

3.15 REINFORCEMENT INSTALLATION

Shall be placed continuously, with splices lapped 152 mm (6 in), except that they shall be interrupted at all control and expansion joints. Corners and intersections of walls shall be reinforced with preformed corner and intersection units. Vertical spacing of reinforcement courses shall be as final construction shown on the drawings and/or as specified herein for the type of wall construction, except that in all cases walls over and under openings shall have reinforcement in the first two course joints immediately over and under the openings and extending not less than 813 mm (32 in) on each side. Unless otherwise noted, concrete block walls and/or multiple wythe brick walls using running bond shall have continuous reinforcement in each horizontal joint for both the top and bottom 406 mm (16 in) of wall, and in every second joint between these limits. Walls using stack bond shall be as above except the top 610 mm (24 in) of wall shall have reinforcement in each course.

3.16 ANCHORS AND TIES

Where required, anchors and ties shall be installed as shown on the construction drawings or required by the masonry design. Masonry passing steel or concrete surfaces as a veneer shall be anchored to the steel or concrete by corrugated anchors of dovetail, hook or weld-on type as appropriate for the surface, installed on 406-mm (16-in) centers.

3.17 CLEANING AND REPAIRS

All masonry shall be cleaned, and all defects repaired as follows before acceptance of the work.

- A. Masonry shall be cleaned with trisodium phosphate and detergent, 0.24 liters (1/2 cup) of each to each 3.8 liters (one gallon) of water. Before cleaning, all dirt, excess loose mortar shall be scraped or brushed off and masonry saturated with clean water. The cleaning solution shall be scrubbed on with stiff brushes as required and rinsed off thoroughly with clean water until all mortar, dirt and cleaning solution are removed.
- B. As the cleaning progresses, all joints shall be examined for cracks, holes and imperfect pointing. Defective joints shall be cut out and repaired by tuck pointing.
- C. Sandblasting or use of commercial cleaners shall be used only with approval and only after test demonstration of the suitability of the method acceptable to the Engineer.

END OF SECTION

103 - BRICK MASONRY

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	103 - 1
1.02 APPLICABLE CODES AND STANDARDS	103 - 1
<u>PART 2: PRODUCTS</u>	
2.01 MATERIALS	103 - 1
<u>PART 3: EXECUTION</u>	
3.01 GENERAL	103 - 2
3.02 INSTALLATION	103 - 2
3.03 TESTING AND INSPECTION	103 - 3
3.04 SUBMITTALS	103 - 3
LAST PAGE	103 - 3

103 - BRICK MASONRY

PART 1: GENERAL

1.01 DESCRIPTION

The Contractor shall furnish all labor, materials and perform all operations required for the brick masonry work as specified herein and under Section Masonry Work and as is evidently necessary to complete the work.

1.02 APPLICABLE CODE AND STANDARDS

Within this Section of the Specification, wherever reference is made either directly or indirectly to United States (U.S.) Codes and Standards, corresponding Indonesia and Japanese Codes and Standards may be used subject to acceptance by the Engineer.

- A. ASTM - American Society for Testing and Materials
 - C 216 Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
 - C 62 Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
- B. JIS - Japanese Industrial Standards
 - R 125 Common Bricks

PART 2: PRODUCTS

2.01 MATERIALS

- A. General: All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.
- B. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- C. Bricks

All bricks shall be hard, sound, well-burnt, even and uniform in shape, free from cracks and other defects and equal to samples deposited with and approved by the

Engineer. Bricks with an absorption of more than 20% by weight after immersion in water for 24 hours shall not be accepted.

Bricks shall be, nominally, 22 cm long, 11 cm thick and 5 cm deep with a tolerance of \pm 5 mm and equal to ASTM C 216, C 62 and JIS R 125.

Bricks for fair-faced walling not plastered or rendered shall be especially selected from the stacks. When bricks are delivered to site they shall be unloaded by hand and neatly stacked.

D. Reinforcement. - As specified under Part 3 - Para 3.02 D

E. Flashing Membrane - As specified in Section 106

PART 3: EXECUTION

3.01 GENERAL

All work shall conform to the requirements for Masonry Work in Section 102 of the specifications.

3.02 INSTALLATION

- A. All bricks shall be thoroughly soaked with water before being laid and if the last course laid has become dry it shall be well wetted before any further courses are laid.
- B. All brickwork one brick thick and over shall be laid in running bond in mortar as described. Half-brick and brick-on-edge walls (if any) shall be laid stretcher bond in mortar as described.
- C. All brickwork shall be carefully laid and flashed up every course in mortar with all vertical and cross joints filled in solid as the work proceeds. No four courses with their joints shall rise more than 3.7 cm higher than four bricks laid dry. No bats or broken bricks shall be used except as closers. The prebends shall be truly kept, and the quoins, jambs and other angles plumbed as the work proceeds. All brickwork shall be built up in even stages and no part of the work shall be carried up more than 130 cm above adjoining sections of the same wall or walls bonded thereto.
- D. Bonding of Walls and Partitions

Bonding to concrete walls and columns shall be effected by means of 6-mm diameter mild steel rods not less than 45 cm long cast into the concrete at 40 cm vertical centers and projecting 30 cm from the concrete face and built into joints of brickwork.

3.03 TESTING AND INSPECTION

Periodic field verifications of brick absorption rate shall be performed by drawing on the surface of a brick, with a wax pencil, a circle of 25-mm (1-in) diameter and dropping rapidly, with a medicine dropper, 20 drops of water within the circle. If all of the water has been absorbed in less than 1 1/2 minutes, the initial rate of absorption is excessive and the brick shall be wetted.

3.04 SUBMITTALS

- A. The initial absorption rate of all types of brick selected for the work shall be determined by an approved independent testing laboratory in accordance with ASTM C67 and three (3) copies of the test report shall be furnished to the Engineer prior to laying brick.
- B. Sample Panel. - Shall be provided for each type of masonry wall construction shown on the final construction drawings.

END OF SECTION

104 - ARCHITECTURAL STRUCTURAL STEEL FRAMING

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	104 - 1
1.02 APPLICABLE CODES AND STANDARDS	104 - 1
1.03 SUBMITTALS	104 - 3
1.04 TRANSPORTATION, HANDLING AND STORAGE	104 - 4
1.05 QUALITY CONTROL	104 - 4
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	104 - 4
2.02 MATERIALS	104 - 5
<u>PART 3: EXECUTION</u>	
3.01 FABRICATION	104 - 6
3.02 CONNECTIONS	104 - 8
3.03 SHOP PAINTING	104 - 13
3.04 ERECTION	104 - 14
3.05 FIELD MODIFICATIONS	104 - 15
3.06 FIELD PAINTING	104 - 15
3.07 FINAL CLEAN UP	104 - 16
LAST PAGE	104 - 16

104 - ARCHITECTURAL STRUCTURAL STEEL FRAMING

PART1: GENERAL

1.01 DESCRIPTION

- A. Work Included: Furnish, fabricate, mark for erection identification, pack, crate, or otherwise properly prepare for shipment, and ship to the site and erect all structural steel indicated on the Drawings, described in these Specifications, or otherwise required for proper completion of the Work. Provide all other materials required for completion of erected structural steel.
- B. Related Work Specified Elsewhere
1. Section 022 CAST-IN-PLACE CONCRETE
 2. Section 106 METAL FABRICATIONS
 4. Section 108 ROUGH CARPENTRY
 5. Section 123 PAINTING

1.02 APPLICABLE CODES AND STANDARDS

- A. The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for review and approval by the Engineer in advance of their use.
- B. ANSI - American National Standards Institute, Inc:
- B18.2.1 Square and Hex Bolts and Screws
 - B18.2.2 Square and Hex Nuts
 - B27.2 Plain Washers
 - B27.4 Beveled Washers
- C. ASTM - American Society for Testing and Materials:
- A 6 Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use, Specifications for General Requirements for
 - A 36 Structural Steel, Specification for
 - A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-coated, Welded and Seamless, Specification for

- A 242 High Strength Low Alloy Structural Steel, Specification for
 - A 307 Carbon Steel Externally and Internally Threaded Standard Fasteners, Specification for
 - A 325 High Strength Bolts for Structural Steel Joints, including Suitable Nuts and Plain Hardened Washers, Specification for
 - A 441 High Strength Low-Alloy Structural Manganese Vanadium Steel, Specification for
 - A 490 Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints, Specification for
 - A 500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes, Specification for
 - A 501 Hot-Formed Welded and Seamless Carbon Steel Structural Tubing, Specification for
 - A 572 High-Strength Low Alloy Columbium-Vanadium Steels of Structural Quality, Specification for
 - E 109 Dry Powder Magnetic Particle Inspection
- D. AWS - American Welding Society:
- A5.1 Specification for Mild Steel Covered Arc Welding Electrodes
 - A5.5 Specification for Low Alloy Steel Covered Arc Welding Electrodes
 - A5.17 Specification for Bare Mild Steel Electrodes and Fluxes for Submerged Arc Welding
 - B3.0 Welding Procedure and Performance Qualification
 - D1.1 Structural Welding Code - Steel
- F. JIS - Japanese Industrial Standards
- G 3101 Hot-Rolled Steel for General Structure
 - G 3192 Dimensions, Weight and Permissible Variations of Hot Rolled Steel Sections

- B 1180 Hexagon Head Bolts
- B 1186 Sets of High Strength Hexagon Bolts, Hexagon Nuts and Plain Washers for Friction Grip Joints
- G 3452 Carbon Steel Pipes for Ordinary Piping
- G 3454 Carbon Steel Pipes for Pressure Service
- G 3457 Electric Arc Welded Carbon Steel Pipe
- Z 3212 Covered Electroded for High Tensile Strength Steel

1.03 SUBMITTALS

Materials Report:

At least 30 days prior to material delivery the following shall be submitted by the Contractor to the Engineer for review:

1. A copy of mill order and Certified Mill Test Report for all lots of materials.

Pre-Construction Submittals:

At least 45 days prior to commencement of fabrication, assembly, erection or installation, the following shall be submitted to the Engineer for review:

1. Detail Drawings and/or Fabrication Drawings, and details for connections.
2. Assembly, Erection and Installation Drawings and Manuals indicating the sequence of work, welding and bolting procedures to be used, the location of permanent or temporary supports to be used. Cambers for trusses and large span girders shall be shown.
3. For composite construction the details and calculation of False Work and Forms supporting the concrete work on Steel Structures shall be submitted.

