

ITEM 11 : FINISHES

GENERAL

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete all finishing works and painting for the buildings as indicated on the drawings and as specified herein.

Wall, floor, ceiling and other finishing works shall include but are not limited to the following:

WALLS

1. Exterior
 - a. Aluminum composite panel for the exterior facade which is the upper portion of the wall with the PPA Building signage, the parapet wall of concrete canopy and Columns as specified in the plans
 - b. Plain cement finished painted with elastomeric paint.
 - c. Decorative stones
2. Interior
 - a. Plain cement finished painted with elastomeric paint.
 - b. 300mm x 600mm vitrified glazed tiles for toilets.

FLOORS

1. 600mm x 600mm Vitrified ceramic unglazed tiles (F1) for
 - a. Security Check-in Area
 - b. Concessionaire's Area
 - c. Offices/ Ante Room / Hallway
 - d. Electrical & Control Room
 - e. Toilets / Janitor's Closet
 - f. VIP Lounge
 - g. Ecumenical Room
 - h. Mothers Nursing Area / Diaper Change
 - i. Passenger's Waiting Area
2. 600mm x 600mm Vitrified non-slip floor tiles (F2) for
 - a. Entrances
 - b. Drop-off point
 - c. Stairs & Landings
3. Non-skid or rough cement finish for ramps (F3).
4. Waterproof finish for all roof deck.

CEILING**1. Interior**

- 600m x 1200m x 0.70mm aluminum clip-in perforated ceiling panel, bone white or its equivalent (C1)
- 600mm x 600mm x 0.70mm aluminum clip-in perforated ceiling panel, bone white or its equivalent (C2)
- 0.40 mm thick Pre formed / pre painted ribbed type spandrel metal ceiling (C3)
- 13mm thick Gypsum Board on 0.40mm thick galvanized steel ceiling suspension system at 400mm O.C. (furring) carrying channel and 600mm O.C.B.W. suspension rod (C4).
- Painted finish underside of RC Slab.

SUBMITTAL

1. Shop drawings for all finishing and painting works for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.
2. The Contractor, before placing order for the finishing materials shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.
3. Samples of all walls finishes, measuring not less than 1000mm x 1000mm shall be submitted to the Engineer for approval as to its finish texture and workmanship.

MATERIAL REQUIREMENTS**WALL FINISHES AND COUNTERTOPS****1. Plain Cement Finish**

- a. Sand shall be clean and hard material. Sand shall be free from deleterious substances and conforming with the requirements of ASTM C 33.
- b. Cement shall be Portland cement conforming with the requirements of ASTM Designation C 150.
- c. Water shall be clean and potable.
- d. Bonding compound shall conform to ASTM C 631.
- e. Hydrate lime shall conform to ASTM C 206.
- f. Synthetic fibrous reinforcement shall conform to BS 5139 or ASTM C 1116.

2. Wall Ceramic Tiles

- a. Wall tiles shall be glazed ceramic tiles color as per Architect's approval.
- b. Trimmers and moulding shall be lustrous, glazed with size and color corresponding to wall tiles.

- c. Portland cement, sand, bonding compound, lime and water shall conform with the requirements.

3. Granite Tiles

- a. Black granite slabs for toilet countertops, fascia and splashboard. Dimensions as shown on the drawings.
- b. Shall be sound material with uniform and favorable working qualities and with very limited natural faults.
- c. Color, veining and quality shall be approved by Engineer.
- d. Veining shall run vertically on all vertical surfaces and direction of veining shall continue in same directions over horizontal surfaces except as directed by the Engineer.
- e. Sealer
 - e. 1. Shall be a commercial penetrating type free from harmful alkali or acid content specially prepared for marble work
 - e. 2. Shall have a Ph factor between 7 and 9
 - e. 3. Shall not discolor
 - e. 4. Shall produce a slip resistant surface
 - e. 5. Shall have a flash point not less than 35 °C
- f. Cleaning fluid
 - f. 1. Shall be commercial neutral liquid type especially prepared for marble work
 - f. 2. Shall have a Ph factor between 7 and 9
 - f. 3. Shall be free from crystallizing salts or water soluble alkaline salts
 - f. 4. Shall be biodegradable and phosphate free

4. Aluminum Composite Panel

Aluminum Composite Panel (ACP) is a lightweight durable panel made of laminated aluminum and polyvinylidene Fluoride (PVDF) to ensure the excellent durability of the surface finished. It also has a high degree of levelness to preserve the fine architectural design and can be roller bended to suit various design shapes. The laminated structure of ACP ensures exceptional strength of the panel. Total panel thickness shall be 4mm and aluminum skin thickness is 0.21mm.

5. Glass Curtain Wall

A curtain wall system is an outer covering of a building in which the outer walls are non-structural, utilized to keep the weather out and the occupants in. When glass is used as the curtain wall, an advantage is that natural light can penetrate deeper within the building. The curtain wall facade does not carry any structural load from the building other than its own dead load weight. The wall transfers lateral wind loads that are incident upon it to the main building structure through connections at floors or columns of the building. A curtain wall is designed to resist air and water infiltration, absorb sway induced by wind and seismic forces acting on the building, withstand wind loads, and support its own dead load weight forces.

Supply and installation of laminated glass for 6mm thick reflective starry gray tempered glass +1.52 pvb + 6mm thick euro gray tempered glass consist of panels (12mm total thickness of glass).

For GLASS CURTAIN WALL and 15mm thick clear tempered glass consist of glass fin; Using EPCO Spider System - EPCO GWPFA – 4/2/90 (2-way / 4 - way), EPCO 2.11 – M1012 (or approved equal). Flathead fixed bolt, 25mm X 25mm aluminum U-channel embedded on top and bottom. To complete with other fixing accessories (or approved equal).

SPIDER SYSTEM

The EPCO Spider System (or approved equal) the transparent membrane is freed from earthbound and levitated skywards. A constant throughout, the EPCO Spider System can accommodate a range of suspended all-glass assemblies. The fittings are made of grade 316 stainless steel with 600Mpa strength providing a rigid and flexible connection between glass and supporting system (or approved equal).

The fitting's arms are designed to support a maximum loading and allow flexibility to reduce the stress around the glass holes.

Spider Glass Fin System

The main glass façade is suspended from a beam or slab with concealed clamps. Lateral support is provided by tempered glass fins in various designs (or approved equal).

6. Wind Shutter / Roll Up Shutter

Shutter Curtains are made of aluminum / galvalume materials which can resist rust for 15 years surface can be powder coated/ painted without applying chemicals. Endlocks are spot welded on the end of the curtain to prevent lateral movement during operation; there also reduce the noise of the shutter during operation.

Modern machine and technology are used to fabricate the parts which are at par with international standards; springs are computer matched to every door weighed and size.

SLAT SPECIFICATION

SLAT	Gauge / Thickness	WIDTH	WEIGHT Kg/Sqm	Material
S72A	0.60mm to 1.20mm	72mm	7.5 kg- 16 kg	Galvalume/ GI
C75A	0.60mm to 1.20mm	75mm	7.5 kg- 16 kg	Galvalume/ GI

(or approved equal)

7. Phenolic Board Toilet Partition System

Phenolic Compact Board also known as solid phenolic, is a paper fiber-based solid surface material that is warmer to the touch than typical acrylic or polyester materials.

Phenolic anti-bacterial water proof toilet partition 20 mm thick including stainless hinges, locks, bottom support, door knobs and coat hooks.

FLOOR FINISHES

1. Vitrified Ceramic Unglazed Tiles

- a. Vitrified ceramic unglazed floor tiles shall be color varies and as shown on the drawings or to be designated by the Architect.

- b. Portland Cement, sand and water shall conform with the requirements.
 - c. Vitrified ceramic unglazed floor tiles shall be delivered in the manufacturer's original unbroken packages or containers that are labeled plainly with the manufacturer's name and brand. Containers shall be grade sealed. Materials shall be stored in dry weathertight enclosures, and shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.
- 2. Vitrified Non-slip floor finish or floor tiles for all stairs & entrance's landing and for the drop-off point.
 - 3. Non-skid floor finished shall be applied to ramps.
 - 4. Waterproof finish for all roof deck.

EXECUTION

WALL FINISHES

1. Plain Cement Finish

a. Preparation of Surfaces

All surfaces shall be cleaned and projections, dust, loose particles and other materials, which would prevent good bond, shall be removed.

Plaster shall not be applied directly to concrete and masonry surfaces coated with bituminous compounds and surfaces previously painted or plastered.

All surfaces shall be thoroughly wetted before plastering.

b. Trial Mix

A trial mix of at least three (3) different water-cement ratios for a proposed mix shall be prepared under full scale conditions and adequate workability. The proportions by weight of cement to the weight of sand shall not be less than one part of Portland cement to two parts of sand.

The proportion of cement-sand and water necessary to produce the cement plaster of the required consistency shall be subject to the approval of the Engineer. Such approval may be withdrawn at any time and a change in proportions may be required. Based on the approved mix proportions, the Contractor shall prepare a list showing the number of kilograms of the various materials to be used in the cement plaster finish mix.

No cement plaster finish shall be started without an approved trial mix by the Engineer.

c. Cement Finish Application

A brown coat with sufficient pressure shall be applied to fill the gaps, and to secure a good bond. Moistened for 48 hours, each coat of cement plaster shall be kept after application and allow to dry.

A finish coat shall be applied after the brown coat has set. The brown coat shall be moistened before application of the finish coat. Finish coat shall be floated to plumb, even planes and surfaces.

Final plaster finishes shall be rubber sponged.

d. Tolerance

The Contractor shall finish plaster work plumb, level, square and true within tolerance of 3mm in 3 meters, without cracks and other imperfections.

e. Patching and Cleaning

Upon completion of the building, and when directed, all loose, cracked, damaged or defective plastering shall be cut out and re-plastered in a satisfactory and approved manner.

2. Wall Tiles

a. Mortar Preparation

All mortar setting beds shall be mixed by volume in the proportion of 1 part Portland cement and 3 parts dry sand and not more than 1/10 part hydrated lime.

Mortar materials shall be measured in approved containers, which will insure that the specified proportions of materials will be controlled and accurately maintained during the progress of the work. Measuring materials with shovels, "shovel count", will not be permitted. Unless specified otherwise, mortar shall be mixed in proportions by volume, in an approved mortar box.

The quantity of water shall be controlled accurately and uniformly. The aggregates shall be introduced and mixed in such manner that the materials will be distributed uniformly throughout the mass. A sufficient amount of water shall be added gradually and the mass further mixed until a mortar of the elasticity necessary for purpose intended is obtained. Mortar boxes, pans and wall surfaces shall be kept clean and free from debris or dried mortar. The mortar shall be used before the initial set of the cement has occurred. Re-tempering of mortar in which cement has started to set will not be allowed.

b. Application of Wall Tile

Interior masonry shall be clean, thoroughly dry, sound and sufficiently rough to provide strong mechanical bond. Surfaces shall be evenly damped immediately prior to the application of the scratch coat.

Scratch coat shall be applied to masonry, as backing for wall tile, not less than 24 hours or more than 48 hours before starting the tile setting. The scratch coat shall not be less than 6 mm from the face of the masonry. The scratch coat shall be applied with sufficient pressure to ensure a proper bond with the base for the setting bed. While the mortar is still plastic, the scratch coat shall be cut with a trowel at all internal vertical angles for the depth of the coat with the full height of the tile bed and shall be cross-scratched, in 25 mm centers for the extent of the tile bed.

Immediately before the application of mortar setting bed, the scratch coat shall be moistened thoroughly but not saturated. Temporary screeds shall be applied to the

scratch coat with mortar to provide a true and plumb surface, the proper distance back from the finished wall line. The setting bed shall be applied, rodded and floated flush with the screeds over an area not greater than the area to be covered with the tile while the bed remains plastic. The thickness of the setting bed shall not exceed 15mm and the mortar shall not be re-tempered. The setting bed shall be cut with a trowel at all internal corners as specified for the scratch coat.

Mounted tiles shall be soaked in clean water a minimum of one hour before they are set. Absorptive mounted tiles shall be damped by placing sheets on a wetted cloth in a shallow pan before setting. A skim coat of neat Portland cement mortar, mixed with water to the consistency of a pasty, thick cream, shall be applied 0.8mm to 1.6mm thick to the mortar setting bed, or to the back of each tile as laid. The tiles shall then be pressed firmly on the setting bed and tamped until flush and in the plane of the other tiles. The tiles shall be applied before the mortar bed has taken its initial set.

Intersections and returns shall be formed accurately. Where cutting of tiles is necessary it shall be done at the internal angles of the walls or wainscots. Cutting and drilling tiles shall be done neatly without marring the surfaces. The cut edges of tiles against trim, built-in fixtures, and similar surfaces shall be ground and jointed carefully. The tiles shall fit closely with plumbing fixtures and around electric outlets, pipes and fittings, so that the plates or escutcheons will properly overlap the tiles. Wainscots shall be within one half of the heights indicated without cutting of the tiles.

Bases, caps, bull-nose corners, and all other trimmers moulded or shaped features, and accessories shall be backed thoroughly with mortar and set firmly into place. All lines shall be kept straight and true, and all finished surfaces brought to true and even planes, straight and plumb, and internal corners squared and external corners rounded.

Horizontal joints shall be maintained level and vertical joints plumb and in alignment. The completed work shall be free of broken, cracked, damaged or otherwise faulty tiles.

Joints shall be parallel and uniform in width, plumb, level and in alignment. End joints in broken-joint work shall be made as far as practicable, on the center line of adjoining tiles. Except in special arrangement and design, as indicated or specified, square tiles shall be set with straight joints, and oblong tiles shall be set with broken joints.

Joint widths shall be uniform and spaced to accommodate the tile in the given spaces with a minimum of cutting. Tiles shall be wetted, if they have become dry, before applying grout. Joints 3mm or less in width shall be grouted with a neat Portland cement grout of the consistency of thick cream. Other joints shall be pointed with mortar consisting of one part Portland cement and two parts pointing sand. The grout for walls and other vertical surfaces shall contain non-staining white Portland cement. Grout and pointing mortar shall be forced into joints by using trowel, brush or finger application.

Before the grout or mortar sets, the joints of cushion edge tiles shall be struck or tooled to the depth of cushion, filling all skips or gaps, and the joints of square edge tiles shall be filled completely flush with their surface. Dark cement shall not show through grouted white joints. Care shall be taken to avoid scratching glazed finishes. All mortar or grout shall be removed before it has set or hardened.

c. Cleaning and Curing

All completed tile work shall be thoroughly sponged and washed diagonally across joints, and finally polished with clean, dry cloth. Acid cleaning of unglazed tile, when necessary, shall not be done within ten days after setting tile. All metal shall be covered with an approved grease and the tile shall be wetted with clean water, before tile is cleaned with 10% muriatic acid solution. After acid cleaning, the tile shall be flushed with clean water, and the grease coating on metal shall be removed. Acid cleaners shall not be used on glazed tile.

d. Protection

Tiled walls outside corners (external angles) shall be protected with board corner strips in areas used as passage ways by workmen. Extreme care should be taken not to disturb walled tiled until mortar has fully set.

