Flashing

a. Aluminum alloy Alcad 3004 or approved equal and not less than 3 mm thick.
b. Weather-stripping
c. Vinyl rubber bulb seal.

(f) Fasteners

Shall be # 14 self-tapping screws made of Type 304 stainless steel, cadmium plated, with bonded combination stainless steel and neoprene washers. Spacing of fasteners shall be 30 cm O.C. maximum.

(g) Glazing

(i) Materials

Clear Float or Polished Plate Glass;

Clear float or polished plate glass shall comply with BS 952 Party 1M, Table 1. The thickness shall be not less than 6 mm.

Wired Glass;
Wired glass shall comply with BS 952 Part 1M Table 4. The thickness shall be not less than 4 mm.

Mirrors;
The glass shall be 6 mm thick silvering quality float glass silvered one side, copper backed, varnished and painted. Edges of mirrors shall be beveled.

(ii) Seal
All glazing shall be sealed with vinyl rubber bulb seal all around, between the glazing and the sash, to obtain Weather tightness.

(iii) Fastening
Fastening of glazing sheets shall be by continuous clamping action around the edges of each sheet and no holes shall be pierced to the sheets. Clamping action shall maintain the sheets in place under a load equal to at least twice the design load, but shall also permit for proper expansion of the sheet. For fastening panels to supports, fasten to vertical mullions of windows with aluminum cap mullion strip designed to permit expansion of panels and fasten to horizontal members of windows with Type 304 stainless steel self-tapping screws, cadmium plated, with bonded combination aluminum or stainless steel and neoprene washers.

(iv) Cleaning
All glazing sheets shall be cleaned of all labels, dirt, paint etc. and washed cleanly inside and outside, just prior to hanging of sash in window openings.

(v) Broken Glass
Contractor shall replace all glasses broken during construction at no cost to Engineer.

(h) Erection
All windows shall be set plumb, level, square and shall be continuously caulked to provide weather tight seal at all joints between frames and siding, masonry, concrete or grits with silicone rubber sealant per manufacturer's recommendation.

6605 Louvers

(1) General

The location and the area of the louvers shall be determined by ventilation requirements.

(2) Louver Type

All louvers shall be fixed type.

(3) Design Loads

(a) Wind Loads

All exterior louvers shall be designed for a wind load of 100 kg/m^2.

(b) Wind Load Design

Unless otherwise indicated, all louver and louver frames in exterior walls, including connections, fasteners and other accessories, shall be designed to withstand the specified wind loads over the entire area of each louver, without permanent distortion and without exceeding allowable unit stresses and allowable deflections. Allowable deflections shall be 20 mm maximum.

(4) Design Requirements

(a) Free Area

The free area shall be 45% minimum as determined by using the equation in AMCA Standard 500.

(b) Pressure Drop

Both the intake and exhaust static pressure drop through a louver with an interior screen shall not exceed 3.8 mm WG (water gauge) at a velocity of 240 m/min through the free area when tested according to AMCA Standard 500, Figures 5.4 and 5.5 (wall mounted).

(c) Water Penetration

Water penetration of a louver shall not exceed 60 and 250 cc of water per m^2 of free area in 15 minutes, at free area velocities of 240 and 300 m/min, respectively. The water flow rates and length of time for each test shall be the minimum values specified in AMCA Standard 500.

(d) Louver Size

Louvers and louvers frames shall be 15 cm in depth. The maximum louver width shall be limited to 0.90 m and the maximum louver height shall be limited to 2.00 m for a single louver.

(e) Screens

All Louvers shall be provided with aluminum insect screens.

(f) Assembly

Welding and/or mechanical fasteners shall assemble louvers.

(g) Louver Blades

Louvers shall have drainable blades.

(h) Louver Mullions

Horizontal and vertical louver mullions shall be provided as required.

(i) Mounting Angles

Shall be continuous aluminum mounting angles as required. When using vinyl gaskets for sealing, the mounting angles shall be grooved for permanent insertion of seals.

(5) Materials

(a) Louver Frames and Blades

Louver frames and blades shall be extruded 6063-TS aluminum alloy or approved equal. The minimum thickness of louver frame and blades shall be 3 mm or approved equal.

