PÖYRY

ELLOMAY
Pumped Storage (2014) Ltd.

PSPP MANARA
156 MW

ISRAEL

PARTICULAR

CIVIL SPECIFICATIONS

TS-18 – Architectural Finishing

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TABLE OF CONTENTS

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1.0 First edition
2.0 Second edition: April 2019
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Note:

Owner means Owner/Employer and/or Owners Engineer (OE)

It is further hereby clarified that any approval/non-objection made by the Owner shall not, in any way, release the Contractor from any of its responsibilities and liabilities, nor shall it impose any obligation or responsibility on the Owner which fully relies on the Contractor's expertise. It is further clarified that in any event of Owner's reservations and/or comments, it shall be the sole responsibility of the Contractor to recheck and confirm any such comment.

The Owner disclaims any and all liability for any errors, inaccuracies or incompleteness contained in this document. To the extent that the terms and conditions set forth herein conflict with the terms and conditions of the EPC Contract Agreement and/or O&M Contract Agreement, as applicable, the terms and conditions of the EPC Contract Agreement and/or O&M Contract Agreement, as applicable, will prevail.

Notwithstanding anything to the contrary in this document or any other Project Document, the Design and Works and Services (as applicable) shall be done and executed in compliance and shall adhere to the Israeli applicable standards. Compliance with an applicable recognized international standard shall not in no way derogate from the above requirement to comply at all times with the Israeli applicable standards. In the event that no Israeli standard is applicable the Design and Works and Services (as applicable) shall be done and executed in compliance and shall adhere to the relevant standard specified in the list included in the general specifications (Volume 2 Section IV, Section VI of the RFP Documents).

1 SCOPE OF WORK

This specification covers the requirements for the execution of Architectural Finishing Works as specified, including supply of all plant, labor, equipment, appliances and materials, performance and completion of all works, and provision of all related services.

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

a) Doors

b) Windows

c) Louvers

d) Floor finish

e) Built-up roofing

f) Ceiling

g) Building appliances

h) Interior and exterior walls finish

2 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:

SII	Standards Institution of Israel
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
AWWA	American Water Works Association
LIA	Lead Industries Association, Inc. U.S.A
NAAMM	National Association of Architectural Metal Manufacturers, U.S.A
NEMA	National Electrical Manufacturers Association, U.S.A
NFPA	National Fire Protection Association, U.S.A
SSPC	Steel Structures Painting Council, U.S.A.
UL	Underwriters Laboratories, U.S.A
IEC	International Electro-technical Commission
BS	British Standard

The works shall comply with local Standards where available but shall be in no case of lower quality than the above mentioned standards indicate.

3 SUBMITTALS

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

- 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.
- Samples of each type of finish and materials from the manufacturers or Contractor produced range as requested by the Owner to enable the selection of quality, color, pattern and the like.
- Samples of each type of finish mounted on the correct background and each material in accordance with the specification. Sample panels shall be a minimum of 600 x 600 mm or a sufficient size, in the opinion of the Owner, to enable him to assess and establish the quality of workmanship. The Contractor must obtain the approval of the Owner concerning quality, application, jointing, evenness and workmanship before work commences. No subsequent work, which is substandard to the approved sample panel and material shall be accepted. Samples of larger units items such as building appliances and specialties should be available at the manufacturer’s and/or fabricator’s showroom to enable the Owner to access, and make selection of the item for approval.
- Engineering calculations supporting the design in conformity with this specification.
- Certification of test results and label of materials conforming to cited requirements and standards.

4 DRAWINGS

- After approval or comments by the Owner, all drawings shall be stamped as "Final Drawing Approved for Construction". Only drawings identified as such will be released on site for construction.
- Drawings shall provide all information required at site for construction and shall include full details regarding dimensions, recesses, openings, embedded parts, reinforcements, etc.
- 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.
- As-built drawings related to the works shall be submitted with soft copy.

5 DOORS

5.1 Design Load

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

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.

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.

5.2 Swing Hollow Metal Doors

5.2.1 Hollow Metal Door Usage

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.

Interior Doors:

Seamless hollow steel constructions, with 1.27 mm face sheets and additional channel reinforcement at head and prepared for mortised hinges, unless otherwise indicated. Doors shall comply to fire resistance F30 or F60 as required.

Class F30 doors shall be used for all exterior door locations. Class F60 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.

5.2.2 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.

5.2.3 Materials

Face sheets shall be roller-levelled or stretcher-levelled prime quality cold-rolled carbon steel.

Stiffeners, reinforcing and other accessories shall be prime quality carbon steel.

Glazing:

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.

Door Frames:

The frames for hollow metal doors shall be steel channel frame (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:

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 Owner. All hardware shall meet the Owner's prior approval.

5.2.4 Door Construction Details

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.

a) 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.

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) Astragals: 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.

5.2.5 Door Treatment

Exterior Doors:

a) 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 galvanised 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.

b) Alternatively a painting scheme as specified in the Specification S-440 shall be considered.

c) 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.