3. Painting Works

a. Surface Preparation

Allow new masonry to dry for 14 days (for exterior surfaces) to 28 days (for interior surfaces) under normal conditions before painting. Surface to be painted should be clean and dry, free from oil, grease, dirt, dust, contaminants, and all loose grit and mortar.

Without mesh:

1st Coat: Elastomeric Wall Covering Sealer

2nd and 3rd Coat: Elastomeric Wall Covering Basecoat

4th Coat: Elastomeric Wall Covering Topcoat

With mesh:

1st Coat: Elastomeric Wall Covering Sealer

2nd Coat: Elastomeric Wall Covering Basecoat
Reinforcing Membrane: Fiberglass Matting

3rd and 4th Coat: Elastomeric Wall Covering Basecoat

5th Coat: Elastomeric Wall Covering Topcoat

FLOOR FINISHES

1. Vitrified Ceramic Tiles

a. Mortar Preparation

Mortar mix proportion and preparation shall be in accordance with the requirements.

b. Surface Preparation

Surfaces to receive the tiles shall be clean, free of dust, dirt, oil, grease, and other deleterious substances. Floor tile operations in spaces receiving wall tile shall not be started until wall tile installation has been completed. Before tile is applied with a dryset mortar bed, the structural floor shall be tested for levelness or uniformity of slope by flooding it with water. Areas where the water ponds shall be filled and leveled with mortar and shall be retested before the setting bed is applied.

c. Placing of Setting Beds and Floor Tile

Mortar setting beds shall have a minimum thickness of 20mm for floors. The structural concrete slab shall be soaked thoroughly with clean fresh water on the day before the setting bed is to be applied. Immediately preceding the application of the setting bed, the structural slab shall again be wetted thoroughly, but no free water shall be permitted to remain on the surface.

A skim coat of neat Portland cement mortar shall then be applied not more than 4mm thick. The mortar shall be spread until its surface is true and even and thoroughly compacted, either level or sloped uniformly for drainage, as the case requires. A setting bed, as large as can be covered with tile before the mortar has reached its initial set, shall be placed on one operation; but in the event that more setting mortar has been placed than can be covered, the unfinished portion shall be removed and cut back to a clean beveled edge.

All mounted tiles shall be soaked in clean water a minimum of one hour before they are set. Absorptive mounted tile shall be dampened by placing sheets on a wetted cloth in a shallow pan before setting. No free water shall remain on the tiles at the time of setting. Before the initial set has taken place in the setting bed, a skim coat of neat Portland cement mortar, 0.7mm to 1.6mm thick, shall be trowelled or brushed over the setting bed and/or the back of the tile, or a thin layer of Portland cement, 0.79mm to 2mm thick, may be hand-dusted uniformly over the setting bed and worked lightly with a trowel or brush until thoroughly damp.

The tiles shall then be pressed firmly upon the setting bed, and beaten into the mortar until true and even with the plane of the finished floor line. Beating and leveling shall be completed within one hour after placing tiles or sheets. Borders and defined lines shall be laid before the field or body of the floor. Where floor drains are provided, the floors shall be sloped to drain properly to the drains. Intersections and returns shall be formed accurately.

Cutting of tile, where necessary, shall be done along the outer edges of the floor. As far as practicable, no tiles of less than half size shall be used. Cutting and drilling of tiles shall be done neatly without marring the tile surfaces. The cut edges of tile against trim, bases, thresholds, pipes, built-in fixtures, and similar surfaces shall be ground and jointed carefully. Tile shall fit closely and neatly at all plumbing fixtures and around electrical outlets, pipes and fittings so that cover plates or escutcheons will overlap the tiles properly. Tiles shall be secured firmly in place and loose tiles or tiles sounding hollow shall be removed and replaced. All lines shall be kept straight, parallel, and true, and all finished surfaces brought to true and even planes. The inner edges of borders shall be kept straight and, where practicable, shall form right angles at all returns. The paper and glue shall be removed from mounted tile, without using excess water, within one hour after installing the tiles.

Joints shall be parallel and uniform in width, plumb, level and in alignment. End joints in broken-joint work shall be made as far as practicable, on the center lines of

adjoining tiles. Except in special arrangement and design, as indicated or specified, square tiles shall be set with straight joints, and oblong tiles shall be set with broken joints.

Joint widths shall be uniform and spaced to accommodate the tile in the given spaces with a minimum of cutting. Tiles shall be wetted, if they have become dry, before applying grout. Joints 3.2 mm or less in width shall be grouted with a neat Portland cement grout of the consistency of thick cream. Other joints shall be pointed with mortar consisting of one part Portland cement and two parts pointing sand. The grout or mortar for joints on floors shall be white Portland cement or as specified by the Engineer. Grout pointing mortar shall be forced into joints by using trowel, brush or finger application. Before the grout or mortar sets, the joints of cushion edge tile shall be struck or tooled to the depth of the cushion, filling all skips or gaps, and the joints of square edged tiles shall be filled completely flush with their surface. Dark cement shall not be seen through grouted white joints.

All surplus mortar or grout shall be removed before it has set or hardened.

d. Cleaning and Curing

Floors shall be covered with waterproofed paper with all joints lapped at least 96 mm and allowed to damp cure for at least 72 hours before foot traffic is permitted thereon.

All completed tile work shall be thoroughly sponged and washed diagonally across joints, and finally polished with clean, dry cloth. Acid cleaning of unglazed tile, when necessary, shall not be done within ten days after setting the tile. All metal shall be covered with approved grease and the tile shall be wetted with clean water, before tile is cleaned with 10% muriatic acid solution. After acid cleaning, the tile shall be flushed with clean water, and the grease coating on metal shall be removed.

Finished tile floors shall be covered with clean building paper before foot traffic is permitted on them. Board walkways shall be placed on floors that are to be continuously used as passage ways by workmen. Thresholds shall be covered with boards. Tiles vertical outside corners (external angles) shall be protected with board corners strips in areas used as passage by workmen.

3. Plain Cement Floor Finish with Non-metallic Floor Hardener

a. Trial Mix

No plain cement floor finish work shall be started without the approval of the Engineer of the trial mix.

b. Application

The concrete sub-floor shall be cleaned and projection, dust, loose particles and other materials which would prevent good bond shall be removed. The sub-floor surface shall be moistened but not soaked, dry cement shall then be sprinkled over it and the mortar shall be spreaded on the setting bed. The surface shall be tamped to assure a good bond over the entire area and screeded to provide a smooth and level bed at proper height.

Mortar mix shall be one part Portland cement to three parts sand. Following the placing of leveling concrete on the floor and after the concrete is free from excess water, a dry mixture of 2 parts of floor hardener and 1 part Portland cement shall be

uniformly dusted over the floor. Three kilograms of floor hardener shall be used for every square meter of flooring or in accordance with approved manufacturer's specifications. The dry mixture shall be floated thoroughly into the surface which shall be finished by steel trowelling and cured by water or curing compound for seven (7) days.

4. Protection

- a. Before turn over of the building to the Owner, wash pebble surfaces with 1 part muriatic acid to 6 parts clean water.
- b. Apply an overlapping strokes of water shield using brush or by low pressure spraying. Dries to a tack-free surface in 4-6 hours and cures to form an effective water repellant film in approximately 24 hours.
- c. Protect finished surface with specified hardeners and sealants.

ALUMINUM COMPOSITE PANEL

1. Surface Preparation

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

2. Sub-Framing Installation

Lay-out the location of the aluminum tube at every termination or as required in the approved shop drawing.

Drill the wall where the expansion bolt is to be placed and fix the angle bracket to the wall by securing it firmly with the expansion bolt.

Connect the aluminum tube to the expansion bolt by waferteks

3. Fabrication and Installation

Lay-out the dimension of the panel as per approved termination based on actual measurements and as per approved by the Engineer.

Cut the panel sizes using cutting machine

Finally, install the produced panel to the aluminum tube by waferteks.

4. Sealant Application

After the panel is put into place, peel off the protective film at the edges of the panel.

Fill in the gap with the backer rod. Wipe the edges of the panel by rags. Cover the edges of the panel with masking tape. Apply the sealant of approved color.

As soon as the application of sealant is finished, carefully remove the masking tape and wipe off excess sealant on the panel.

5. Cleaning and Protection

Removed temporary protective films. Clean finished surfaces as recommended by aluminum composite panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt and sealant. Maintain in a clean condition during construction.

Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair

6. Warranty

a. Workmanship Warranty

The installer shall warrant the finished assembly to remain in its integrity under normal condition for a period of one (1) year. Normal condition shall not cover force majeure, deliberate vandalism, improvement repair works and the likes.

b. Paint Finish Warranty

The manufacturer shall warrant against fading, chalking, peeling, or cracking of paint finish for a period of ten (10) years.

INSTALLATION OF DOORS

1. Surface Preparation

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

DOORS AND WINDOWS

DOORS

D-1A - 1.5mm thk. Aluminum Framed Powder Coated Finish with 10 mm thk. Reflective Tempered Glass Double Swing Door (1.90m x 2.05m)

D-1B - 1.5mm thk. Aluminum Framed Powder Coated Finish with 10 mm thk. Reflective Tempered Glass Double Swing Door with Fixed Type Transom Window (1.90m x 2.65m)

D-2 - 1.5mm thk. Aluminum Framed Powder Coated Finish with 8 mm thk. Reflective Tempered Glass 4-Panel Sliding Door with Fixed Type Transom Window (3.60m x 2.65m)

D-3 - 6mm Thk. Marine Plywood Finish Flush Door with 8mm thk. Clear Glass (0.90m x 2.10m)

D-4 - 6mm Thk. Marine Plywood Finish Flush Door with 8mm thk. Clear Glass (0.60m x 2.10m)

D-5 - 6mm Thk. Marine Plywood Finish Flush Door with 8mm thk. Clear Glass (D-5) (0.90m x 2.10m)

D-6 - 6mm Thk. Marine Plywood Finish Flush Door (0.80m x 2.10m)

- D-7 - Cold Rolled Steel Emergency Exit Door with Panic Push Bar Lock)
(0.90m x 2.10m)
- D-8 - 6 mm Thk. Marine Plywood Finish Flush Door with Louver at the
Bottom Portion (1.00m x 2.10m)
- D-9 - 6 mm Thk. Marine Plywood Finish Flush Door with Louver at the
Bottom Portion (0.80m x 2.10m)
- D-10 - 6 mm Thk. Marine Plywood Finish Flush Door with Louver at the
Bottom Portion (0.60m x 2.10m)

INSTALLATION OF WINDOWS

1. Surface Preparation

Ensure surfaces to receive panels are structurally sound, even, smooth, clean, dry, and free from defects detrimental to work.

- W-1 1.5mm thk. Aluminum Framed Powder Coated Casement Type Window
with 10mm Thk. Reflective Tempered Glass (W-1) (1.20m x 1.70m)
- W-2 1.5mm thk. Aluminum Framed Powder Coated Casement
Type-Cum-Fixed Windows with 10mm thk. Reflective Tempered Glass
(4.50m x 1.70m)
- W-3 1.5mm thk. Aluminum Framed Powder Coated Fixed Type Window
with 8mm thk. Reflective Tempered Glass (1.20m x 1.20m)
- W-4 1.5mm thk. Aluminum Framed Powder Coated Casement Type Window
with 10mm thk. Reflective Tempered Glass (3.60m x 1.70m)
- W-5 1.5mm thk. Aluminum Framed Powder Coated Awning Type Window
with 10mm thk. Reflective Tempered Glass (2.40m x 0.60m)
- W-6 1.5mm thk. Aluminum Framed Powder Coated Awning Type Window
with 10mm thk. Reflective Tempered Glass (1.20m x 0.60m)
- W-7 1.5mm thk. Aluminum Framed Powder Coated Awning Type Window
with 10mm thk. Reflective Tempered Glass (3.60m x 0.60m)
- W-8 1.5mm thk. Aluminum Framed Powder Coated Casement Type Window
with 10mm thk. Reflective Tempered Glass (5.40m x 1.20m)
- W-9 1.5mm thk. Aluminum Framed Powder Coated Casement Type-Cum-Fixed
Windows with 10mm thk. Reflective Tempered Glass (4.50m x 1.20m)
- W-10 1.5mm thk. Aluminum Framed Powder Coated Casement Type Window
with 10mm thk. Reflective Tempered Glass (W-10) (1.20m x 1.20m)
- W-11 1.5mm thk. Aluminum Framed Powder Coated Casement Type Window
with 10mm thk. Reflective Tempered Glass (1.80m x 1.20m)

- W-12 1.5mm thk. Aluminum Framed Powder Coated Casement Type Window with 10mm thk. Reflective Tempered Glass (2.40m x 1.20m)
- W-13 1.5mm thk. Aluminum Framed Powder Coated Window with 8mm thk. Reflective Tempered Glass (4.50m x 2.10m)
- W-14 1.5mm thk. Aluminum Framed Powder Coated Window with 8mm thk. Reflective Tempered Glass (2.70m x 2.10m)
- W-15 1.5mm thk. Aluminum Framed Powder Coated Fixed Type Window with 8mm thk. Reflective Tempered Glass (2.70m x 1.20m)

ITEM 12: PAINTING

GENERAL

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

SCOPE OF WORK

This Section covers the surface preparation, coating materials and application of coatings systems required for the Works.

The work shall consist of furnishing of all labor, materials, equipment and other incidentals necessary for the supply of painting materials and the complete painting of surfaces as shown on the drawings in accordance with this Specification and as directed by the Engineer.

The term paint as hereinafter used includes emulsion paints, varnishes, oils, pigments, thinner and dryers.

All exposed metal surfaces, except metal surfaces embedded in concrete, shall be painted unless otherwise specified.

STANDARD

The following publications listed below, but referred to thereafter by basic designation only, forms a part of these Specifications to the extent indicated by the reference thereto:

Steel Structures Painting Council (SSPC) U.S. Specification JIS K 5628 Red-lead Zinc Chromate Anti-Corrosive Paint.

SUBMITTAL

1. The Contractor shall submit work method statements with lists of materials to the Engineer for approval twenty eight days before the starting of works. This statement shall include following items:
 - a. Type of paint and manufacturer
 - b. Manufacturer's specifications
 - c. Storage and delivery of materials
 - d. Surface preparation
 - e. Finish painting and drying
 - f. Touch-up painting, if any
 - g. Equipment
2. The Contractor, before placing order for the painting materials, shall submit to the Engineer for approval samples of materials. No placing of orders for material shall be made without his approval.

STORAGE AND DELIVERY

1. The Contractor shall deliver all material to the site in the original labeled sealed cans and containers, with labels intact and seal unbroken.
 - a. Seals shall remain unbroken until after inspection and acceptance of material by the Engineer.

