

## SECTION 30500 STRUCTURAL STEEL WORK

- 30501**  
**Scope of Work**
- 30501.1 Scope of Works**  
The scope of work covered by this section of the Specification includes the supply, fabrication, protective treatment, delivery and erection of all Steelwork including the supply of all bolts, purlins, bracing, steel sections etc. necessary for the satisfactory performance of the complete works required for the completion of buildings. The Contractor shall include furnishing all labor, tools, materials, construction plant, and other items necessary for the steel work at the locations indicated on the Drawings and as specified herein.
- 30501.2 Brackets, Braces, Straps, Anchors, etc.**  
The Contractor shall provide all necessary metal brackets, wind and others braces, straps, and anchors, whether they are indicated on the Drawings, but where it is obvious they shall be required to satisfactorily stabilize the structure or support or fix various fittings. They shall be respectively welded or drilled as required for bolts, screws, etc.
- 30502**  
**General**
- The Work shall be executed by a specialist manufacturer of high reputation with many years of experience in such types of steel structures as those incorporated in the Contract.
- The Contractor shall, prior to engaging such specialist manufacturer, submit substantiating documents, such as lists of accomplished works, plants and machines, technical staff and number of mechanics and qualified welders of the manufacturer to the Engineer for his approval. The Contractor shall discontinue, when directed by the Engineer, engagement of the specialist manufacturer who has been found in the course of the Work to be unqualified or unsuitable in workmanship or in any other matter.
- 30503**  
**Delivery and Storage**
- Materials shall be delivered, stored, handled and installed in a manner to protect them from all damage during the entire construction period.
- Steel shall be stored under cover and protected from rust, oil, grease or distortion. Only steel needed for immediate use shall be removed from storage.
- 30504**  
**Marking**
- Each piece of steelwork shall be clearly marked in accordance with marking diagrams to be prepared by the Contractor. The form of marking shall be subject to the prior approval of the Engineer and shall be such that it is still clear after transport of the piece to site. Two copies of the drawings shall be supplied to the Engineer when the steelwork is despatched.
- 30505**  
**Off-site Inspection**
- Where this Specification requires approval by the Engineer of operations carried out off site, the Engineer may appoint an authorized inspecting agent and/or require the manufacturer or fabricator to certify that the Specification requirements have been met.
- 30506**  
**Materials and Workmanship**
- 30506.1 Specification**  
Structural steel shall comply with the requirements of ASTM A-36 or equivalent approved. Steel yield strength (fy) shall be 252 N/mm<sup>2</sup>. Steel test certificates shall be supplied in accordance with ASTM A-6 or ASTM A-568 .
- 30506.2 Bolts, Washers and Nuts**  
Bolts, washers and nuts shall comply with the requirements of ASTM A325. Equivalent standards may be applied subject to approval by the Engineer
- 30506.3 Electrodes for Manual Welding**  
Electrodes for manual metal arc welding of steel shall comply with the requirements of the specifications of the American Welding Society AWS A5.1 or equivalent approved by the Engineer.

Electrode wires and fluxes for submerged-arc welding shall comply with AWS A5.23

The electrodes used for procedure trials and fabrication shall all be supplied by one manufacturer. They shall be stored in accordance with his instructions and the coating shall be dry at the time of use.

#### **30506.4 Access to Work Places**

The Contractor shall ensure that the Engineer shall have access at all reasonable times to all places where work is being carried out and shall provide all the necessary facilities for inspection of material and workmanship during fabrication.

### **30507 Working Drawings**

The Contractor shall prepare working drawings and submit them to the Engineer for his approval. The working drawings shall indicate the position, size and dimensions of all members, details of joints, size and dimensions of anchor bolts. Details of bolt joints shall indicate the diameter, gauge, pitch and clearance of bolts and details of welded joints shall indicate root opening, groove angle and groove depth of butt weld and size of fillet weld.

The working drawings shall be submitted for checking and approval in accordance with the following procedure

Approval by the Engineer of working drawings shall indicate that the general requirements of the design have been satisfied. Approval shall not be taken to imply that the dimensions or the correct matching and design of connections of joints have been checked and this will remain the responsibility of the Contractor. Drawings submitted for approval shall be of a good standard and any drawing which clearly requires considerable amendment will be returned for alteration without a detailed review of all the corrections which may be required.

The Contractor shall supply to the Engineer two complete sets of working drawings.

After drawings have been submitted to the Engineer for approval one copy will be returned to the Contractor, each drawing having been given one of the following classifications.

- Approved

In this case the drawing is quite satisfactory and fabrication may proceed.

- Approved Subject to Amendment

In this case the drawing is substantially satisfactory except for small changes required. The drawing shall be amended by the Contractor and submitted again for approval. However, fabrication need not be held up pending final approval.

- Rejected

In this case a drawing is considered by the Engineer to require major alteration and must be resubmitted. Fabrication shall not commence until the resubmitted drawings have been returned marked "Approved" or "Approved Subject to Amendment".

### **30508 Welding**

#### **30508.1 Specification**

Unless otherwise described in the Contract all welding shall comply with AWS D1.1

#### **30508.2 Approval for Welding Schedule**

The general welding schedule for shop site welds, including particulars of the preparation of fusion faces, the method of preheating where required, the methods of making the welds, and the types of electrodes shall be submitted to the Engineer for his approval before the work is put in hand. No departure from the agreed welding schedule or from the details shown on the Drawings shall be made without the

agreement of the Engineer. Electrodes and fluxes shall be so chosen that the properties of the deposited metal are not inferior to those of the parent metal.

#### **30508.5 Built – Up Assemblies**

In the fabrication of built-up assemblies, all butt welds in each component part shall be completed, whenever possible, before the final assembly.

#### **30508.6 Weld for Temporary Attachments**

The position of welds required for temporary attachments shall be agreed by the Engineer before the work commences.

#### **30508.7 Studs**

Stud shear connectors shall be welded in accordance with the manufacturer's instruction. No welding shall be carried out on wet surfaces or at temperatures below 10°C.

### **30509 Welding Plant**

The welding plant shall be capable of maintaining, at the weld, the voltage and current specified by the manufacturer of the electrodes. The Contractor shall supply instruments for verifying voltages and current as and when required by the Engineer.

### **30510 Qualification and Testing of Welders**

Welders shall show evidence to the satisfaction of the Engineer of having satisfactorily completed appropriate tests in accordance with JIS 23801 or equivalent approved.

Welders who fails in such test or certificate documentation shall be replaced.

### **30511 Supervision of Welding**

#### **30511.1 General**

Welding shall be carried out only under the direction of an experienced and competent supervisor. Unless otherwise agreed by the Engineer a record shall be kept to enable major butt welds to be identified with the welders responsible for the work, but finished work shall not be marked by hard stamping for this purpose.

#### **30511.2 Weld Repairs**

Any welding condemned by the Engineer shall be cut out and re-welded to his entire satisfaction.

### **30512 Welding and Flame Cutting Procedure Trials**

#### **30512.1 General**

When directed by the Engineer and before fabrication is commenced, welding and flame cutting procedure trials shall be carried out using representative samples of materials to be used in the steelwork.

#### **30512.2 Samples of Material**

The samples of material shall be selected and marked by the Engineer when the materials for the work are inspected.

#### **30512.3 Approval**

The welding and flame cutting trials shall demonstrate to the satisfaction of the Engineer the procedures to be adopted on the fabrication of the work which shall include:

- Welding procedure in accordance with AWS.
- The heat control techniques required to ensure that the flame cut surfaces of steel are free from cracks, local hardness, and any other defects which would be detrimental to the finish of the work.

### **30513 Correction of**

The Contractor shall correct defects of weld as follows:

Harmful defects such as poor fusion, poor penetration, slag inclusion, pits, blow holes

**Defective Weld**

shall be removed and rewelded.

Welds with cracks shall be removed in the full length and re-welded.

Undercut, insufficient filling of crater, insufficient size and length of weld shall be corrected.

Overlap, excess reinforcement shall be removed.

Part of weld failed in the ultrasonic test shall be removed, rewelded and retested.

Parent metal with crack caused by welding shall be replaced.

The diameter of electrodes to be used for correction of defective weld shall be not more than 4 mm.

Defects of weld found after the materials are delivered at the site shall also be corrected as directed by the Engineer but the materials with serious defects shall be rejected.

**30514**

**High Strength  
Friction Grip  
Bolts**

High strength grip bolts shall comply with ASTM A-325. The bolts shall be tightened by a part-torque part-turn method. The part-torque tightening for bedding down shall be carried out by a calibrated tightening device such as a torque-controlled manual wrench or power operated wrench. The bedding torque to be applied to the bolts shall be as given in Table 30500.1.

After bedding down the joints, each nut and protruding threads of the bolt shall be permanently marked to record their relative positions. The nuts shall then be tightened to the approval of the Engineer by the part-turn of the nut method in accordance with ASTM.

**TABLE 30500.1 Preliminary Tightening of Nuts**

Nominal dia of bolt mm	16	20	22	24
Bedding torque + 10% kg	8	16	21	27

High strength grip bolts shall be stored in their original package on elevated floor at the site and protected from moisture, damage and staining.

Holes for high strength grip bolt shall be shop drilled. Holes on plate less than 12 mm thick may be punched.

Mill scale in an area covered by twice the washer diameter on the contact surface of plates shall be removed by blasting or grinding and allow the contact surface rust uniformly. There shall be no irregularity on the contact surface such as burr, warp or caving.

Filler plates shall also be worked as above.

Irregularities of the contact surface under bolt heads and washers shall also be corrected.

Loose rust, oil, paint or dust on the surface shall be removed prior to fabrication. Filler plate shall be used for difference of thickness exceeding 1 mm. Bolt holes not matched after fabrication shall be corrected with reamer and the dust left by reaming shall be completely removed.

Members to be jointed shall be tightened with temporary bolts not less than two in number and not less than a third of the number of bolts of that joint and of the diameter same as the permanent grip bolts to be used. High strength grip bolts may serve as temporary bolts.

Bolts shall be tightened with a tool recommended by the bolt manufacturer starting from central zone and then outward by first applying approx. 70% pressure to all bolts and then 100% of the design pressure, and strictly in accordance with the procedure

recommended by the bolt manufacturer.

**30515  
Anchor Bolts**

Anchor bolts shall be embedded in concrete true to line and level by use of templates. The top of bolts shall be at such a level as to leave more than three threads projected above nut when the object to be anchored is set and tightened. Washers of suitable thickness shall be used under the nuts.

Anchor bolts shall be held in position accurately with steel bars welded to reinforcement or fixed to form work or other structures.

Anchor bolts shall be wrapped with cloth or vinyl covering after embedding and protected against bending, damage to threads, rust and spoiling.

Leveling mortar shall be cement sand mortar 1: 1 mix or epoxy. Mortar shall be screened at the central surface of base concrete to the correct level. After the column or object to be anchored is erected, the clearance under the base plate shall be packed with mortar.

For columns with base plate of not more than 300 mm square, mortar may be screened on the whole base surface to the correct level.

**30516  
Transport and  
Erection**

The Contractor shall submit detailed transport and erection program to the Engineer for his approval. The steel materials shall be marked with symbols, letters or numbers to facilitate erection.