(b) Screens

Screen frames shall be 6063-TS extruded aluminum with a minimum thickness of 2 mm, and shall be re-wirable. The screens mounted on the interior or exterior faces of louvers shall be 19 mm meshes. Wire shall be aluminum with 2.3 mm diameter intercrimped at 6 mm intervals.

(c) Seals

Blade and jamb seals shall be vinyls.

(d) Fasteners

Fasteners used in the assembly of louvers shall be stainless steel.

(e) Finishes

General Provisions:

a. Each louver shall have a fluoropolymer finish, with color matching the adjacent wall.
b. Louver mullions and exterior screens shall have the same finish and color as the louver.
c. Screen assembly shall be painted prior to installation to louver frames.
d. Mounted angles and interior screens shall be mill finished.

Fluoropolymer Finish:

This finish shall be a polyvinylidene fluoride coating containing a minimum of 75% Kynar 500 resin or approved equal. The coating shall be oven baked in accordance with the manufacturer's printed procedures.

(6) Installation

The installation of louvers shall be in strict accordance with louver manufacturer's printed instructions. Louver frames shall be continuously caulked externally and internally. An acceptable alternate to interior caulking is either extruded vinyl bulb gaskets or sealing tape.

6606 Floor Finish

(1) General

Floor finishes shall be applied in the various locations based on these criteria. Separate concrete floor finishes shall not be applied until all machinery and equipment is in place. Where floor drains are required in monolithic or separate finish a 3 mm slope per 30 cm in the finish floor from high point of floor to floor drain shall be used.

(2) Types of Floor Finish

(a) Ceramic Tiles

(i) Requirements:

a. Ceramic tiles shall be prime quality and tile color; size and pattern shall be approved by the Engineer.
b. The tiles shall be soaked and bedded on a prepared screed, in 1: 3 by volume cement sand mortar with thickness of 10 mm. The tiles shall be laid square and true with 3 mm wide joint's grouted in matching cement mortar.

Provide bonding adhesive as specified.

The Contractor shall include all cutting and fitting tiles to abutments and protecting floor tiles after laying. The surface of the background shall be keyed or otherwise prepared in accordance with the tiling manufacturer's instructions. All tiles shall be bedded solidly by evenly applied pressure over the tile to ensure that the whole tile is properly fixed. Excess bedding material shall be removed from the face of the tile immediately after installation. The tiles shall be polished washed and left clean on completion.

(ii) Uses:

a. Pump room
b. Auxiliary substation
c. Toilet
d. Shower room
e. Pantry

(b) Terrazzo Tiles Flooring and Skirting

(i) Requirements:

a) Terrazzo floor tiles

They shall comply with approved standards and sizes. They shall generally be e 300 x 300 x 20 mm thick or 200 x 200 x 20 mm thick or 200 x 200 x 25 mm thick with a ground, grouted and polished surface to a fine grit finish. The wearing face of tiles shall be plain, free from projections, depressions and cracks. All angles shall be right angles and all arises shall be true and sharp. Color and texture of terrazzo tiles shall be as per the standard approved by the Engineer.

b) Terrazzo Skirting

Terrazzo skirting shall be supplied by the same manufacturer as the tile manufacturer. Color and texture of terrazzo skirting shall match the one of floor tile and approved by the Engineer. Terrazzo skirting shall be 100 mm high, fixed to the wall in accordance with manufacture's instructions.

c) Terrazzo Tread Unit for Stair

Tiles or treads units for stair treads shall have reinforced nosing and shall be specifically formed to the profile of the stairs. The tread unit shall incorporate a proprietary non slip tread insert.

(ii) Uses:

a. Office Areas
b. Hall, corridor and stair
c. As indicated on the drawings approved by the Engineer

(iii) Installation:

All sub-surfaces to receive terrazzo tiles flooring shall be examined by the Contractor to ensure that they are in proper conditions. Starting of work in any area shall constitute acceptance by the Contractor for such surfaces as being satisfactory, and any defects resulting from use of such accepted surfaces shall be corrected without additional expense to the Engineer.

6607 Interior and Exterior Wall Finish

(1) General

Interior and Exterior Walls Finish shall be applied in the various locations based on the criteria. The following interior and exterior walls finish works are specified in the relevant standard specifications:

a. For brick and plaster works, see Section 6200
b. For painting works, see Section 6500.