Test Reports and Certificates:

Test reports and certificates shall be prepared and submitted as specified in the other parts of this Specification.

1.04 TRANSPORTATION, HANDLING AND STORAGE

1. Transportation and Handling: Structural steel shall not be handled until paint has thoroughly dried. Care shall be exercised to avoid paint abrasions and other damage.

Steel Work shall be transported in the largest practical lengths and in such a way as not to overstress the fabricated sections.

All pieces bent or otherwise damaged shall be rejected.

2. Protection: Material shall be stored out of mud and dirt and proper drainage of the storage area shall be provided. Protect from damage or soiling by adjacent construction operations.
3. Storage: Storage of fabricated steel at the job site shall be the responsibility of the Contractor. Store material at the job site in a manner which does not overload the existing or newly-constructed structures. Protect material against excessive deflection, corrosion or deterioration.

Steel work shall be stored in an orderly manner. Particular attention shall be given to storing by color code and with the member mark visible clearly.

Galvanized nuts and bolts shall be shipped and stored in the same container.

1.05 QUALITY CONTROL

The Contractor shall be responsible for the quality of all materials and workmanship and as such, shall develop and submit a Quality Control Program for review. The program shall cover those items intended for shop inspection, field supervision and tests and the procedures for carrying out same.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from an in-country manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

B. Structural Steel:

1. Shapes and Plates shall conform to the following:

ASTM A 36

ASTM A 242, Improved Weathering and Corrosion Resistance required where specified in plans.

ASTM A 441

ASTM A 572

JIS G 3101

Bend Test shall be required where specified on Contract Drawings.

2. Pipes and Tubing shall conform to the following:

ASTM A 53 Grade B

ASTM A 500

ASTM A 501

JIS G 3452

JIS G 3454

C. Fasteners:

1. High Strength Bolts shall conform to ASTM A 325 (Types 1 and 3), ASTM A 490 (Types 1 and 3) or JIS B 1180, JIS B 1186 and shall be heavy hexagon bolts with hexagon nuts and hardened washers. Type 3 bolts when specified on contract drawings shall not be replaced by type 1 bolts.

Galvanized bolts and nuts shall conform to ASTM A 325 (Type 1) and JIS B 1185.

2. Unfinished Bolts shall conform to ASTM A 307 regular hexagon bolts with nuts and shall be of low carbon steel.

3. General dimensional requirements for Fasteners shall conform to the following:

ANSI B 18.2.1	Square and Hex Bolts & Screws
ANSI B 18.2.2	Square and Hex Nuts
ANSI B 27.2	Plain Washers
ANSI B 27.4	Beveled Washers

D. Welding:

Welding electrodes for manual shielded metal-arc welding shall conform to the AWS A 5.1, AWS A 5.5 and shall be of low hydrogen type.

Bare electrodes and granular flux used in the submerged-arc process shall conform to F60 or F70 AWS - flux classification of AWS A 5.17, or the provisions of applicable AISC specifications.

PART 3: EXECUTION

3.01 FABRICATION

- A. General: No fabrication will be commenced until documents under "Submittals", 1.03 herein, are reviewed by the Engineer. The Contractor shall be responsible for the correct interpretation of the Work to be done and for the accuracy of the detailed dimensions. No unauthorized splicing of members shall be permitted. Due consideration shall be given to occupational safety and hazards.
- B. Fabrication Requirements, General Structural Steel Work: Fabricate structural steel in accordance with referenced AISC standards.

1. Fabricating tolerances shall conform to the requirements of the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings generally as follows, unless otherwise shown on the contract drawings:

a. Straightness:

Structural members consisting primarily of a single rolled shape shall be straight within the appropriate tolerances allowed by ASTM Specification A6 or as prescribed in the following paragraph. Built-up structural members fabricated by bolting or welding shall be straight within the tolerances allowed for wide flange shapes by ASTM Specification A6 or by the requirements of the following:

- Compression members shall not deviate from straightness by more than 1/1000 of the axial length between points which are to be literally supported.
- Completed members shall be free from twists bends, and open joints. Sharp kinks or bends shall be cause for rejection of material.

b. Length:

A variation of 1 mm (1/32 in.) is permissible in the overall length of members with both ends finished for contact bearing. Members without ends finished for contact bearing, which are to be framed to other steel parts of the structure, may have a variation from the detailed length not greater than 2 mm (1/16 in.) for members 10 meters or less in length, and not greater than 3 mm (1/8 in.) for members over 10 meters in length.

2. Milling and Planting: shall be according to the contract drawings.
3. Drilling and Punching: Holes shall be drilled or punched at right angles to the surface of the metal, not more than 2 mm (1/16 in.) larger than the connector diameter. Do not make or enlarge holes by burning. Punching of holes in materials having a thickness in excess of the connector diameter or in materials thicker than 22 mm (7/8 in.) shall not be permitted. Holes shall be clean-cut with no torn or ragged edges. Remove outside burrs resulting from drilling operations.
4. Holes, Slots, and Openings: Provide holes, slots, and openings required together with necessary reinforcing as shown on contract drawings. Use suitable templates for proper location of these openings. Steel requiring adjustment shall be provided with slotted holes as shown on contract drawings.
5. Gusset Plates: Gusset plates shall be as shown on the drawings. In no case shall thickness of a gusset plate be less than 8 mm (5/16 in.).

C. Fabrication Requirements, Architecturally Exposed Structural Steel: Members specifically designated on the design drawings as "Architecturally Exposed Structural Steel" shall be fabricated, handled and erected in strict accordance with the requirements of the AISC Specification for Architecturally Exposed Structural Steel and as specified herein.

1. Tolerances: The as-fabricated straightness tolerances of members shall not exceed one-half of the standard camber and sweep tolerances in ASTM A6.
- D. Manufacturing Requirements, Steel Joists: Steel Joists shall be manufactured in strict accordance with the referenced AISC Specifications on Joists. Steel Joists shall be one of the series and sizes shown with properties defined in the AISC Specifications or shall be provided for the depth, spacing, and loads indicated. Except as otherwise specified, Joists shall be designed as structural trusses in accordance with the referenced AISC Specifications.
1. Holes in Chord Member: Provide holes in chord members where shown on contract drawings for securing other work to the steel Joists; however, the area of the holes shall be deducted from the area of the chord when calculating the strength of the member.
 2. Ceiling Extensions: Ceiling extensions shall be provided in areas having ceilings attached directly to the joist bottom chord. Either an extended bottom chord element or a separate unit shall be provided. These extensions shall suit manufacturer's standards and be of sufficient strength to support the ceiling construction. Extend ends to within 13 mm (1/2 in.) of the finished wall surface.

3.02 CONNECTIONS

A. GENERAL

1. All connections shall be as shown on the Contract Drawings. Shop, assembly, erection and installation drawings that show the connections shall be prepared by the Contractor as specified in Subsection 1.03. The contractor shall not re-design or alter any connection without prior approval of Engineer.
2. All connections will be one of the following:
 - a. Bolts
 - High strength bolts, minimum 20 mm (3/4") diameter.
 - Unfinished bolts, minimum 20 mm (3/4") diameter.

b. Welds

- Welds (Manual shielded metal arc, or submerged arc). The minimum size of welds shall comply with Section 1.17 of the AISC Specification for "Design, Fabrication & Erection of Structural Steel for Buildings".

B. Bolting:

1. High-Strength Bolts: High-strength bolting shall be in accordance with the requirements of the AISC Specifications for Structural Joints using ASTM A 325 or A 490 Bolts and as specified herein.

High-strength bolts shall be used in bearing or friction, as shown in plans. High-strength bolted joints shall be made without the use of erection bolts. Bolts shall be of a length that will extend not less than 6 mm (1/4 in.) beyond the nuts. Bolts shall be inserted into holes without damaging the thread. Members shall be brought tightly together with sufficient high-strength "fitting-up" bolts which shall be retightened as all the bolts are finally tightened. Bolt heads shall be protected from damage during placing. Bolts that have been completely tightened shall be marked for identification.

Bolted parts shall fit solidly together and shall not be separated by interposed compressible materials.