The steel materials shall be protected against warping, twisting or any other damage in transport by use of bracings or reinforcing members if necessary.

Deformation of materials shall be corrected before erection.

All damage to the shop paint occurred during handling, transport and erection shall be made good by the Contractor with two coats of the same paint as applied at the shop. Erection shall be carried out in the sequence and with method shown in the approved program.

Erection plants shall have enough capacity and properly installed, maintained and operated. The Contractor shall take every precautionary measures for safety of workers and for prevention of accidents by maintaining the working area in good order and restricting other works in the neighborhood.

Slender members shall be reinforced and framings shall be fastened temporary with sufficient number of bolts and shall be braced securely against lateral forces.

The Contractor shall correct the fall and distortion of frames, measure principal distances and inclinations and submit report of the measurements to the Engineer before permanent fastening.

The tolerance of the frame shall be as follows:

Measurement	Tolerance
Fall of Frame	0.02 H (H: height)
Location of Column	3 mm
Level of Base Plate	3 mm

**30517**

**30517.1 General**

**Preparation of Surfaces Prior to Paint**

All steelwork shall be dry blast cleaned to an adequate surface prior to the application of paint.

The abrasive used for blast cleaning shall be free from harmful contamination and any recovered material shall be cleaned to the satisfaction of the Engineer before re-use. The maximum roughness (highest peak to lowest trough) of the blast cleaned surface for new steelwork shall not exceed 60 microns and for old steelwork 100 microns.

**30517.2 Mechanical Cleaning**

Mechanical cleaning shall be carried out by power driven tools such as carborundum grinding discs, chipping hammers and needle guns, followed by steel wire brushing and dusting to remove all loosened material. Excessive burnishing of the metal through prolonged application of rotary wire brushes shall be avoided. Visible peaks and ridges produced by the use of mechanical cleaning tools shall be removed.

**30517.3 Chemical Cleaning**

Chemical cleaning may be employed where approved by the Engineer.

**30517.4 Application of Paint**

Painting shall only be applied to surfaces which satisfy these Specifications at the time the treatments are applied.

**30518 Protection of Joints**

**30518.1 General**

Within 14 days of the joints having been made and passed by the Engineer, the parent and joint material, exposed parts of bolts, nuts and washers, weld and weld affected areas shall be prepared and painted.

**30518.2 Seal Against Water**

All bolted joints shall be sealed against the ingress of water. Before painting commences, and subject to the approval of the Engineer, gaps at joints shall be plugged with an approved filler. The perimeter of all joints shall be sealed with subsequent coats of paint.

**30519 Application of Paint**

**30519.1 Type of Paint**

The Contractor shall submit to the Engineer duplicate copies of Paint System sheets relating to each of the paints he proposes to use, considering that the buildings are located near the seashore. These shall be accompanied by the manufacturer's Paint Data Sheet.

**30519.2 Paint Sheets for Approval**

Paint System sheets shall show the manufacturer's name, the brand name, reference number, color and description of the paint; the surface preparation to which it is to be applied; the minimum wet and dry film thickness; the coverage per liter and the number of coats to be applied, all to the Engineer's requirements. Following the Engineer's written instruction, the requirements of the Paint System Sheets shall be adopted for the works. The Contractor shall ensure that the paint manufacturer's Data Sheets cover the conditions at works and at Site, including temperature and humidity, under which the paints are to be applied.

**30519.3 Paint Application Trials**

Where called for by the Engineer the Contractor shall carry out paint application procedure trials either at the fabricator's works or at Site as appropriate, with the equipment and labor to be used in the Works. The Contractor shall supply suitable blast cleaned steel and sufficient paint for the trials and must demonstrate his ability to apply each coat of paint of a designated paint system in accordance with the specification and the paint manufacturer's data sheet. No painting of the contract steelwork will be permitted until the procedure trials have been completed to the

satisfaction of the Engineer.

#### **30519.4 Painters**

All painting shall be carried out by skilled and experienced painters under constant supervision by competent qualified staff.

#### **30519.5 Conditions for Paint Applications**

Paint shall not be applied under the following conditions:

- a) When the relative humidity rises above 90 per cent.
- b) During rain, fog or mist.
- c) Where the amount of moisture on the surface or that likely to be caused by subsequent condensation may have a harmful effect.

#### **30519.6 Workshop**

All shop painting shall be carried out in a fully enclosed workshop unless otherwise agreed by the Engineer.

#### **30520 Storage of Paint**

Paint shall be stored in sealed containers in a lock-up store where it is not exposed to extreme temperature. The temperature of the store shall be kept between 4°C. and 25°C unless otherwise accepted by the paint manufacturer and approved by the Engineer. Any special storage conditions recommended by the manufacturer shall be observed.

#### **30521 Storage of Steel and Fabricated Steelwork**

##### **30521.1 General**

The Contractor shall take precautions to minimize exposure to chemical pollution of steel awaiting fabrication.

##### **30521.2 Fabricated Steelwork Storage**

Fabricated steelwork which is stored, awaiting delivery to site or erection, shall be kept clear of the ground and shall be laid out or stacked so as to prevent water or dirt accumulating on or against any of the surfaces. Suitable packing shall be placed between layers of stacked steelwork. Where cover is provided it shall be ventilated sufficiently to keep condensation to a minimum.

##### **30521.3 Transportation**

No steelwork shall be loaded for transport until the paint system has been passed by the Engineer as being sufficiently dry for handling.

#### **30522 Repairs to Damaged Surfaces**

##### **30522.1 Paint Repair**

Areas of paint which have been damaged shall be cleaned to bare metal and the edges of the undamaged paint beveled with sandpaper.

##### **30522.2 Overlap for New Painting**

The full specified painting system, excepting blast or etch primers which may be omitted at the recommendation of the paint manufacturer, shall then be applied in such a manner that the new paint overlaps the existing paint by at least 50 mm all round the affected part.

#### **30523 Uncoated Surfaces**

Unless otherwise described in the Contract, surfaces which will have concrete cast against them shall be left uncoated and shall be clean and free from loose rust and scale at the time of concreting. The shop applied system on adjoining surfaces shall be extended 25 mm as marginal strips within the contact surface.

## SECTION 30600 MASONRY WORKS

### 30601 General

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

### 30602 Sample, Sample Panels and Test

The Contractor shall submit sample of bricks and concrete hollow blocks to the Engineer for approval.

One sample panel of the face block works conforming to the requirement of under this section shall be constructed by the Contractor in the place directed at site. The panel shall have a dimension of 2000 mm long and 900 mm high and shall be properly maintained during the construction period.

Testing for block work shall be carried out by an approved independent laboratory. The Contractor shall submit the name of the testing laboratory to the Engineer for approval before commencement of the block works.

### 30603 Materials

#### a) Bricks

All bricks shall be of size 60 x 105 x 200 mm unless otherwise approved by the Engineer. The bricks shall be uniform in size and shape and shall be deep red in color and must be sufficiently well burnt. The bricks shall be wholly clean and free from flaws, cracks and even surfaces. The Contractor shall submit to the Engineer sample bricks for his approval.

#### b) Concrete Hollow Blocks

Concrete hollow blocks to be used shall be hollow core blocks and hard, even in shape, square with true arises, well matured and of dense, well consolidated mixture having exterior dimensions of 390 x 190 x 100, 150 and 200 mm in thickness. The concrete hollow block shall have a compressive strength of not less than 40 kg/cm<sup>2</sup> and an apparent specific gravity, air dried of not less than 1.7 conform to JIS A 5406, ASTM or equivalent approved by the Engineer.

#### c) Lime

Lime shall be freshly burnt lime conforming to JIS R 9001 or approved equivalent. The lime at the site shall be protected from the weather by being kept in a weather proof shed with impervious floor and sides.

#### d) Cement and Sand

Cement and sand required for masonry work shall conform to the requirements of the 30400 CONCRETE WORKS.

#### e) Mortar

Mortar for brickwork shall be composed of one part of cement and unless otherwise specified or directed, three parts of sand thoroughly mixed with clean water.

Mortar for concrete hollow block shall be composed of one part of cement and three parts of sand, unless otherwise directed by the Engineer.



**30604**  
**Laying**

a) **Brick Laying**

The brick shall be thoroughly soaked with water before their use and they shall be laid end and side in one operation in close compact mortar joints. The cement mortar to be used shall have a ratio as stated above. The brick work unless otherwise specified, shall be built in English bond with no joints wider than 10 mm. Except where indicated to be fair face, all joints shall be thoroughly raked out as the work proceeds.

b) **Concrete Hollow Block Laying**

The concrete hollow block shall be laid in straight and struck joints of about 10 mm thick with 1:3 cement mortar as shown on the Drawings. All horizontal and vertical joints shall be struck off flush with the wall as each block is laid. After mortar has begun to stiffen, joints shall be finished to face work by square raking to a depth of 6 mm and hereafter left clean. The finish mortar for joints shall be of 1:1 ratio.

The concrete block walls shall be reinforced with steel deformed reinforcement bars of a diameter of 10 mm in a manner as shown on the Drawing. Anchor steel bars shall be preinstalled to the surrounding floor, columns, walls and ceiling at an intervals and locations to enable connection to the reinforcement bars. All splices shall be taken 40 times the bar diameter. The vertical and horizontal joints through which the reinforcement bars run shall be thoroughly filled with 1:3 cement mortar.

c) **Joints with adjacent Structures**

The top course of all block walls shall be solid block, unless otherwise detailed. A 30 mm gap shall be left between the top of all non-bearing walls and the soffits of concrete beams and slabs. This joints shall be filled with an approved compressible fillers. Where block work walls abutt or pass concrete walls and columns, the block work wall shall be tied at every second course with 4 mm diameter galvanized wire ties built into the concrete. The ties shall project 200 mm into the bed joints and shall be bent to form a key.

d) **Lintels and Caulking**

Where required to install doors, windows and any other openings in the concrete block walls, reinforced concrete lintels shall be provided over opening. The lintels shall rest on each side of adjacent block walls not less than 200 mm in length. The Contractor shall design the lintels and obtain the approval of the Engineer.

Unless otherwise specified, all junctions between block work and other building components shall be sealed with an approved elastometric silicone caulking sealant to render the building completely watertight.

Laying of the concrete blocks shall not exceed 1200 mm in height per day.

**30605**  
**Stone Masonry**

a) **General**

The Work under this Sub-section shall comprise the supply of labor, materials and plant and the performance of all work required for stone masonry work in

the buildings. The work shall be carried out as shown on the Drawings or as directed by the Engineer and as specified herein.

b) Samples and Shop Drawings

The Contractor shall submit samples of each materials and shop drawings for approval of the Engineer prior to fabrication.

c) Materials

The works consist of granite stone counter top and door sills. The materials shall be of hard and durable, free from flaws, cracks, knot, stain and shall be uniform of its kind. The color shall be selected by the Engineer.

d) Delivery and Storage

Materials shall be wrapped by an appropriate paper and soft plastic sheet on its surfaces to protect against any damages after fabrication. The materials shall be delivered, stored and handled carefully during the entire construction period.

e) Fabrication

The materials shall be fabricated at the quarry to a dimension and shapes in accordance with the approved shop drawings. The materials shall be ground with emery powder ranging from coarse to fine and polished with wax to a luminous to achieve satisfactory finish using appropriate grinding machine or by hand.

f) Installation

Before installation of counter top granite, the rendering mortar shall be applied evenly and uniformly on the top of lining masonry block. Then the granite counter top shall be laid and fixed securely on the base by using brass or stainless wire clamps to a location and even required.