- b. The Contractor shall deliver materials in ample quantities sufficiently in advance of the need to avoid any delay or interruptions in the works.
2. Paint in thinner shall be stored in accordance with the approved manufacturer's instructions.
- a. All regulations required for storage of paint shall be observed and all necessary safety signs required by governing codes shall be posted.
 - b. Any damage caused by failure to exercise proper precautions in paint storage shall be repaired.

MATERIAL REQUIREMENTS

PAINT

Paints for the protective coating system shall be the product of a manufacturer approved by the Engineer.

Paints for exterior finish must be with tile like durability and elegance, fast drying, solvent based acrylic, highly suitable for coastal or polluted areas with excellent anti-fungus properties and alkali resistance.

100% Acrylic, water based, quick-drying, easy to clean-up and environmentally friendly, resist dirt, stains, alkali, water, humidity, algae, mold and mildew growth and highly durable paint for interior finish.

An all-purpose synthetic quick dry paint for all types of wood and metal surfaces. It has high gloss, good color retention and outstanding durability.

For pipes, valves and equipment, galvanized and ungalvanized ferrous metal, use a 100% acrylic gloss paint, has excellent resistance to ultraviolet rays and resists chalking, cracking and color fading, dries fast and environmentally friendly.

SCHEDULE OF PAINTING

Paint manufacturers shall be BOYSEN, DAVIES or approved equal.

Architectural Items	
a. Exterior Finishes	
1. On Concrete Walls	
Three Coats, Concrete Masonry Paint	Boysen Titan Superflex, Elastomeric Paint or approved equal
2. Unprimed Ferrous Metal	
First Coat	Boysen Red Oxide Primer, #310 or approved equal
Second & Third Coat	Boysen Quick Dry Enamel or approved equal

3. On Concrete Block Wall	
Masonry Neutralizer	Boysen Masonry Neutralizer #44 or approved equal
Three Coats Concrete Masonry Paint	Boysen Titan Superflex Elastomeric Paint or approved equal
4. On Wood	
First Coat Exterior Wood Primer	Boysen Flatwall Enamel or approved equal
Second & Third Coat Exterior enamel	Boysen Quick Drying Enamel or approved equal
b. Interior Finishes Location of the various finishes are listed in the Finish Schedule on the drawings or else will be confirmed by PPA	
1. On primer and coated metal two coats of interior semi-gloss enamel or as indicated in the Schedule finish	Boysen Red Oxide Primer #310, Boysen Quick Dry Enamel or approved equal
2. On Plaster	
First Coat	Boysen Masonry Neutralizer #44 or approved equal
Three Coats	Boysen Titan Superflex, Elastomeric Paint or approved equal
3. On Wood	
First Coat Enamel undercoater	Boysen Flatwall Enamel or approved equal
Second & Third Coat Exterior enamel	Boysen Quick Drying Enamel or approved equal
4. Wood Stain Finish	
First Coat Second & Third Coats Fourth & Fifth Coats	Boysen Oil Wood Stain , Boysen Lacquer Sanding Sealer #1254 Boysen Clear Gloss Lacquer #1250 or approved equal
c. Non – Architectural Items (Piping, valves, equipment, etc.)	
1. Piping, valves, equipment etc. in rooms are to be painted	
2. Galvanized pipes and ducts	
Primer – one coat	Boysen Red Oxide Primer, #310 or approved equal
Finish – one coat	Boysen Quick Dry Enamel or approved equal
3. Black steel pipes	
Primer – one coat	Boysen Red Oxide Primer, #310

Finish – one coat	or approved equal Boysen Quick Dry Enamel or approved equal
4. Mechanical Items	
a. Ungalvanized ferrous metal Primer – one coat Finish – one coat	Boysen Red Oxide Primer, #310 or approved equal Boysen Quick Dry Enamel or approved equal or approved equal
b. Galvanized ferrous metal Primer – one coat Finish – one coat	Boysen Red Oxide Primer, #310 or approved equal Boysen Quick Dry Enamel or approved equal or approved equal
c. Submerged galvanized ferrous metal Primer – one coat	Boysen Red Oxide Primer, #310 or approved equal
d. Buried miscellaneous ferrous surface valves, & flanged joints (excl. pipe) Primer – one coat	Boysen Red Oxide Primer, #310 or approved equal

EXECUTION

SURFACE PREPARATION OF STEEL

1. Steel surfaces shall be cleaned as follows:
 - a. All round welds, burrs and sharp surface projections shall be ground smooth and all weld splatter shall be removed prior to blast cleaning.
 - b. Sand abrasives, if used, shall be clean, and free from salt and extraneous matter. The sand shall pass through a 2.0mm test sieve, and be substantially retained on a 0.18mm test sieve, with at least 25 percent retained on a 0.355mm test sieve.
 - c. Metallic abrasive, if used, shall be sharp, hard and free from dust, and shall pass through a 1.8 mm test sieve.
 - d. Blast cleaning operations shall not be conducted on surfaces that will be wet after blasting and before coating, or when the surfaces are less than 10°C above degree points, or when the relative humidity of the air is greater than 95 percent.
 - e. Any oil, grease, soil, dust or other foreign matter deposited on the cleaned surfaces shall be removed prior to painting. In the event that rusting occurs after completion of the surface preparation, the surfaces shall be cleaned again in accordance with the specified method.
 - f. Particular care shall be taken to prevent the contamination of other corrosive chemicals before the application of the paint. Such contamination shall be removed from the cleaned surface by flash blasting and the paint applied immediately.

- g. Care shall be taken to prevent contamination of cleaned and painted surfaces by cleaning operations in an adjacent area.
- h. Surfaces not to be painted shall be suitably protected from the effects of cleaning and painting operations.

SURFACE PREPARATION OF WOOD

1. Wood surfaces shall be sanded to a fresh surface. Surface mould where present, shall be removed by washing, rubbing down and burning off as necessary. Resinous exudation and large knots shall be removed and replaced with filler or other materials approved by the Engineer.
2. Parts of timber to be enclosed in walls shall always be primed unless already impregnated. Priming shall be brushed on and a minimum of two coats applied to end grain. When the priming paint is hard, all cracks, holds, open joints, etc. shall be made good with hard stopping and rubbed down with fine abrasive paper. Priming of joinery shall be applied only on site after the Engineer has approved such joinery and before it is fixed. For internal surfaces primer coats shall be carefully flattened.

SURFACE PREPARATION OF CONCRETE AND PLASTER

Concrete and cement plaster surfaces to be painted shall be prepared by removing efflorescence, dust, dirt, grease, oil, asphalt, tar, excessive mortar and mortar dropping and by roughening to remove glaze. A zinc sulfate solution shall be applied before prime coat.

SURFACE PREPARATION FOR FIBER CEMENT SURFACES

Shall be dry and clean prior to application of the specified first-coat material. Oil, grease, or rust stains shall be carefully removed by the use of suitable solvent. Wire brushing will not be permitted. After the first coat has become dry and prior to application of finish coats, touch-up coats shall be applied to suction spots.

ALUMINUM FRAMES FOR DOORS AND WINDOWS

All metal surfaces shall undergo pre-treatment process which includes: desmutting, water-rinsing, degreasing/etching, water rinsing, zinc phosphating, water rinsing and acid rinsing.

Powder coating application, shall be factory applied and shall be done in one operation using an electro-static powder gun. The materials to be coated should be well connected to earth. Coating thickness should be kept to a minimum of 60 microns for exposed areas. On details which are to be treated mechanically after coating (drilling, sawing, etc.), the coating film must not exceed 100 microns.

The powder coating shall be oven cured in the range of 20 minutes at 220° C (metal temperature measured on the area with greatest metal thickness). The temperature variation in the oven should not exceed +/- 10° C.

Handling

Coated items should be cooled to no less than 40° Centigrade before handling. Precautions should be taken to avoid damages on the finished coating during stacking, storing and transportation.

Storage and Delivery

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water and easily accessible for inspection and handling. Store materials neatly on the floor, properly stacked on non-absorptive strips or wood platforms. Protect finished surfaces during shipping and handling using manufacturer's standard method.

WOOD REPAIR

Badly decayed areas shall be removed and repaired. Areas and pieces decayed beyond repair shall be replaced with new pieces that match originals in all respects. Moderately decayed areas, weathered, or gouged wood shall be patched with approved patching compounds, and shall be sanded smooth. The source or cause of wood decay shall be identified and corrected prior to application of patching materials. Wet wood shall be completely dried to a moisture content not exceeding 12 percent, as measured by a moisture meter, to its full depth before patching, unless otherwise authorized. Wood that is to be patched shall be clean of dust, grease, and loose paint.

1. Epoxy Wood Repair

Epoxy wood repair materials shall be applied in accordance with manufacturer's written instructions. Health and safety instructions shall be followed in accordance with the manufacturer's instructions. Clean mixing equipment shall be used to avoid contamination. Mix and proportions shall be as directed by the manufacturer. Batches shall be only large enough to complete the specific job intended. Patching materials shall be completely cured before painting or reinstallation of patched pieces.

2. Epoxy Consolidant and Epoxy Paste

Epoxy liquid wood consolidant shall be used:

1. To penetrate and impregnate deteriorated wood sections in order to reinforce wood fibers that have become softened or absorbent.
2. As a primer for areas that are to receive epoxy paste filler. Epoxy paste shall be used to fill areas where portions of wood are missing such as holes, cracks, gaps, gouges, and other voids.

MIXING AND THINNING

Mixing and thinning of paint shall be done in accordance with the approved manufacturer's printed instructions. The pot life of each paint as stated by the manufacturer shall not be exceeded.

WEATHER CONDITION

The paint shall not be applied when the relative humidity is above 85 percent. The paint shall not be applied in rain, wind, fog, dust or mist.

APPLICATION

Workmanship shall be first class in every respect. All work shall be done in a workmanship manner so that the finished surfaces shall be free from runs, chop, ridges, waves, laps and unnecessary brush marks. All coats shall be applied in such manner as to produce an even film of uniform

thickness. Edges, corners, crevices, welds and rivets shall receive special attention to ensure that they receive an adequate thickness of paint.

All painting shall be done by thoroughly experienced workmen.

Safety regulations shall be adhered to at all times, including the wearing of respirators by persons engaged on assisting in spray painting. Adjacent areas and installation shall be protected by the use of cloths or other approved precautionary measures.

Plain enamel and varnish shall be applied carefully with good clean brushes or approved spraying equipment, except that the initial coat on any surface shall be applied with brush. Sufficient time shall be allowed between coats to assure thorough drying and each coat shall be in proper condition before receiving the next coat.

Sanding and dusting as required shall be performed between coats in varnishing work. Finish coat shall be smooth and free from runs, sags, and other defects. Exterior paint shall not be applied during rainy days.

All paint when applied shall provide a satisfactory film and smooth, even surface. Paint shall be thoroughly stirred and kept at a uniform consistency during application. Powdered metallic pigments added at the time of use shall be mixed by adding the powder in small increments to about one-third of the base paint or vehicle, with thorough mixing to obtain a smooth paste. The remainder of the base paint shall then be thoroughly stirred in.

Different brands of emulsion paints shall not be mixed prior to application of the materials.

Where necessary to suit conditions of surface temperature, weather and method of application, the package paint may be thinned immediately prior to application in accordance with the approved manufacturer's directions, but not in excess of 125 cc of suitable thinner per liter (one pint per gallon). Before using, the paint shall be mixed to a uniform consistency and shall be stirred frequently during application.

Paints other than water-thinned paints shall be applied only to surfaces which are completely free of moisture as determined by sight or touch and only such combinations of humidity to be painted as will cause evaporation rather than condensation.

Surfaces which have been cleaned, pretreated and/or otherwise been prepared for painting shall be primed or painted with one coat of finish paint as soon as practicable after such preparation has been completed, but in any event prior to any deterioration of the prepared surfaces.

The first coat of paint on all exterior surfaces shall be applied by brush. Interior prime coats and all other subsequent coats on either exterior or interior surfaces may be applied by brush or spray. Whenever spraying is permitted all areas inaccessible to spray painting shall be coated by brushing or other suitable means. Brushes to be used for application of water-emulsions shall be soaked in water for a period of 2 hours prior to use.

All cloths and cotton waste which might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day.

Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site or destroyed in a manner approved by the Engineer. Paint spots, or stains upon adjacent surfaces shall be removed and the entire job left clean and acceptable to the Engineer.

No smoking shall be permitted in the vicinity where painting is going on.

TOUCH-UP PAINTING

Touch-up painting shall be done with the same paint as used for the original coat. The resulting minimum dry film shall be the same as for the original coat.

Touch-up painting shall include cleaning and painting of field connections, welds and all damaged or defective paint and rusted areas.

During touch-up painting, only loose, cracked, brittle or non-adherent paint shall be removed during cleaning. All exposed edges shall be feathered. Touch-up painting shall be performed in a manner which will minimize damage to sound paint. Rust spots shall be thoroughly cleaned and edges of the existing paint shall be scraped back to sound material.

DRYING

1. No primer or paint shall be forced to be dried under conditions which will cause cracking, wrinkling, blistering, formation of pores which would detrimentally affect the condition of the paint.
2. No drier shall be added to the paint unless specified in the approved manufacturer's instructions.
3. Painted surfaces shall be protected from dust, dirt, and the elements of the weather until dry to the fullest extent practicable.
4. After drying, any areas of paint damaged from any cause shall be removed, the surface again prepared and then touched-up with the same paint and to the same thickness as the undamaged areas as specified in sub-section 4.14.3.7 above.

HANDLING

1. Precautions shall be taken to minimize damage to paint films resulting from stacking for drying.
2. Paint which is damaged in handling shall be scraped off and touched-up with the same paint and in the same thickness as was previously applied to the damaged area at Contractor's expense.

INSPECTION

1. All works and materials supplied under this Specification shall be subject to inspection by the Engineer.
2. The Contractor shall correct such works or replace such materials found defective under these Specifications at his own expense.

ITEM 13 : DRY WALL PARTITION

GENERAL

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete construction of dry wall partition for the building as indicated on the drawings and as specified herein.

DRY WALL

Stud:	76 mm (3 inches) 3.00 meter length
Track:	76 mm (3 inches) 3.00 meter length
Board:	1.20 x 2.40 x 12mm fiber cement

SUBMITTAL

1. Shop drawings for all finishing and painting works for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.
2. The Contractor, before placing order for the finishing materials shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.
3. Samples of all walls finishes, measuring not less than 1000mm x 1000mm shall be submitted to the Engineer for approval as to its finish texture and workmanship.

EXECUTION

All materials will be delivered and installed on site.

ITEM 14 : CARPENTRY AND JOINERY WORKS**SCOPE OF WORK**

The work shall consist of furnishing all tools, labor, equipment and materials, unless otherwise specified to complete all carpentry and joinery works shown on the Drawings and specified herein.