Interior Doors:

d) Inside surfaces of doors shall be treated, before fabrication, with a rust inhibitor, as approved by the Owner.

a) Exposed surfaces of doors shall be treated with Bonderite after fabrication.

b) Primer paint shall be applied and baked on at 150°C for not less than one-half hour.

5.3 Rolling Steel Doors

5.3.1 Shutter

Exterior Doors:

Shutter for external rolling steel doors shall be of interlocking slats, roll formed (not drawn) from not lighter than 1.27 mm hot-dip galvanized steel sheets of structural quality, conforming to the applicable requirements of ASTM A446 for Grade A steel, or better, with not less than G90 galvanizing. Galvanized surfaces shall be provided with phosphate coating for good paint adhesion (painting shall be also by this Contractor).

Interior Doors:

Shutter for interior rolling steel doors shall meet the same requirements as for exterior doors, except that slats shall be of manufacturer's standard gauge required for these doors.

Slats:

Slats of shutter shall be formed in easy curves without sharp bends, and shall be of the proper size and cross section to maintain the deflection within safe allowable limits. Assembly of slats shall be such that damaged slats can be removed and replaced easily.

Coiling:

Shutter shall be coiled on a steel pipe of sufficient size to carry the door load with vertical deflection not to exceed 0.80 mm per 300 mm of opening width, and evenly balanced with helical springs contained in the pipe. All springs shall be anchored to the tension rod, and held in position by the same adjusting wheel, which shall be accessible from the outside.

Weather Stripping:

a) Weather stripping shall be provided for all exterior doors, essentially continuous around each door, for an airtight and weather tight seal.

b) Rubber weather-stripping shall be provided on both sides of guides to reduce the infiltration of air around the ends of curtain. Rubber shall be not less than 1.60 mm thick. Weather-stripping shall be attached to guides with continuous flat bars arranged to permit replacement of worn weather-stripping.

c) Weather-stripping at door head shall be sheet rubber, not less than 1.60 mm thick; and shall be attached to head with a continuous flat plat to permit replacement of worn weather-stripping.

Bottom Bar:

The bottom bar shall be made of two structural steel angles complying with ASTM A36 or better, with hot-dip galvanized finish.

Combination Safety Device and Weather Seal:

a) Combination safety device and weather seal at the bottom of curtain shall be manufacturer's standard, with electrical control to stop and reverse curtain travel automatically. Weather seal shall be extended full length of the door to provide airtight and weather tight seal.

b) If any rolling steel door in closed position rests on the top of railroad track rails, which project above floor level, the combination safety device and weather seal shall be in three separate sections (from jambs to rails on both sides, and between rails) and shall extend to floor level. A cut-out in door at each rail shall be provided, with the width of cut-out equal to rail head width plus 50 mm and the height of cut-out equal to rail height above floor plus 75 mm. Reinforcement of door shall be made horizontally across cut-out sections, and loop type rubber astragals shall be provided projecting 75 mm below top of cut-outs when door is in open position.

5.3.2 Accessories

Coil Brackets:

Coil brackets shall be high-test grey iron castings of uniform texture, or fabricated from steel plate not less than 6.35 mm thick. All surfaces shall be smooth and even.

Hood:

Shutter coil shall be housed in a sheet metal hood formed from hot-dip galvanized steel sheets, the thickness not less than 0.635 mm, conforming to the applicable requirements of ASTM A525 for G90 coating class, or better. Galvanizing shall be treated for good paint adhesion as herein before specified for the shutter.

Separate galvanized steel sheet metal with baked enamel finish flashing shall be provided as indicated or as required on the approved drawings, to close the top of the hood tight against the adjacent wall or structure to provide a weather-tight seal.

Guides:

Guides shall be formed from structural steel complying ASTM A36 or better, to provide slots of sufficient depth to guide the shutter. Continuous locking bar shall be provided at each guide for anchoring windlocks. Guides shall be hot-dip galvanized.

Endlocks:

Malleable iron endlocks shall be provided on each slat for interior doors.

Windlocks:

Windlocks on each slat shall be provided regardless of width, for all exterior doors, and for interior doors where required.

Windlock capacity shall be as required for the wind load specified in Clause 3.1.1.

5.3.3 Motors

Electric motor operated rolling steel doors shall be used for large access openings.

5.3.4 Operators

Mounting:

Operators shall be bracket mounted on hood except operators for exterior mounted doors shall be wall mounted inside the building.

Gearing:

Operator gearing shall be high efficiency worm gearing, running in an oil bath, complete with spring-set 400 V or 110 V a-c solenoid operated brake, completely housed in an enclosure with a degree of protection of IP53 if located indoor and a degree of protection of IPW66 if located outdoor.