Cement grout shall then be filled up to any gaps between counter top and the base mortar. The excess cement mortar around the counter top shall be completely cleaned out by wet lags and polished to original finished surfaces. The surfaces shall be protected from any stains wrapping up with an impervious sheet until the completion of any adjacent works.

The completed surfaces shall be cleaned by non-staining synthetic detergent and polished with wax to original surfaces.

## SECTION 30700 WATERPROOFING WORKS

### 30701 General

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

a) Samples and Shop Drawings

The Contractor shall submit samples of each materials and shop drawings for approval of the Engineer prior to delivery.

b) Certificate

The Contractor shall submit the guarantee certificate of each materials to be obtained from manufacturer for the approval of the Engineer. The work shall be guaranteed for period of not less than ten (10) years.

### 30702 Materials

All materials shall be of the best quality and shall comply with the following standards. The materials shall be delivered to the site in sealed containers bearing the manufacturer's original labels.

- Asphalt shall conform to JIS K 2207 Type 3 or equivalent approved.
- Mastic asphalt roofing felts (Synthetic fiber base) shall conform to JIS A 6022 or equivalent approved.
- Sanded asphalt roofing felts shall conform to JIS A 6007 or equivalent approved.
- Primer for asphalt shall be recommended by the manufacturer.
- Polysulfide sealing compound shall conform to JIS A 5758 or equivalent approved.

### 30703 Application

a) Surface Preparation

Leveling mortar with the mixing ratio 1:3 shall be applied onto the roof slabs to make a smooth surfaces free from holes, joints, cracks and any projections and to achieve a uniform slope towards the roof drains as shown on the Drawings. Before application of waterproofing on the surfaces, the Contractor shall obtain the Engineer's approval on the surfaces.

b) Priming

The surfaces to be waterproofed shall be uniformly coated with the primer at the rate of not less than 0.3 liter/square meter of the surfaces. Primer shall be dried before application of bitumen.

c) Roofing Membrane

Membrane waterproofing shall consist of two types: 3-layers and 2-layers membranes. The 3-layers shall be applied to roof top area, while 2-layers shall be applied to minor indoor areas. The application of 3-layers membrane waterproofing shall basically conform to the following tables and

specifications:

- Asphalt Primer	0.3 liter/m <sup>2</sup>
- Asphalt	1.2 kg/m <sup>2</sup>
- Asphalt Roofing Felt	1.6 kg/m <sup>2</sup>
- Asphalt	1.2 kg/m <sup>2</sup>
- Asphalt Roofing Felt	1.6 kg/m <sup>2</sup>
- Asphalt	1.5 kg/m <sup>2</sup>
- Asphalt Roofing Felt	1.6 kg/m <sup>2</sup>
- Asphalt	1.5 Kg/m <sup>2</sup>
- Cement Mortar Screed	T= 15 mm

The Contractor shall submit the manufacturer's application tables for the approval of the Engineer prior to commencement of the works.

Asphalt shall be uniformly heated to a temperature of 170°C in its melting point. The asphalt roofing felt shall be laid onto the smooth leveling mortar after priming has been completely dried. The roofing shall be well rolled with a minimum 100 mm overlaps and laid strictly in accordance with manufacturer's instructions.

Around the roof drains, anchors for water supply facility, drain pipes, laying asphalt felt shall be carefully exercised. An additional layer of 200 mm outward to the roof drains shall be applied for reinforcing the area. Vertical area of the parapet shall also have an additional layer of sanded asphalt roofing felt.

The final layers of sanded asphalt roofing felts shall be applied around the parapet. The upper end of the felts shall be fixed into the aluminum angle flashing or approved materials and sealed all around the flashing as shown on the Drawings. Aluminum surfaces in contact with masonry, concrete, dissimilar metals shall be coated with bituminous paint, vinyl primer or zinc chromate paint.

Cement mortar screed (as curing cement mortar) shall be mixed with the same proportion as the leveling mortar specified in the item a) Surface Preparation in this Sub-section.

**30704  
Flood Test**

Prior to application of the covering concrete, waterproofed areas shall be tested for securing watertightness. The test shall be made by plugging all drains and bywatering in the area allowing standing for 24 hours to observe if the water level change. When it change the broke area shall be repaired and retested.

**30705  
Caulking and**

Where required and directed by the Engineer, asphalt compound shall be applied at the end of asphalt roofing felt and around the sleeve pipes. Polysulfide sealing compound

**Sealant** shall be applied where directed by the Engineer.

**30706 Completion** Upon completion of the work, the finished surfaces shall be thoroughly cleaned.

**30707 Protection Concrete** The protection concrete shall cover the entire faces of the waterproofed roofing in a minimum thickness of 60 mm and shall be finished with waterproof cement mortar specified under Section 30900 hereinafter. The materials such as cement, aggregate and sand, mixing, casting and curing of concrete shall comply with applicable provision in Section 30400 CONCRETE WORKS hereinbefore.

The concrete shall be reinforced with 6 mm  $\phi$ , 100 by 100 steel welded mesh and provided with expansion joints to the full depth in a grid pattern of not larger than 3000 mm. Top of the joint shall be filled up with asphalt compound to a thickness of 25 mm on top of bituminous or foamed plastic board approved.

## SECTION 30800 TILE WORKS

- 30801 General** The work under this Section shall comprise the supply of all labor, materials and plant and the performance of all work required for the various tile works in the buildings. The work shall be performed as shown on the Drawings and as specified herein.
- 30802 Samples** The Contractor shall submit samples of tiles and catalogues for the approval of the Engineer prior to delivery. The materials, colors and patterns shall be directed by the Engineer.
- 30803 Shop Drawings** The Contractor shall submit shop drawings to the Engineer for approval prior to installation.
- 30804 Delivery and Storage** Materials shall be delivered, stored, handled and installed in a manner to protect them from all damage during the entire construction period.
- 30805 Materials** Only first quality tiles shall be used in the works. The quality of the tiles shall comply with JIS or ASTM or equivalent approved.
- a) **Ceramic Tile to Floor**  
Ceramic tile to floor shall be approximately 330 mm x 330 mm x 9 mm in size and shall have unglazed surfaces. Colors and patterns shall be selected by the Engineer.
  - b) **Granite Stone Tiles to Floor**  
Granite tile to floor shall be approximately 330 mm x 330 mm x 9 mm in size and shall have the similar pattern of unglazed granite stones surfaces.
  - c) **Ceramic Tile to Interior and Exterior Walls**  
Ceramic tile to interior wall for toilets and kitchens and other places as shown on the Drawings shall be approximately 200 mm x 300 mm x 6 mm in size and shall have semi-glazed surfaces. The ceramic tile to exterior walls shall be mixed pattern with 330 mm x 330 mm x 9, 330 mm x 165 mm x 9 mm and 165 mm x 165 mm x 9 mm in size and have unglazed surfaces. The patterns and colors shall be selected by the Engineer.
  - d) **Ceramic Tile and Granite Stone Tiles to Skirting**  
The size of skirting of ceramic and granite stone tiles shall be approximately 330 x 120 x 9 with the round cushion at the top and have unglazed surfaces. Color shall be selected by the Engineer.
  - e) **Non- Slip Stair Nosing Tiles**  
The non-slip stair nosing tile shall have the nosing at its one end and have the non-slip grooves. The nosing tile shall have unglazed surfaces to match with the floor tiles.
- 30806 Tile Setting** Floor tile installation shall not be started before completion of wall tiling in the area. Surfaces to receive floor tile shall be clean and free from dirt, dust, oil, grease and other foreign matter. The tiles shall be set with 1:3 cement mortar to a level and slope

specified and as shown on the Drawings.

Wall and skirting tiles shall be commenced before application of floor tiles in the respected area. Concrete and/or block surfaces to receive the tiles and skirting shall be cleaned and free from dirt, oil, grease and other deleterious substances and soaked with clean water prior to application of the rendering cement mortar base. The rendering cement mortar base for the tile works shall be specified in Section 30900 hereinafter.

The joints of ceramic tile 330 x 330 mm to floor and nosing shall be 6 mm wide, uniform and true to line and grouted flush with cement paste. The joints of ceramic tile 200 x 200 mm to toilet floor shall be 2 mm wide and grouted with white cement paste. The joints of ceramic tiles to walls shall be 6 mm wide and grouted with cement paste. The joints of ceramic tiles to toilet walls shall be 2 mm wide and grouted with white cement paste.

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

Plumbing fixtures and any others to be built in the tile surfaces shall be installed to suit tiling works.

Damage or defective tiles shall be replaced by the Contractor at his own expense.

## SECTION 30900 PLASTERING WORKS

**30901  
General**

The work under this Section shall comprise the supply of all labor, materials and plant and the performance of all works necessary for the plastering works to floors, walls and other portions of the buildings. The works shall be performed as shown on the Drawings or as directed by the Engineer and as specified herein.

**30902  
Delivery and  
Storage**

Materials shall be delivered, stored, handled and installed in a manner to protect them from all damage during the entire construction period.

All branded materials shall be delivered to the site in their original packing, bearing the trade name of the material concerned. Cement and lime shall be stored off the ground, under cover and away from all possible sources of dampness. Sand shall be stored under clean conditions to prevent them from contamination with soil or deleterious substances.

**30903  
Materials**

Cement, aggregates and water shall conform to the requirements of the Section 30400, CONCRETE WORKS.

The lime shall be hydrated lime conforming to JIS R 9001 or equivalent approved by the Engineer. White cement where required shall be special cement obtained from an approved manufacturer.

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

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

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

Applying Bed	Place of Application	Rendering Coat Cement: Sand	Finish Coat Cement: Sand: Lime
Concrete	Floor	-	1:2
	Interior wall	1:2	1:3:03
	Ceiling	1:2	1:3:03
	Exterior wall	1:2	1:3
Brick & Block masonry	Interior wall	1:3	1:3:03
	Exterior wall	1:3	1:3

**30904  
Surface  
Preparation**

Surface to receive a plaster shall be roughened, brushed or washed clean, free from all laitance, scum, loose carbonate scale, loose aggregate, dirt and other foreign matter. Smooth concrete surfaces shall be treated with a suitable bonding coat or well hacked



to form a plaster key, all to the approval of the Engineer.

Concrete surfaces shall be kept thoroughly wet for 24 hours prior to application of plaster to ensure satisfactory bond. In case of brick and block, their surfaces shall be sufficiently and uniformly dampened immediately before application of cement mortar.

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

**30905**  
**Mixing of**  
**Plaster**

The Contractor shall apply three-coat cement mortar plaster where shown on the Drawing and as directed by the Engineer. Three-coat cement mortar plaster consisting of a screed coat, a rendering coat and a finish coat shall be applied to all walls to be plastered.