(2) Wall Tiles

a. Ceramic wall tiles shall comply with BS 1281 or approved equal and shall be 150 x 150 mm or 200 x 200 mm, 6 mm thick.
b. Rounded edge tiles shall be used on all external angles and unprotected ends of tiling.
c. The backing for wall tiles shall be cement, lime, sand, and plaster 1:1:6 applied in one 10 mm thick coat with a slightly scratched finish. Tiles shall be fixed to this backing with an approved adhesive. All tiles shall be aligned properly, with straight joints in even widths determined by the spacers in the title.
d. Tiles shall be grounded as separate operation after the adhesive has set.

6608 Roof Waterproofing and Insulation

(1) General

Roof waterproofing shall be constructed with the layers of (from the bottom), steel trawled mortar on roof slab, water proofing membrane, heat insulation board (50 mm thk) concrete cover and finished with cement mortar tile (30 mm thk.) with cement mortar base. Aluminum flashing shall be fixed to the edge of waterproofing on the parapet wall in order to apply asphalt caulking. Corner drain for rain water down pipe shall be installed as per the approved drawings. The water proofing system shall be guaranteed for a period of 10 years.

(2) Insulation

The insulation materials shall conform to BS 3837:1977, expanded polystyrene boards or approved equal. It shall be either type A, grade UHD (moulded boards with skins) or type A, Grade SHD (extruded brands with skins) having a standard dimensions of 1250 x 600 x 50 mm. The insulation shall be 50 mm thick having minimum density of 32 kg/m3 calculated as per BS 4370 method 2 and thermal conductivity of 0.028 W/mk calculated as per BS 4370 method 7. The insulation materials shall be approved by the Engineer.

(3) Installation

Waterproofing system and insulation system shall be installed by an approved specialist and the application shall in all respects conform to BS Code of Practice No. 144 Part 3. The surface to be waterproofed shall be rendered and cleaned of all loose material, dirt, dust, etc. and a mortar shall be finished smooth by trawling. The screed shall then be cured and dried. The surface treated with waterproofing coating shall be covered by insulation, and laying of 200 x 200 x 30 mm thick white cement tiles bedded and jointed on 20 mm mortar over 50 mm screed.

6609 Ceiling Work

(1) General

This section covers acoustical ceiling and louvered grid ceiling, including supports and accessories. Exposed tee suspended acoustic tile ceiling shall be used for the other area such as office, conference room, manager's room and control room etc.

(2) Materials

(a) Exposed Tee Suspended Acoustical Tile Ceilings

One of the following types and makes with lay-in units, installed in exposed painted metal grid suspension system.

(i) Suspension System:

a. Exposed tee system, direct hung, with interlocking cross tees and all required accessories.

b. Exposed tee system, snap lock, direct hung, with interlocking beam cross tees and all required accessories.

(ii) Tile:

a. Incombustible mineral fiber, 60 cm x 60 cm x 1.90 cm, shadow line panel, glacier pattern, non-directional with aluminum foil back.

b. Incombustible mineral fibber, 60 cm x 60 cm x 1.90 cm, reveals edge, texture-tone pattern, and non-directional with aluminum foil back.

(b) Anchorage of Hanger

Steel sub-framing: Continuous hanger support steel sub-framing, spaced 1.20 m on centers for acoustic tile ceiling shall be welded in place to the structural supports. Anchorage of hanger to concrete with sleeve type or self-drilling anchors will not be permitted.

(c) Tie Wire

18-8 stainless steel, 1.587 mm or equivalent approved by the Engineer.

(d) Hanger

All hangers shall be galvanized. Minimum size of galvanized annealed wire hangers shall be 2.8 mm for acoustic tile ceilings. The hanger size for each location shall be as required by the weight of the suspended ceiling and spacing of the hangers. Provide extra hangers at each corner of the light fixtures and as required for the Work, so that there are at least two additional hangers for each 1.20 m length of light in addition to the regular grid system hangers.

(3) Election

(a) General Provision

Erection of all acoustical ceilings shall conform to the applicable requirements of ANSI or BS Standard Specifications and to the requirements herein specified. The ceiling grid and fixing system shall be designed and installed in a manner that will allow ready access for ease of maintenance.