GENERAL REQUIREMENTS**a. Lumber Grades**

Lumber shall be of the best grade available, of the respective kinds required for the various parts of work; well seasoned, thoroughly dry and free from loose or unsound knots, sap, shakes or other imperfections impairing its strengths, durability and appearance. All exposed woodwork shall be smooth by dressed and sandpapered unless otherwise indicated or specified. Framing lumber shall be of the rough dimensions unless otherwise shown on the drawings.

b. Substitution of Lumber

Any lumber equally good for the purpose intended maybe substituted for the kind specified, subject to prior written approval of the Engineer. Provided, however, that in the substitution of the cheaper kind of lumber than that specified, a reduction in the contract price equal to the difference in the costs of the two kinds of lumber shall be made.

c. Delivery and Storage

The Contractor shall deliver lumber to the site in undamaged condition. Lumber shall be stacked in such a manner as to insure proper ventilation and drainage, and shall be supported at least 150 mm above-ground. Lumber shall be protected against dampness before and after delivery, and enough protection under cover in well ventilated enclosure, not exposed to extreme changes of temperature and humidity; and in a manner as to provide air-circulation around all surfaces of each pile to insure thorough air-seasoning. Lumber or millwork in buildings shall not be finished until concrete, masonry work and plaster are dry. Lumber shall be delivered at least thirty (30) days before use.

d. Grading of Plywood

Each sheet of plywood shall bear the mark identifying the plywood as to wood species, glue type and grade.

MATERIALS**a. Lumber**

Lumber for various uses shall be one of the species listed for the purpose indicated unless otherwise specified in the drawing. For any use not specified, the lumber shall be the best commercial grade normally used for the purpose, subject to the approval of the Engineer.

All framings shall be done as far as possible with carefully fitted mortise and tenon joints.

All doors, windows, transoms, or other opening where so indicated on plans, shall have frames and sills of the dimensions shown or as hereafter detailed, and all frames coming in

contact with concrete shall be anchored by means of 20-d nails, spaced not more than 0.20m, apart, all around the contact surfaces. All frames shall be rabbetted, molded and cut with saw and cut under for water drips.

SPECIE	U S E
Yakal	All door jambs, headers and transom bars, wood plates and all other woodwork in contact with concrete or masonry and where indicated.
Apitong (pressure treated)	All truss members and rafters and where indicated; all wood framings and carpentry, except when in contact with concrete.
Tanguile (Kiln dried)	All exterior and interior mill work, siding, finish and trim, frame work and all other wood works not specifically mentioned; except when in contact with concrete.

b. Plywood

Plywood shall conform to Commercial Standard PSI and shall be of local manufacture.

Plywood to be varnished shall be tanguile or kalantas veneers (as indicated), ribbon grained, water resistant, Class B and of the thickness indicated.

Plywood to be painted shall be tanguile veneer ordinary rotary-cut, water resistant, Class C and of thickness indicated.

Plywood exposed to the outside elements or where indicated shall be waterproof or marine plywood and of the thickness indicated.

c. Laminates

Decorative laminate is commonly used to surface kitchen counters, table tops, and cabinetry because of its resistance to stains, scratches, and heat.

The wood laminates shall be 3mm thick to be glued on 12mm thick plywood as specified on plans

d. Fastenings

Fastenings shall be common nails, glue or specified, flat-head wood screws (F.H.W.S.), rough-head wood screws (R.H.W.S.), bolts or lag screws where specified or called for shall be used. Conceal fastenings as much as possible; where not possible, locate them in inconspicuous places, where nailing is permitted through woodwork smooth-finished face, conceal nail heads.

1. Nails

Shall be of the smooth shank, zinc coated, common wire nails of local manufacture, and of types and sizes best suited for the purpose.

2. Wood Screws

Shall be brass or cadmium plated of the best available commercial quality, and of types and sizes suited for the purpose.

PRESSURE TREATED LUMBER

a. Preservative Treatment

All lumber indicated to be pressure treated, shall contain any of the following net retention of solid preservative.

- | | | | |
|----|----------------|---|--|
| a. | Boliden Salts | - | 45.5 kg. dry chemical per cubic foot of wood |
| b. | Wolman Salts | - | 0.31 kg. dry chemical per cubic foot of wood |
| c. | Tenalith Salts | - | 0.34 kg. dry chemical per cubic foot of wood |

The Contractor shall submit an affidavit signed by an official of the preservative treatment company to the Engineer. This affidavit shall indicate the net retention of solid preservatives obtained and shall certify that pressure treated lumbers have a moisture content that does not exceed 17 percent upon shipment from the treatment plant.

Where it is necessary to cut or bore pressure-treated lumber on the job, two coats of prepared concentrated preservatives solution shall be applied to the end-cut or bored surfaces.

ROUGH CARPENTRY

All work shall be well fitted, accurately set, and rigidly secured in place. Anchors and bolts (with nuts and washers) straps and tie rods shall be provided as required.

a. Cutting and Fitting

Cutting and fitting to accommodate other work shall be done in the required manner, and cut or damaged work shall be patched and made good.

b. Framing and Structural

Framing and structural lumber shall be well-seasoned, straight, square-edge stacks, and free from loose or unsound knots, bark edges or other defects that will impair its strength.

c. Plates for Walls and Partitions

Plates for walls and partitions shall be of the same width as the studs and shall form continuous horizontal ties.

Structural members shall not be cut, bored or notched for the passage of pipes or conduits without prior approval of the Engineer. All members damaged by such cutting or boring shall be reinforced by means of specially formed and approved sheet metal or steel shapes or remove or replaced with new member as directed.

Anchors, connectors and fastenings not indicated or specified otherwise shall be of the size and types necessary to suit the conditions encountered. Size, type and spacing of nails, screws or bolts for installation of manufactured building materials shall be as recommended by the product manufacturer unless indicated or specified otherwise.

Rough hardware, exposed to weather or in contact with exterior walls or masonry or slabs shall be zinc-coated except as specified otherwise.

All lumber surfaces in contact with concrete or masonry shall be given a brush coat of bituminous paint before installation.

JOINERY WORK

All lumber used for the joinery work shall be of the kinds and grades specified and shall be of the contours, patterns and profiles indicated.

All joints shall be made, installed tight and securely fastened in a manner approved by the Engineer. Exterior joints shall be mitered and interior angles coped. Panels shall be fitted to allow for shrinkage, avoid swelling, and insure that the work remain in place without warping, splitting and opening of joints.

Interior trims shall be approved standard stock moldings, except where special patterns or profiles are indicated.

Joints for cabinet work shall be glued in addition to nails or other fastening device required. Nailing shall be concealed where practicable. Where face nailing is used, nails shall be set for putty stopping.

All exposed surfaces shall be machined or hand sanded finished to an even smooth surface. No hammer marks or other unsightly marks shall be allowed on any wood panel or veneer.

ITEM 15 : SUPPLY AND INSTALL OF STAIR NOSING**GENERAL**

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete supply and install of stair nosing for the buildings as indicated on the drawings and as specified herein.

STAIR NOSING

1. Supply and installation of 50mm x 10mm thick. Stair Nosing (Rigid Type)

SUBMITTAL

1. Shop drawings for all stair nosing for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.
2. The Contractor, before placing order for the finishing materials shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.

ITEM 16 : MODULARS, TABLES, CHAIRS, AND GANG CHAIRS OF VARIOUS TYPE INCLUDING ACCESSORIES**GENERAL**

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete supply of gang chairs for the buildings as indicated on the drawings and as specified herein.

MODULARS

<i>Modular System</i>	<i>Unit</i>	<i>Quantity</i>
Rectangular Worktop (1500mm x 600mm) with grommet	pc	2.00
Stall countertop (1850mm X 400mm)	pc.	2.00

CHAIRS

<i>Chairs</i>	<i>Unit</i>	<i>Quantity</i>
Mid back Chair / Clerical Chair	set	2.00
4 - Seater Gang Chair	set	23.00
5 - Seater Gang Chair	set	22.00
6- Seater Gang Chair	set	50.00

SUBMITTAL

1. Shop drawings for all gang chair for the building shall be submitted in advance to allow twenty eight days for review and approval. Shop drawings shall indicate materials and details of finishing works. The Contractor shall be responsible for all errors of detailing and fabrication, and for the correct finishing work items shown on the shop drawings.
2. The Contractor, before placing order for the supply shall submit to the Engineer for approval representative samples of finishing materials. No placing of orders for material for finishing works shall be made without his approval.

EXECUTION

All materials will be delivered and installed (if needed to be installed) on site.

ITEM 17 : SIGNAGES

SCOPE OF WORK

Furnish materials and perform labor to include miscellaneous works required for the installation of room identification for the toilets and port office.

SAMPLE AND SHOP DRAWINGS

The Contractor shall submit samples for approval by the Engineer. For the room I.D. full size lettering layout and installation method shall be submitted to the Engineer for approval before start of work.

MATERIAL REQUIREMENTS

ROOM MARKERS

Black acrylic letters, 38mm (1-1/2") high on white acrylic background, 63mm (2-1/2") high, with clear acrylic cover. Lengths shall be as required by the full notation therein.

EXECUTION

WORKMANSHIP

Workmanship shall be executed in high quality comparable with artworks.

MOUNTING

For all mounted assemblies, appropriate mounting hardware and connectors which are concealed shall be sufficiently used.

Assemblies shall be mounted plumb, straight, level, and at prescribed heights.

INSTALLATION

Installation shall be done in a secure and permanent manner at prescribed heights and/or layout. The backwall shall not be mutilated. After the dowels are positioned, fill with expanding grout, or other approved fillers, and retouch, flashed to the backwall surface.

ITEM 18: FACILITIES AND DEVICE FOR PERSONS WITH DISABILITY

SCOPE OF WORK

The work shall consists of furnishing materials, tools, labor and incidentals necessary for the construction/installation of facilities and device for disabled persons as shown on the Drawings and in accordance with the Implementing Rules and Regulations of Batas Pambansa Bilang 344 and this Specification.

MATERIAL REQUIREMENTS

GRAPHIC SIGNS

Graphic signs like the International Symbol of Access shall be fabricated from plastic materials, white color with either dark blue background. Letters and symbols shall be laminated and raised from the background.

HANDRAILS

Handrail for ramp shall be 50mmØ tubular stainless steel buff finished. It shall be provided with a small hole as of a Braille system.

GRABRAIL

Grab rail shall be manufactured from gauge 18 tubular stainless steel 50mmØ and provided with safety grip finish.

Flip up bar shall be 38mmØ tubular stainless steel buff finished.

CONCRETE MATERIALS FOR RAMPS

1. Portland cement shall conform with the requirement of "Reinforced Concrete".
2. Aggregates shall conform with the requirements of "Reinforced Concrete".
3. Temperature bars shall have diameter of 10mm conforming with the requirements of "Concrete Works".

EXECUTION

GRAPHIC SIGNS

1. Directional and information signs, indicating the location of the ramp for physically handicapped persons, shall be installed / placed at the front of the main entrance of the Terminal Building. The signed board size and dimensions shall be based on DOTr approved Standard Design, schedule 40, sign post and the text and arrow shall be in accordance with the International Symbol of Access "B". Manual (See attached drawings and tabulation).
2. Signs shall be placed at the entrance and exits of the ramps and toilets, installed at conspicuous locations. The signboards shall be based on DOTC approved Standard Design Manual (See attached drawings and tabulation).

RAMP

The ramp shall be constructed as shown on the drawings and with a nonskid surface and tactile strips.

GRABRAILS

Lavatories, urinals and water closets of the Terminal Building where indicated on the drawings shall be provide with grabrails. The position and distance from the floor shall be as shown on the drawings.

ITEM 19 : CONCRETE WATERPROOFING

GENERAL

General Requirements contain provisions and requirements essential to these specifications and apply to this Section, whether or not referred to herein.

SCOPE OF WORK

The work shall cover the waterproofing requirements for building as shown on the drawings.

The work shall consist of furnishing all labor, materials, equipment and other incidentals necessary for the integral waterproofing works where required as shown on the drawings and in accordance with the requirements of these specifications as directed by the Engineer.

SUBMITTAL

1. The Contractor shall submit for approval of the Engineer the name of the manufacturer nominated for the supply of materials and installation. Sub-contracting documents shall be submitted to the Engineer by the Contractor.
2. The Contractor shall submit the procedure of waterproofing application for approval of the Engineer.
3. Waterproofing materials shall be applied only by an experienced applicator and shall be applied in accordance with the approved manufacturer's application procedures or methods, approved by the Engineer.

PRODUCT HANDLING

Materials shall be delivered and dosed to the batching plant/s in the sealed drums and packages bearing the manufacturer's name.

ALTERNATIVE

No substitution of materials shall be made unless authorized in writing by the Engineer prior to starting the work of waterproofing.

MINIMUM GUARANTEE PERIOD

The Contractor shall guarantee the work for a minimum guarantee period of ten (10) years. The Contractor shall make sub-contract agreement with approved manufacturer in which following conditions shall be included:

1. Minimum guarantee period of (10) years after the issuance of Take-Over Certificate.
2. The Contractor shall transfer all the rights to the Employer free of charge after the issuance of Taking-Over Certificate.

MATERIAL REQUIREMENTS

All concrete such as Slab and Beam at Roof Deck, Cistern Tank and Water Tanks, shall be waterproofed by the addition of HYDROPHOBIC POREBLOCKING INGREDIENT (HPI) named 3CC product or approved equivalent complying with items 6, 7 and 8 of the minimum requirement stipulated below and approved by the Engineer. The dosage of 3CC shall be at the rate of 15 liters per cubic meter of concrete and shall be combined with SUPERPLASTICISER at the manufacturer's recommended rate.

Furthermore, concrete containing 3CC shall comply strictly with the following minimum requirements:

1. The concrete cement (OPC) content shall not be less than 350 kg per cubic meter or minimum of 300 kg per cubic meter of Ordinary Portland Cement (OPC) and 80 kg per cubic meter of Fly Ash (using Fly Ash) or Concrete Compressive Strength shall be at least 30 MPa.
2. The water content shall be reduced to adjust for the 3CC usage and maintain the required workability; however the water/cement ratio must not exceed 0.45
3. Steel Reinforcement shall be using hard rib deformed bars.
4. Other details of 3CC concrete shall be conforming to current recommendations and requirements.
5. A trial mix must be conducted prior to construction and the cement content is to be stated on the premix concrete dockets.
6. The concrete shall contain HYDROPHOBIC POREBLOCKING INGREDIENT(HPI) named 3CC in such a way that the concrete shall have a corrected 30 minute water absorption of not greater than 1.50 % as measured by BS 1881:Part 122:1983 except that the age at test shall be 7 days.
7. The product to be used must be proven by an independent authority to have had no reduction in performance after field exposure for a minimum of 15 years.
8. The 3CC concrete performance shall be warranted for 10 years including construction joints, pipe projections and tie rod points.
9. The Engineer reserves the right to require the concrete as placed and cured in the actual structure to comply with the water absorption limit within 7 days of placement. The Contractor shall provide costing for water absorption testing by an independent laboratory, and if so required, samples shall be taken during construction as directed by the Engineer. These samples shall be tested according to BS 1881: Part 122:1983 and shall conform with the water absorption requirement. The Engineer further reserves the right to take cores from the structure to confirm compliance.