Finish, rendering and screed mixes shall be accurately measured by volume in the proportion specified in the foregoing clause 30903 Materials. The mix proportion of screed coat shall be 1 part of cement and 3 part of sand. The lime and other admixtures shall not used for screed coat.

The mixes may be varied to suit local conditions and climate, subject to the approval of the Engineer.

All materials for finish, render and screed shall be mixed dry in a mechanical mixer, until the materials are uniformly mixed and then water added to give a workable consistency. Mixing by hand shall only be permitted for small quantities and shall be done on hard clean platform.

The plaster shall be completely used within thirty minutes after mixing and hardened plaster shall not be remixed but removed from the Site.

**30906**  
**Application**

The thickness of three coat plaster or render on walls shall be approximately 20 mm.

The thickness of two coat plaster or render on concrete soffits and beams shall be approximately 15 mm.

Rendering coat for tile work shall be 18 mm thick and shall be mixed with approved waterproofing admixture for an interior wall tile in the toilets and shower rooms as well as an exterior wall for tile works.

The first screed coat shall be thrown on to the concrete or brickwork surfaces evenly to form a sharp key for the next coat. The screed coat shall be protected against drying for approximately 20 hours before applying the rendering coat. The second rendering coat shall be applied evenly to the required thickness, and shall be screeded in all direction and then scratched to provide satisfactory bond for the finish coat. The rendering coat shall be protected against drying for approximately 24 hours before finish coat shall be applied with a wooden float or with a steel trowel as specified to a smooth level finish.

The finish coat shall be applied approximately 5 mm in such a manner as to produce a uniform smooth surface which is true to line. The surface shall be finished with a steel trowel. Each surface to be plastered shall be finished in one operation to avoid joining marks. Arrises shall be slightly rounded.

Two coat work shall be as specified for three coat work but with the second undercoat

omitted. After the initial set the coats shall be kept wet by spraying or other suitable means for a period of seven days to avoid rapid drying out and cracking.

Metal wire lath shall be provided where shown on the Drawings, or directed by the Engineer. The metal lath shall be fixed to brick or concrete hollow block wall surfaces and into the waterproofing cement mortar of the roof gutters and parapet coping before application of cement mortar plaster. The metal lath shall be of galvanized expanded metal sheet with reinforcing ribs and shall be fixed with staples.

**30907**  
**Waterproof**  
**Cement Mortar**

Waterproof cement mortar shall be applied to roofs, parapets coping, eaves and other portions where shown on the Drawing or as directed by the Engineer. Cement mortar shall conform to the Specification as provided for in the foregoing Section. Waterproof admixture shall be used in the cement mortar in accordance with the manufacturer's recommendations to effect waterproofing. Catalogues of waterproofing admixture shall be submitted to the Engineer for his approval.

**30908**  
**Curing**

As soon as the finish coat has taken its initial set, the cement plaster shall be protected against direct rays of the sun or rapid drying for at least six (6) days. During this time, cement plaster shall be kept moist by frequent fogspraying. Care shall be taken to prevent staining the cement plaster.

**30909**  
**Acceptance and**  
**Rejection**

Cement plaster with cracks, blisters, pits, checks, color streaks or discolorations shall be removed and replaced satisfactory with new material. Cement plaster shall be clean and sound after all other related work has been completed, and pointing and repairing of damaged portions shall be performed in an acceptable manner. Pointing and repairs shall match the existing cement plaster in texture and color.

**30910**  
**Cleaning**

Upon completion of the Work, the scaffolding, equipment and rubbish accumulated from the Work shall be removed from the Site and the cement plaster shall be left in clean condition.

**30911**  
**Colored Cement**  
**Mortar**

The sand to be used shall have the same quality and grading as specified in this Clause. The mix proportion of the colored cement mortar shall be 1:2:6:9 in volume of white cement, ordinary Portland cement, slaked lime and sand. Waterproofing admixture and pigment shall be applied and approved by the Engineer. Colored cement mortar shall be applied in two coats. The first coat shall be applied thinly and the second coat in sufficient thickness to produce a uniform appearance in color and texture. The second coat shall be applied 24 hours after the first coat.

**30912**  
**Washed Gravel**

The gravel to be used for washed gravel shall be a coarse aggregate of well-graded, sound granular materials passing through a 9 mm mesh screen and retained on 6 mm mesh screen, unless otherwise instructed by the Engineer.

The mix proportion of the washed gravel shall be 0.05 : 1: 2 by volume of mineral pigment for coloring, ordinary Portland cement and coarse aggregate. The subsurface on which cement paste to be applied shall be swept clean and thoroughly moistened. The mix shall be laid on the subsurface not less than 15 mm thickness to a level, dense and even surface by metal rollers formed by a clear wood strips.

Before the topping surface hardens, the surface shall be thoroughly washed down with bluish and clean water until coarse aggregate is exposed about 1/3 of the surface thickness. The completed gravel surface shall be kept moist for a 5-days curing period protected from any damages.

The surface shall be washed down with cleaning compound mixed with warm water,

and shall be finished with a fine abrasive. Where washed gravel meet with other surfaces, 10 mm wide groove line shall be provided.

## SECTION 31000 DOOR AND WINDOW WORKS

### 31001 General

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

a) Samples and Shop Drawings

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

b) Certificates

The Contractor shall submit a certificate from the manufacturer or producer of doors and windows for the Engineer's approval prior to delivery.

c) Delivery and Storage

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

d) Materials in General

Aluminum materials shall conform to JIS H 4000, JIS H 4001 and JIS H 4100, ASTM or equivalent approved. Aluminum surfaces shall be of natural anodized finish, which shall conform to JIS H 8601, ASTM or equivalent approved.

Steel materials shall conform to JIS G 3101, JIS G 3131 and JIS G 3141, ASTM or equivalent approved.

Wooden materials shall be thoroughly seasoned and matured, sound, straight, free from warp, sapwood, signs of rot, large and loose knots, worm holes, waness, cracks and other defects. These materials shall conform to JIS, ASTM or other local standards approved by the Engineer;

All exposed faces of timber shall be wrought unless otherwise specified. Wrought faces shall be rubbed down with sand paper and finished smoothly with slightly rounded exposed arrises.

Plywood shall be of a size and thickness specified or shown on the Drawings and shall conform to JIS, ASTM or equivalent approved.

All nails, screws and other fastening shall be of a suitable type and size approved by the Engineer.

All hardware shall be of stainless steel, chromium plated brass and cast or anodized aluminum unless otherwise specified and of robust construction. Materials not specified herein shall conform to relevant JIS, ASTM or other standards approved by the Engineer.

Insect screen shall be of stainless steel wire mesh or aluminum wire mesh with 16 mesh/ft.

The Contractor shall supply a key boxes as directed by the Engineer.

c) **Workmanship**

The Contractor shall verify all measurements at the building site and shall be responsible for all dimensions, fittings and proper attachment of items directly connected with the door and window installation.

Frames shall be plumbed, leveled and rigidly secured in place. Temporary supports shall be installed until the wall at the frame is completed and the frame is securely anchored in its final position.

Doors, windows and louvers shall be installed in accordance with the Drawings, approved shop drawings and manufacturer's recommendations.

Anchors and inserts for guides, brackets, and other work shall be accurately located. Upon completion, doors and windows shall be free from warp, twist or distortion and shall be lubricated and properly adjusted to operate smoothly.

All damages of the doors and windows shall be repaired or replaced by the Contractor at his own expense.

**31002  
Wooden  
Door Leaves**

**31002.1 Wooden Door Leaves**

Wooden door leaves shall be flush and assorted panel types with 40 mm in total thickness, where indicated on the Drawings or directed by the Engineer, installing wood louvers or panes.

Doors shall be manufactured to the dimensions and finishes as shown in the Door Schedules by an approved manufacturer, where applicable, in accordance with JIS A 4601, ASTM or equivalent approved.

Doors shall be covered with 4mm thick plywood on the solid core or craft paper core and shall otherwise comply with JIS A 4601, ASTM or equivalent approved. Joints of frames shall be formed using tenon and mortise joints using adhesive for adequate strength and firmness.

Door and window frames shall be fixed to block walls using metal fasteners and door sill with dowels. On concrete, the fixing shall be made by plugs or countersunk screws driven into concrete.

Plywood flush doors shall be kept clear off the ground in well ventilated conditions and under cover at all times. The Contractor shall provide all boxing and temporary covers to protect the doors.

Doors to be painted shall be knotted and primed before fixing in position. All joinery prepared other than on Site is to be knotted and primed before delivery to Site. Where adjustments are made on Site the priming shall be made to the satisfactory surfaces.

All of the wood material shall be of the timber without pith and the seasoning shall be of kiln drying with moisture of less than 15%. Adhesive to be used for bonding of wood shall be of water-tight Phenol Resin as specified in JIS K 6802, ASTM or equivalent approved.

Pane or louvers, if provided, shall be fixed into the door with adequate beads.

### 31002.2 Hardware

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

The hardware shall comply with the following requirement:

- Butt Hinges : Bronze or stainless steel, 130 mm in approximate size, 3 hinges  
for each door leaf
- Knobs : Stainless steel
- Lock Sets : Bronze, cylindrical lock, 3 sets of key to be furnished
- Door Closer : Die-cast aluminum body, oil and spring activated with 90 degree stop device
- Push and pull : For toilet door, plastic made 15 cm x 25 cm in handle size

### 31003 Steel Doors Leaves and Frames

#### 31003.1 General

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

#### 31003.2 Hollow Steel Door Leaves and Frames

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

Panel	1.6 mm
Stiffener plate and anchor plate	2.3 mm

The door leaves shall be full flushed seamless panel type, 40 mm thick unless otherwise specified. All four edges shall be sealed and ground smooth. The hollow steel transom shall be of flush type panels having the same appearance and specification as hollow steel doors. Panels shall be complete with 1.6 mm cold rolled steel sheet welded to an astragal and all fastenings shall be hidden.

Door frames shall be formed of cold rolled steel sheet. The sheet thickness shall be as follows unless otherwise specified:

Frame	1.6 mm
Architrave	1.2 mm
Threshold	2.3 mm

Door frames shall be profiled accurately to the details and dimensions as shown on the shop drawings approved by the Engineer. The door frames shall be reinforced, drilled and tapped to receive hardware and all frames shall be provided with rubber bumpers.

Door frames shall be provided with adjustable anchors as required. Perimeters of door

frames facing outdoors shall be securely caulked with approved caulking materials.

### 31003.3 Hardware

Hardware for the steel door shall comply with the requirements specified in the list of door on the Drawings. The Contractor shall submit catalogues and samples to the Engineer for his approval.

Each door shall be provided with the following hardware:

But Hinges	: Bronze or stainless steel, 130 mm approximately in size, 3 or 4 sets as required for each door leaf
Knob	: Stainless steel hair line finish
Lock sets	: Bronze, Cylindrical lock, 3 sets of keys to be furnished
Door Bolts	: Bronze, surface or flush type
Door Closer	: Die-cast aluminum body, oil and spring activated with 90 degree stop device

### 31003.4 Steel Sliding Doors

Steel (double or single) sliding doors for the Container Freight Station and Maintenance and Repair Shop shall be fabricated with steel frames reinforced by diagonal and horizontal members. The door shall be netted with galvanized welded wire mesh, 50 x 50 mm mesh, neatly and securely welded to the frames.