Motors and Controls:

a) Motors

Shall be designed for outdoor operation, high starting torque, hoist type, 400 V, three-phase, 50 Hz, squirrel-cage, of sufficient power to operate doors at an approximate speed of 0.3 m per second. For detailed electrical requirements see Part 5, Standard Specification E-218.

b) Pushbutton Stations

Unless otherwise indicated, each operator shall be equipped with a momentary contact heavy duty three-button pushbutton station, marked "OPEN" - "CLOSE" - "STOP" and with limit switches, of type acceptable to the Owner, which will stop motor at limits of travel. Reversing magnetic contactor complete with 400/110 V control transformer and thermal overload elements will be furnished by others. Pushbutton stations shall be for wall mounting, unless otherwise indicated.

c) Limit Switches

Shall be heavy duty type, in IPW64 as defined by IEC 529 or NEMA Type 4 enclosures for outdoor operation, with provisions for terminating Owner's conduit and conductor wires. Limit switches shall be rated for 0.5A inductive at 250V dc.

d) Control Circuits

Shall be suitable for 110 V a-c operation.

e) Emergency Chain Operation

Emergency hand chain operator, who will not affect the timing of the limit switch, shall be provided to operate each door in case of power failure or removal of motor for inspection and servicing.

5.3.5 Installation

Rolling overhead steel doors and door frames shall be installed by an installer approved by manufacturer, in strict accordance with manufacturer's printed instructions.

5.4 Wooden Doors

5.4.1 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 Owner 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.

5.4.2 Suitable Timbers

Unless otherwise approved by the Owner 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	15 mm plastic faced plywood (Weisboard or similar approved)

5.4.3 Decorative Plastic Laminate

Decorative laminated plastic sheeting shall be "Formica" brand 1.5 mm thick. Color and type shall be to the engineer's standard and to the approval of the Owner.

5.4.4 Pressure Impregnation

1) The Contractor shall treat cut ends and notches, etc. made on site with a brush applied preservative recommended by the manufacturer.

2) Wood staining and finishing is specified under Painting and Decoration.

5.4.5 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.

5.4.6 Priming

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

5.4.7 Ironmongery

1) 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 Owner's approval. Brass shall be used as approved by the Owner.

2) 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 cubicles doors shall be 75 mm x 40 mm heavy pattern stainless steel hinges.
- They shall be fitted with stainless steel screws.

3) Door Closures

External doors opening outwards shall be fitted with a back check door closer.

4) Door Handles

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

5) 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.

5.4.8 Quality Requirements

1) All timber shall be of sound stock, thoroughly seasoned treated with preservatives described below and well manufactured, free from warp or other defects, which would impair strength or durability. No timber should be used which has a moisture content of more than 19%.

2) All timber shall be treated with approved preservative solution to preserve against maestri penetration, fungal decay, insect and vermin attack and to improve the dimensional stability of the wood.

3) Chipboard shall be good quality particle board, resin bonded with a density of 7 kg/m3. Where veneered it shall have a local species of hardwood veneer if available fully bonded to the face and with a balancing veneer on the reverse side.

4) Hardwood for finishing shall be of a local species if available selected for straight grain and uniformity of color and texture. It shall have a wrote planed face on all exposed edges.

5) Plywood shall be good external or internal quality multiply depending upon location of finished product. Perfect face veneer shall be used for all work exposed to view.

6) Nails shall be steel, flat head.

7) Wood screws shall be steel, flat heads, slot drive.

8) Bolts shall be steel, zinc or cadmium plated.

9) Doors and door frames shall be proprietary types assembled at the manufacturer's premises before delivery to site.

10) The Contractor shall be responsible for taking all necessary measurements of the "hard" openings in which door frames and doors shall be installed before they are respectively fabricated or final dimensions dispatched to the manufacturer. Cutting or adapting items on site shall not be allowed and incorrect items shall be returned to the manufacturer for replacement.

11) Doors shall be in accordance particularly with the Owner's standards details when applicable.

12) All necessary mortising, tensioning, grooving, matching, tonguing, housing, rebating and all other work necessary for correct jointing shall be executed in a first class manner.

13) The joints shall be constructed exactly as shown on the drawing details (if any). Where joints are not specifically indicated they shall be the recognized forms of joints for each position.

14) Glued joints shall be executed with best quality animal glue, resistant to all forms of fungicide or insect attack.

5.4.9 Veneering

1) All interior doors shall be flush teak veneered on both side of the door as indicated and varnish finished except in the toilet area, the doors shall have plastic lamination on one side of the door.

2) The melamine or hardwood veneer shall be securely glued to the timber core using a melamine/urea-formaldehyde adhesive.

3) The veneer shall be checked for uniformity of color and texture. Doors, which in the opinion of the Owner have unacceptable variations in the color or texture of the veneer, shall be removed from site.

4) Edges and arises shall be neatly formed true and square with hair line butt joints.

5) All lumber shall be varnish finished.

6 WINDOWS

6.1 General

All exterior windows shall be either sliding or top-hung aluminium windows having float glass glazing.

6.2 Design Loads

Wind Loads:

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

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.

6.3 Hollow Metal Window

6.3.1 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 drawings.

6.3.2 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.