CURING COMPOUND

Curing of HPI Concrete shall be using CALCURE B or approved equivalent

WATERSTOP

All construction joints, pipe projections, floor drains and tie rod points shall be using waterstop, a controlled expansion waterstop, an active butyl rubber based waterstop which activates after approximately 5 - 10 days of constant exposure to water. The waterstop material should not expand prematurely and should not absorb water from the fresh concrete poured against it.

FLOODTESTING

Floodtest for a duration of 48 hours shall be undertaken upon completion of waterproofing installation to determine any leakage or defect on the materials and/or workmanship.

ITEM 20 : STEEL AND METAL WORKS**GENERAL**

General Requirements contain provisions and requirements essential to these specifications; and apply to this Section, whether or not referred to herein.

SCOPE OF WORK

The work includes the furnishing of all labor, materials, equipment and other incidentals necessary for the fabrication and installation of structural steel and miscellaneous metal works as specified in relevant items of these specifications and as indicated on the drawings.

SUBMITTAL

1. Before placing orders for materials for the steel and metal works, the Contractor shall submit to the Engineer for approval shop drawings for all steelwork. All project shop drawings shall show the dimension of all parts, method of construction, bolts, welding sectional areas and other details.
2. The detail of connections shown on the shop drawings shall be such as to minimize formation of pockets to hold condensation, water or dirt. A minimum gap between abutting angles and the like shall be provided wherever possible to eliminate any traps and facilitate maintenance painting.
3. No materials shall be ordered nor fabrication commenced until the shop drawings are approved by the Engineer.

STORAGE OF MATERIALS

Structural materials, either plain or fabricated, shall be stored above the ground upon platforms, skids, or other supports. Materials shall be kept free from dirt, grease, and other foreign matter and shall be protected from corrosion.

MATERIAL REQUIREMENTS

1. Unless specified herein all steel structures and metals shall conform with the requirements of "Steel and Metal Works." Connections where details are not specified or indicated herein, shall be designed in accordance with the American Institute of Steel Construction (AISC), Manual of Steel Construction, latest edition.
2. Structural steel works consisting of channels, gusset plates and other structural steel shape shall be as indicated on the drawings and shall be structural carbon steel conforming to ASTM A 36. Shapes shall be as given in AISC, Manual of Steel Construction.
3. High strength structural bolts, shall conform to ASTM A 325, Types 1 or 2. Nuts shall conform to ASTM A 560, Grade A, heavy hex style, except nuts 38 mm (1-1/2 inch) may be provided in hex style. Washers shall conform to ANSI B 18.22.1, Type B.
4. Electrodes for arc welding shall be E70 series conforming to American Welding Society Specifications A5.1.
5. Tests are required under the ASTM Standards for steel to be used in the Works and shall be carried out in the presence of the Engineer and at least four (4) days notice must be given to him of the dates proposed for such tests. Four (4) calendar days notice on which fabricated steelwork will be ready for inspection in the Contractor's yard.

6. Standard bolt shall conform to ASTM A 307 Carbon Steel Externally Threaded Standard Fasteners.

EXECUTION

QUALIFICATION

Qualification of steel fabricators, erectors and welders shall comply with the requirements.

FABRICATION REQUIREMENTS

1. Workmanship

Fabrication shall be performed within the permissible tolerance by the approved fabricator. All workmanship shall be of the best quality with respect to internationally recognized standards of practice.

2. Cutting

Low-carbon structural steel may be cut by machine-guided torch instead of by shears or saw. Harmful notches, burrs, irregularities, etc., shall not be developed at the cut surface.

3. Contact Faces

Contact surfaces between bases or other elements bearing directly upon bearing plates shall be ground or milled as necessary for full effective bearing. Edges for welding shall likewise be properly prepared.

4. Bolt Holes

Bolt holes shall be according to engineering practice and as specified in these specifications. Gas burning of holes will not be permitted.

5. High Strength Bolt Assembly Preparation

Surfaces of high strength bolted parts in contact with bolt heads and nuts shall not have a slope of more than 1:20 with respect to a plane normal to the bolt axis.

Where the surface of a high strength bolted part has a slope of more than 1:20, a beveled washer shall be used to compensate for lack of parallelism.

High strength bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible materials.

When assembled, all joint surfaces including those adjacent to washers shall be free of scale except tight mill scale, and shall be free from dirt, loose scale, burrs, and other defects that would prevent solid seating of parts.

Contact surfaces of friction-type joints shall be free from oil, paint, lacquer or galvanizing.

6. Welding

All welding shall be done only by welders certified as to their ability to perform in accordance with accepted testing requirement.

Welding of parts shall be in accordance with structural standards and the Standard Code for Arc and Gas Welding in Building Construction of AWS, and shall only be done where shown, specified, or permitted by the Engineer.

Damage to galvanized areas by welding shall be thoroughly cleaned with wire brushing and all traces of welding flux and loose or cracked zinc coating shall be removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight. As an alternative to the above, the Contractor may submit for approval the use of a galvanizing rod or galvanizing solder to repair damaged areas.

The welding machine shall be a stable welder, and have suitable functions for the dimension of materials to be welded. The auxiliary tools used for welding shall perform sufficiently and adequately.

The welding machine used for field welding shall be of readily adjustable for electric current.

7. Shop Assembly

Structural units furnished shall be assembled in the shop. An inspection shall be made to determine that the fabrication and the matching of the component parts are correct.

Jigs shall be used for the assembly of units as much as possible to maintain appropriate position of mutual materials.

Approval of the Engineer shall be required when drilling temporary bolt holes or welding temporary support to the assembled structure.

The tolerances shall not exceed those allowed by codes and each unit assembled shall be closely checked to insure that all necessary clearances have been provided and that binding does not occur in any moving part.

In order to maintain accurate finished dimensions and shape, appropriate reverse strain or restraint shall be provided as required. Assembly and disassembly work shall be performed in the presence of the Engineer, unless waived in writing by the Engineer any errors or defects disclosed shall be immediately remedied by the Contractor.

Before disassembly for shipment, component parts of the structures shall be match marked to facilitate erection in the field.

FABRICATION TOLERANCES

1. Dimensional Tolerances for Structural Work

Dimensions shall be measured by means of an approved calibrated steel tape at the time of inspection. Unevenness of plate work shall not exceed the limitation of the standard mill practice as specified in the American Institute of Steel Construction, "Manual of Steel Construction".

2. Camber

Reverse camber in any structural steel members in excess of 1/1,000 of the span length shall cause rejection. The minimum dead load camber for any structural steel member shall be as allowed by Code, or otherwise specified.

INSPECTION AND TEST OF WELDING

1. Inspection of Welding

Inspection of welding shall be executed for the following work phases.

a. Before Welding

Scum, angle of bevel, root clearance, cleaning of surface to be welded, quality of end tab, drying of welding rod.

b. During Welding

Welding procedure, diameter of coil and wire, type of flux, welding current and voltage, welding speed, welding rod position, length of arc, melting, cleaning of slag of each level under surface chapping, supervision of welding rod.

c. After Execution of Welding

Assurance of bead surface, existence of harmful defects, treatment of crater, quality of slag removal, size of fillet, dimension of extra fill of butt welding, treatment of end tab.

2. Testing of Welding

Twenty percent (20%) of welds contributing in the overall strength of the structure and which will be inaccessible for the inspection in service shall be tested.

Welding shall be tested by ultrasonic test to the extent specified herein or as directed by the Engineer.

Where partial inspection is required, the ultrasonic test shall be located at random on the welds so as to indicate typical welding quality.

If ten percent (10%) of the random ultrasonic tested indicate unacceptable defect, the remaining eighty percent (80%) of the welding shall be tested. Repair welding required shall be ultrasonic tested after the repairs are made.

CORRECTIONS

In lieu of the rejection of an entire piece or member containing welding which is unsatisfactory or which indicates inferior workmanship, corrective measures may be permitted by the Engineer whose specific approval shall be obtained for making each correction. Defective or unsound welds or base steel shall be corrected either by removing and replacing the entire weld, or as follows.

1. Excessive convexity or overlap shall be reduced by grinding.
 2. Undercuts, lack of weld shall be repaired with necessary reinforcement of weld after removal of any foreign materials such as slag, dust, oil, etc.
 3. Any defects such as slag inclusions, incomplete fusion, or inadequate joint penetration, shall be completely removed, cleaned and re-welded.
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4. Cracks in welds or base steel, shall be removed to sound steel throughout their length and 5cm beyond each end of the crack, followed by welding. The extent of the crack, depth and length, shall be ascertained by the use of acid etching, magnetic particle inspection or other equally positive means.

The removal of welded steel shall be done by chipping, grinding, oxygen cutting, oxygen gouging, or air carbon arc gouging and in such a manner that the remaining welded steel or base steel is not nicked or undercut. Defective portions of the welding shall be removed without substantial removal of the base steel.

INSTALLATION

1. Installation Program

a. Prerequisite Condition

Prior to executing steel fabrication and field installation, the Contractor shall prepare a comprehensive installation program including engineering supervision organization, fabrication procedures, field installation procedures, material application, machinery applications, inspection procedure, scope and standard of quality judgment, and submit to the Engineer for approval.

b. Special Technical Engineering

Special technical engineering different from contract specifications can be applied upon receiving approval of the Engineer.

2. Installation Requirement

a. Setting of Anchor Bolt and Others

- a. 1. Anchor bolts shall be set in accurate position by using templates.
- a. 2. The setting method shall be proposed to the Engineer for his approval before setting starts.
- a. 3. The threads of bolt shall be cured with an appropriate method against rust and/or any damage before tightening.
- a. 4. Non-shrink mortar shall be placed under base plates, well cured to obtain the sufficient strength before bearing loads are applied to base plates.

b. Temporary Bracing

- b. 1. Temporary bracing shall be installed as necessary to stay assemblies and assume loads against forces due to transport, erection operations or other work.
- b. 2. Temporary bracing shall be maintained in place until permanent work is properly connected and other construction installed as necessary for support, bracing or staying of permanent work.
- b. 3. Extent and quality of temporary bracing shall be as necessary against wind and other loads, including seismic loads not less than those for which the permanent structure is designed to resist.

c. Adequacy of Temporary Connections

During erection, temporary connection work shall be securely made by bolting and/or welding for all dead load, wind and erection stresses.

d. Alignment

No permanent bolting or welding shall be done until the alignment of all parts with respect to each other shall be true within the respective tolerances required.

e. Field Welding

e. 1. Any shop paint or surfaces adjacent to joints where field welding is to be executed shall be wire brushed to remove paint/primer.

e. 2. Field welding shall conform to the requirements specified herein, except as approved by the Engineer.

f. High Strength Bolts

Final tightening of high strength bolts shall be done by using manufacturer's power operated equipment without any overstress to the threads.

g. Correction of Errors

g. 1. Corrections of minor misfits by use of drift pins, and reaming, chipping or cutting will be permitted and shall be provided as part of erection work.

g. 2. Any errors to be corrected or adjusted, preventing proper assembly, shall be immediately reported to the Engineer, and such corrections or adjustments shall be made as necessary and approved by the Engineer.

g. 3. Cutting or alterations other than as approved will not be permitted.

h. Erection

h. 1. Erection and installation shall be as per approved shop drawings.

h. 2. Each structural unit shall be accurately aligned by the use of steel shims, or other approved methods so that no binding in any moving parts or distortion of any members occurs before it is finally fastened in place.

h. 3. Operations, procedures of erection and bracing shall not cause any damage to works previously placed nor make overstress to any of the building parts or components. Damage caused by such operations shall be repaired as directed by the Engineer at no extra cost to the Employer.

GALVANIZING

PREPARATION

All mild steel parts exposed to weather shall be hot-dipped galvanized after fabrication in accordance with the requirements of ASTM A 123 or ASTM A 153. Prior to galvanizing, the surfaces shall be cleaned of dirt, weld splatter, grease, slag, oil, paint or other deleterious matters. The steel surfaces shall be chemically de-scaled and cleaned with the same abrasive blast or other suitable method as approved by the Engineer.

COATING

The zinc coating shall consist of uniform layers of commercially pure zinc free from abrasions, cracks blisters, chemical spots or other imperfections, and shall adhere firmly to the surface of the steel. The weight of zinc coating per square meter of actual surface shall not be less than 550 grams. Any surface damaged subsequent to galvanizing shall be given two coats of approved zinc rich paints.

PAINTING

This work shall consist of the preparation of the metal surfaces, the application, protection and drying of the painted surfaces, and supplying of all tools, tackle, scaffolding, labor and materials necessary for the entire work. Painting shall be applied in the field or shop as approved by the Engineer.

Unless otherwise specified or approved, all painting work for structural steel shall comply with the requirements of this Section.

SHOP PAINTING

All structural steel shall be given a shop primer after fabrication and cleaning before delivery to the site.

All steel work shall be thoroughly dried and cleaned of all loose mill scale, rust and foreign matters by means of sand blasting or other suitable methods approved by the Engineer before shop painting shall be applied. Each individual piece shall be painted prior to assembly. Portions where field welding or field contact with concrete is required shall not be painted.

Except for galvanized surfaces and items to be encased in concrete, clean ferrous metal surfaces shall be given one coat of Amerlock 400 Epoxy Primer at 100 Microns or approved equal. Additional coat shall be applied to surfaces that will be concealed or inaccessible for finish painting by Amerlock 400, Top Coat at 150 Microns with color or equivalent.

FIELD PAINTING

After erection, the Contractor shall thoroughly prepare and clean the entire surface of all structural steel from all dirt, grease, rust or other foreign matters. The entire surface of all members shall then be field painted.

MATERIALS

1. Structural Steel Work

- a. After surface preparation, steelwork shall be given one coat of approved prefabricating primer.
- b. Before final assembly of steelwork at the fabricator's shop, two shop coats of special red lead primer shall be applied to the surface of sections to be in permanent contact, meeting faces and all other concealed surfaces. After final assembly, but before delivery to the project site, the steelwork shall likewise be given two shop coats of special red lead primer.

2. Galvanized Steelwork

All galvanized steelwork shall be treated with zinc chromate two-pack etch primer followed by one coat of non-etch zinc chromate primer.

3. Miscellaneous Metal Work

Unless otherwise specified in other Sections of the Specifications or shown on the drawing, miscellaneous metal works such as ladders, structural steel ladder rungs, etc. shall be given two shop coats of epoxy primer and two coats of epoxy enamel.

CONSTRUCTION METHODS

1. Cleaning of Surfaces

Surfaces of metal to be painted shall be thoroughly cleaned; removing rust, loose mill scale, dirt, oil or grease, and other foreign substances. Unless cleaning is to be done by sand blasting, all weld areas, before cleaning is started, shall be neutralized with a proper chemical, after which they shall be thoroughly rinsed with water.