- a) Door leaf shall be suspended from hanger rail and guided by guide roller and all of which systems shall be manufactured by the company approved by the Engineer.
- b) Doors shall be complete with door handles, lock bar assembly to permit padlocking from inside or outside the room.
- c) Doors shall be designed to sustain safely strains or stressed to which they normally may be subjected.

### 31004 Steel Roll-up Doors

Steel overhead roll-up doors shall be heavy duty, electrical and manual operative galvanized industrial type, GA # 18 (1.2 mm) Wt. 20 kg/sq. m. The door shall be composed of slats, guide rails, rolling drum, cover case, bottom bars, electrical winding motor with chain operating device, safety switch for preventing falling, windlock, unlockable key both from the inside & outside and complete with other accessories approved by the Engineer. In crane operating areas, the door shall be designed to be located in the free space.

Specifications for the various components shall be as follows:

Slats	: Interlocking type, steel plates 1.5 mm thick, designed against a wind velocity of not less than 25 m/s
Guide rail	: 2.3 mm thick formed stainless steel plates, depth 60 mm, with safety stop at a height of 2.2 m above the floor, anchored securely to the concrete jams.
Cover case	: 1.6 mm thick steel panel with adequate reinforcement and inspection door.

- Motor : Electric power source : 400 volt, 3-phase, 50 Hz.
- Operation speed : 3 to 5 m/min. Motor to be installed in the cover case
- Operation box : Installed on the side wall at an adequate height and provided with both manual operation devices complete with all accessories in a steel box.

The manual operation device shall be allowed to suitably operate by one person. The Contractor shall submit detailed shop drawings prior to fabrication. The outside perimeter of the shutter guide rails shall be securely caulked with approved caulking materials.

### 31005

#### Aluminum Doors, Windows, Louvers and Frames

##### 31005.1 General

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

Aluminum doors and windows shall conform to JIS A 4702, JIS A 4706 and JIS A 4707, ASTM or equivalent approved.

Aluminum window frames shall be of extruded aluminum shapes with natural colored as shown on the Drawings. Before delivery they shall be protected with strippable plastic. The plastic shall be removed after the major construction work has been completed.

Doors or windows specified as fire resistant shall have steel frames with thickness to be approved by the Engineer.

All windows and their components shall be designed to resist the test pressure of 2400 N/m<sup>2</sup> and certificates shall be submitted to the Engineer conforming to this requirement.

##### 31005.2 Doors and Windows

All doors, windows and louvers shall be products of reputable, nationally known manufacturers approved by the Engineer. All window frames shall be constructed to withstand a minimum 130 kg/sq m. wind load with the sashes or blades in closed position. Windows shall be designed for glazing from outside, with continuous glazing beads.

Generally all windows shall have a clear glass at least 6 mm thick. Screws where required for attaching loose aluminum glazing beads at window opening shall be pan head machine screws. Holes in framing members shall be threaded. Screws shall have a sufficient length to properly draw up tight on beads.

Framings which are to receive glass shall have removable glass stops and glazing beads. Joints in frame members shall be watertight, fitted tightly and reinforced. Window flashing at the bottom of windows shall be furnished to all windows. Shapes shown on the Drawings are representation of design, function and required profile. Alternative shapes, dimension profiles and functions may be submitted to the Engineer for approval.

Prior to installation of doors, windows and louvers, the Contractor shall ensure that the surfaces of the concrete or steel to receive the frames are free from all loose and foreign materials. Windows and doors shall be firmly fixed into the openings and frames by using fixing lugs. Metal and Metal Joints shall be sealed. All aluminum surfaces in directly contact with cement mortar, concrete or dissimilar metals other than stainless



steel, zinc or white bronze, shall be coated with bituminous paint or provide with polyethylene film.

Gaps between the frames and the surrounding concrete shall be grouted with cement mortar and outside perimeters shall be sealed with approved caulking materials.

All windows shall be protected from damage after installation. Doors, windows or frames that are damaged prior to completion or acceptance shall be restored to the original condition or shall be replaced at the Contractor's expense.

### **31005.3 Louvers**

The aluminum louvers shall be furnished and installed as shown on the schedules and Drawings. The aluminum louvers shall be fabricated by a manufacturer approved by the Engineer.

The blades of louvers shall be of 1.2 mm thick aluminum plate with fixing pitch at 45°, complete with frames, sills and mullions as shown on the Drawings. The louvers shall be reformed for site assembly, and shall be anodized to match the windows. The back of the louvers shall be fitted with insect screens.

The glazed louver windows shall be of opening area adjustable type with approximately 6 mm thick clear or figured glass blade. All support struts, stiffeners, adjusters including other reinforcing accessories as may be necessary for securing louvers solidly and rigidly in place and in any angle shall be provided. All formed aluminum drip pans and flashing plate at the base of louvers shall be included.

Concrete block louvers where indicated on the drawing shall be screen blocks with rain protection.

Shop finish on all aluminum members shall be a clear anodized to a natural color finish.

### **31005.4 Insect Screen**

Insect screen shall be fabricated with extruded aluminum frames and wire mesh secured in the frame by means of PVC beads or stainless screws and shall be fixed to the outside of windows and louvers. Screen shall be removable and rewirable. Wire mesh shall be of aluminum or stainless wire mesh with 16 mesh / ft. approved.

### **31005.5 Workmanship**

Doors, windows and louvers shall be installed in plumb and square without springing or forcing, and securely anchored to the walls. The complete installation shall be made to secure waterproof and weathertight.

### **31005.6 Hardware**

Locks, knobs and levers, handles, door closers, floor springs, door bolts, door stops, window adjusters and all other hardware shall be of the first grade and as supplied by a notable manufacture or equivalent approved by the Engineer.

The Contractor shall submit samples of hardware to the Engineer for his approval prior to any order being placed. The hardware subsequently delivered to the site shall be of no lesser standard of quality than those of the approved samples.

All hardware shall be kept carefully wrapped and protected against defacement by mortar and plaster droppings, paint smudges, etc.

Three keys to each lock shall furnished with clean marking of the designation number

and the door number. All locks shall be of outside key, inside thumb-turn type unless otherwise specified.

Hardware shall be furnished in accordance with the Door and Window Schedule and door layout. All locks and hinges shall be properly fixed with suitable screws provided to match the work and all moving parts except nylon components shall be well oiled and any necessary adjustments shall be made before handing over the Work.

The hardware shall comply with the following requirement:

Floor Hinge	: Cast iron body with stainless steel cover, oil and spring activated with 90 degree stop device
But Hinges	: Bronze or stainless steel, 13cm in approximate size, 3 hinges to each door leaf
Push and Pull Handle	: For entrance door, stainless steel, 20 cm x 20 cm in size
Knob	: Stainless steel
Lock Set	: Bronze, cylindrical lock, 3 sets of key to be furnished
Door Closer	: Die-cast aluminum body, oil and spring activated with 90 degree stop device
Door Bolt	: Bronze, surface or flush type
Window Fastener	: Die-cast aluminum
Window Adjuster	: Die-cast aluminum
Glass Blade Adjuster	: Die-cast aluminum

**31006  
Cleaning  
and  
Protection**

Upon completion of the Work, finished surfaces shall be thoroughly cleaned and protected. Damaged or defective materials shall be repaired or replaced by the Contractor at his own expense.

**31007  
Glazing**

**31007.1 General**

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

**31007.2 Material**

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

- a) Plate glass- 8 mm thick
- b) Plate glass- 5 mm thick
- c) Plate glass- 3 mm thick
- d) Figured glass- 5 mm thick

- e) Heat absorbing figured wire glass 6.8 mm thick
- f) Wired glass- 6.8 mm
- g) Figured wire glass-6.8 mm
- h) Tempered glass(for tempered glass doors)-12 mm

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

#### **31007.3 Glazing**

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

#### **31007.4 Protection and Cleaning**

Fixed glass shall be protected from damages by labeling warning or covering with plywood as necessary. Glass shall be thoroughly cleaned in side and outside before completion of construction. Damaged materials shall be replaced by the Contractor at his own expense.

## SECTION 31100 PAINTING WORKS

### 31101 General

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

The Contractor shall be responsible for taking all precautions necessary for securing health and safety of his workmen from the execution of all preparation and painting work including wet rubbing down of paint work and provision of washing facilities and others. The surfaces to be painted shall be excluded, except otherwise specified or directed by the Engineer, the following surfaces and materials:

- Non-ferrous metals
- Equipment and materials with complete factory finish
- Other items designated by the Engineer

#### a) Samples

The Contractor shall submit samples of all materials, color samples and application schedule recommended by the manufacturer to the Engineer for his approval prior to commencement of the work. Twocolor samples of each type of paint shall be submitted providing on the 300 mm x 300 mm strips of the board.

#### b) Delivery and Storage

All material shall be delivered to the job site in the original labeled and sealed containers that shall be clearly show the designated name, formula or specification number, batch number, color, quantity involved, date of manufacture, name of manufacturer, all of which shall be legible at the time of use.

Paint and thinner shall be stored in accordance with the manufacturer's printed instructions. The Contractor shall follow all regulations required for storage of paint and post all necessary safety signs required by governing codes. Paint shall be stored in a condition approved by the Engineer. All containers of paint shall remain unopened until required time for use. No paint shall be used which has exceeded the life of manufacturer's recommendation under any circumstances.

#### c) Workmanship

The painting work shall be performed by skillful and well trained crew in the use of materials specified herein.

Workmanship shall be first class in every respect. Enamel and varnish paint shall be applied more carefully by using clean brushes or approved spraying equipment, except the initial coat which shall be allowed to apply on any surfaces with brush. Sufficient time shall be allowed between first coat and succeeding coat to assure thorough drying. The finish coat shall be smooth and

free from runs, drips and other defects.

The Contractor shall so arrange his work that surfaces to be painted which will subsequently be concealed are painted before they become inaccessible.

All brushes, tools, pots, kettles, etc. used in carrying out the Work shall be clean and free from foreign matter and shall be thoroughly cleaned out before being used for a different type or class of material.

Before commencement of all painting, possible precaution shall be exercised to keep out all dust. Clean dust sheets shall be furnished sufficiently to protect the Work.

**31102  
Material**

Painting materials shall conform to JIS K, ASTM or equivalent standard approved by the Engineer and shall comply with the following requirements:

- a) Paint shall be procured from a manufacturer approved by the Engineer.
- b) Flexibility: Paint shall show no evidence of cracking, chipping, stripping or flaking.
- c) Skinning : Paint materials shall not form a thin membrane surface at the top of the liquid within 48 hours in a closed container.
- d) Odor: Paint in the container, during and after application shall not be abnormally pungent, offensive or disagreeable.
- e) Mildew resistance : All paint shall contain an effective amount of fungicidal and mildew-proofing agent, which shall prevent the coating from showing any mould growth and shall be inherently fungistatic by nature of their constituents, and shall be so guaranteed.
- f) Quality: All paints shall be of the best of their respective kind and approved for each particular purpose.