6.3.3 Window Components

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

6.3.4 Window Framing and Hinge Material

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

6.3.5 Flashing

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

6.3.6 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.

6.3.7 Glazing

1) Materials

a) 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.

b) Clear Sheet Glass

Clear sheet glass shall comply with BS 952 Part 1M Table 2. The thickness shall be not less than 4 mm.

c) Cast Glass

Cast glass shall comply with BS 952 Part 1M Table 3. The thickness shall be not less than 4 mm.

d) Wired Glass

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

e) 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.

f) Insulating Glass

Shall be minimum 25 mm overall thickness which consist of 6 mm grey tinted polished float glass with heat reflective coating outboard and 6 mm clear polished float glass inboard with 13 mm air space between. Insulating glass glazing shall be used for windows in air conditioned, control rooms etc.

2) Seal

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

3) 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.

4) 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.

5) Broken Glass

Contractor shall replace all glasses broken during construction at no cost to Owner.

6.3.8 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 girts with silicone rubber sealant per manufacturer's recommendation.

6.4 Wooden Windows

6.4.1 General

1) Joinery timber shall be sound, well-conditioned, properly seasoned to suit the particular use and free from the defects listed under carpentry timber. No timber should be used which has moisture content of more than 19%.

2) Hardwood for general joinery use shall be locally obtained hardwood if available unless specifically named in the contract documents or by the Owner. All samples of joinery timber shall be approved by the Owner.

3) Samples of hardwoods are to be submitted to the Owner for approval and the timbers used throughout the Works are to be equal in all respects to the approved samples having particular regard to consistency of grain and colour.

6.4.2 Fixing Materials

All mails screws, bolts and units shall be sufficient size and strength and be adequately spaced to ensure that all lumber work and joinery work is constructed in the best possible manner.

6.4.3 Priming

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

6.4.4 Ironmongery

1) All ironmongery shall be fixed with matching screws and shall be properly fitted and lubricated to ensure proper operation.

2) The window system shall include all matching hardware necessary for the efficient functioning of the windows. Fixings shall be concealed. They shall be to a design and finish approved by the Owner and shall include:

- Hinges
- Handles
- Retaining stays or brackets.

6.4.5 Quality Requirements

1) All necessary mortising, tenoning, grooving, matching, tonguing, housing, rebating and all other work necessary for correct jointing shall be executed in a first class manner.

2) The joints shall be constructed exactly as shown on the drawing details (if any). Where joints are not specifically indicated they shall be the recognized forms of joints for each position.

3) Glued joints shall be executed with best quality animal glue, resistant to all forms of fungicide or insect attack.

4) Window frames shall be fixed true and square in the openings. They shall be fixed to lugs, supplied the window manufacture and fixed to the reveals by plugging. The Contractor shall follow the manufacturer's instructions with respect to fixing, bedding and pointing.

6.4.6 Veneering

1) The veneer shall be checked for uniformity of color and texture. Window in the opinion of the Architect, have unacceptable variations in the color or texture of the veneer shall be removed from site.

2) Edges and arises shall be neatly formed true and square with hair line butt joints.

3) All lumber shall be varnish finished.

7 LOUVERS

7.1 General

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

7.2 Louvre Type

All louvers shall be fixed type.

7.3 Design Load

7.3.1 Wind Loads

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

7.3.2 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.

7.4 Design Requirements

7.4.1 Free Area

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

7.4.2 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).

7.4.3 Water Penetration

Water penetration of a louver shall not exceed 60 and 250 cc of water per m2 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.

7.4.4 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.

7.4.5 Screens

All Louvers shall be provided with aluminum insect screens.

7.4.6 Assembly

Louvers shall be assembled by welding and/or mechanical fasteners.

7.4.7 Louver Blades

Louvers shall have drainable blades.

7.4.8 Louver Mullions

Horizontal and vertical louver mullions shall be provided as required.

7.4.9 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.

7.5 Materials

7.5.1 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.

7.5.2 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 mesh. Wire shall be aluminum with 2.3 mm diameter intercrimped at 6 mm intervals.

7.5.3 Seals

Blade and jamb seals shall be vinyl.

7.5.4 Fasteners

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

7.5.5 Finishes

General Provisions:

a) Each louver shall have a fluoropolymer finish, with colour matching the adjacent wall.

b) Louver mullions and exterior screens shall have the same finish and colour 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. The coating shall be oven baked in accordance with the manufacturer's printed procedures.

7.6 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.

8 FLOOR FINISH

8.1 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.

8.2 Types of Floor Finish

8.2.1 Monolithic Finish

Requirements:

a) Monolithic finish is one produced on structural concrete slabs, which are poured all at one time with one concrete mix. Concrete for structural slabs with monolithic finish shall be of the driest consistency possible to work with a sawing motion of screed.

b) Surface shall first be screeded and then be floated to a smooth, compact surface. Any excess water shall be removed during floating operation by covering surface with burlap or similar material and spreading cement or a cement-sand mixture, directly on top of burlap. Spreading of cement or cement-sand mixture directly on top of concrete will not be permitted.

c) After floating, the surface of concrete shall be steel trowelled to a smooth, slate-like surface. Final trowelling shall be done after concrete is so hard that no mortar accumulates on trowel and a ringing sound is produced as trowel is drawn over surface. Finish surface shall not be marked off in areas or scored in any manner.