Three methods of cleaning are provided herein. The particular method to be used shall be as directed by the Engineer.

2. Hand Cleaning

The removal of rust, scale, and dirt shall be done by the use of metal brushes, scrapers, chisels, hammers or other effective means. Oil and grease shall be removed by the use of gasoline or benzene.

Bristle or wood fiber brushes shall be used for removing loose dirt.

3. Sandblasting

All steel shall be cleaned by sandblasting. The sandblasting shall remove all loose mill scale and other substances. Special attention shall be given to cleaning of corners and re-entrant angles. Before painting, sand adhering to the steel in corners and elsewhere shall be removed. The cleaning shall be approved by the Engineer prior to any painting which shall be done as soon as possible before rust forms.

4. Flame Cleaning

All metal, except surface inside boxed members and other surfaces which shall be inaccessible to the flame cleaning operation after the member is assembled, shall be flame cleaned in accordance with the following operations.

- a. Oil, grease, and similar adherent matter shall be removed by washing with a suitable solvent. Excess solvent shall be wiped from the work before processing with subsequent operations.
- b. The surface to be painted shall be cleaned and dehydrated (free from occluded moisture) by the passage of oxyacetylene flames which have an oxygen to acetylene ratio of at least 1.0. The oxyacetylene flames shall be applied to the surfaces of the steel in such a manner and at such speed that the surfaces are dehydrated; dirt, rust loose scale in the form of blisters or scabs, and similar foreign matters are freed by the rapid, intense heating by the flames. The number arrangement and manipulation of the flames shall be such that all parts of the surfaces to be painted are adequately cleaned and dehydrated.
- c. Promptly after the application of the flames, the surfaces of the steel shall be wire brushed, hand scraped wherever necessary, and then swept and dusted to remove all free materials and foreign particles.

- d. Paint shall be applied promptly after the steel has been cleaned and while the temperature of the steel is still above that of the surrounding atmosphere.

5. Weather Conditions

a. Exterior Coatings

Coatings to surface shall not be applied during foggy or rainy weather, or under the following surface temperature conditions: below 4°C, or over 35°C, unless approved by the Engineer.

b. Interior Coatings

Coatings shall be applied when surfaces to be painted are dry and the following surface temperatures can be maintained: between 18 to 35°C during the application.

6. Application

- a. Paint shall be factory tinted and mixed. All paint shall be field mixed before applying in order to keep the pigments in uniform suspension.

b. Field Painting

When the erection work is complete, including all bolting and straightening of bent metal, all adhering rust, scale, dirt, grease or other foreign materials shall be removed as specified above.

As soon as the Engineer has examined and approved each steel and metal works structures, all field bolts, all welds, and any surfaces from which the top or first coat of paint has become worn off, or has otherwise come defective shall be cleaned and thoroughly covered with one coat of paint.

Surfaces to be bolted and surfaces which shall be in contact with concrete, shall not be painted. Surfaces which shall be inaccessible after erection shall be painted with such field coats as are required. When the paint applied for retouching the shop coat has thoroughly dried, and the field cleaning has been satisfactorily completed, such field coats as are required shall be applied. In no case shall a succeeding coat be applied until the previous coat is dry throughout the full thickness of the paint film. All small cracks and cavities which were not sealed in a watertight manner by the first field coat shall be filled with a pasty mixture of red lead and linseed oil before the second coat is applied.

The following provision shall apply to the application of both coats. To secure a maximum coating on edges of plates or shapes, bolt heads and other parts subjected to special wear and attack, the edges shall first be striped with a longitudinal motion and the bolt heads with a rotary motion of the brush, followed immediately by the general painting of the whole surface, including the edges and bolt heads.

The application of the second field coat shall be deferred until adjoining concrete work has been placed and finished. If concreting operations have damaged the paint, the surface shall be re-cleaned and repainted.

c. General Manners

Painting shall be done in a neat and workmanlike manner. Paint may be applied with hand brushes or by spraying, except aluminum paint which preferably shall be applied by spraying. By either method the coating of paint applied shall be smoothly and uniformly spread so that no excess paint shall collect at any point. If the work done by spraying is not satisfactory to the Engineer hand brushing shall be required.

d. Brushing

When brushes are used, the paint shall be so manipulated under the brush as to produce a smooth, uniform, even coating in close contact with the metal or with previously applied paint, and shall be worked into all corners and crevices.

e. Spraying

Power spraying equipment shall be used to apply the paint in a fine spray. Without the addition of any paint, the sprayed area shall be immediately followed by brushing, when necessary, to secure uniform coverage and to eliminate wrinkling, blistering and air holes.

f. Removal of Paint

If the painting is unsatisfactory to the Engineer the paint shall be removed and the metal thoroughly cleaned and repainted.

ITEM 21 : PLUMBING AND SANITARY WORKS**SCOPE OF WORK**

The work covered for this section shall consist of furnishing all labor, tools, equipment, materials and incidentals necessary for the complete installation, testing and operation of the plumbing and sanitary system within the buildings and premises in accordance with these Specifications and as shown on the drawings or as directed by the Engineer. The septic tank and their effluent and discharge pipelines shall be part of other section of these specifications.

MATERIAL REQUIREMENTS**SUBMITTAL**

1. The Contractor shall submit his work method statement with necessary shop drawings to the Engineer for approval twenty eight (28) days before the start of the works.

Shop drawings shall be dated and shall contain the name of the project and location of the subject item in the shop drawing which is to be installed.

The Engineer will review and approve or return for correction all shop drawings with reasonable promptness. The Contractor shall make any corrections required and file with the Engineer three (3) corrected copies of the shop drawings.

2. The drawings shall indicate the general arrangement of all pipings, however, where actual conditions necessitate re-arrangement in opinion of the Contractor and/or the Engineer, the Contractor shall prepare and submit to the Engineer for approval, twenty eight (28) days before placing the order for materials, shop drawings of the proposed re-arrangement. Because of the small scale of the drawings, shop drawings to indicate all offsets, fittings and accessories shall be prepared. The Contractor shall carefully examine the drawings and shall carefully investigate actual structural and finish conditions affecting all his work.
3. The Contractor shall be responsible for the proper fitting of materials, equipment and accessories without substantial alteration and at no cost to the Employer.
4. The Contractor shall be responsible for the proper coordination of the work and shall provide all necessary clearance where necessary.

STANDARDS

Use of materials shall further be governed by other requirement imposed on other sections of these Specifications. Materials shall be subject to tests necessary to ascertain their fitness if the Engineer so requires. All works shall comply with the pertinent provisions of the Plumbing Code of the concerned city or town, the Code on Sanitation of the Philippines, and/or the National Plumbing Code of the Philippines.

MATERIALS

1. Identification of Materials

Each length of pipe, fittings, traps, fixtures and devices used in the plumbing work shall have cast, stamped or indelibly marked on it, the approved manufacturer's trademark or

name, the weight, type and class of product when so required by the standards mentioned above.

2. Alternative Materials

Use of any material not specified in this Specification may be allowed provided such alternate has been approved by the Engineer and provided further that a test, if required, shall be done by an approved agency in accordance with generally accepted standards.

3. Soil, Waste, Drain, Vent Pipes and Fittings

Soil, waste and vent pipes shall be unplasticized Polyvinyl Chloride (uPVC) pipes. Diameter shall be as indicated on the Drawings. It shall conform to ASTM D 1784 or ASTM D 2729.

Drainage pipes shall be reinforced concrete pipes (RCP), diameter shall be as indicated on the Drawings.

4. Jointing Material

The joint material for uPVC pipes shall be PVC solvent cement as recommended by the approved pipe manufacturer.

5. Water Supply Pipes

Water supply pipes shall be polypropylene random-80 (PPR-80) pipes PN 20 conforming to DIN Standards DIN 1988/DIN 8078, German made. Jointing shall be fusion welded.

6. Cleanouts, Plugs and Tee

Cleanouts shall be of the same material as the pipe to be fitted. Cleanouts installed in connection with uPVC hubs and spigot pipes shall consist of a long sweep quarter bend of $\frac{1}{4}$ as shown on the drawings.

7. Pipe Sleeves

Pipe sleeves shall be installed and properly secured in place at all points where pipes passes through masonry or concrete. Pipe sleeves shall be uPVC pipe, Schedule 40.

8. Downspout

All downspout shall be unplasticized polyvinyl chloride (uPVC) pipe class DWV conforming to ASTM D2729 or ASTM D1784 for sanitary pipes, Series 1000.

9. Splash Block

Provide splash blocks at the outlet of downspout emptying at grade which shall be made of pre-cast concrete, with smooth finished counter sunk dishes sloped to drain away from the building. Dimensions as shown on the Drawings.

10. Roof Strainers

The Contractor shall provide fittings and install 100mm G.I. mesh wire strainers where

shown or indicated on the drawings and/or where the Engineer directs. Each strainer shall fit the size of the corresponding downspout which is to be installed.

11. Shower, Floor and Urinal Drain

Shower and floor drains shall be made of stainless steel non-tilting grate, perforated or slotted. Urinal drains shall be cast iron dome type drain.

12. Pipe hangers, Inserts and Support

- a. Pipe hangers shall be wrought iron, malleable iron pipe hangers spaced not over 1.5meters apart for uPVC pipes and 3.0meters apart for iron pipes. Chain straps, perforated bars or wire hangers will not be permitted.

Hangers shall have short turnbuckles or other approved means of adjustment. Turnbuckles may be omitted on hangers where space does not permit their use. Trapeze hangers may be used in lieu of separate hangers for pipes running parallel to each other and close together.

- b. Inserts shall be of cast iron or cast steel and shall be of a type to receive a machine bolt head or nut after installation.

- c. Wrought iron clamps or collars shall be used to support vertical runs of pipes.

13. Unions

Union pipe 50mmØ and smaller shall be malleable iron. Union on water piping 63mmØ and larger shall be flanged pattern and shall be of galvanized (zinc coated) cast iron. Gaskets for flange unions shall be of best quality fiber plastic or leather.

14. Valves

Valves shall be cast bronze or brass body. Chrome plated finish for all fixture taps and faucets and natural finish for all others, like hose bibbs, gate valves and which are not tapped directly to a plumbing fixture. Concrete valve boxes shall be installed where required and will be of sufficient size for operating the valve.

15. Fixtures

a. Water Closets

All water closets for toilets as shown on the drawings shall be TANK TYPE, white with complete fittings and mounting accessories.

b. Lavatories

b. 1. Lavatory (Wall Hung)

Shall be vitreous china, wall hung lavatory with rear overflow holes, fitting ledge suitable for single faucet holes on centers complete with faucet, standard fittings, trap and lavatory brackets and other accessories.

b. 2. Lavatory (Countertop Lavatory)

Shall be vitreous china, oval or round shaped countertop lavatory with front overflow hole, complete with faucet, supply valve and fittings with P-trap. Fitting ledge suitable for single hole on center.

c. Urinals

c. 1. Urinals for all comfort buildings shall be built-in urinal trough as shown on the drawings.

c. 2. Urinals shall be vitreous china, wall-hung washout urinal, flushing rim, integral trap, 19mm top and shall be provided with water saving flush system.

d. Service Sinks

Service sinks where indicated or shown on the Drawings shall be stainless steel, with single bowl and with complete U.S. or Japan imported fittings.

e. Slop Sinks

Slop sink shall be concrete in ceramic tile finish with concealed hanger and faucet, as specified in plan.

Hose bibb shall be of brass finish.

f. Soap Holder

Soap holder and toilet paper holder shall be vitreous china, wall mounted. All toilet/bath rooms will be provided with soap holder, toilet paper holder and chrome plated towel racks.

g. Faucet for lavatory

Faucet for lavatory shall be in chrome-finish.

h. Grab Bar

Grab bar shall be tubular stainless steel, 50mmØ or as specified in the drawings.

i. Bidet Spray Combination

Installed in every cubicle near on the water closet, colored white or its equivalent

16. Concrete, Reinforcing Steel, Pipe and Steel Plate

Materials for wash pits, catch basins and manholes shall conform to the requirements as follows:

- a. Concrete materials shall conform with the requirements in "Concrete Works" and shall be Class C concrete with a 28-day minimum compressive strength of 21 MPa (3,000 psi).

- b. Reinforcing steel shall be as shown on the drawings and shall conform with the requirements of reinforcing steel bars in "Concrete Works."
- c. Pipes shall be as shown on the drawings and shall comply with the relevant item of the particular pipe.
- d. Steel plates shall be as shown on the Drawings and shall comply with Section "Steel and Metal Works".

17. Non-reinforced Concrete Pipe

Non-reinforced concrete pipe shall be as shown on the Drawings and shall conform with the requirements of non-reinforced concrete pipes AIC latest edition. Concrete shall be with a 28-day minimum compressive strength of 20.7 MPa.

18. Valve for Drinking Fountain

Valve where drinking fountain will be connected shall be polished brass pipe and shall have red enameled handle.

EXECUTION

All installation works shall be in conformity with the National Plumbing Code of the Philippines (NPCP).

EXCAVATION, TRENCHES AND BACKFILLING

1. Trenches for all underground pipelines shall be excavated to the required depth. The bottom of trenches shall be tamped hard and graded to secure the required fill. Bell holes shall be excavated so that pipes will rest on solid ground for their entire length.

Rocks where encountered, shall be excavated to a depth of 150mm below the bottom of the pipe and before the pipe is laid, the space between the bottom of the pipe and the rock shall be filled with sand. Sewer and water pipes shall be laid in separate trenches.

2. After pipelines have been tested, inspected and approved by the Engineer and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris.

Materials for backfilling shall consist of acceptable excavated soil, borrow of sand, gravel or other materials approved by the Engineer and shall be free from trash, lumber or other debris. Backfilling shall be placed in horizontal layers not exceeding 150 mm in thickness and properly moistened to approximate optimum requirements. Each layer shall be compacted by hand or machine tamper or by other suitable equipment to a density that will prevent excessive settlement or shrinkage.

Backfilling shall be brought to a suitable elevation above grade to provide for anticipated settlement and shrinkage thereof.

Water pipes shall have a sand cushion 150mm below and above the pipes.

INSTALLATION OF SOIL, WASTE DRAINS OR VENT PIPES

1. Horizontal Drainage Pipe and Vent Piping

Horizontal waste pipes 75mmØ and smaller shall have a minimum grade of 6.5mm per 0.30m and for 100mmØ and larger, 3.2mm per 0.30m. All main vertical soil and waste stacks shall be extended full size above the roof line as vents, except where otherwise specifically shown.

Where practicable, two (2) or more vent pipes shall be connected together and extended as one pipe through the roof. Vent pipes in roof spaces shall be run as close as possible to the underside of roof with horizontal piping pitched to stacks using fittings as required without forming traps in pipes.

Vertical pipe vents may be connected to a vent line carrying other fixtures. The connection shall be at least 1.20m above the floor on which the fixtures are located to prevent the use of vent lines as waste. Horizontal waste lines receiving the discharge from two (2) or more fixtures shall be provided with vents, unless separate venting of fixtures is noted.