All under and finish coats materials shall be supplied by one manufacturer.

The tints of undercoats shall be approximate the same as those of the finishing color but in order to identify the number of coats applied, a slightly different tint shall be applied in each succeeding coat. Each coat shall be applied as a continuous film of uniform thickness free of pores.

**31103  
Application**

**31103.1 General**

All metal components other than galvanized steel shall be primed in the shop and finish painted after erection. All damaged portions shall be cleaned and touched-up after erection.

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

All wood surfaces to receive paint shall be cleaned of all dirt, grease, dust or any other

deleterious matters. All surfaces shall be thoroughly sanded and all nail holes, cracks and any other defects shall be puttied, re-sanded to a smooth and flush finish. The painted surfaces shall show a smooth, level and uniform finish, free from any stains and shall be uniform in color and shade.

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

All painting works shall conform to the manufacturer's specifications and instruction approved by the Engineer.

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

All the surrounding works shall be protected in an appropriate measure from paint drops and overspray. All smeared and damaged surfaces shall be cleaned or repaired to the Engineer's satisfaction.

### **31103.2 Application**

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

- a) External and internal ferrous metal surfaces other than galvanized surfaces shall be primed with two coats of red lead primer. Two coats of synthetic resin alkyd paint or similar approved shall be applied.
- b) Internal wood surfaces, shall be knotted, stopped and primed with one coat of primer paint, one coat of undercoat, and one coat of finish semi-gloss synthetic resin alkyd paint.
- c) External concrete surfaces or cement plastering shall be thoroughly dried out and cured for 20 days before being given one coat of primer and two coats of exterior quality semi-gloss acrylic resin emulsion paint or similar approved. Apply zinc-sulfate solution before prime coat. Minimum 12 hours shall be allowed before application of each successive coat.
- d) Internal concrete surfaces or cement plastering shall be thoroughly dried out and cured for 20 days before being given one coat of primer, one coat of undercoat and one coat of synthetic resin emulsion paint. Apply zinc-sulfate solution before prime coat.
- e) Internal gypsum board surfaces shall be puttied to remove any flaws, and gaps and rubbed down with fine sand paper to a smooth surface. An acrylic resin primer coat shall then be applied. For finishing, one coat of undercoat and one finish coat of acrylic resin emulsion paint shall be applied. Minimum 12 hours shall be allowed before application of each successive coat.
- f) Structural Steel members shall be grit blasted and cleaned with mechanical methods by metal scrapers and wire brush to remove all mill scale rust and any other deleterious materials. Two coats of lead red primer and one coat of epoxy resin paint shall be applied on the surfaces at factory. The top coat of epoxy

resin paint shall be applied only after completion of erection of the structural steelwork. All damaged coats shall be carefully retouched.

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

- h) Clear Lacquer and Varnish Finish

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

**31104  
Floor Hardener**

The floor hardener shall be applied to the floor and slopes where shown on the Drawings and as directed by the Engineer and as specified herein.

The floor hardener shall be of an unfilled, solvent-free epoxy resin with gray colored and shall be applied onto the concrete floor with four coats. Materials and application shall conform to the recommendations of the manufacturer and shall be approved by the Engineer.

The concrete floor surfaces to be applied shall be at least 28 days age and sound, free from dust, oil and grease or any other contaminants that might prevent from satisfactory bond of epoxy resin. The surfaces shall be etched with a 10 % solution of hydrochloric acid (1 part of commercial grade hydrochloric acid with 2 parts of water) evenly broadcasting and blush into the surfaces with broom. The surfaces shall be thoroughly washed down all traces of acid. The surfaces shall be dried before application of epoxy resin.

The floor hardener shall consist of four layers: The hardener mixed with chemically inert granule as a dust coat shall be applied on the treated surfaces, the first coat by an approved epoxy resin shall be floated into the concrete surfaces, the second coat shall be applied and floated in the same manner as the first coat to correct any variance of color caused by the float in the previous operation. The final coat operation shall be followed by a steel trowelling. Addition of water to any coats shall not be permitted.

When the epoxy resin coat has hardened sufficiently to permit foot traffic, the excess, unbounded granule shall be swept up.

## SECTION 31200 CARPENTRY AND JOINERY WORKS

### 31201 General

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

#### a) Samples

The Contractor shall submit samples of each materials for approval of the Engineer prior to delivery to the Site.

#### b) Shop Drawings

The Contractor shall submit working drawings for respective work items in this Section to the Engineer for approval. Shop drawings shall cover of all sections, joints and other details covering all items of the work required.

### 31202 Materials and Workmanship

#### 31202.1 General

Timber shall be of suitable kinds for the purposes and the best grade of each kind available locally. Selection of timber shall be subject to the approval of the Engineer.

All timber shall be well-seasoned and shall be free from large knots, flaws, shakes or blemishes of any kind. Timber with loose, rotten or dead knots will not be accepted. Sawn timber shall have the shape and size shown on the Drawings and twisted or warped materials shall no be used.

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

#### 31202.2 Wooden Handrails

Wooden handrails shall be molded hard wood and polished as shown on the Drawings. Wood handrails shall be fixed on the concrete wall by using metal lugs and nails at 300 mm intervals. The surfaces of handrails shall be puttied and sanded to a smooth surfaces and finished with clear lacquer.

#### 31202.3 Wooden Door Frames

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

#### 31202.4 Wooden Skirting

Wooden skirting shall be made of hard wood with mortise joints, molded at top as shown on the Drawings or a directed by the Engineer. The skirting shall be securely fixed on the wall by using galvanized steel lugs at approximately 900 mm at intervals before applying the wall plastering.

The surfaces of the skirting shall be puttied and sanded to a smooth surface and



finished with oil paint.

**31202.5 Venetian Blinds Boxes**

Venetian blind boxes shall be fabricated with wood board with mortise joint. The boxes shall be fixed on the walls by using galvanized steel bracket fixing by bolts at approximately 900 mm intervals as shown on the Drawings. The boxes shall be sanded to a smooth surfaces and finished with oil paint.

## SECTION 31300 INTERIOR FINISHING WORKS

### 31301 General

The work under this Section shall comprise the supply of all labor, materials, and plant, and the performance of all work necessary for the construction of the interior finishing works in the building. The work shall be performed as shown on the Drawings or as directed by the Engineer and as specified herein. The Contractor shall submit working drawings for respective work items in this Section to the Engineer for his approval.

#### a) Samples

The Contractor shall submit samples of each materials for approval of the Engineer prior to delivery to the Site.

#### b) Shop Drawings

The Contractor shall submit shop drawings for respective work items in this Section to the Engineer for his approval. Shop drawings shall show ceiling and wall panel arrangements and partial details covering the work items as required.

### 31302 Materials

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

#### 31302.1 Mineral Fiber Acoustical Tile Suspension Systems

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

#### 31302.2 Metal Spandrel and Panel Ceiling

Metal spandrel ceiling shall be of a siding board approximately 0.8mm thick, 100 mm wide anodized aluminum sheathing flanged on both sides

Metal panel shall be of formed aluminum panel ceiling approximately 1000 mm x 1000 mm in size and 2.0 mm thick with recessed joints. The panel shall be anodized to a color approved.

#### 31302.3 Gypsum Board Suspension System

Gypsum board shall be of a plastered board laminated with craft papers on both sides with a dimension approximately 600 mm x 1200 mm x 9 mm in size. The tiles to be used for toilets, pantry and exterior or similar portions as shown on the Drawings shall be of moisture resistant type.

#### 31302.4 Cement Fiber Board Suspension System

Cement fiber board shall be of a compressed cement fiber reinforced board produced with silicic calcium fiber mixed with cement paste with a dimension approximately 600 mm x 1200 mm x 5 mm in size. The panel shall be pre-painted type.

#### 31302.5 Gypsum Board Wall

Gypsum board shall be of plastered board laminated with craft papers on both side of

board with a dimension approximately 1200 mm x 2400 mm x 12 mm in size with tapered edges for provision of seamless joint construction. The board shall be installed on the light weight steel partition framing specified hereinafter.

#### **31302.6 Wire Mesh Partition**

Wire mesh wall partition shall be constructed to the dimensions and located as shown on the Drawings. Posts, braces, bracing straining rails etc. shall be medium galvanized seamless steel tubes.

The wire mesh shall be of 50 mm diamond pattern, approximately 3.0 mm diameter heavy galvanized wire or equivalent approved. Tension wire shall be 4.0 mm diameter galvanized member.

### **31303 Installation**

#### **31303.1 Mineral Fiber Acoustical Tile Suspension System**

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

Main runner shall be provided at an interval of approximately 600 mm, installed with allowance for adequate camber. They shall be designed against ceiling loads of 70 kg/m<sup>2</sup>. Cross T shall be provided at an interval of approximately 1200 mm depending on ceiling materials. Adjustable suspending rod shall be provided at all meeting point on main runners. Appropriate reinforcing metal framing shall be provided for mounting the lighting fixtures and ceiling access holes.

Acoustical tile shall be installed on the main runner and cross T true to line and level.

Wall angle shall be of the same steel with system and fixed to the marginal walls as shown on the Drawings.

The entire suspended ceiling shall be to the level shown on the Drawings with appropriate camber and shall not have a deviation in levels and lines of more than 3 mm in 4000 mm bay.

#### **31303.2 Metal Spandrel and Panel Ceiling**

Aluminum spandrel shall be fixed on the aluminium ceiling suspension system.

The ceiling suspending system shall consist of anchors, hangers, clips, main runners, furring strips and other accessories and all other related works required. The method of installation shall strictly comply with the manufacturer's specification.

Main runner shall be provided at approximately 900 mm intervals and installed with allowance for adequate camber. They shall be designed for ceiling loads of 70 kg/m<sup>2</sup>.

Furring strips shall be provided at an interval of 300 mm depending on the ceiling materials of manufacturer's requirements. Adequate reinforcing metal members shall be provided for mounting the lighting fixtures and other openings.

Aluminum spandrel shall be securely fixed to the aluminium suspended ceiling systems with stainless screws true to line and levels. Completed surface shall not have a deviation in level and lines of more than 3 mm in 4000 mm bay.

Ceiling trims shall be of aluminum molding with uniform color to a spandrel ceiling and fixed to marginal walls and lighting fixture as shown on the Drawings.

Expansion joints and reinforced openings for lighting fixtures shall be provided where shown on the Drawings.

The aluminum panel ceiling shall be fixed on the metal suspension system as specified herein. The joints shall be of aluminum trims with uniform color to a panel ceiling.

### **31303.3 Gypsum Board and Cement Fiber Board Suspension Systems**

Gypsum board and cement fiber board ceiling suspension systems shall be constructed in the same method as in the acoustical tile suspension systems stated hereinbefore and in accordance with manufacturer's instructions.

### **31303.4 Gypsum Board Wall**

Gypsum board shall be installed on the light-gage steel partition system by the galvanized screws. The light-gage steel partition system shall consist of studs, runners, spacers and braces complete with all required components, accessories. The partition shall be fixed and designed conforming to the following requirements. The materials shall be formed light-gage steel and comply with JIS A6517, ASTM or equivalent standards approved. The type of studs shall be of 75 mm depth channel depending on the weight of wall resting on the stud. All other members and framing design shall be determined in accordance with the manufacturer's instructions approved by the Engineer.