- a) High-Strength Friction Bolted Connection Contact Surfaces: The contact surfaces in high-strength bolted connections shall be free of oil, paint, lacquer, loose scale or other coatings. The faying surfaces shall be machined flat.

Friction type connections on galvanized faying surfaces shall not be permitted unless the design incorporates the reduction of slip resistance or surface is specially prepared for such a use.

- b) Tightening: Final tightening of high strength bolts shall be by turn-of-nut method as specified in the AISC manual. Retightening shall not be permitted.

Whenever the Contractor intends to use other means of tightening he shall include a testing plan for this purpose and implement it. The testing plan shall show the torque values or the direct tension indicator gap needed to develop the required bolt tension.

2. Unfinished Bolts: Unfinished bolts may be used in locations where high-strength bolts are not shown or specified. Draw unfinished bolt heads and nuts tight against the work with a suitable wrench. Bolt threads for unfinished bolts shall be peened to prevent the nuts from backing off.
3. Bolting at Slotted Holes: Bolts at the slotted holes shall be furnished with double nuts. After the completion of the erection the inner nut shall be finger tightened first then untightened one full turn and locked in place by the outer nut.
4. Anchor Bolt Setting: Anchor bolts shall be set by use of templates secured firmly in place prior to the placement of concrete.

C. Welding: Welding shall be in compliance with the requirements of AWS D 1.1 and these specifications. Welding procedure and performance qualifications shall conform to AWS B 3.0.

1. Welding Procedure. Welding procedure shall be based on the specific analysis of any given heat of steel (based on the certified mill test reports: and shall be subject to the review of the Engineer.

These procedures shall call for one or all of the following:

- Proper head shape.
 - Minimized penetration to prevent dilution of the weld metal with the alloy elements.
 - Pre-heating, controlled interpass temperature and controlled heat input.
2. Qualifications of Welders: Welding shall be performed by operators who have been qualified as per AWS D 1.1 within the preceding one year period under AWS standard qualification procedure for the type of work required.
 3. Welding Symbols and Prequalified Joints: Use of standard weld symbols as adopted by AISC is mandatory.

Prequalified joints which are detailed, prepared and welded in accordance with the requirement of the AWS standards and as modified by AISC specifications shall invariably be used.
 4. General Requirements: Structural welding shall not commence until joint elements are bolted or tacked in intimate contact and adjusted to dimensions shown with allowance for any weld shrinkage that is expected.

Welding sequence shall be planned and controlled to minimize undue stress increase or undue distortions in restrained members. Heavy sections and those having a high degree of restraint shall be welded with low hydrogen type electrodes.

5. Wire Spacers: If copper wire spacers are used between two surfaces to be welded to reduce transverse stresses in the weld, care shall be taken that they do not mix with the weld metal.
6. Bead Shape: Concave bead shapes shall be avoided. Ratio of weld width to weld depth shall preferably vary from a minimum of 1 to 1 to a maximum of 1.4 to 1.

$$\frac{\text{Width of Weld}}{\text{Depth of Fusion}} = 1 \text{ to } 1.4$$

7. Field Welding: Field welding shall not be permitted unless shown on the contract drawings.
8. Seal Welding and Vent Holes: Subsequent to fabrication, the overlapping or contacting surfaces or other closed sections (such as tubular, box section) which are inaccessible to painting or galvanizing shall be seal welded. Due consideration shall be given to provide vent holes in large overlapped surfaces or closed sections to prevent destructive pressure build up in the entrapped gases when the assembly is heated to the galvanizing temperatures.
9. Welded Connection for Tubular Construction: Cutting of the pipe and preparation of the joint surfaces shall be done in a neat manner for a good fit up.

Order of assembly of the tubular sections shall consist of welding the tensile member to the main member first. Compression member shall be cut back to overlap the tensile member and then welded to both of these members.

10. Welded Connections for Architecturally Exposed Structural Steel shall be as specified in sub paragraph 3.02 C except as follows:

- a. Fillet Welds

Faces of welds exposed to view shall have as-welded surfaces that are reasonably smooth and uniform. No finishing or grinding shall be required except where clearances or fit of other items may so necessitate, or as specifically required by contract drawings.

b. Butt and Plug Welds

Faces of butt and plug welds exposed to view shall have as-welded surfaces that are reasonably smooth and uniform and shall not project more than 2 mm (1/16 in.) above the surfaces joined. No finishing or grinding shall be required except where clearances or fit of other items may so necessitate, or as specifically required by contract drawings.

D. Inspection and Testing:

All inspection and testing requirements for fabrication, assembly, erection and installation of structural steel including responsibilities of the inspectors and testing laboratories, required inspections, tests and hold points shall be clearly outlined in the Contractor's Quality Control Program. After the Quality Control Program has been reviewed and agreed upon with the PJKA, it will become part of the Specifications and thereafter all inspection and testing shall be performed strictly according to its requirements.

Inspection and Testing - Bolted Connections: All high strength bolted connections will be inspected in accordance with AISC Specifications for Structural Joints Using A 325 or A 490 Bolts.

Inspection and Testing - Welding: Welding will be inspected and tested during fabrication and erection of structural steel as follows:

1. Contractor shall certify all welders, and identify types and locations of defects which may be found in the work with the corrective measures required to correct such defects. Contractor shall supply mock up weld samples, if required, for initial testing and the setting of the job standard.
2. All welded connections shall be visually inspected.
3. In addition to a visual inspection of all welds, magnetic particle, ultra-sonic or other equivalent testing method approved by Engineer shall be used as specified on the Contract Drawing and in the Quality Control Program.

- The method of magnetic particle testing shall be in accordance with ASTM E 109. Magnetic particle inspection shall be made both on the root pass and finished weld. Any type of crack or zone of incomplete fusion or penetration revealed by such test shall not be acceptable.

- Ultra-sonic testing shall be performed in accordance with AWS D1.1.

4. Records of tests, location of all defects, corrective measures and corrective work shall be documented.
5. Welder Identifying Symbols: Each bolting crew and/or welder shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the crew or person making the connection.
6. Repair and Retesting of Welds: Defective welds shall be repaired in accordance with ASW D1.1, Article 3.7; or replaced. The repaired or replaced welds shall be tested using the same methods as above. Additionally, when defective welds are found, the cause of the defective welding shall be determined and the contractor shall institute immediate corrective action.

E. Anchoring, Grouting and Dry Packing:

Anchor bolts shall be carefully installed by use of templates to permit true positioning of the bearing plates and assemblies. When in plans anchor bolts are shown to be installed in sleeves or corrugated cannisters, the sleeves or cannisters shall be completely filled with grout.

All bearing plates, bearing assemblies and masonry plates shall be set level and to the elevations shown on plans. These shall be shimmed with approved means and grouted to assure full bearing on the supporting substrate regardless of the tolerances otherwise permitted. The grout shall be mixed and placed as per manufacturer's instruction. Air pockets in the grout packing shall be avoided.

3.03 SHOP PAINTING

A. General

All structural steel shall be cleaned and primed in accordance with the requirements of the specification on Painting, Section 123, except as follows:

1. Members encased in concrete.
2. Contact surfaces of welded connections and areas within 50 mm (2 in.) of field welds if any.
3. Contact surfaces of high-strength bolted (friction type) connections.

4. Milled surfaces.
5. Top surface of steel beam flanges to receive shear connectors, but not supporting metal deck.
6. Members to receive sprayed fire proofing.
7. Members to receive galvanizing treatment.

B. Surface Preparation:

1. Cleaning: Clean all surfaces not otherwise specified in accordance with the referenced painting specifications.

Steel work not required to be painted however, shall be cleaned of oil, grease, soil, salt and contaminants by solvent cleaning.

2. Shop Coat: Cleaning shall be done after fabrication and immediately prior to shop painting or shipment. Apply shop coat of paint within 4 hours after cleaning and before rust-bloom occurs.

C. Primer Application:

Apply primer which is compatible to the finish coat where required by brush, spray, roller, or other approved means to provide the required minimum dry film thickness. No painting shall be done when the surface temperature is below that at which condensation will occur. Apply paint thoroughly and evenly to dry surface in accordance with manufacturer's instructions. Painting during relative humidity above 90% is not permitted.

3.04 ERECTION

- A. General: All structural work shall be erected in accordance with the approved erection drawings. The Contractor shall be responsible for setting out the works.

The suitability and capacity of all plant and equipment used for erection shall be to the satisfaction of the PJKA. These shall be regularly serviced and maintained.

Occupational safety practices shall be strictly adhered to and shall be to the satisfaction of the PJKA.

- B. Plumbing, Leveling, and Aligning: Individual pieces shall be plumbed, leveled, and aligned in accordance with the requirements of Code of Standard Practice for Steel Buildings and Bridges.
- C. Drift Pins: Drift pins may be used only to bring together the several parts. They shall not be used in such manner as to distort or damage the metal.