(b) Suspension System

a. Acoustical lay-in type ceilings shall be unrestrained perimeter construction, providing freedom of movement at intersections with walls.

b. Hangers shall be of ample length and shall be attached to the overhead construction in such a way that the ceiling is securely and rigidly braced and supported so that it will not sag or become displaced as a result of either downward load or upward pressure. Attachments shall develop the full strength of each hanger.

c. Main tees shall be spaced not more than 60 cm apart with outer lines not more than 20

cm from walls and parallel thereto. Tees shall extend to within 25 mm of walls at ends and shall be continuous for their full length. Splices shall be made with manufacturer's standard splicers.

d. For furring, cross tees shall be erected at right angles to main tees and spaced as required by the ceiling layouts. Cross tees shall be securely attached to the main tees at each crossing by special clips or by saddle tying.

(4) Clean Up

After ceiling work has been completed, all rubbish shall be removed, surfaces of ceiling panels and trim shall be cleaned and floors shall be left clean.

6610 Building Appliances and Specialties

(1) General

This shall include contractor's furnishing and installing complete kitchen units and lockers as indicated on the general arrangement drawings.

(2) Kitchen Unit

Kitchen unit shall be provided to the pantry room. The unit shall include but not limited to the following including all accessories:

a. Electric cooking range with two burners.
b. Stainless steel sinks and counter top with bottom cabinet.
c. Upper cabinets

Install kitchen unit completes with all plumbing connections, all electrical wiring, switches etc. integral with equipment and ready for plug-in to electrical outlets and all conduit and outlet boxes as required. The color of the appliance cabinets and counters will be selected by the Engineer.

6611 Quality Assurance/Quality Control (QA/QC)

The QA/QC procedures shall include the requirements defined in this specification, but not limited to, such as:

a. Shop drawings and related documents
b. Fabrication, manufacturing and shop testing
c. Packing and shipping
d. Erection and installation procedures
e. Tolerance
f. Tests at site
g. Commissioning and cleaning.

6612 Measurement and Payment

(1) Doors, Windows and Louvers

Measurement for payment will be based on the number of square meter (interior or exterior). Measurement for payment for windows and louvers of each type furnished and installed as approved by the Engineer will be made on the square meter installed, including flashing on all sides. Payment will be made at the Contract unit price per unit of each type furnished and installed. The unit price shall include but not be limited to all labour, design, accessories, caulking painting, galvanizing, cleaning and testing etc. as required for complete installation of each of the items.

(2) Floor Finish

Measurement for payment will be based on the number of square meters of each thickness and type of floor finish installed as approved by the Engineer. Payment will be made at the Contract unit price per square meters of each type furnished. The unit price shall include but not be limited to all labour, reinforcing steel, insulation, concrete etc. as required to complete the work as required by the Engineer or as indicated on the approved drawings.

(3) Floor and Wall Tiles

Measurement for payment will be based on the number of square meters of each type of Tiles furnished and installed as approved by the Engineer. Payment will be made at the Contract unit price per square meters of each type of tile furnished and installed. The unit price shall include but not be limited to all labour, cutting materials including, adhesives, grouts, etc. as required for complete furnishing and installation of work as required by the Engineer or indicated on the approved drawings.

(4) Roof Waterproofing and Insulation

Measurement for payment will be based on the number of square meters of built-up waterproofing and insulation as installed and as approved by the Engineer. Payment will be made at the Contract unit price per square meter of each type furnished and installed. The unit price shall include but not be limited to all labour, materials including accessories, mortar screed, etc. as required for complete furnishing and installation of the Work.

(5) Ceiling Work

Measurement for payment will be based on the number of square meters of each type of ceiling installed as approved by the Engineer. Payment will be made at the Contract unit price per square meters of each type of ceiling furnished and installed. The unit price shall include but not be limited to all labour, cutting, materials, etc. as required for complete furnishing and installation of work.

SECTION 6700 LIGHTING, SOCKET OUTLETS AND LIGHTNING PROTECTION SYSTEMS

6701 General

(1) General

a. This Section covers technical specifications for the lighting, socket outlets and lightning protection systems in the building.
b. The concerning Sections or Sub-sections of Division 9, Electrical Works shall be applied to this section.