2. Fittings

All changes in pipe sizes on soil waste lines shall be made with reducing fittings or recessed reducers. All changes in direction shall be made by the appropriate use of forty five (45) degree wyes. Long sweep quarter bends or elbows may be used in soil and waste lines where the change in direction of flow is from the horizontal to the vertical and on the discharge from water closets.

Where it becomes necessary to use short radius fittings in any location, the approval of the Engineer shall be obtained before they are installed.

3. Joints

a. PVC Soil Pipe

All joints in uPVC soils, waste and vent pipe shall be accomplished by the use of PVC solvent cement.

b. All joints for uPVC shall be accomplished by applying the manufacturer's recommended solvent before connection to the pipe.

4. Cleanouts

Cleanouts at the bottom of each soil stack, waste stack and where else indicated shall be the same size at the pipe.

Cleanouts on floors shall be by uPVC plug adapter fit into the hub and fitted with uPVC screw plugged flush with the floor.

Cleanout shall be provided at every change in direction greater than 45 degrees.

5. Flashings

All pipes passing through the roof shall be provided with lead flashings. All flashings shall be built to 40 lbs. bituminous felts and shall extend up to the pipe and down-over to top of pipe

at least 150mm and along the roof not less than 300mm and shall lap over flashing to make a weatherproof joint.

6. Traps

Each fixture and piece of equipment requiring connections to the drainage system, except fixtures with continuous waste shall be equipped with a trap. Traps shall be specified to be supplied with the fixtures. Each trap shall be placed as near to the fixtures as possible. Traps installed on threaded pipes shall be recessed drainage pattern.

7. Pipe Sleeves, Hangers and Supports

Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through masonry or concrete except unframed floors on earth.

Pipes shall not be permitted to pass through footings or beams unless noted on the drawings.

Pipe sleeves in floors shall extend not less than 25mm and not more than 50mm above the finished floor. After installation of the pipe, the space around the pipe shall be packed with plastic material and made watertight. Flashing shields for sleeves passing through waterproofing membrane shall be thoroughly mopped into the membrane. The space between the pipe and sleeves shall be made watertight by inserting approved sealing and caulking materials.

INSTALLATION OF WATER PIPES, FITTINGS AND CONNECTIONS

1. Gate Valves and Outlets

Gate valves shall be installed close to the point of connection to the existing service line outside the building. The piping shall be extended to all fixture outlets and equipment from the gate valves. Outlets where indicated shall be capped or plugged and left ready for future connections.

2. Mains, Branches and Runouts

All runs of piping shall be installed as shown on the drawings. The piping shall be cut accurately to measurements, and installed at the building site by the Contractor and shall be worked into place without springing or forcing. Care shall be taken not to weaken the structural portions of the buildings.

All pipes above ground shall be run parallel with the lines of the building unless otherwise shown on the drawings. Branch pipes from service lines may be taken off on top of mains, bottom of mains or side of mains, using such cross over fittings as may be required by structural or installation conditions.

All service pipes, valves and fittings shall be kept at sufficient distance from the other work to permit finished covering not less than 6.5mm from such other work and not less than 13mm between finished covering on different services. No water piping shall be buried in floors unless specifically indicated on the drawings or approved. Changes in pipe sizes shall be made with reducing fittings.

The use of long screws and bushings is prohibited.

3. Joints

Joints and connections in the plumbing system shall be gas-tight and watertight for the pressures required by test.

After cutting and before threading all pipes shall be reamed and shall have burrs removed. All screwed joints shall be applied with an approved graphite compound or TEFLON tape to facilitate connections. Threads shall be full cut and not more than three threads on the pipe shall remain exposed.

Caulking of threaded joints or top to prevent leaks shall not be permitted.

Unions shall be provided where required for disconnection. Threaded swing bolts shall be used for branch connections to risers and mains.

4. Unions

Where required unions shall not be concealed in walls, ceilings or partitions.

5. Tests

The following tests shall be conducted by the Contractor at his expense under the supervision of the Engineer.

a. Tests for Drainage and Venting System

The entire drainage and venting system shall have necessary openings plugged to permit the entire system to be filled with water to the level of the highest vent stack above the roof. The system shall hold the water for 30 minutes with a drop not greater than 100mm.

b. Sterilization

The entire water supply piping system shall be sterilized with a solution containing not less than fifty (50) parts per million of available chlorine, either liquid chlorine or a solution of sodium hypochlorite. The sterilizing solution shall remain in the system for a period of not less than 8 hours during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chloride content is not more than 0.2 parts per million.

c. Pressure Test for Water Lines

1. After the pipe have been installed, the joints completed and with joints exposed for examination, all newly installed pipe or any valve section, thereof, shall be subjected to hydrostatic pressure one and one half (1½) the designed working pressure of the system or as specified by the Engineer.
2. The duration of each pressure test shall be at least 20 minutes unless otherwise specified by the Engineer.
3. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by

means of a pump connected to the pipe in a manner satisfactory to the Engineer. During the filling of the pipe and before applying the test pressure, all air shall be expelled from the pipeline. To accomplish this, tap shall be made if necessary, at the highest point of the pipe under test and after completion of the test, the taps shall be tightly plugged unless otherwise specified. During the test, all exposed pipes, fittings, valves, joint and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound materials at his expense. The test shall then be repeated until satisfactory results are obtained.

d. **Leakage Test for Water Lines**

1. Leakage test shall be conducted after satisfactory completion of the pressure test and shall consist of an examination of all exposed joints for leakage as well as an overall leakage test of the completed pipeline.
2. The pressure to be maintained during the test shall be the designed working pressure of the system.
3. Leakage test shall be made only after a minimum of 24 hours after the pipe to be tested has been filled with water.
4. The duration of each leakage test shall be two hours unless otherwise specified by the Engineer.
5. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation shall be applied by means of a positive displacement type pump and reservoir connected to the pipe in a manner satisfactory to the Engineer.
6. Before starting the leakage test, all air shall be expelled from the pipe. All exposed pipes, fittings, valves and joints shall be examined for leakage during the test.
7. Allowable leakage rate per 100 joints per inch of Pipe Diameter at Pressure Stipulated.

PRESSURE		LEAKAGE RATE	
psi	kg/cm ²	liters/hr.	liters/2 hrs.
50	3.50	1.45	2.90
75	5.30	1.75	3.50
100	7.00	2.05	4.10
125	8.80	2.30	4.60
150	10.50	2.50	5.00
200	14.00	2.90	5.80

e. **Defective Work**

1. If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated until satisfactory to the Engineer.
2. All repairs to piping shall be made with new materials at the expense of the Contractor.

3. No caulking of screwed joints or holes will be accepted.

ASSEMBLY, INSTALLATION AND CONNECTION OF FIXTURES

Fixtures shall be supported and fastened in a satisfactory manner. Where secured to concrete or masonry work walls, fixtures and equipment shall be fastened with brass bolts or machine screws in lead-sleeve type anchorage units or with brass expansion bolts. Expansion bolts shall enter 7.5 cm into solid concrete or masonry works and shall be fitted with loose tubing or sleeves of proper length to bring expansion sleeves into the solid concrete masonry walls.

Where wood screws are used, screws shall go into solid pieces set between studs. Where through-bolts are used, bolts shall be provided with plates or washers at back set, so that they will be concealed by plaster. Bolts and nuts shall be hexagonal and exposed nuts, cap nuts, and screw heads shall be provided with chromium plated brass washers.

PROTECTION OF FIXTURES

Pipe openings shall be closed with caps or plugs during installation. Fixtures shall be tightly covered and protected against dirt, water and chemical injury. At the completion of all works, all fixtures shall be thoroughly cleaned and delivered in a condition satisfactory to the Engineer.

FIXTURES AND FASTENING

All fixtures shall be supported and fastened in a satisfactory manner as follows:

1. Where secured to concrete or concrete hollow block walls, they shall be fastened with one quarter inch brass bolts with twenty threads to the inch and of sufficient length to extend at least 7.5 cm into solid concrete or hollow block work, fitted with loose tubing or sleeve insert and shall be securely anchored and installed flush with the finished wall and shall be completely concealed when the fixtures are installed.
2. Where through-bolts are used, they shall be provided with plates or washers back set so that heads, nuts and washers will be concealed by plaster. Bolts and nuts shall be hexagonal. Exposed bolts, nuts, capnuts and screw heads shall be provided with chromium plated brass washers.

GUARANTEE

Upon completion and before final acceptance of the equipment installation, the Contractor shall furnish the Engineer a written guarantee stating that all equipment installed under this Section free from defects. The guarantee shall be for a period of one (1) year from the date of final acceptance of the work. Any part of the equipment that becomes defective during the term of the guarantee shall be replaced, renewed and/or made good by the Contractor, at his own expense and in a manner satisfactory to the Engineer.

Guarantees made by the approved manufacturers or suppliers beyond one year, shall be transferred to PPA without any expense on his part.

CLEANING UP

Upon completion of the work, all parts of the installation shall be thoroughly cleaned of grease, metal cuttings and sludge which may have accumulated during the testing operation.

PLUMBING, FIXTURES AND TOILET ACCESSORIES INSTALLATION

All installation works shall be as shown on the drawings and shall conform to the applicable standards set forth by the Philippine National Plumbing Code. All fixtures shall be fastened and/or supported in accordance with the given requirements.

ITEM 22 : SUPPLY, DELIVER AND INSTALL OF STAINLESS STEEL WATER TANK, WATER PUMPS, AND PRESSURED TANK**GENERAL**

General Requirements contain provisions and requirements essential to these Specifications; and apply to this section, whether or not referred to herein.

SCOPE OF WORK

The work covered by this section consist of furnishing all labor, materials, equipment, tools and incidentals necessary to undertake, complete supply of water tank, water pump and pressured tank for the building as indicated on the drawings and as specified herein.

Water Tank/ Pressure Tank/ Water Pump**STAINLESS STORAGE TANK**

1. Design: Horizontal Cylindrical with B.I. Stand
Capacity: 2,000 ltrs./ 526 gallons
Diameter: 123 cm/ 48 inches
Length: 191 cm/ 75 inches
Height: 148 cm/ 58 inches
Thickness: 0.6 mm
S/S Grade: 304
Fittings: 1" diameter (inlet/ outlet/ air vent/ drain)

2. Design: Horizontal Cylindrical with B.I. Stand and B.I. Exterior Ladder
Capacity: 15,143 ltrs./ 4,000 gallons
Diameter: 240 cm/ 87 inches
Length: 443 cm/ 174 inches
Height: 253 cm/ 99.5 inches
Thickness: 1.2 mm
S/S Grade: 304
Fittings: 1" diameter (inlet/ outlet/ air vent/ drain)

PRESSURE TANK

1. Rated Size: 450 gallons
Tank Volume: 119 gallons/ 450 liters
Diameter: 66 cm.
Height: 153 cm.
Connectors: 1 ¼ inches
Pressure: 125 psi

WATER PUMP

1. Power: 2.0 hp.
 Capacity: 80 lpm @ 30 meters tdh
 Pipe: 1 inch suction/ 1 inch discharge
 Specs: 220 volts, 60 HZ, 3500 RPM

EXECUTION

All materials will be delivered and installed on site.

ITEM 23 : DRAINAGE WORKS

SCOPE OF WORK

The works shall consist of excavation, backfilling and construction of lateral drains, construction of manholes, reconnection to existing lateral and other related works in accordance with the dimensions, size, elevation and grade as shown on the drawing and shall conform with the Specification.

At least thirty (30) days before the start of any construction related to drainage works, the Contractor shall submit to the Engineer for his approval, shop drawings of the drainage work he intends to construct. The shop drawings shall include the materials and the general method of installation he intends to employ.

MATERIAL REQUIREMENTS

SELECTED FILL

Fill shall be in accordance with Item "Reclamation and Fill".

CRUSHED AGGREGATE BASE COURSE

Gravel base course shall be in accordance with Item "Crushed Aggregate Base Course".

CONCRETE

Mixing/Casting and steel reinforcements shall be in accordance with Item "Reinforced Concrete" while the dimensions shall be as shown on the Drawings.

CEMENT MORTAR

Cement mortar shall consist of one part portland cement to two parts of fine aggregate with water added as necessary to obtain the required consistency.

REINFORCED CONCRETE PIPE

The fabrication of reinforced concrete pipes shall conform to the Specifications of ASTM C-76. The Engineer reserves the right to inspect and test the pipe delivered for intended purpose. Defects that are discovered after acceptance of delivery of the pipe but before installation shall be a cause for rejection.

Reinforced steel bar for pipe shall be in accordance with Item "Reinforced Concrete" while concrete to be used shall be 4,000 psi.

EXECUTION

EARTHWORKS

All earthworks for concrete pipe culvert shall conform to the lines, grades and elevations shown on the drawings or as directed by the Engineer.

The lateral drain shall be excavated to the depth, grade and width established by the Engineer. The bedding surface shall provide a firm foundation of uniform density throughout the entire length. Soft, spongy, or otherwise unstable material encountered that will not provide a firm foundation for the

concrete drainage shall be removed to the full width of the trenches and replaced by suitable material to a depth of not less than 30 cm. 100mm thick gravel bedding shall be used as foundation or otherwise as specified.

PIPE LAYING

The pipe shall be tested for water-tightness of joints before backfilling the trench. Unsatisfactory work shall be corrected without additional cost to the PPA. The collar shall have set sufficiently prior to backfilling.

LATERAL DRAIN

Concrete cover and the existing steel gratings shall be set to the required elevations as shown on the drawings to fit the adjoining surfaces and shall be installed after the adjoining concrete is struck off and finished, and the fit on the frames shall be such that there is no rocking.

All completed structures shall be thoroughly cleaned of any accumulations of silts, debris or foreign matter of any kind, until finally accepted and put into service.

CATCH BASIN INLETS, MANHOLES AND OUTLETS

Lid frames shall be set to the required elevations as shown on the drawings to fit the adjoining surfaces. Lids shall be installed after the adjoining concrete is struck off and finished, and the fit on the frames shall be such that there is no rocking.

Where reconstruction of existing catch basin inlets, manholes, outlets, or similar structures are indicated, the work shall be in accordance to the details and elevations as shown on the drawings, including re-installation of existing metal frames, gratings and lids, or replacing of concrete covers instead of gratings that may have been lost or found lacking. All completed structures shall be thoroughly cleaned of any accumulations of silts, debris or foreign matter of any kind, until finally accepted and put into service.

FIELD DENSITY TEST

Field Density tests to determine the percent of compaction of the fill material shall be conducted until a field density of at least 95 percent of the maximum dry density in accordance with AASHTO T180, Method D has been achieved. In place density determination shall be made in accordance with AASHTO T191.

ITEM 24 : ELECTRICAL GENERAL REQUIREMENTS**GENERAL****APPLICATION**

This section applies to all sections of "Electrical Division" of this project except as specified otherwise in each individual section.