- D. Temporary Bracing and Guy Lines: Temporary bracing and guy lines shall be provided to ensure proper alignment and to adequately protect all persons, property and to withstand all loadings per JPP 2812 to which the structure may be subjected to during erection. Such bracings shall remain in place as long as they are required for the safety and stability of the structure.
- E. No erection shall be permitted more than 2 storeys above a completely bolted and/or welded floor.
- F. No erection shall be permitted more than 2 storeys above a decked or net surface.
- G. Placement of joists shall not start until the supporting work is secured. Temporary bridging, connections and anchors shall be provided to assure lateral stability during erection.
- H. Bridging to steel Joists shall be installed immediately after joist erection, before any construction loads are applied. Horizontal or vertical bridging shall be provided for the type of span of the joists in accordance with the referenced AISC Joist Specifications. Ends of the bridging lines shall be anchored at top and bottom chords where terminating at walls or beams.
- I. Permissible Deviations: The Contractor shall control the erection of steel structures, in such a way that the error does not exceed 1:500 provided that the displacement of the centre line of columns is no more than 25 mm. The error shall be measured from the designed position or level given by the dimensions and coordinates on the drawings. For architecturally exposed steel, requirements of Section 3.01.C of these specifications shall apply.

In structures where movement due to temperature change is considerable, the deviations listed above will apply at the mean position of the member being checked.

3.05 FIELD MODIFICATIONS

Corrections to accommodate minor misfits in steel structures by the moderate use of drift pins and reaming will be permitted. Errors that cannot be corrected by these measures, but require modification must be reported immediately to the Engineer along with Contractor's proposed solution.

3.06 FIELD PAINTING

A. Touch up Painting:

Field touch up painting shall comply with the requirements of the referenced Specification Section No. 123.

B. Cleaning:

After erection, clean exposed surfaces of field connections, unpainted areas adjacent to field connections, and damaged areas in the shop coat according to the same standards required for the shop coat, and paint with the same primer used in the shop coat.

3.07 FINAL CLEAN UP

Upon completion of work, leave premises neat and clean, to the satisfaction of the Engineer.

END OF SECTION

105 - METAL ROOF DECK

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	105 - 1
1.02 APPLICABLE CODES AND STANDARDS	105 - 1
1.03 SUBMITTALS	105 - 2
1.04 PRODUCT HANDLING	105 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	105 - 3
2.02 MATERIALS	105 - 3
2.03 FABRICATION	105 - 4
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION	105 - 4
3.02 INSTALLATION	105 - 5
3.03 SAFETY PROCEDURES	105 - 6
LAST PAGE	105 - 7

105 - METAL ROOF DECK

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing, erection and installation of metal roof deck and accessories to be used with insulation and a roofing material such as built-up roofing in the locations indicated on the Contract Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.

B. Related Work Specified Elsewhere:

Section 104 ARCHITECTURAL STRUCTURAL STEEL FRAMING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted to the Engineer for review and approval in advance of their use.

A. ANSI - American National Standards Institute:

- B18.6.4 Slotted and Recessed Head Tapping Screws and Metallic Drive Screws

B. ASTM - American Society for Testing and Materials:

- A 36 Structural Steel

- A 446 Zinc-Coated (Galvanized) Steel Sheets of Structural Quality, Coils and Cut Lengths.

- A 611 Steel, Cold Rolled Sheet, Carbon, Structural

C. AWS - American Welding Society:

- D1.1 Structural Welding Code

D. JIS - Japanese Industrial Standards

- G3101 Rolled Steel for General Structures

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

A. Certifications:

1. Name of the manufacturer of the metal deck.
2. Calculations and/or manufacturer's laboratory reports showing that the metal deck meets all the specified requirements.
3. Welders to be used have been tested and qualified in accordance with AWS D.1.1.

B. Shop Drawings:

1. Drawings shall show deck erection layout, framing and supports with unit dimensions and sections.
2. Type and location of welds and/or screwed fasteners. Welding shall be indicated by AWS standard welding symbols.
3. Number, size and locations of all holes to be cut and openings to be provided.
4. Deck depth, gauge, configuration and section properties.
5. Details of accessories, showing cants, sump pans, ridge and valley plates, closure strips and reinforcement of all openings.

C. Copies of manufacturer's catalogs, specifications and recommended installation instructions. Suggested method is shown in Paragraph 3.02.

D. Samples of the metal deck, 300 mm long by full width of sheet, and samples of all accessories.

1.04 PRODUCT HANDLING

A. Metal deck shall be handled and shipped so as not to bend the sheets or mar the galvanized surface.

B. Metal deck shall be stored above ground with one end elevated to provide positive drainage, and covered with a non-asphaltic waterproofed covering, adequately ventilated to prevent condensation.

C. Metal deck of different gauges shall be clearly marked and stored separately.

- D. Welding electrodes shall be stored in moisture-controlled containers until ready to use.

PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.
- B. Section properties, configurations, depth and gauge of metal roof deck shall be as shown on the Contract Drawings.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Metal roof deck and accessories shall be manufactured from galvanized steel sheets in accordance with ASTM A 446, Grade A, B, C, D or F; or cold rolled steel sheets in accordance with ASTM A 611, Grade C or D.
- C. Structural steel for miscellaneous steel shapes shall be in accordance with ASTM A 36.
- D. Welding electrodes shall be in accordance with AWS D1.1.
- E. Self-tapping screws shall be in accordance with ANSI B18.6.4.
- F. Flexible closure strips shall be closed-cell neoprene rubber and provided by the metal roof deck manufacturer.
- G. Joint sealant material shall be nonskinning, gun-grade, bulk compound as recommended by the metal roof deck manufacturer.
- H. Primer paint and galvanizing touch-up paint shall be as recommended by the metal roof deck manufacturer.
- I. Cant strips shall be galvanized sheet steel of the same quality as the deck units and shall be 0.9 mm (approx. 20 gauge) thick, minimum, before galvanizing.
- J. Insulation clips shall be of the non-piercing type and furnished by the metal deck manufacturer.
- K. Welding washers shall be uncoated steel with a minimum thickness of 1.5 mm (approx. 16 gauge).

2.03 FABRICATION

A. Deck units shall be fabricated to the length shown on the Shop Drawings with flush, telescoped or nested 50 mm minimum end laps and nesting side laps.

B. Roof Sump Pans:

1. Shall be fabricated from a single piece of galvanized sheet steel of the same quality as the deck units.
2. Minimum thickness shall be 1.8 mm (approx. 14 gauge) before galvanizing.
3. Bottom shall be level and sides sloping to direct water flow to drain.
4. Bearing flanges shall be a minimum of 75 mm wide.
5. Recess shall be a minimum of 35 mm below roof deck surface.

C. Ridge and Valley Plates:

1. Shall be fabricated of galvanized sheet steel of the same quality as the deck units.
2. Minimum thickness shall be 0.89 mm (approx. 20 gauge) before galvanizing.
3. Strips shall be bent to provide a tight-fitting closure at open ends and side of deck units.

D. Protective Coatings:

Steel conforming to ASTM A 611, either grade, shall be prime painted. Steel shall be phosphatized and both sides shall be roller coated with an oven-cured flexible primer before forming.

PART 3: EXECUTION

3.01 INSPECTION

- A. The Contractor shall check all materials upon arrival at the site for compliance with the specifications.
- B. The Contractor shall check supporting members for correct layout and alignment and verify that surfaces to receive roof deck are free of debris.
- C. The Contractor shall correct all defects before proceeding with installation.

3.02 INSTALLATION

- A. General: The Contractor shall install the roof deck units and accessories in accordance with the reviewed manufacturer's installation instructions, reviewed shop drawings and as specified below. If the manufacturer's recommendations differ significantly from those specified below, the manufacturer's recommendations shall be followed, except that specified minimum requirements shall prevail.
- B. Placing Roof Deck Units:
1. Position roof deck units on supporting steel framework and adjust to final position with ends bearing on supporting members and accurately aligned end to end before being permanently fastened.
 2. End laps shall be not less than 50 mm.
 3. Do not stretch or contract the side lap interlocks.
 4. Place deck units flat and square and secure to adjacent framing without warp or deflection.
- C. Fastening Deck Units:
1. Secure roof deck units to supporting members with 13 mm minimum diameter fusion welds or size 12 corrosion-resistant self-tapping screws spaced a maximum 150 mm on center at end laps and a maximum of 300 mm on center at intermediate supports. Welding washers shall be used when roof deck is less than 0.7 mm (approx. 22 gauge) thick.
 2. Lock side laps between adjacent deck units at intervals not over 750 mm on center. Weld side laps when indicated on the Contract Drawings.
 3. Welding shall conform to AWS D1.1 and be performed by certified welders.
- D. Joint Sealing (Where Required):
1. Remove dust, dirt and moisture from joint surfaces.
 2. Apply sealant in accordance with manufacturer's instructions.
- E. Cutting and Fitting:
1. Cut and fit roof deck units and accessories around projections through roof decking.

2. Make cuts neat, square and trim.
3. Cut openings in roof deck true to dimensions using metal saws or drills. Flame cutting or burning is not allowed.

F. Roof Sump Pans:

1. Place roof sump pans over openings in roof decking and weld to top decking surface.
2. Space welds a maximum of 300 mm on center with at least one weld at each corner.
3. Cut opening in bottom of roof sump pan to accommodate drain.

G. Ridge and Valley Plates:

1. Weld ridge and valley plates to top surface of roof decking.
2. Lap end joints a minimum of 75 mm with laps in direction of water flow.

H. Closure Strips: Flexible closure strips shall be installed in accordance with the manufacturer's recommendations.

I. Roof Insulation Support:

1. Provide where required metal closure strips for support of roof insulation where rib openings in top surface of roof decking occur adjacent to edges and openings.
2. Weld closure strips into position.