(2) Scope of Works

The works shall include designing, transportation of the materials, installation, adjustment and testing of lighting and socket outlet works interior and exterior of the building.

a. Interior lighting covers all interior illuminations of the pump house.
b. Exterior lighting covers the area light for around the pump station and floodlight for external plant area.
c. Emergency lighting covers the emergency lights for interior of the pump house.
d. Socket outlet system shall include general use and maintenance use outlets.
e. Power distribution boards for the systems shall be included.
f. All feeders and branches cables and wiring shall be included.
g. Lightning conductors and air terminals

6702 Outline of Lighting and Socket Outlet System

(1) General lighting system

All areas or rooms of the pumping station building will be equipped with general lighting and systems as mentioned herein after.

(a) System composition

The system will consist of general lighting fixtures, emergency lighting fixtures, distribution boards, control system and wiring.

(b) Lighting intensity

Designed lighting intensity and installed fixture type are as shown on the following table.

Schedule for Lighting intensity and fixture

Type of room/area	Lighting Intensity (lx)	Fixture Type
Office	300	A
Conference room	300	A
Manager room	300	A
Rest room	200	A
Control room	300	A
Workshop	300	B
Pump room/maintenance area	250	D and B
Toilet	200	B
Corridor	200	B
Electrical room/area	300	B
Mechanical room/area	150	B or C
Cable chamber	100	B
Gate area	150	E
Pumping station site	50	F

(2) Emergency lighting system

The emergency lighting fixtures are installed into all interior area or rooms of the building to prevent darkness by the general lighting failure. The emergency lighting fixture is ceiling or wall surface mounted type for incandescent lamp powered by centrifugal battery system. Designed lighting intensity of the emergency lighting is 50 lux for every escape root in the building.

(3) Control method of the lighting system

The general lighting fixtures installed into the separate room are turned on or off by the local lighting switch in each room. The other general lighting fixtures or fixtures installed in pump room, mechanical or electrical rooms, public rooms such as corridor or toilet, basement and exterior area are turned on or off by the remote control switches located in suitable locations. Each remote control switch will control a magnetic contact relay installed in branch circuit for the fixtures in distribution board.

(4) Socket outlet system

All interior rooms or areas are equipped with general use socket outlets to power supply for small electrical consumers. Additionally two types of special purpose socket outlets are installed into pump house, maintenance area, workshop and basement. The general use socket outlet is 2-pole plus earth pole and 220 V, 15 amp, wall surface flush mounted type. The special purpose socket outlets are specified as follows. One is single phase 220 V, 30 amp and the other is three phase 380 V, 20 amp and these outlets is set in wall surface mounted metallic cabinet of IP 51.

(5) Distribution board

For supply power to these lighting fixtures and socket outlet the lighting distribution board is installed in each floor of the building. The distribution board is composed with main circuit breaker, branch circuit breakers, earth leakage current relays, magnetic contact relays and voltage indication lamps. The molded case circuit breaker is adopted for main and branch breakers. To automatic control of exterior site lighting a photocell switch and time switch will be provided to branch circuits of the site lighting fixtures.

6703 Lamps and Lighting Fixture

(1) General Requirements

a. Lamps and lighting fixture shall be of commercial standard types and shall be furnished and installed as required.
b. Lamps of the proper type, wattage and voltage rating shall be furnished and installed in each fixture.
c. Lamps shall be delivered to the Project locale in their original numbers and installed in the fixtures just prior to completion of the Project.
d. Fluorescent lamp shall be of the suitable type for use with glow start gear.

(2) Lighting Fixtures

a. All lighting fixtures shall be suitable for trouble free operation in the system voltage specified, and complete with all internal wiring.
b. Accessories such as strap, mounting plates, nipples or brackets shall be provided for proper installation.
c. All fluorescent high intensity discharge lamp fixtures shall have power factor of not less than 85%.
d. All fluorescent fixture shall be furnished with start gear, lamp-holder and fluorescent lamps.
e. Diffusers of fluorescent fixtures shall be of the best quality material guaranteed against discoloration in the climatic conditions of the site.