Uses:

a) Structural concrete floor slabs where monolithic finish is indicated or as required.

b) Floor areas where resilient tile finishes (asphalt, rubber, vinyl etc.) are indicated or as required.

8.2.2 Separate Concrete Floor Finish

Requirements:

a) A separate concrete finish for the following areas shall be applied over the rough slab finish. The separate finish shall be reinforced and steel trowelled concrete finish similar to monolithic finish and shall have minimum 245 kg/cm2 compressive strength at 28 days.

b) Provide bonding adhesive for separate concrete floor finishes up through 10 cm thick.

c) Material of aggregate, cement, reinforcing bar and water shall conform to the requirements of Standard Specification S-310.

d) Field control test shall cover all material and concrete test required and shall be done in accordance with the requirements of TS-9.

e) Cure, seal and dust proof surfaces of monolithic and separate concrete floor finish immediately after finishing by applying one coat of membrane curing compound, resin base type (wax base not permitted) with applying at rate of approximately 7 mm3 per liter, conforming to applicable requirements of ASTM C 309, type 1.

Uses:

a) All areas where switchgear equipment is to be installed shall be provided with 75 mm separate concrete finish reinforced with welded wire fabric to permit accurate setting of the base channels and provide a true level surface in these areas. The top of the rough concrete shall be set 75 mm below the nominal floor elevation.

b) Where specifically required for setting of contractor's other equipment.

8.2.3 Ceramic Tiles

Requirements:

a) Ceramic tiles shall be prime quality and tile color; size and pattern shall be approved by the Owner.

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.

c) The bonding adhesive shall be approved by the Owner.

d) The Contractor shall include all cutting and fitting tiles to abutments and protecting floor tiles after laying.

e) The surface of the background shall be keyed or otherwise prepared in accordance with the tiling manufacturer’s instructions.

f) All tile 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.

Uses:

a) Office Areas

b) Kitchen and Dining Area

c) Hallway and Stair Landing

d) Toilet

e) Shower room

f) Locker area.

g) Other area unless otherwise indicated.

8.2.4 Chemical Resistant Coating Work

Scope:

a) The Contractor shall arrange for the services of a qualified coatings manufacturer to provide coating system(s) for the areas and under the conditions specified. Such systems(s) shall be guaranteed by the Contractor for the period of time and to the extent herein specified.

b) The areas involved are indicated on the approved drawings including concrete surfaces of floors, trenches, curbs and embedded steel items etc. in the following structures:

- Battery Rooms
- Chemical Storage Rooms

c) The Work includes the selection of the total coating systems, preparation of substrate surfaces, priming, coating application, preparation of each coat to accept next coat, for a multi-coat application and treatment of the finish surface. The Owner will select the color of the coating.

Documentation to be submitted:

a) The Contractor shall submit the following documents for the Owner's review before selection of a coating:

- Information and manufactures certificates of the proposal coating to various chemical agents.
- Generic description and identification numbers of proposed materials, recommended dry film thickness of each coating, application and color if different for each area.
- Preparation procedures for concrete and steel, application procedures including, but not limited to details of corner, concrete crack, drain, curb, equipment base, joint treatment and curing methods.
- Ambient environmental and safety conditions required, prior to, during and after application until curing is completed.
- Test and experience data indicating proposed system's past success in performing under similar conditions.
- Detailed repair procedures.

Warranty:

a) The Contractor shall guarantee the coating system(s) provided, for a period of five years following the commercial operation.

b) This guarantee shall cover any failure of the coating system(s) relative to abrasion, cracking, blistering, delaminating and discontinuities, which occur during exposure to the service conditions specified in Clause 13~~13~~

c) Upon notice by the Owner of any failures the Contractor shall promptly visit the Site, examine the failure and advise the methods of repairs, time when repair can be made and environmental conditions required for repairing the failure.

d) Repairs under the guarantee shall be at no cost to the Owner and shall be performed promptly at the Owner's convenience.

e) Such repair or removal and replacement shall be guaranteed for the remaining time of the original guarantee.

f) If desired the Contractor will be allowed to periodically inspect coating system as to continuation of specified service conditions and possible signs of imminent failure.

Service and Surface Conditions:

a) Chemical exposures

- Floor surfaces shall be considered as subject to "splash and spillage", trenches shall be considered as totally immiscible areas, with trenches immersed 50 percent of the time. These conditions will prevail throughout the estimated service life of the coating system(s).
- Coated areas may be exposed to either acidic or caustic conditions based on the worst possible combinations of the fluids as determined by the Contractor.

b) Abrasion Exposure

- Floor Surfaces: Constant foot traffic, occasional rubber wheeled fork lift traffic, empty and weighted.
- Trenches: Slow flow of effluent.

c) Temperature

- Floor Surface : Operating temperature range varies from 20°C to 50°C.
- Trenches and Sump Surfaces: Operating temperature range, 20°C to 50°C; temperature shock as determined by the Contractor for the effluent.

d) Existing Conditions of Surfaces.