J. Cant Strips: Shall be installed where shown on the Contract Drawings and as detailed on the Shop Drawing. They shall be attached as shown on the Shop Drawings.

K. Touch-Up Painting:

1. Wire brush, clean and paint scarred areas, and rust spots on top and bottom surfaces of decking units and supporting steel members.
2. Touch-Up cut or damaged galvanized surfaces and field welds with galvanizing repair paint applied in accordance with the manufacturer's instructions.

3.03 SAFETY PROCEDURES

- A. The Contractor shall not use deck units for storage or working platforms until permanently secured in position.

- B. The Contractor shall ensure that construction loads do not exceed carrying capacity of deck.
- C. Metal deck shall be attached to support structure as soon as possible after being placed in position. Under no conditions will placed decking be left unattached at the end of a working day.

END OF SECTION

106 - METAL FABRICATION

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	106 - 1
1.02 APPLICABLE CODES AND STANDARDS	106 - 1
1.03 SUBMITTALS	106 - 5
1.04 TRANSPORTATION, HANDLING AND STORAGE	106 - 5
1.05 QUALITY CONTROL	106 - 6
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	106 - 6
2.02 MATERIALS	106 - 6
2.03 FASTNERS	106 - 8
2.04 UNIDENTIFIED STOCK MATERIAL	106 - 9
2.05 DISSIMILAR METALS	106 - 9
<u>PART 3: EXECUTION</u>	
3.01 FABRICATION	106 - 9
3.02 ERECTION	106 - 12
LAST PAGE	106 - 13

106 - METAL FABRICATION

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and installation of all miscellaneous metalwork and related accessories, whether shown on the Contract Drawings in detail or required in general to perform the intent to make a complete and operable facility. The following listed items, however, not limited to same, are considered to be representative of miscellaneous metalwork.

1. Anchor bolts
2. Handrails
3. Steel stairs
4. Floor plates and/or trench covers
5. Grating
6. Vertical ladders
7. Equipment support frames

- B. Related Work Specified Elsewhere:

1. Section 104 ARCHITECTURAL STRUCTURAL STEEL FRAMING
2. Section 123 PAINTING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for review and approval by the Engineer in advance of their use.

- A. AISC - American Institute of Steel Construction:
- Manual of Steel Construction
- B. AISI - American Iron and Steel Institute:
- AISI 302 Washers

- AISI 303 Bolts and Nuts

C. ANSI - American National Standards Institute:

- B 18.2.1 Square and Hex Bolts and Screws

- B 18.2.2 Square and Hex Nuts

- B 18.10 Track Bolts and Nuts

- B 18.21.1 Lock Washers

- B 18.22.1 Plain Washers

- B 18.23.1 Beveled Washers

D. ASTM - American Society for Testing and Materials:

- A 1 Carbon-Steel Tee Rails, Spec. for

- A 6 General Requirements for Rolled Steel Plates, Shapes Sheet Piling, and Bars for Structural Use, Spec. for

- A 27 Mild to Medium Strength Carbon-Steel Castings for General Application, Spec. for

- A 36 Structural Steel, Spec. for

- A 47 Malleable Iron Castings, Spec. for

- A 48 Gray Iron Castings, Spec. for

- A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless, Spec. for

- A 120 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses, Spec. for

- A 123 Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Plates, Shapes, Bars, and Strip, Spec. for

- A 148 High-Strength Steel Castings for Structural Purposes, Spec. for

- A 153 Zinc Coating (Hot-Dip) or Iron and Steel Hardware, Spec. for

- A 164 Electrodeposited Coatings of Zinc or Steel, Spec. for

- A 165 Electrodeposited Coatings of Cadmium on Steel, Spec. for
- A 167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip, Spec. for
- A 242 High Strength Low-Alloy Structural Steel, Spec. for
- A 269 Seamless and Welded Austenitic Stainless Steel Tubing for General Service, Spec. for
- A 276 Stainless and Heat-Resisting Steel Bars and Shapes, Spec. for
- A 307 Carbon, Steel Externally and Internally Threaded Standard Fasteners, Spec. for
- A 312 Seamless and Welded Austenitic Stainless Steel Pipe, Spec. for
- A 320 Alloy-Steel Bolting Materials for Low-Temperature Service, Spec. for
- A 385 Providing High Quality Zinc Coatings (Hot-Dip) Recommended Practice for
- A 386 Zinc Coating (Hot-Dip) on Assembled Steel Products, Spec. for
- A 441 High-Strength Low-Alloy Structural Manganese Vanadium Steel, Spec. for
- A 500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes, Spec. for
- A 501 Hot-Formed Welded and Seamless Carbon Steel Structural Tubing, Spec. for
- A 525 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements, Spec. for
- A 532 Abrasion Resistant Cast Irons, Spec. for
- A 536 Ductile Iron Castings, Spec. for
- A 570 Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality, Spec. for
- A 666 Austenitic Stainless Steel, Sheet, Strip Plate, and Flat Bar for Structural Applications, Spec. for

- A 668 Steel Forgings, Carbon and Alloy, for General Industrial Use, Spec. for
 - B 108 Aluminum-Alloy Permanent Mold Casting, Spec. for
 - B 179 Aluminum-Alloy in Ingot Form for Sand Castings, Permanent Mold Castings and Die Castings, Spec. for
 - B 209 Aluminum-Alloy Sheet and Plate, Spec. for
 - B 211 Aluminum-Alloy Bars, Rods, and Wires, Spec. for
 - B 221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes, Spec. for
 - B 308 Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded, Spec. for
- E. AWS - American Welding Society:
- A 5.1 Specification for Carbon Steel Covered Arc Welding Electrodes
 - A 5.5 Specification for Low-Alloy Steel Covered Arc-Welding Electrodes
 - A 5.17 Specification for Bare Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
 - D 1.1 Structural Welding Code
- F. JIS - Japanese Industrial Standards
- G 3101 Rolled Steel for General Structure
 - G 3114 Hot-rolled Atmospheric Corrosion Resisting Steels for Welded Structure
 - G 3125 Superior Atmospheric Corrosion Resisting Rolled Steels
 - G 3452 Carbon Steel Pipes for Ordinary Piping
 - G 4304 Hot-Rolled Stainless Steel Sheets and Plates
 - G 4305 Cold-Rolled Stainless Steel Sheets and Plates

- G 5101 Carbon-Steel Castings
- G 5501 Gray Iron Casting
- G 5702 Blackheart Malleable Iron Castings
- H 4000 Aluminium and Aluminium Alloy Sheets and Plates, Strips and Coiled Sheets
- H 4040 Aluminum and Alloy Rods, Bars and Wires
- H 4080 Aluminum and Aluminum Alloy Seamless Pipes and Tubes

1.03 SUBMITTALS

- A. Catalog Cuts and Manufacturer's Data: The Contractor shall provide, prior to purchase, catalog cuts and manufacturer's data for all pre-engineered products to be purchased, for review by the Engineer.
- B. Certifications:

Material certificates issued by the Supplier setting forth the type and chemical composition of all stock metal. Manufacturer's certificates setting forth the name or brand of all "off-the-shelf items", and certification that all materials and products furnished conform to the specified requirements.
- C. Shop Drawings:
 1. Drawings shall show erection layout, framing and supports with unit dimensions and sections.
 2. Type and location of welds and/or bolted fasteners. Welding shall be indicated by AWS standard welding symbols.
- D. Samples: Furnish for all items of Work where the color or style is not specified and when requested by the Engineer one sample for each item.
- E. Contractor Quality Control Program: To include method, materials, quality control and testing proposed for all the Work.

1.04 TRANSPORTATION, HANDLING AND STORAGE

1. Transportation and Handling: Structural steel shall not be handled until paint has thoroughly dried. Care shall be exercised to avoid paint abrasions and other damage.

Steel Work shall be transported in the largest practical lengths.

All pieces bent or otherwise damaged shall be rejected.

2. Protection: Material shall be stored out of mud and dirt and proper drainage of the storage area shall be provided. Protect from damage or soiling by adjacent construction operations.
3. Storage: Storage of fabricated steel at the job site shall be the responsibility of the Contractor. Store material at the job site in a manner which does not overload the existing or newly-constructed structures. Protect material against excessive deflection, corrosion or deterioration.

1.05 QUALITY CONTROL

The Contractor shall be responsible for the quality of all furnished items and as such, shall develop and submit a Quality Control Program for review. The program shall cover those items intended for shop inspection, field supervision and the procedures for carrying out same.

PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

B. Steel:

1. Shapes, bars and plates shall conform to ASTM A 6 and one of the following:

- a) Yield strength minimum 2528kgf/cm^2 (36 ksi), use ASTM A 36.

- b) Yield strength minimum 3518kgf/cm^2 (50 ksi), use ASTM A 441.

- c) Stainless, use ASTM A 167 or A 276.

2. Sheets and Strips shall conform to ASTM A 6 and one of the following:

- a) Carbon Steel, use ASTM A 570
- b) Stainless, use ASTM A 666
3. Pipe shall conform to ASTM A 6 and one of the following:
 - a) General application, use ASTM A 120.
 - b) Stainless, use ASTM A 312.
4. Tubing shall conform to ASTM A 6 and one of the following:
 - a) Hot formed, use ASTM A 501.
 - b) Cold formed, use ASTM A 500.
 - c) Stainless, use ASTM A 269.
5. Checkered floor plates shall conform to ASTM A 36.