The partition shall be designed and constructed with conforming to the following requirements:

- a) Spacers shall be zinc coated steel, fixable to studs.
- b) Reinforcing members shall be of rustproof steel and provide for reinforcement of openings.
- c) Drift pins, small screws and bolts for assembly and installation shall be zinc galvanized.
- d) Runners shall be fixed on both floor and bottom of floor slabs or beams with drift pins at the intervals of approximately 900 mm. When installing to structural steel frames or backing of light gage suspended ceiling, they shall be fixed with tapping screws or welding.
- e) Studs shall be installed at the intervals of 450 mm where sheathing board is also used. In case the finish board is directly applied on the frames, the studs shall be installed at an interval of 300 mm. The top and bottom of studs shall be inserted into runners.
- f) Braces shall be installed at approximately 1200 mm in height from the bottom runner.
- g) Spaces shall be used to fix the end of each stud, and be attached to studs at an interval of approximately 600 mm.
- h) Up and side walls of entrance and similar openings shall be reinforced by inserting reinforcing members. Opening for ducts or the like shall be reinforced by the same method.

- i) Stud located along concrete wall shall be fixed to the upper section of braces using drift pins.
- j) End corners of wall board shall be reinforced with corner bead and putted to aground smooth.
- k) Rustproof paint shall be applied to the welded portion

#### **31303.5 Wire Mesh Partition**

The posts shall be erected truly vertical and line up straight between corner posts or corner posts and end posts. All posts shall be attached to the concrete foundation and /or underside of the mezzanine concrete walls/beams using approved masonry anchors or cast in bolts. End posts and intermediate posts shall be 40 mm nominal bore and spaces as shown on the Drawings. Gate posts shall be 50 mm nominal bore and located as shown on the Drawings.

All bays shall be fitted with three (3) horizontal rails, 32 mm nominal bore. The rails shall be attached to the posts with approved galvanized fittings. The mesh shall be fastened to the top and bottom horizontal rails and end posts with 3.15 mm galvanized wire ties at 60 mm maximum centers and shall be tied to each intermediate post with similar ties in three places. Straining wires shall be 3.15 mm galvanized steel.

The gates shall be fabricated to suit the clear openings as shown on the Drawings. The wire mesh covering on the gates shall be as for main screen. Gate framing shall be constructed from 40 mm nominal bore medium galvanized steel tubes. Drop bolts shall fitted to all gate leaves with a corresponding galvanized steel fixing socket set in a concrete floor. Gates shall be provided with chain and brass padlocks to the satisfaction of the Engineer.

#### **31304 Protection**

All installed portions shall be protected against damage and any chipped and warped and damaged portion shall be replaced and the work shall be finished perfect on completion.

#### **31305 Carpeting**

Floor carpeting shall be laid on the cement mortar plastered floor in the area where shown on the Drawings and directed by the Engineer or specified herein.

The floor carpet shall be of tufted carpet and shall be fitted together with a 12 mm thick felt underlay, throughout the area designated. The exposed edges shall be fastened to floor surfaces and have trim, beveled 1:20, along the entire length of the exposed edge.

The Contractor shall submit catalogues and samples to the Engineer for his approval.

## SECTION 31400 MISCELLANEOUS METAL WORKS

### 31401 General

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

#### a) General requirement

All materials to be furnished under this Section shall be of the best quality of their respective kind. Catalogues of roof drains, floor drains and other items required by the Engineer shall be submitted for his approval.

The work shall be shop fitted and shop assembled where possible.

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

#### b) Shop Drawings

The Contractor shall prepare and submit shop drawings for all items under this Section to the Engineer for approval. Shop drawings shall show complete details of all miscellaneous steel parts, assemblies, components, supports, connections and erection including catalogue cuts and brochures.

### 31402 Materials and Installation

#### 31402.1 Roof and Floor Drains

Roof and floor drains of the buildings shall be of cast iron body, horizontal and vertical type suitable for a kind of waterproofing and shall be heat coated with asphalt. Roof drain shall have two flanges. Bottom flange shall be integrated with the drain body and shall be set by anchor lugs to coincide with waterproof membrane or top surface of the surrounding concrete. The top flange shall be screwed to the bottom flange and shall be set at the level lower than the surrounding roof finish. The two flanges shall be used to clamp the roof waterproof membrane.

Care shall be exercised in fitting in the surrounding waterproofing works to prevent any damage to the waterproof membrane. Caulking shall be applied to all portions as required.

Floor drains shall be fitted with flat removable cast iron grate. Roof drain grates shall be convex in profile at least as high as the pipe diameter and the total area of the openings of the grate shall be larger than the cross sectional area of the drain pipe. Grates shall be fixed with non-corrosive screws.

#### 31402.2 Steel Handrails

Steel handrails shall be provided for steel stairs, parapets, verandah, and other portions as shown on the Drawings. Steel handrails shall be fabricated with galvanized mild structural steel pipes and installed securely on the structures by welding or embedded into the concrete. The embedded feet of balusters shall be welded to the reinforcement bars in the structures. Painting shall be applied to all steel surfaces in accordance with the Specifications.

### **31402.3 Steel Ladders and Steel Caged Ladders**

Steel ladders and steel caged ladders shall be fabricated and installed on the concrete structures as shown on the Drawings. Anchor bolts and plates shall be embedded into the concrete while the concrete is being placed, or recesses shall be left in the concrete for provision of anchors and grouted with cement mortar after setting of anchors. Painting shall be applied to all steel surfaces in accordance with the Specifications.

### **31402.4 Door Mats**

Vinyl door mat shall be provided at the entrance vestibules with the dimension and location as shown on the Drawings. The door mat shall be approximately 12 mm thick rubber links on cadmium plated 3 mm  $\phi$  spring wire. The door mat shall be set in the floor recess provided with aluminum flat bars 3 mm x 40 mm all around the recess. A polyvinyl chloride drain pipe 50 mm  $\phi$  shall be provided under the door mat recess. The color of door mat shall be selected by the Engineer.

### **31402.5 Cable Trench Covers**

Cable trench covers for the floor cable duct shall be fabricated with checkered steel plate 4.5 mm thick and steel angles unless otherwise specified. The checkered steel plate covers shall be reinforced with steel angle sections at the back side when the width of floor cable duct is more than 450 mm and shall have the lifting holes and set flush with the floor finish. The trench covers shall be rested on the steel bearing angle section to be provided on both sides of the duct and securely anchored into the floor concrete. Concealed surfaces shall be anti-corrosive painted and the surfaces exposed to view shall be painted in accordance with the Specifications.

### **31402.6 Roof and Eaves Gutters**

Roof and eaves gutters shall be provided at the location and dimensions as shown on the Drawings. The size of gutters shall vary from approximately 150 mm x 250 mm to 400 mm x 850 mm in size as shown on the Drawings and fabricated with colored galvanized steel sheet 0.5 mm in thickness reinforced with steel frames and supporting arms at less than 1000 mm intervals. The arms shall be securely fixed to the eaves frames with bolts. The eaves gutter for the entrance canopy of the Port Administration Building shall be fabricated with a galvanized steel sheet with 1.2 mm thickness to a dimension as shown on the Drawings. All steel shall be galvanized and the surfaces exposed to view shall be painted in accordance with the Specifications. All meeting points shall be carefully caulked to secure watertightness.

### **31402.7 Parapet Rings**

Parapet rings shall be provided at the location on the top of the roof as shown on the Drawings. The rings shall be composed of 100 mm diameter steel ring with 19 mm  $\phi$  steel bars, 9 mm thick steel arm with 19 mm  $\phi$  steel dowel bar and fabricated and securely embedded into the parapet concrete as shown on the Drawings. Caulking shall be applied to all around at the foot of supporting arm. All steel exposed shall be galvanized and painted in accordance with the Specifications.

### **31402.8 Formed Steel Roof Sheeting**

Steel roofing for the structural steel framed buildings and entrance canopy shall be of formed steel roof sheeting systems consisting of roof sheeting, ridge capping, barge board, fascia board, flashing, top lighting and other accessories required to the works.

The roof sheeting shall be pre-painted 0.5 mm thick galvanized steel sheeting laminated with organic film with approximately 0.5 mm in total coated thickness. The roof sheeting shall be of roll formed steel roofing with formed side hems conforming to ASTM A792M or equivalent approved.

The top lighting shall of formed fiber plastic board with the same formation and installation as the formed steel roof sheeting.

The steel roofing shall be fixed on the steel purlines provided at approximately 1000 to 1800 mm intervals and adjusted for proper alignment. The method of installation shall strictly comply with the manufacturer's specifications.

#### **31402.9 Formed Steel Wall Sheet**

Steel wall cladding to the exterior wall of the structural steel framed buildings shall be of formed steel wall sheet systems consisting of steel wall sheeting, corner cover, flashing plates at the bottom of walls and around the wall openings, fixing clips, window trims and other accessories required to the works. The wall sheeting shall be pre-painted 0.5 mm thick galvanized steel wall sheeting laminated with organic film approximately 0.5 mm in total coating thickness. The steel wall sheeting shall be of roll formed steel sheet conforming to ASTM A792M or equivalent approved.

The steel wall sheet shall be fixed on the furring strips provided on the structural frames at approximately 1000 mm intervals and adjusted for proper alignment. The steel wall sheet shall be fixed strictly comply with the manufacturer's specifications.

#### **31402.10 Bird's Screen**

Bird's Screen shall be provided at the top light roof in the Container Freight Station and Maintenance and Repair Shop buildings as shown on the Drawings.

The bird's Screen consisting of steel angle frames, galvanized wire mesh having 30 x 30 mm mesh and fixing steel lugs shall be fabricated at the factory and securely fixed on the wall frames at site. Steel frames and fixing lugs shall be shop primed and painted in accordance with the Specifications.

#### **31402.11 Steel Stair**

Steel Stairs shall be provided at the various buildings where shown on the Drawings and as directed by the Engineer.

The steel stair shall consist of steel stringer, steel steps, steel pipe handrails and concrete foundations as detailed in the Drawings. All components shall be fabricated neatly and true to line by welding at factory and installed by bolting at sites. Steel surfaces shall be shop primed and finished in accordance with the Specifications. The outdoor steel stairs such as an emergency stair at Port Administration Building and those at Container and Cargo Gates shall be finished with heavy duty paint in accordance with the Specifications.

#### **31402.12 Steel Grilles**

Steel grilles shall be provided at external surfaces of marginal windows on the ground floor where shown on the Drawings and as directed by the Engineer.

Steel grilles consisting of steel flat bars for grilles and frames shall be fabricated at factory neatly and precisely, free from warp, twist of distortion to a dimension as



shown on the approved shop drawings. Steel grilles shall be securely fixed on the wall beds by welding and bolting. All steel surfaces shall be smooth, true to line and shop primed and finished in accordance with the Specifications.

**31402.13 Door and Column Protector**

Door and column protectors shall be provided at equipment entrance doors or around the independent columns on the ground floor where shown on the Drawings or directed by the Engineer.