(3) Types of lighting fixtures

Types of fixtures shall be as follows:

(i) Fixture (TYPE – A)

a. Type	: Ceiling surface mounting type
b. Lamp	: Fluorescent lamp: 2 x 32W or 3 x 32W
c. Housing	: Sheet steel, stove enameled high reflectance white acrylic paint (IP 51)
d. Cover	: Metallic low brightness louver

(ii) Fixture (TYPE – B)

a. Type	: Surface mounting open type
b. Lamp	: Fluorescent lamp: 1 x 32W or 2 x 32W
c. Housing	: Sheet steel, stove enameled high reflectance white acrylic paint (IP 51)

(iii) Fixture (TYPE – C)

a. Type	: Pipe pendant type
b. Lamp	: Fluorescent lamp: 1 x 32W. 2 x 32W
c. Housing	: Sheet steel, stove enameled high reflectance white acrylic paint (IP 51)
d. Cover	: White lamella reflector

(iv) Fixture (TYPE – D)

a. Type	: High ceiling mounting type
b. Lamp	: High pressure sodium lamp: 1 x 400W
c. Housing	: Aluminum with wide beam type (IP 51)
d. Cover	: Metallic reflector
e. Others	: Ballast enclosure shall be built-in to the fixture

(v) Fixture (TYPE - E)

a. Type	: Flood light fixture
b. Lamp	: High pressure sodium vapor lamp: 1 x 400W
c. Body	: Die cast aluminum (IP 65)
d. Cover	: Wide range grass cover

(vi) Fixture (TYPE – F)

a. Type	: Pole top mounting area light fixture
b. Lamp	: Low pressure sodium vapor lamp: 1 x 125W
c. Housing	: Opal white, acrylic plastic (IP 65)
d. Pole	: Tapered hot dipped galvanized steel pole (4.0m)

(vii) Fixture (TYPE – G)

a. Type	: Wall surface mounting fixture
b. Lamp	: Fluorescent lamp: 1 x 32W
c. Housing	: Opal white, acrylic plastic (IP 65)

(viii) Fixture (TYPE – H)

a. Type	: Wall surface or ceiling surface mounting fixture
b. Lamp	: Incandescent lamp: 1 x 100W
c. Housing	: Metallic (IP 51)
d. Cover	: Open types (No cover)

6704 Ballast

(1) Fluorescent lamp ballast

a. Transformer portion of ballast with rated secondary voltage exceeding 300V shall be both leakage and insulated types.
b. Live Parts and iron core of ballast housed in a fireproof case; except fireproof casing will not be required when ballast built into fixture and windings are covered with fireproof materials.
c. Windings and adjacent fibrous insulating material completely treated with insulating varnish or other approved materials.
d. Metal, other than iron core and stainless steel, shall receive rust inhibiting coating.
e. Terminals: Comply with the following:
f. Grounding Terminal: Brass screw or bolt-nut, 4-mm diameter minimum.
g. Other Terminals: Same as grounding; except in case of press set screw 3.5 mm diameter minimum.
h. Terminals, except grounding, securely mounted to withstand by itself a tensile load of 2 kg applied gradually to plane on which it is mounted in direction perpendicular to said plane.
i. Ballast with rated voltage of leads or terminals exceeding 150V shall have grounding terminal mounted on case or other suitable locations; not required for ballast built into fixtures.
j. Capacitor used as a part of ballast shall be furnished with a proper discharging device which will reduce terminal voltage of capacitor to 50 V or less within 1 minute after breaking of power-supply circuit.
k. Secondary voltage of any ballast shall be within 90 to 110 percent of rated value marked on ballast.
l. Input current and input power of ballast shall be within 90 to 110 percent of values marked on ballast.
m. Power factor of any ballast shall be not less than 0.85.
n. Noise generated by any ballast shall not be sufficient to cause trouble when functioning when the rated input voltage and the rated frequency is applied between input terminals of a ballast associated with reference lamp as load.

(2) High pressure sodium lamp ballast

a. Live parts and iron core of ballast shall be housed in a rain-tight case.
b. Insulating materials used in or adjacent to windings shall be class A (105℃)
c. Metal, other than iron core and stainless steel shall receive rush inhibiting coating.
d. Grounding terminal shall be mounted on case
e. Performance of the ballast shall comply with the following:
- Secondary voltage of ballast comprising a transformer shall be within range of 90 to 110 percent of indicated value; and shall be not less than starting voltage of the lamp.
- Secondary short-circuit current of the leakage transformer shall not exceed 115 percent of rated value.