C. Aluminum:

1. Shapes shall conform to ASTM B 308.
2. Plates and sheets shall conform to ASTM B 209.
3. Extrusions shall conform to ASTM B 221.
4. Checkered floor plates conform to ASTM B 209.
5. Thread plates shall conform to ASTM B 209, grade 3003 alloy, abrasive thread plate.

D. Casting Metals:

1. Mild-to-Medium-Strength Carbon-Steel Castings for General Application, ASTM A 27.
2. White cast-iron castings shall conform to ASTM A 532.
3. Gray cast-iron castings shall conform to ASTM A 48.
4. Malleable iron castings shall conform to ASTM A 47.
5. Ductile iron castings shall conform to ASTM A 536.
6. Aluminum alloy castings shall conform to ASTM B 108 and/or B 179.

E. Forging Metals:

1. Carbon-Steel Forgings for General Industrial Use, ASTM A 668.

2. Plain Washers ANSI B 18.22.1
3. Beveled Washers ANSI B 18.23.1

2.04 UNIDENTIFIED STOCK MATERIAL

Unidentified stock material consisting of material which cannot be identified by a certified mill test report, may be used subject to the requirements of this Section.

Testing requirements for unidentified stock material shall be determined by the Contractor and reviewed by the PJKA. All testing requirements shall be included or amended to the Contractors Quality Control Program and implemented according to the requirements of Section 01430.

2.05 DISSIMILAR METALS

Use of dissimilar metals liable to lead to galvanic action shall not be permitted in the Work.

PART 3: EXECUTION

3.01 FABRICATION

- A. General: No fabrication shall commence until documents under "Submittals", 1.03 herein, are reviewed by the Engineer. The Contractor however, shall be responsible for the correct interpretation of the Work to be done and for the accuracy of the detailed dimensions.
- B. Steel: Fabricate all steelwork in accordance with Part 3, SECTION 104.
- C. Castings: Castings shall be made free from cracks, swells, holes, and cold shuts, and shall have a smooth finish. Before leaving the foundry all castings shall be thoroughly cleaned, treated and tested in accordance with the requirements shown in the ASTM Standard selected by the Contractor from listing in Sub Section 2.01.E.

After testing, all acceptable castings which will not be galvanized shall be hot-dipped in asphalt varnish or given a shop coat of coal tar paint.

- D. Anchor Bolts: Anchor bolts shall be as listed and detailed on the Contract Drawings. Sleeves, anchor bolt shields, and anchor plates shall also be provided where they are indicated on the Contract Drawings. Each bolt shall be furnished with two nuts and sufficient threads to permit a nut to be installed on each side of the base plate.

All anchor bolts, nuts, and washers shall be hot-dip galvanized after fabrication, threads being undercut to provide a tolerance equal to ANSI B 18.2.1, Class 2A, unless shown to be black on the Contract Drawings.

E. Embedments:

1. Embedded materials shall be accurately fabricated and assembled. Warped or bent sections which do not fit into the concrete forms as required shall be replaced with suitable material. All miscellaneous iron embedded in concrete shall be galvanized.
2. Sleeves through concrete and masonry, except as otherwise noted, shall be fabricated from standard-weight steel pipe or from a 4-mm thick steel plate. Sleeves shall be machine cut or flame cut and ground smooth.
3. Aluminum material shall not be used for embedment in concrete, unless specifically shown on the Contract Drawings.

F. Vertical Ladders:

1. Ladder assemblies shall be constructed of either steel or aluminum shapes, plates, rods or bars, as shown on the Contract Drawings, conforming to ASTM A 36 or B 209, respectively.
2. Fabricate ladders for locations shown on the Contract Drawings with dimensions, spacings, details and anchorages, as indicated thereon.
3. Fit rails in centerline of side rails, plug-weld and grind smooth on outer rail faces.
4. Provide all necessary brackets and fasteners for installation. Brackets for vertical ladders to hold the ladder centerline a minimum of 180 mm from face of structure to which affixed.
6. All welding shall be done with all fillets dressed to uniform radius, all excess metal removed, and all welds ground smooth and flush. Butt welded joints shall be of the flush type.
7. Steel assemblies shall be galvanized, unless noted otherwise on the Contract Drawings, in conformance to ASTM A 386.

G. Handrails:

1. Handrailings shall be constructed of material which is smooth and free of mill scale, roll marks and pitting. ASTM A 120 pipe shall be used unless shown otherwise on the Contract Drawings. Maximum spacing of posts shall be 1.8 meters (6 feet) unless shown otherwise on the Contract Drawings.

All angles, offsets, and other changes in alignment of railings shall be made with accurately mitred joints or welded railing fittings.

2. All welding shall be done with all fillets dressed to uniform radius, all excess metal removed, and all welds ground smooth and flush. Welded joints shall be of the flush type. Members shall be neatly coped and continuously welded at all junctions of posts and rails. Flattening of the rail or post ends at junctions of posts and rails will not be permitted. Fittings or other connectors shall not be used at junctions of posts and rails.
3. Steel handrailings exposed to the weather and/or shown on the Contract Drawings to be galvanized shall be galvanized after fabrication. Prior to galvanizing, fabricated sections shall have internal openings so that there are no closed or blind sections of pipe.
4. When assembled, all posts shall be vertical, and longitudinal members shall be parallel with each other and with the platform or walkway surface or slope of stairs, or other supporting members. In any section or run of railing, the center lines of all members shall be in true alignment, lying in the same vertical plane. Except as otherwise indicated on the Contract Drawings, the top rails shall run continuously over the posts and the posts shall be continuous through the lower rail or rails. Hand-railings that intersect structural bracing shall be fabricated in normal lengths for field cutting and welding to the bracing.

H. Floor Plates:

1. Floor plates shall be fabricated from a skid-resistant raised-pattern plate, minimum thickness 6 mm. Steel types shall be galvanized, unless shown otherwise.
2. Holes for bolting, unless shown to be field welded, shall be shop punched, reamed and countersunk to suit fasteners to be used.

I. Gratings:

1. All gratings shall be of the type material shown on the Contract Drawings.
2. Connections shall be by bolting or a proprietary fixing device as recommended by the manufacturer.
3. All steel gratings shall be galvanized.

4. Grating shall be banded at all edges and at cut-outs.

J. Welding:

1. Except as otherwise specified, all welds, welding, and related operations shall be in conformity with the applicable provisions of AWS D1.1.
2. Except as otherwise specified, welding shall be performed using only those joint details which have a prequalified status when performed in accordance with the referenced AWS code.
3. Electrodes shall be selected for steel parts as specified in Sub-section 2.01.G.
4. Components to be welded shall be accurately positioned and shall be rigidly secured during welding.

- K. Protective Coatings: All steel exposed to the weather or any other corrosive environment shall be galvanized. All steel galvanized or black that is to receive a finish coating of paint shall be shop primed.

Protective coatings generally shall be in conformance with the following:

1. Galvanizing - shall conform to ASTM A 385 and one of the following:
 - Assembled steel products, ASTM A 386.
 - Rolled, pressed and forged shapes, plates, bars and strip steel, ASTM A 123.
 - Bolts and similar threaded fasteners, castings and iron hardware, ASTM A 153 or ASTM A 164.
 - Steel Sheets, ASTM A 525.
2. Electroplating - cadmium metal coating, ASTM A 165.
3. Shop Primers - prepare surfaces and supply one or two shop coats of primer. One shop coat of primer acceptable if finish paint also shop applied. Two shop coats of primer shall be used if finish paint to be applied in the field. Finish Paint specified in SECTION 123, PAINTING.

3.02 ERECTION

A. General:

1. All metalwork and/or other parts of fabricated assemblies, prior to delivery, shall be checked by the Contractor's Shop Quality Control Representative for

workmanship and conformity to shop drawings. Holes and/or other provisions for field connections shall be accurate and shop checked so that proper fit will be provided when the units are assembled in the field. Erection drawings shall be prepared and all separate pieces shall be piece marked as indicated on such drawings. Where required, either by notations on the drawings or by the necessity of proper identification pieces shall be matchmarked.

2. The suitability and capacity of all plant and equipment, as well as all occupational safety practices associated with the Work, shall be to the satisfaction of the Engineer.
3. All parts shall be assembled accurately as indicated on the drawings and matchmarks shall be carefully followed. Light drifting to draw the parts together will be acceptable, but drifting to match unfair holes will not be acceptable. Enlargements of holes necessary to make connections in the field may be done by burning followed by grinding with care being taken not to weaken the adjoining metal.

B. Field Welding: Field welding shall conform to the requirements specified under Welding, 3.01 herein.

C. Field Painting:

1. Galvanized surfaces scratched or otherwise damaged during delivery, unloading, or erection shall be thoroughly cleaned by wire brushing the damaged area to remove all loose, cracked or bruised galvanizing. Cleaned areas shall then be painted with galvanizing repair paint.
2. Damaged or inadequate paint films of shop painted miscellaneous metal materials, and all accessible surfaces of field welds and connection bolts, shall be cleaned and prime painted as specified for the shop priming.
3. Aluminum surfaces which will be in contact with dissimilar metals shall be heavily coated with zinc chromate pigment, synthetic resin type paint. Aluminum surfaces which will be in contact with concrete or mortar shall be given a heavy coat of alkali resistant bituminous or coal tar product.
4. Finish painting shall be accordance with SECTION 123, PAINTING.