- Concrete Cracks: Concrete surfaces may have shrinkage cracks. The coating system shall be applied, without cracking (failure) exceeding 0.25 mm in width, against movement of the existing cracks and the occurrence of new cracks in the concrete.
- Concrete finish shall have a minimum age of 30 days prior to the application of the coating. Concrete shall be made using Type II cement and shall have minimum of 245 kg/cm^2 compressive strength at 28 days.
- Steel: Surfaces may or may not have shop applied primes.

Work Conditions:

a) The Contractor shall protect existing equipment and surfaces, which are not to be coated against coating deposits, dust and other detrimental factors associated with coating work.

b) Coating shall be applied after the completion of the equipment erection or as directed by the Owner.

Quality Assurance and Control:

a) Application of the coating system materials shall conform to the printed instructions of the coatings manufacturer regarding environmental, preparation of surfaces, material mixing, material application, curing and repair.

b) Material Information shall be submitted to the Owner.

c) Documentation indicating that the coating system(s) have been applied cured and inspected per coating manufacturer's requirements shall be submitted to the Owner.

d) Documentation indicating that coated surfaces in trenches the Contractor have been spark-tested with voltage(s) required by the Contractor and have the criteria shall be submitted to the Owner.

Acceptance Criteria:

The coating system(s) shall meet the following criteria before acceptance by the Owner.

a. Surfaces.

- Floors shall have an evenly distributed nonskid surface.
- Trenches shall have smooth surfaces.
- The surfaces shall be free from blistering, delamination, cracks and discontinuities.
- The coating system shall be of the required minimum and maximum dry film thickness shall be as per manufacturer’s specification and accepted by the Owner.
- Surfaces shall be uniform in texture, color and appearance.

Uses are as indicated on the approved drawings

8.2.5 Acid Resistant Membrane

Requirements:

a) The acid resistant membrane shall have minimum 2.5 mm thick high density.

b) The Contractor shall provide to protect monolithic floor finish from acid leakage attach where required.

c) Penetrations through protective membranes shall be completely sealed using manufacturer's standard.

d) Clearing, curing and traffic shall be in strict accordance with manufacturer's printed standards.

Document to be Submitted:

Clause 8.2.3. applies hereto

Warranty :

Clause 8.2.3. applies hereto

Surface and Surface Condition :

Clause 8.2.3. applies hereto

Work Conditions :

Clause 8.2.3. applies hereto

Quality Assurance and Quality Control:

Clause 8.2.3. applies hereto

Acceptance Criteria:

Clause 8.2.3. applies hereto

Uses:

All area as indicated on the approved drawings.

8.2.6 Vinyl Flooring and PVC Skirting

Requirements:

a) Vinyl floor tiles

They shall comply with approved standards and sizes. They shall generally be 300 x 300 x 3 mm thick. Colorless tile adhesive shall be a proprietary brand obtainable from the same supplier as the tiles.

b) PVC Skirting

PVC skirting shall be supplied by the same manufacturer as the tile manufacturer. Color of PVC skirting shall match the one of floor tile and approved by the Owner. PVC skirting shall be 60 mm high, fixed to the wall with the adhesive in accordance with manufacturer's instructions.

Uses:

a) Office Areas

b) Electrical Control rooms

c) As indicated on drawings

Installation:

All sub-surfaces to receive vinyl 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 Owner.

Surfaces shall be dried adequately before applying materials. At the direction of the Owner the Contractor shall perform simple calcium chloride test to ensure that the concrete are free of moisture.

Fill all cracks in sub-surfaces using approved crack-filler in accordance with the manufacturer's specification.

8.2.7 Terrazzo Tiles Flooring and Skirting

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 Owner.

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 Owner. Terrazzo skirting shall be 100 mm high, fixed to the wall in accordance with manufacturer'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.

Uses:

a) Office Areas

b) Hall, corridor and stair

c) As indicated on the Outline Tender Drawings approved by the Owner

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 Owner.

9 INTERIOR AND EXTERIOR WALLS FINISH

9.1 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:

- Masonry and Plastering Works: See TS-21
- Painting Works: See TS-22.
- Metal Siding and Roofing: See TS-23.

9.2 Wall Tiles

1) Glazed ceramic wall tiles shall comply with BS 1281 and shall be 150 x 150 mm, 6 mm thick.

2) Rounded edge tiles shall be used on all external angles and unprotected ends of tiling.

3) The backing for wall tiles shall be cement, lime, sand, 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.

4) Tiles shall be grounded as separate operation after the adhesive has set.