The protectors shall be fabricated with 150 mm or 100 mm diameters galvanized steel pipes with steel cap at head and embedded in the concrete foundation as shown on the Drawings. The pipes shall be filled up with small gravel concrete prior to installation into the foundation. At the foot of the steel pipe on the floor, cement mortar mound beveled and caulking compound shall be provided all around.

Steel surfaces exposed to view shall be primed and finished in accordance with the Specifications.

**31402.14 Steel Hatch Cover**

Steel hatch cover shall be provided on the roof top of the Port Administration Buildings as shown on the Drawings.

The hatch cover shall be fabricated at factory with steel angle frames, steel plate, steel channel frame and hinges/lock devices to a dimension as shown on the Drawings. The hatch cover shall be securely fixed on the concrete wall by steel lugs and caulked all around the portion where required. All steel surfaces exposed shall be shop primed and finished in accordance with the Specifications.

## SECTION 31500 MISCELLANEOUS WORKS

### 31501 General

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

#### a) General Requirement

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

#### b) Shop Drawings

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

### 31502 Materials and Installation

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

#### 31502.1 Downspouts

Downspouts shall be of polyvinyl chloride heavy duty pipes with adaptable fitting accessories. The downspouts shall be securely fixed to the walls or columns with galvanized steel supports at approximately 2000 mm intervals. All surfaces exposed to view shall be painted in accordance with the Specifications.

Where shown on the Drawings or directed by the Engineer, the lower portion of downspouts approximately 2100 mm high shall be protected from any damages by providing with 200 mm  $\phi$  galvanized steel pipes.

#### 31502.2 Room Name Plates

Room name plates shall be provided on the wall just beside the entry door in each room. The plates shall be made of acrylic resin plate and fixed with stainless screws or other approved fixing devices. Size of plates shall be approximately 80 mm x 350 mm. On the plates shall be engraved the name of the room as directed by the Engineer.

#### 31502.3 Roof Insulation

The roof insulation shall be of 25 mm thick foamed polystyrene board conforming to JIS A9511, ASTM or equivalent approved. The insulation board shall be stored carefully in order to prevent defects due to sunlight, temperature and humidity. The board shall be installed on the form of roof slabs by using the galvanized fixing bolts with washers before placing the concrete. The concrete shall be carefully placed. After removal of form, the Contractor shall neatly repair any damaged or depressed portion of board. The repairing work shall be subject to the Engineer's approval.

The completed surfaces shall be cleaned. Where the insulation board exposed to view,

the surfaces shall receive with two coats of waterproof type emulsion paint.

#### **31502.4 Mirrors**

Mirrors to be furnished under the building works shall be 6mm thick polished second silvered glass and shall have a dimension of 850 mm x 700 mm as shown on the Drawings. The mirror shall be set in chromium-plated metal arms which shall be securely fixed on the walls with decorated bolts or approved means. All parts shall be smooth and true.

#### **31502.5 Gate Numbers**

Gate number plates shall be installed under the gable fascia of the Container Gate and Cargo Gate buildings as shown on the Drawings and as directed by the Engineer or specified herein.

The gate number shall be fabricated with cement fiber board 12 mm thick framing by extruded anodized aluminum frames and shall have a dimension of 500 mm x 700 mm in size. The board shall be applied with two coats of vinyl paint with an Arabic numbers in the respective plates and securely fixed on the furring strips through steel wall sheeting by stainless screws. Waterproofed plywood 9 mm thick shall be provided under the aluminum frames in order to isolate the dissimilar metals.

Colors and letters shall be selected by the Engineer.

#### **31502.6 Rope Ladders**

Rope ladders shall be provided on the bridge walk in the Container Gate and Cargo Gate buildings for the access to the roof top of cargoes or transportation cars for the inspection as shown on the Drawings.

The rope ladder shall be of 900 mm long and 600 mm wide ladders consisting of approximately 15 mm  $\phi$  nylon rope, stainless steel safety chains at the level of railing of handrails and 30 mm x 60 mm section hard wood timber rungs to be provided at 300 mm spacing. The safety chain shall be removable and timber rungs shall be painted. The Contractor shall submit sample of materials to the Engineer for his approval.

#### **31502.7 Corrugated Cement Fiber Sheet Roofing**

Corrugated cement fiber board shall be used for the roof sheeting of the Parking Shed building and other area as shown on the Drawings or as directed by the Engineer and as specified herein.

The cement fiber board roof sheeting shall be included roof sheeting, ridge capping, barge board, fascia board, flashing and other accessories required to complete the works. Minimum height and thickness of corrugation shall be approximately 35 mm and 9 mm respectively. The corrugated sheet shall be securely fixed on the structural purlins provided at 1000 mm intervals by using galvanized fixing clumps. The side lap shall be not less than 1.5 times corrugation and hip lap shall be not less than 200 mm. The installation shall be made in accordance with the manufacturer's specification. All materials shall be subject to the Engineer's approval.

#### **31502.8 Toilet Partition**

Toilet partitions shall be installed in the toilets as shown on the Drawings. The partition shall consist of aluminum frames, panels and hardware. The frame shall be of 40 mm x 40 mm extruded aluminum stud with bottom and top rails and shall be securely fixed on the floor and walls by using anchor sockets and bolts. The door

frames shall be constructed with aluminum tubular frames similar to the main frames. The panels shall be of compressed wood fiber board laminated with melamine sheet and shall be fitted in the frames by using aluminum bead with chromium plated screws. Hardware shall consist of door stop, latch, hinges and rubber bumpers. All aluminum shall be anodized to a natural color. The Contractor shall submit samples and shop drawing and manufacturer for the approval of the Engineer.

#### **31502.9 Bumpers**

Bumpers shall be installed on the edge of loading deck of the Container Freight Station building as shown on the Drawings and as specified herein.

The bumpers laminated rubber bumpers (old tires and angles) shall be welded to 300 mm channel which shall be cast into the concrete walls. The bumpers shall have approximately dimension 150 mm W x 300 mm H, 600 mm long and shall be provided two set for each bay as shown on the Drawings. Shape of bumpers, materials, installation method and exact location of bumpers shall be submitted to the Engineer for approval. The 300 mm edge channel with approximately 3500 mm long shall be provided at each bay by casting into concrete or anchored at approximately 300 mm on centers. All steel exposed shall be painted in accordance with the Specifications.

#### **31502.10 Equipment Foundations**

Various type of foundations shall be constructed for the following equipment:

- Weighing Bridge
- Weigh Scale
- Electrical Equipment
- Air-conditioner's Outdoor Units
- Antenna Pole
- Expansion Tank
- Control Gates

The foundations shall be constructed to a location, a dimension and a level as shown on the Drawings and as directed by the Engineer and as specified herein.

The foundations shall be made by reinforced concrete and provided with block-outs on its top as a provision of anchoring to be furnished and installed by the equipment supplier. All concrete surfaces exposed to view shall be finished with cement mortar.

#### **31502.11 Isolation Joint Filler**

Isolation joint filler shall be provided at the meeting points of the finishing components where shown on the Drawings or directed by the Engineer.

The isolation joint filler shall be of 20 mm thick elastomeric formed bituminous joint fillers and installed to a full depth of joints leaving 25 mm at top where bituminous compound shall be filled up to a flush of the floor.

## SECTION 31600 OUTDOOR WORKS

### 31601 General

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

#### a) General Requirement

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

#### b) Shop Drawings

The Contractor shall prepare and submit shop drawings for all items under this Section to the Engineer for his approval. Shop drawings shall show complete details and erection of all outdoor works.

### 31602 Materials and Installation

#### 31602.1 Plant Boxes

The plant box shall be constructed with 150 mm thick concrete hollow bricks to a location, width and height as shown on the Drawings. The boxes shall be plastered inside and finished with slates stone masonry to exposed outside surfaces and top. The boxes shall be provided with 50 mm  $\phi$  PVC drain pipe at approximately 1500 mm intervals. The sample of masonry shall be constructed and approved by the Engineer.

#### 31602.2 Planting and Turfing

Planting and turfing area shall be constructed where shown on the Drawings. The work shall consist of setting of concrete border block, laying top soil, fertilizing, planting trees and flowers and turfing. The top soil shall be fertilized black soil and shall be placed in required depth as shown on the Drawings. The trees, flowers and turf shall be of the best quality and appearance available in the area and approved by the Engineer.

The Contractor shall be responsible for the care of planting and turfing areas for a period of not less than 30 days, and shall water the areas whenever necessary, and when directed by the Engineer during this period, any trees, shrubs or sodding which die or fail to take root shall be replaced with his own expenses.

#### 31602.3 Drain Ditch and Catch Basins

Drain ditch and catch basin shall be constructed with reinforced concrete to a dimension and location as shown on the Drawings and as directed by the Engineer.

Concrete covers shall be provided onto the drain ditches and catch basins with slits for lifting.

#### 31602.4 Gate and Fence

Gates and fences shall be provided at the main entrance area and power supply station as shown on the Drawings.

The gate door shall consist of steel pipe frames, steel pipe gates, steel reinforcing plates, steel door bars to provide padlocks door handles, hinges, guide rails as required, door stops and strikes, diagonal bracings and door bolts as shown on the

Drawings. The gate door shall be fabricated according to the shop drawings approved and securely installed in the concrete foundations. The root of the columns contact with the foundation shall be caulked all around.

The fence shall consist of steel pipe frames for upper, bottom and medium rails covering with galvanized wire fabric. The wire fabric shall be of 50 mm diamond mesh, woven with 3.2mm dia. galvanized steel wire and shall be fixed on the steel frames by using galvanized steel flat bars with fixing bolts.

Three strands of barbed wire B.W.G. No.14 overhang outward shall be fixed on the top of the fence at the power supply station, and air-conditioning equipment area.

#### **31602.5 Parking Shed**

Parking shed shall be constructed at the location and to a dimensions as shown on the Drawings. The parking shed shall be constructed with structural steel framing and shall be covered with corrugated cement fiberboard including barge board, fascia board and other accessories by using galvanized clamps. All structural steel frames shall be applied with an epoxy resin paint in accordance with the Specification.

The floor shall be of reinforced concrete slabs on grades with broom finish sloping toward road side. The drain ditch shall be constructed at the foot of the slope with heavy duty galvanized steel made grating covers.

Eaves gutters and downspouts shall be provided as shown on the Drawings.

#### **31602.6 Guard Box**

The guard box shall be required two bays to be constructed at main entrance and beside the Container Freight Station as shown on the Drawings

The guard box shall be constructed with concrete foundation, concrete hollow block masonry wall and steel frame roof with corrugated cement fiber board as shown on the Drawings. The box shall be provided reception counter with aluminum sliding windows, a steel door and a glazed aluminum window. Eaves gutter and PVC downspout shall also be provided. The box shall be finished with emulsion paint (exterior quality) on cement mortar plastered.

#### **31602.7 Pavements**

The pavement under the building works shall consist of interlocking block pavement for pedestrian path, gravel pavement for equipment area, concrete border block for connection of turfing and pavement and concrete pavement as shown on the Drawings.

Each pavement shall be constructed with the required thickness of materials and sub-grade layers as shown on the Drawings.