END OF SECTION

107 - ASBESTOS CEMENT SIDING

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	107 - 1
1.02 APPLICABLE CODES AND STANDARDS	107 - 1
1.03 SUBMITTALS	107 - 2
1.04 PRODUCT HANDLING	107 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	107 - 2
2.02 MATERIALS	107 - 2
2.03 ASBESTOS CEMENT SHEETS	107 - 2
2.04 FASTENERS	107 - 3
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION	107 - 3
3.02 INSTALLATION	107 - 3
3.03 SAFETY PROCEDURES	107 - 4
LAST PAGE	107 - 4

107 - ASBESTOS CEMENT SIDING

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing and installation of Asbestos Cement Siding and related accessories in the locations and quantities shown on the Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the work.

B. Related Work Specified Elsewhere:

1. Section 105 METAL ROOF DECKING
2. Section 106 METAL FABRICATION

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for Engineer review and approval in advance of their use.

ASTM - American Society for Testing and Materials

- | | |
|-------|---|
| C 150 | Specification for Portland Cement |
| C 221 | Specification for Corrugated Asbestos-Cement Sheets |
| C 458 | Test for Organic Fiber Content of Asbestos-Cement Products |
| C 460 | Definitions of Terms Relating to Asbestos-Cement and Related Products |
| C 595 | Specification for Blended Hydraulic Cements |

JIS - Japanese Industrial Standard

- | | |
|--------|--|
| A 0006 | Standard Size of Building Boards |
| A 1408 | Method of Bending Test for Building Boards |

- A 5403 Asbestos Cement Sheets
- R 5210 Portland Cement
- Z 9001 General Principles for Sampling Inspection Procedures

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Certificates: Furnish manufacturer's certification that materials meet or exceed specification requirements.
- B. Manufacturer's Instructions: Furnish manufacturer's printed instructions for installation of the panels.

1.04 PRODUCT HANDLING

- A. Delivery and Handling
 - 1. Deliver materials to the jobsite with manufacturer's labels intact and legible.
 - 2. Handle materials with care to prevent damage in accordance with the manufacturer's instructions.
- B. Storage: Store materials inside, under cover, stacked flat, off floor and in accordance with the manufacturer's instructions.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 ASBESTOS CEMENT SHEETS

- A. Asbestos Cement Sheets shall be of the corrugated-slate, large-corrugation type, fabricated from Portland Cement and chrysotile asbestos in the proportions by weight of 85% cement and 15% asbestos, with the addition of not more than

3% by weight of organic fiber. Slates shall have an impact load of 400 kg minimum and a water absorption rate of 28% maximum.

1. Roof slates shall be 2420 mm long x 960 mm wide x 6.3 mm thick, with 7.5 corrugations, having a depth of over 35 mm and a pitch of 130 mm.
2. Barge-Board Edging shall be 2420 mm long x 200 mm wide x 130 mm deep with a pitch of 130 mm.
3. Roof-Edge Corner Rolls shall be of dimensions to match the size and pitch of the roof slates.
4. Roof-Ridge Roll shall be of appropriate dimensions to match the size, pitch and cant of the roof slates.

- B. Flat Asbestos-Cement Sheet shall be as indicated on the Drawings.

2.04 FASTENERS

- A. Roof slates shall be fastened in place with galvanized-steel, 6-mm diameter hook bolts.
- B. Edging shall be fastened in place with galvanized-steel, 6-mm channel bolts.

PART 3: EXECUTION

3.01 INSPECTION

- A. The Contractor shall check all materials upon arrival at the site for compliance with the specifications.
- B. The Contractor shall check supporting members for correct layout and alignment and verify that surfaces to receive Asbestos Cement Slates are free of debris.
- C. The Contractor shall correct all defects before proceeding with installation.

3.02 INSTALLATION

- A. General:

The Contractor shall install the Asbestos Cement Slates and accessories in accordance with the manufacturer's instructions, shop drawings and as specified below. If the manufacturer's recommendations differ significantly from those below, the manufacturer's recommendations shall be followed, except that specified minimum requirements shall prevail.

B. Placing Roof Slates

1. Position roof slates on supporting steel framework and adjust to final position. Accurately align slates before permanently fastening in place.
2. End laps shall be 150 mm, minimum.
3. Side laps shall be 1 ridge on each slate.

C. Fastening Roof Slates

1. Secure roof slates to supporting members with 6-mm hook bolts or channel bolts as required.

D. Cutting and Fitting

1. Cut and fit roof slates and accessories in a neat, square and trim manner.

3.03 SAFETY PROCEDURES

- A. The Contractor shall ensure that construction loads do not exceed the carrying capacity of the roof slates.
- B. Roof slates shall be attached to support structure as soon as possible after being placed in position. Under no conditions shall placed roof slates be left unattached at the end of a working day.

END OF SECTION

108 - ROUGH CARPENTRY

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	108 - 1
1.02 APPLICABLE CODES AND STANDARDS	108 - 1
1.03 QUALITY ASSURANCE	108 - 2
1.04 SUBMITTALS	108 - 3
1.05 PRODUCT HANDLING	108 - 3
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	108 - 4
2.02 MATERIALS	108 - 4
2.03 OTHER MATERIALS	108 - 6
<u>PART 3: EXECUTION</u>	
3.01 VERIFICATION IN FIELD	108 - 6
3.02 INSTALLATION	108 - 6
LAST PAGE	108 - 7

108 - ROUGH CARPENTRY

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section includes, but is not limited to the furnishing and installation of wood blocking and nailers for all trades, frames for non-load bearing partitions, miscellaneous, frames, ceiling frames, decks and trellises, plywood backing panels for equipment and other miscellaneous rough wood work as shown and detailed on the Contract Drawings. The Contractor shall furnish all labor, materials, tools and equipment necessary to complete the Work.

B. Related Work Specified Elsewhere:

1. Section 022 CAST-IN-PLACE CONCRETE
2. Section 123 PAINTING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. ANSI - American National Standards Institute:

- A 199.1 Construction and Industry Plywood

B. ASTM - American Society for Testing and Materials:

- A 36 Specification for Structural Steel
- A 446 Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality, Spec. for,
- A 525 Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, General Requirements
- D 245 Methods for Establishing Structural Grades for Visually Graded Lumber
- E 84 Surface Burning Characteristics of Building Materials

C. AWPA - American Wood Preservers Association:

- C1 All Timber Products - Pressure Treatment (General Requirements)
- C2 Lumber, Timbers, Bridge Ties and Mine Ties - Pressure Treatment
- C9 Plywood - Pressure Treatment
- C20 Structural Lumber, Fire-Retardant - Pressure Treatment
- C27 Plywood, Fire-Retardant - Pressure Treatment
- M4 Care of Pressure Treated Wood Products

D. AWPB - American Wood Preservers Bureau

- LP-2 Standard for Softwood Lumber, Timber and Plywood Pressure Treated with Water-Borne Preservations for Above Ground Use
- LP-4 Standard for Softwood Lumber, Timber and Plywood Pressure Treated with Volatile Hydrocarbon Solvent-Penta Solution for Above Ground Use
- LP-22 Standard for Softwood Lumber, Timber and Plywood Pressure Treated with Water-Borne Preservatives for Ground Contact Use
- LP-44 Standard for Softwood Lumber, Timber and Plywood Pressure Treated with Volatile Hydrocarbon Solvent-Penta solution for Ground Contact Use

E. JIS - Japanese Industrial Standards

- G 3101 Hot-Rolled Steel for General Structure
- G 3131 Hot-Rolled Mild Steel Plate, Sheet and Strip

F. JAS - Japanese Agricultural Standard

1.03 QUALITY ASSURANCE

- A. Lumber and Grating: Comply with ASTM D 245 or with the applicable Lumbermen's Association rules under which each species of lumber is produced.

- B. Plywood Grading: Comply with ANSI A 199.1
- C. Grade markings: Factory mark each piece of lumber with the official grade mark of the appropriate association or authorized inspection service under whose rules the lumber is graded.
- D. Sizes and Patterns: Unless noted otherwise on the Contract Drawings, provide lumber which is dressed S4S (surface 4 sides) and worked to such patterns as shown on the Contract Drawings. Dimensions shown on Contract Drawings designate the nominal undressed size of the item.
- E. Moisture Content: Provide lumber which has been seasoned by air drying or kiln drying to a moisture content not to exceed 19 percent.
- F. Flame Spread Rating: Maximum flame spread rating shall be 25 in accordance with ASTM E 84.

1.04 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing Work:

- A. Shop Drawings: Submit shop drawings indicating framing connection details, fastener connections and dimensions if details are not shown on the Contract Drawings.
- B. Certificates:
 1. Pressure-treated wood: Submit certification by treating plant stating chemicals and process used, net amount of salts retained and conformance with applicable standards.
 2. Preservation-treated wood: Submit certification for water-borne preservative that moisture content was reduced to 19 percent maximum, after treatment.
 3. Fire-retardant treatment: Submit certification by treating plant that fire-retardant materials comply with applicable standards and that treatment will not bleed through finished surfaces.
- C. Samples: Submit samples of wood, plywood, nails and connectors when requested by the PJKA.