9.3 Glass Blocks

1) Glass blocks shall have dimensions of 190 mm x 190 mm x 100 mm thick and be of a proprietary type as approved by the Owner.

2) Mastic sealant for glass blocks shall be in accordance with BS 5889 and BS 6262.

3) Glass blocks shall be bedded in a 1:4 cement/sand mortar with a clear gap of 3 mm between exposed glass edges.

4) On completion the gap is to be raked out, cleaned and neatly pointed with white mastic sealant as previously specified.

9.4 Glazed Curtain Walls

1) Glazed aluminium curtain walls shall conform to the following standards.
   a) FGMA (Flat Glass Marketing Association)
   b) AISC
   c) AWS
   d) AAMA (Architectural Aluminum Manufacturers Association)

e) ASTM

f) ANSI

g) AA (Aluminum Association)

h) BOCA (Building Officials and Code Administrators)

2) The Contractor shall be sorely responsible for the design, engineering, fabrication, assembly, testing and complete and proper installation of all aluminum curtain wall indicated on the approved drawings which includes, but not limited to, the supply and installation of the glazed aluminum curtain wall.

3) All glazed aluminum curtain wall shall be of a unitized construction system. The design of the system is the responsibility of the Contractor.

4) Exterior glazing shall be supported by projected or non-projected aluminum frames as proposed by the Contractor, reviewed and approved by the Owner.

5) The unitized curtain wall with all components shall be designed to accommodate the required building movements due to live load, dead load, thermal, torsion, creep and sway.

6) Air infiltration test shall be in accordance with ASTM E-283. Static air test shall be in accordance with ASTM E-328.

7) Water infiltration under static pressure and dynamic pressures shall be in accordance with ASTM E-331 and AAMA 501.1 – 83 respectively. Field water test shall be in accordance with AAMA 501.2.

8) Design wind pressure, acting normal to plane of the exterior wall, both positive and negative shall be 35 psf For this pressure, deflection of the curtain wall shall not exceed 1/175 of the span. Structural performance shall be tested in accordance with ASTM E-330.

9) The Contractor shall submit engineering calculations to show that maximum deflections and stress do not exceed specified performance requirements under full design loading.

10) All structural glazing shall conform to AAMA specification CW-13.

11) The curtain wall contractor qualification shall be demonstrated by proven previous experience in markets, ability to design, engineering, fabrication and installation.

12) The Contractor shall provide mock-up of the curtain wall system as directed by the Owner. Mock-up drawings shall be submitted to the Owner for approval.

13) The Contractor shall submit structural design calculations, drawings and samples for the Owner’s approval prior to the fabrication.

- Shop drawings indicating all plans and details the curtain wall system.
- Samples for metal finishes.

- Aluminum panel samples (half size)
- Glass type and finishes

14) Glass shall be of the specified type under foregoing sub-clause “Glass and Glazing”

15) Sealant, primer (if required) and back-up materials shall be used in strict accordance with the manufacturer’s printed instructions.

10 BUILT-UP ROOFING

10.1 General

The built-up roofing over concrete/precast concrete slabs shall comprise of alternate four layers of felt and four layers of bitumen to form a flexible roof cover with sufficient strength to resist normal expansion and contraction forces and a top aggregate layer.

10.2 Materials

10.2.1 Cant Strips

Fiberboard material, 10 cm high by 10 cm wide, beveled at 45°.

10.2.2 Concrete Primer

Solution of petroleum residual asphalt in petroleum solvent, per ASTM D41.

10.2.3 Vapor Retarder

Asphalt coated base sheet 1.8 kg/m^2 per ASTM D2626. For use only on concrete and precast roofs.

10.2.4 Bitumen

Coal Tar (Type III, per ASTM D450).

10.2.5 Permanent Roof System

Coal-Tar-Saturated organic felts (0.65 kg/m^2) per ASTM D227.

10.2.6 Aggregate Surfacing

Pea gravel per ASTM D1863.

10.2.7 Roof Walkway Traffic Pads

Shall be 1 m x 1 m x 25 mm thick precast concrete pads.

10.2.8 Reglets, Metal Flashing and Counter Flashing

Shall be 0.47 mm thick stainless steel conforming to ASTM A240, Type 304.

10.3 Permanent Roofing System

10.3.1 Concrete Primer

The existing concrete/precast concrete channel roof slabs shall be sealed with an asphalt primer. Apply the primer at a rate of 0.2 liter to 0.4 liter per m^2.

Application and curing shall be in accordance with manufacturer's printed instructions.

Vapor Retarder :

- Provide one-ply asphalt coated base sheet on the roof area using asphalt bitumen by solid mopping at a minimum rate of 1.12 kg/m^2.
- The vapor retarder shall be lapped 10 cm over the preceding sheet and 15 cm at the end laps. Extend the vapor retarder 15 cm up all vertical surfaces.
- The vapor retarder (coated base sheet) shall be manually broomed into the hot asphalt and laid without wrinkles, buckles or kinks and free from pockets and blisters.
- The vapor retarder shall be applied so that the direction of water flow is not against the laps.