WORK INCLUDED

The work to be done under this division shall include the furnishing of all tools, labor, supervision, equipment, fixtures and all necessary materials, each complete and in proper working condition unless one or other is specifically excluded or stated otherwise in this specifications but not limited to the following items of works.

- a. All works and material for a complete lighting and power systems including cables and conduits, circuit breakers, panel board and connection to all lighting fixtures and power outlets, motor appliances, switches, supports and accessories.
- b. All excavation works, backfilling, dewatering, removal of surplus earth, preparation of formworks and pouring of concrete envelopes as indicated on the drawings or as required to complete the installation.
- c. All steel support for conduits, wires, panel board, boxes, lighting fixtures, etc. as indicated or as required to complete the installation.
- d. A complete grounding system as required by the governing codes.
- e. A complete testing of all electrical systems.
- f. All items incidentals to and or required for the proper completion such as painting of boxes, conduits and the likes.
- g. Coordination with other trade Contractors.
- h. Coordination with other companies/offices including handling of all materials related to material testing and application of electrical permits.
- i. Preparation of necessary shop drawings required for the proper execution of the works subject to the approval of the Engineer.

WORK INCLUDED UNDER ELECTRICAL WORKS

The work includes the furnishing of the following:

1. Supply, deliver and install of all motors, pumps and their associated control equipment.
 - a. All electrical system installation consists of motor and branch circuit breakers.
 - b. All motor controllers as indicated to be supplied with equipment.
 - c. Structural foundation of the above.

SUBMITTALS

Obtain approval before procurement, fabrication or delivery of items to the job site. Partial submittals will not be entertained and will be returned without review. Submittals shall include the manufacturer's name, trade name, place of manufacturer, catalogue model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference and technical society publication references, and other information necessary to establish contract compliance of each item to be furnished.

1. Shop Drawings

In addition to the requirements of the contract clauses, shop drawings shall meet the following requirements:

- a. Drawings shall be a minimum of 210 mm x 297 mm in size or in A3 size, except as specified otherwise.
- b. Drawings shall include wiring diagrams and installation details indicating the proposed location layout and arrangement, control panels, accessories, and other items that must be shown to assure a coordinated installation.
- c. Wiring diagrams shall identify circuit termination and the internal wiring for each item of equipment and its interconnection.
- d. Drawings shall indicate adequate clearances for operation, maintenance and replacement of equipment devices. If the layout is disapproved, revise the layout and resubmit.

2. Manufacturer's Data

Submittal for each manufactured item shall be current descriptive literature of catalogued products.

3. Publication Compliance

Where equipment or materials are specified to conform to industry and technical society publications of organizations such as American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM) and Underwriters Laboratories, Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In each of the publications referred to herein, consider the advisory provisions to be mandatory as though the word "shall" had been substituted for "should" wherever it appears. Interpret reference in these publications to the authority having jurisdiction, or words of similar meaning, to mean the Engineer. In lieu of the label or testing, submit a certificate from an approved independent testing organization, adequately equipped and component to perform such services, organization's test methods and not the item conforms to the specified organizations publications. The edition or the revised version of such codes and standards current at the date twenty eight (28) days prior to date of bid submission shall apply. During Contract execution, any changes in such codes and standards shall be applied after approval by the Owner.

CERTIFICATES OF COMPLIANCE

Submit manufacturer's certifications as required on products, materials, finish and equipment indicated in the Technical Sections. Certifications shall be documents prepared specially for the contract. Pre-printed certifications and copies of previously submitted documents are not acceptable. The manufacturer's certification shall name the appropriate products, equipment or materials and the publication specified as controlling the quality of the item. Certification shall not contain statement to imply that the item does not meet requirements specified such as "Good As",

"Achieves the same end use and results as materials formulated in accordance with referenced publications" or "Equal or exceeds the service and performance of the specified materials". Certifications shall simply state that the item conforms to the requirements specified; and shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official, authorized to sign certificates of compliance.

OPERATION AND MAINTENANCE MANUALS

Submit as required for systems and equipment indicated in the Technical Sections. Furnish three (3) copies, bound in hardback binders or an approved equivalent. Furnish one complete manual prior to performance of system or equipment tests, and furnish the remaining manual prior to contract completion. Inscribe the following identification on the cover: the word "Operation and Maintenance Manual", the name and location of the system equipment, building, name of Contractor and contract number. Include in the manual the names, addresses and telephone numbers of each sub-Contractor installing the system or equivalent and the local representatives for the system or equipment. Include a table of contents and assemble the manual to conform to the table of contents with the tab sheets placed before instruction covering the subject. The instructions shall be legible and easily read with large sheets of drawings folded in the manual shall include the following:

- a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the system or equipment.
- b. A control sequence describing start-up, operation and shut-down.
- c. Description of the function of each principal item of equipment.
- d. Installation and maintenance manual.
- e. Safety precaution
- f. Diagrams and illustrations
- g. Testing methods
- h. Performance data
- i. Lubrication schedule including type, grade, temperature range and frequency

List qualified permanent servicing organization for support of the equipment, including addresses and certified qualifications.

POSTED OPERATING INSTRUCTIONS

Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include diagrams, control diagrams and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Attach or post the operating instructions adjacent to each principal system and equipment including start-up, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction recommended by the manufacturer of each system for operating instruction exposed to the weather. Operating instructions shall not fade when exposed to the weather and shall be secured to prevent easy removal or peeling.

INSTRUCTIONS TO PERSONNEL

Where indicated in the technical sections, furnish the services of competent instructors to give full instructions to personnel in the adjustment, operation and maintenance of systems and equipment, including safety precautionary measures. Each Contractor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work, instructions shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Engineer for regular operation. The number of man-days (8 hours) of instruction shall be as specified in each individual section.

DELIVERY AND STORAGE

Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations and with the requirements of NFPA 70B, Appendix 1, titled "Equipment Storage and Maintenance during Construction". Replace damaged or defective items with new one.

CATALOGUE PRODUCTS/SERVICE AVAILABILITY

Materials and equipment shall be current products by manufacturers regularly engaged in the production of such products. Products shall have been in satisfactory commercial or industrial use for two (2) years prior to bid opening. The two (2) year period shall include applications of equipment and materials under similar circumstances and of similar size. The two (2) year period shall be satisfactory completed by a manufacturer's catalogue or brochures. Products having less than two (2) year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturer's factory or laboratory tests is furnished. The equipment items shall be supported by service organization, which are reasonable convenient to the equipment on a regular and emergency basis during the warranty period of the contract.

MANUFACTURER'S RECOMMENDATIONS

Where installation procedures or any parts thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendation prior to installation. Installation of the items shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

MATERIALS/SUBSTITUTION/TESTS

All materials to be installed shall be brand new and shall conform to specifications except as otherwise noted on the drawings. All materials where not specified shall be of the best of their respective kind. Samples of said material including its manufacturer's data shall be submitted for approval. Necessary tests on the installations shall be made by the Contractor in the presence of the Engineer. These tests shall include but not limited to ground test, performance test, phase sequence test, etc. Records of approved tests result shall be relayed to the Engineer in writing. This Contractor shall within ten (10) days after the award of the contract, submit a list of materials he proposes to use. All materials installed without prior approval shall be at the risk of the Contractor.

COORDINATION/GUARANTEES/SUSPENSION OR DELAY

The Contractor shall be familiar with the specifications of the other trades and coordinate with them thoroughly so that he can arrange his work and dispose his materials without interfering the work of other Contractors. The Contractor shall guarantee that the electrical systems shall be free from all defects of workmanship and of materials, and that it will remain so for a period of one year from the date of acceptance by the Engineer. Any remedy to correct defects deemed to be caused by such shall be made at the expense of the Contractor. The Contractor shall not suspend or delay the

work without justifiable cause. Subsequent delays shall be deemed as a sufficient cause for penalties or termination of contract in which the Engineer shall have the right to take-over the work and all materials on the site and make arrangements necessary to complete the work. It shall be the sole responsibility of the Contractor to ensure that the Electrical sub-contractor conducts coordination of his activities to other trades.

SLEEVES / INSERTS / CUTTING / PATCHING/BACKFILL

The Contractor shall provide all openings, sleeves, also inserts in walls, floors, and beams as required for his work. All unused openings shall be grouted in. The Contractor shall do all patching requirements necessary and these shall be done so as to exactly match the surrounding area without the evidence of alteration or patching. The Contractor shall provide all necessary backfill on all excavation works of his doing.

TEMPORARY LIGHT AND POWER

The Contractor shall make all arrangements and pay for the provisions of the necessary electrical power of the type and capacity required for the performance of the work of all trades engaged in the construction of the building.

CODES, INSPECTION, PERMITS AND FEES

The work under this contract is to be installed according to the requirements of the latest edition of the Philippine Electrical Code, the rules and regulations of the local authorities of Port of Currimao *and the requirements of local Power Company of Ilocos Norte Electric Cooperative, Inc.*

All necessary permits and electrical fees required for this work shall be obtained by and at the expense of the Contractor. The contractor shall furnish the Engineers and the Owner final certificate of electrical inspection and approval from the proper government authorities after completion of the work. The Contractor shall prepare all as-built plan and all forms and documents required by the approving authorities.

Power service application including drawings for the work shall be obtained by and at the expense of the Contractor. The Contractor shall comply with all requirements of the utility company regarding service applications.

ELECTRICAL CHARACTERISTICS

The electrical characteristics for this project shall be 230v, 3-wire, 3Ø, 60Hz or as per system requirements as shown in the plans.

MATERIAL REQUIREMENTS

NAMEPLATES

Provide laminated plastic nameplates for each panel board, equipment enclosure, relay, switch, and device. Each nameplate inscription shall identify the function and when applicable, the position. Nameplate shall be melamine plastic, 3.2mm thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the black core. Minimum size of nameplates shall be 25mm x 38mm. Lettering shall be a minimum of 6mm, high normal block style.

EXECUTION

NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet metal screws or two rivets.

PAINTING OF EQUIPMENT

1. Factory Applied

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test, except equipment specified to meet requirements of ANSI C37.20 shall have a finish as specified in ANSI C37.30.

2. Field Applied

Paint electrical equipment as required to match finish or to meet safety criteria.

ITEM 25a : INTERIOR WIRING SYSTEMS**GENERAL**

"Electrical General Requirements," applies to this section with additions and modifications specified herein.

SUBMITTALS**1. Shop Drawings**

- a. Panel board

2. Manufacturer's data

- a. Circuit breakers
- b. Switches
- c. Conduit and fittings (each type)
- d. Ground rods
- e. Device plates
- f. Insulated conductors
- g. Outlet and junction boxes

3. Test Reports: Submit test results for approval in report form.

- a. 600Volt - wiring test
- b. grounding system test

4. Quality Assurance

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears. Interpret reference in these standards to "authority having jurisdiction," or words of similar meaning, to mean Engineer.

MATERIALS AND EQUIPMENT REQUIREMENTS

Materials, equipment, and devices shall, as minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70. All items shall be new.

CONDUIT AND FITTINGS

- 1. Rigid Steel Conduit (RSC): Hot dip galvanized: ANSI C80.1.
- 2. Flexible Metal Conduit: UL 1.
 - a. Liquid Tight Flexible Metal Conduit (Steel): UL 360.
- 3. Rigid Plastic Conduit: PVC schedule 40 in accordance with UL 651.

4. Fittings for Metal Conduit, and Flexible Metal Conduit: UL 514B.

Ferrous fittings shall be hot dip galvanized in accordance with UL 514.

a. Fittings for RSC: Shall be threaded-type. Split couplings are not acceptable.

b. Fittings for Rigid Non-metallic Conduit: NEMA TC3.

OUTLET BOXES AND COVERS

UL 514, hot dip galvanized for ferrous metal.

CABINETS, JUNCTION BOXES, AND PULL BOXES (WITH VOLUME GREATER THAN 100 CUBIC INCHES) UL 50, hot dip.

WIRES AND CABLES

Wires and cables shall meet applicable requirements of PEC, NFPA 70 and UL for types of insulation, jackets, and conductors specified or indicated. Wires and cables manufactured more than 6 months prior to date of delivery to site shall not be used.

1. Conductors: Conductor 3.5mm² and smaller shall be solid, 5.5mm² and larger shall be stranded. All conductors indicated shall be copper.

a. Equipment Manufacturer Requirements:

If manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

b. Minimum Conductor Sizes:

Minimum size for branch circuits shall be 3.5 mm²

2. Color Coding

For 230 volt, 3-phase (3Ø), 3- wire, 60 hertz

Phase A - Black

Phase B - Red

Phase C - Green

3. Insulation:

Unless specified for indicated otherwise or required by PEC and NFPA 70, power and lighting wires shall be 600volt, Type THHN / THWN.

4. Bonding Conductors:

ASTM B1, solid bare copper wire for sizes 8.0 mm² and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes 14 mm² and larger diameter.

DEVICE PLATES

Provide UL listed, one-piece device plates for outlets and fittings to suit the devices installed. For metal outlets and fittings, plates on unfinished walls and on fittings shall be of zinc-

coated sheet steel or cast metal having round or bevelled edges. Plates on finished walls shall be urea or phenolic, minimum 2.5mm wall thickness. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine type with countersunk heads in a color to match the finish of the plate. Use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

SWITCHES

1. Switches

Totally enclosed with bodies of thermosetting plastic and mounting strap. Wiring terminals shall be screw-type, side-wired. Switches shall be rated quiet-type AC only, 250 volts, with current rating and number of poles indicated.

WALL SWITCHES AND PLATES

Wall switches in general shall be rated 10 amperes at 230 volts or with ampere and voltage ratings as required. Switches shall be flush mounting and of the rocker type, spring operated. The type of switches shall be tumbler operation and the color, plating and appearance of wall plates shall be as selected by the Engineer. Appropriate samples shall be submitted prior to purchase of wall switches and face plates.

2. Receptacles

UL 498 and NEMA WD 1, heavy duty, grounding type. Ratings and configurations shall be as indicated. Wiring terminals shall be screw type, side-wired. Connect grounding pole to mounting strap.

WALL RECEPTACLE AND PLATES

- a. Receptacle outlets shall be 15 ampere, 230 volts, 2 pole, 3 wire parallel slot, grounding type. Parallel slot outlet rated 15 amps, 125v grounded type shall be acceptable for use with 230v system. Locking type and other special purpose outlets shall be as indicated in the plans.
- b. Provide weatherproof receptacle plate cover for each convenience receptacle outlet indicated as weatherproof.

SPECIAL PURPOSE RECEPTACLES:

Receptacles serving as indicated are special purpose. Provide ratings as indicated. Furnish one matching plug with each receptacle.

PANEL BOARD

UL 67 and UL 50. Panel board for use as service disconnecting means shall additionally conform to UL 869. Panel board shall be circuit breaker equipped unless indicated. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. Where "space only" is indicated, make provisions for the future installation of a breaker sized as indicated. Panel board locks shall be keyed same. Directories shall be typed to indicate load served by each circuit and mounted in a holder behind transparent protective covering.