- Input current and input power shall be within range of 90 to 110 percent, respectively, or marked values.

f. Ratio or lamp current and lamp power of ballast shall be as follows:
   - Lamp Current: Less than 110 percent of indicated value.
   - Lamp Power: More than 92.5 percent of indicated value.
   - Power-factor shall not be less than 85 percent.

g. The ballast shall have a solid-state igniter/starter with an average life in the pulsing mode of 10,000 hours at an igniter/stator case temperature of 90℃.

h. Insulation resistance between live parts connected together and non-live metallic parts and between primary and secondary windings of insulated type transformer shall not be less than 50 Meg ohms.

6705 Switches

a. Remote control switch shall be used in fish market hall with remote control relay and shall have the following specifications.
   - Remote Control Switch - ±24V input signal
   - Manufacture – Matsushita or approval equal

b. Local Switches
   Toggle Switches: Toggles switches shall be totally enclosed with thermosetting plastic and a mounting strap.

   Wiring terminals shall be of the screw type side wired. Switches shall be quiet-motion types, rated as AC 230 volts, 15 A with the current rating and number of poles indicated. The mounting height of all switches other than ceiling switches shall be approximately 1.4 meters.

6706 Socket outlets

Type: Wall surface flush mounting pin type, 2-Poles and neutral
Ratings: AC 220 V, 10 A

6707 Execution

a. Install lighting fixtures and accessories per shop drawings as approved.
b. Securely attach fixtures to structure by means or methods only as approved and at locations and to supporting construction or members only as approved.
c. Fixtures unless otherwise specified, shall be supported by means of heavy factory formed steel straps attached to the outlet boxes, attached by means of thread stem with lock nuts or by means of machine screws to formed straps.
d. Pipe pendant type fixtures shall be supplied with swivel hanger canopy and conduit stems.

6708 Measurement and Payment for Lighting and Socket Outlets Systems

a. Measurement and payment will be based on the number of lighting fixtures or socket

outlets

b. Payment will be made at the Contractor unit price of each type furnished and installed.
c. The unit price shall include but not limited to all labor, design, fixture, ballast, lamps, supporting devices switches, outlet boxes and etc. as required for complete installation of each of the items.

6709 Lightning Protection System

(1) General

This Section covers the technical requirements for the materials, workmanship, fabrication and installation works for the Lightning Protection for the Pump house.

(2) System Requirements

(a) Outline of the system

The system shall consist of air terminals, lightning conductors and down conductors. The air terminals shall be installed on the roof of the pump house and connected by the lightning conductor with each other. The down conductors shall be connected between roof lightning conductor and underground grounding conductor specified in Division 9, Sub-Section 9705 of this specification.

(b) Air terminals

Air terminals shall be made of copper tubular or solid rod sized to be as follows in minimum.

(i) For tubular rod

Diameter: 16 mm, Wall thickness: 0.8 mm, Height: 750 mm

(ii) For solid rod

Diameter: 10 mm, Height: 750 mm

(c) Lightning conductor

Shall be made of copper solid tape sized to be 2 mm of thickness and 25 mm of width in minimum.

(d) Down conductor

Shall be made of copper stranded bare cable sized to be 50 mm^2 in minimum.

(e) Installation

a. Air terminal shall be installed every corner of roof eaves.
b. Air terminal shall be installed every 600 mm in maximum along the eaves of roof.
c. Air terminal shall be installed along the centerline of the roof each interval of 15 m in maximum.
d. All air terminals installed on the roof shall be connected by the lightning conductor.

e. Down conductor shall be installed at each corner of roof connecting the lightning conductor and grounding conductor.
f. Other three down conductors shall be installed against the long sidewall of the pump house, or one is to East Side wall and two is to West Side wall.
g. Connection method shall be as follows.
   - Air terminal and lightning conductor: by bolt connection
   - Air terminal and down conductor: by bolt connection
   - Lightning conductor and down conductor: by bolt connection
   - Down conductor and grounding conductor: by welding
h. All conductors shall be securely fastened to roof or wall structure intervals not exceeding 1.5 meters.
i. Paint, lacquer, grease and other non-conductive coatings on surface of the conductors shall be removed from contact surface to assure good electrical continuity.

(3) Measurement and Payment for Lightning Protection System

Separate payment shall not be made for lightning protection work as such shall be considered lump sum works.