10.3.2 Application of Felts

Coal tar bitumen shall be uniformly applied over the vapor retarder at a rate of 1.22 kg/m^2. Into this coating of pitch, while hot, lay four layers of coal-tar saturated felts lapping each sheet 0.7 m over the preceding one and lapping the ends of the felts not less than 15 cm. End stripping or tapping of these laps will not be permitted. Each ply shall be uniformly mopped, using not less than 1.22 kg/m^2 of bitumen so that in no place shall felt touch felt. At no time shall the mopping extend more than 2.5 m ahead of the root of the felt.

When beginning the membrane roofing installation, install the appropriate width starting strips of felt to achieve the required four-ply system.

Lay plies of felt in single fashion. Apply felts so that the direction of water flow is not against the laps of the plies.

Felts shall be manually broomed into the hot bitumen and laid without wrinkles, buckles or fish-mouths so that the felts are free from pockets and blisters.

At all vertical surfaces extend the felts up 50 mm above the cant strip and mop.

10.3.3 Application of Aggregate Surfacing

The final finishing of the roofing shall be a triple weight application of coal tar bitumen at a rate of 3.66 kg/m^2. Aggregate shall be distributed into the hot bitumen at a rate not less than 20 kg/m^2 of gravel.

Application of the coal tar bitumen and aggregate shall be performed at the same time as laying of the roofing felts, except that in periods of hot and dry weather, the top surfacing may be delayed overnight. For work not completed on the same working day, Contractor shall glaze felts left exposed.

11 CEILING WORK

11.1 General

This section covers acoustical ceiling and louvered grid ceiling, including supports and accessories.

Louvered grid ceiling shall be only used for control room area and other area required by the Owner.

Exposed tee suspended moisture resistant acoustic tile ceiling shall be used for in high moisture areas such as toilet and shower rooms.

Exposed tee suspended acoustic tile ceiling shall be used for the other area such as office, kitchen, dining room etc.

11.2 Materials

11.2.1 Louvered Grid Ceiling

Louvered grid ceiling shall be aluminum with aluminum lacquer finish and shall be square or rectangular with removable core.

11.2.2 Exposed Tee Suspended Moisture-Resistant Acoustic Tile Ceilings

The following type and make with lay-in panels, installed in exposed mill finish aluminum grid suspension system.

Suspension System: Exposed tee type, direct hung.

Tile: Ceramic Acoustical Lay-in Panel, 60 cm x 60 cm x 1.58 cm Travertine Design, washable matte white finish.

11.2.3 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.

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.

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 fiber, 60 cm x 60 cm x 1.90 cm, reveal edge, texture-tone pattern, non-directional with aluminum foil back.

11.2.4 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.

11.2.5 Tie Wire

18-8 stainless steel, 1.587 mm or equivalent.

11.2.6 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.

11.3 Erection

11.3.1 General Provision

Erection of all acoustical ceilings shall conform to the applicable requirements of ANSI 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.

11.3.2 Suspension System

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

Hangers:

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.

Main Tees:

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.

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.

11.4 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.

12 BUILDING APPLIANCES & SPECIALTIES

12.1 General

This shall include contractor's furnishing and installing complete kitchen units, other furnishing and lockers as indicated on the Outline Tender Drawings.

12.2 Kitchen Unit

The unit shall include but not limited to the following including all accessories:

- Electric cooking range with two burners.
- Refrigerator.
- Stainless steel sinks and counter top with bottom cabinet.
- Upper cabinets.

Install kitchen unit complete 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. All electric suitable for operation on 220 Volt, single phase, 2 wire, 50 Hz.

The color of the appliance cabinets and counters will be selected by the Owner.

12.3 Steel Lockers

Metal lockers for locker rooms shall include all components, closures and accessories in compliance with the local Standards. The metal lockers shall be approved by the Owner.

The shelves of all lockers shall be perforated and the upper and lower part of each locker door shall be fully louvered for proper ventilation.

Each locker shall have standard equipment, including metal shelf, chrome plated handle, bolts and nuts and a combination pad lock for each locker.

Doors shall be of heavy construction to resist warp or bending. Each door shall be provided with a number-plate, a name tag plate and means for padlock attachment.

Locker doors shall be equipped with rubber bumpers.

Each locker and steel necessary shall be cleaned of all scale after fabrication, primed with a baked-on primer and finished with baked on enamel of the color approved by the Owner.

Lockers shall be provided with a sloped top to prevent dust build up and set on a 25 mm high concrete pad. Separate wood benches shall be furnished in front of each locker.

Locker door swing and locker number system shall be indicated on the Contractor's drawings.

Lighting shall be located over aisles and passages.

13 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

- Design drawings and related documents
- Fabrication, manufacturing and shop testing
- Packing and shipping
- Erection and installation procedures
- Tolerance
- Tests at site
- Commissioning and cleaning.

required for complete furnishing and installation of work.