1.05 PRODUCT HANDLING

- A. Immediately upon delivery to jobsite, place materials in area protected from the weather and out of direct sunlight.

- B. Store materials a minimum of 150 mm above ground on framework or blocking and cover with protective water-proof covering providing for adequate air circulation or ventilation.
- C. Do not store seasoned materials in wet or damp portions of building.
- D. Protect fire-retardant materials against high humidity and moisture during storage and erection.
- E. Protect sheet materials from breaking of corners and damaged surfaces, while unloading.
- F. Keep all materials clearly identified with all grade marks legible.

PART 2: PRODUCTS

2.01 GENERAL

- A. General: All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Lumber:

Minimum Acceptable Grade
Expressed in Term of
Allowance Stresses (Kg/cm²)

USE	Extreme Fiber in Bending F _b	Horizontal Shear F _v	Minimum Modulus of Elasticity E
Sills, joists studs, general framing	81.6	8.2	81,570
Ground, nailers, blocking, cants, sleepers, furring	40.8	4.1	61,180

2.03 OTHER MATERIALS

- A. All other materials such as anchors and fasteners, not specifically described but required for a complete and proper installation as indicated on the Contract Drawings, shall be new, suitable for the intended use, and subject to review by the PJKA.
- B. All required nails and connectors shall be galvanized.

PART 3: EXECUTION

3.01 VERIFICATION IN FIELD

Examine substrates, adjoining construction, and conditions under which the work is to be installed. The Contractor shall correct all unsatisfactory conditions before proceeding with the Work and shall coordinate the Work with all other trades.

3.02 INSTALLATION

- A. Requirements: Whenever rough carpentry is fitted to other work, obtain measurements of such other work. Verify dimensions shown on the Contract Drawings or shop drawing details.
- B. Rough Framing:
 - 1. Frame to fit closely, and set accurately to required lines and levels; secure rigidly in place in accordance with details and good practice.
 - 2. Use shims for leveling wood members on concrete or masonry.
 - 3. Cut and fit to accommodate other work as required and in a neat workmanlike manner.
- C. Blocking and Nailers: Provide blocking and nailers between framing members and at masonry, concrete, or steel as shown on the Contract Drawings or required.
- D. Grounds:
 - 1. Provide grounds for securing wood trim and other items in plaster work.
 - 2. Size: 38 mm by thickness required to finish flush with surface of plaster or as shown on the Contract Drawings or required.

3. Install rigidly, true to line and dimension.
- E. Furring:
1. Furring: Provide where shown on the Contract Drawings.
 2. Size: 25-mm x 75-mm continuous strips, spaced 400 mm on center unless otherwise shown on the Contract Drawings.
 3. Secure with hardened masonry nails, expansion shields or toggle bolts as appropriate.
- F. Wood Sleepers: Dressed, square-edge, 50 mm x 75 mm. Install in continuous long lengths with square ends, set in parallel rows, leveled and nailed to approved sleeper clips.
- G. Cant Strips: Continuous, cut with square ends, in lengths as long as possible. Secure by nailing to previously installed blocking or nailers.
- H. Repair of Treated Wood Surfaces:
1. Apply two heavy brush coats of wood preservative material to surfaces exposed by sawing, cutting, or drilling. Comply with AWWA M4.
 2. Apply heavy brush coat of same fire retardant chemicals to any surfaces which are cut after treatment.
- I. Priming:
1. Paint rough hardware and ferrous metal with one shop coat of organic zinc-rich primer.
 2. Paint fire-retardant treated wood as specified in Section 123, "PAINTING".

END OF SECTION

109 - ARCHITECTURAL WOODWORK

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	109 - 1
1.02 APPLICABLE CODES AND STANDARDS	109 - 1
1.03 QUALITY ASSURANCE	109 - 1
1.04 SUBMITTALS	109 - 1
1.05 PRODUCT HANDLING	109 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	109 - 2
2.02 MATERIALS	109 - 2
2.03 CASEWORK	109 - 2
2.04 CASEWORK HARDWARE	109 - 3
2.05 HIGH-PRESSURE LAMINATE COUNTER TOPS	109 - 3
2.06 FACTORY FINISHING	109 - 3
<u>PART 3: EXECUTION</u>	109 - 4
3.01 INSPECTION	109 - 4
3.02 INSTALLATION	109 - 4
LAST PAGE	109 - 4

109 - ARCHITECTURAL WOODWORK

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and installation of all architectural woodwork including kitchen cabinets, benches, plastic laminate sink top, plastic laminate kitchen countertop and related accessories as shown on the Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.
- B. Related Work Specified Elsewhere:

Section 108 ROUGH CARPENTRY

1.02 APPLICABLE CODES AND STANDARDS

- A. Architectural woodwork shall be fabricated in accordance with AWI, Architectural Woodwork Institute Guide Specifications, latest edition. Architectural woodwork shall be custom grade as defined by AWI. Kitchen cabinet work shall be flush overlay.

1.03 QUALITY ASSURANCE

- A. Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Engineer.
- B. Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 SUBMITTALS

- A. Product Data: Within 60 calendar days after award of the Contract, submit:
1. Complete materials list of all items proposed to be furnished and installed under this Section.
 2. Sufficient other data to demonstrate compliance with the specified requirements.
 3. Shop drawings showing each of the items to be provided under this Section, completely detailing joinery and other construction, including anchorage.

4. Samples of the proposed woods to be used.
5. Samples of factory-applied finishes.
6. Samples of high-pressure laminates showing manufacturer's available patterns, wood grains and colors.

1.05 PRODUCT HANDLING

- A. Deliver, store and handle materials in manner to prevent damage and deterioration.
- B. Defer delivery to the job until the installation and storage areas are complete and all wet-type construction is dry.
- C. Maintain relative humidity in storage areas not to exceed 60 percent. If such conditions cannot be achieved at job site prior to installation, store woodwork off site in a suitable warehouse acceptable to the Engineer.
- D. Protect all surfaces of materials subject to damage while in transit.
- E. Provide temporary skids under all large or heavy items.

PART 2: PRODUCTS

2.01 GENERAL

- A. General: All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 CASEWORK

- A. All architectural woodwork other than plastic laminate tops shall receive transparent finish. Fabricate woodwork from material meeting the following requirements:

1. AWI quality grade: Custom
- B. Solid Wood
1. Yellow Birch - "Select Red" (Heartwood), Yellow Birch - "Select White" (Sapwood), or Hard Maple "Select White" (Sapwood); quarter sawn.
- C. Solid Wood
1. Red Oak or White Oak; plain sawn.
- D. Plywood
1. Yellow Birch - "Select Red" (Heartwood), Yellow Birch - "Select White" (Sapwood), or Hard Maple "Select White" (Sapwood); quarter sliced.
- E. Plywood
1. Red Oak or White Oak; half-round sliced.
- 2.04 CASEWORK HARDWARE
- A. All casework hardware shall be furnished and installed by the casework manufacturer.
- 2.05 HIGH-PRESSURE LAMINATE COUNTER TOPS
- A. AWI quality grade: Custom.
 - B. Laminate Selection.
 1. Plastic-laminate manufacturer shall be as approved by the Engineer.
 2. Patterns and colors shall be as selected by the Engineer from manufacturer's samples of (1) solid colors, (2) wood grains, and (3) patterns. Various solid colors, wood grains and patterns will be required and selected.
- 2.06 FACTORY FINISHING
- A. Transparent Finish
 1. Items:
 - a. Kitchen cabinets
 - b. Locker room benches.

- c. Reception desk.
- d. Wall paneling.
- 2. AWI Factory Finish System No. 4: Vinyl Catalyzed.
- 3. AWI quality grade: Custom.
- 4. Stain: Medium.

PART 3: EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install casework, counter tops, benches and all components of this Section in strict accordance with the original design and the approved shop drawings.
- B. Casework
 - 1. Install casework plumb and level without distortion.
 - 2. Shim as necessary with concealed shims.
 - 3. Accurately, scribe and closely fit all face plates, filler strips and trim strips to irregularities of adjacent surfaces.

EN OF SECTION

110 - BUILDING INSULATION

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	110 - 1
1.02 APPLICABLE CODES AND STANDARDS	110 - 1
1.03 MATERIALS	110 - 1
1.04 PRODUCT HANDLING	110 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	110 - 2
2.02 MATERIALS	110 - 2
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION	110 - 3
3.02 INSTALLATION	110 - 3
3.03 VAPOR BARRIER	110 - 4
3.04 CLEAN-UP	110 - 4
LAST PAGE	110 - 4

110 - BUILDING INSULATION

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and installation of building insulation for walls and ceilings as shown on the Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.
- B. Related Work Specified Elsewhere:
1. Section 022 CAST-IN-PLACE CONCRETE
 2. Section 111 BUILT UP BITUMINOUS ROOFING
 3. Section 127 GYPSUM WALLBOARD SYSTEM

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. ASTM - American Society for Testing and Materials
- C 578 Preformed, Block-Type Cellular Polystyrene Thermal Insulation
 - C 591 Rigid Preformed Cellular Urethane Thermal Insulation
 - E 84 Surface Burning Characteristics of Building Materials
- B. JIS - Japanese Industrial Standards
- A 9511 Form Polystyrene Heat Insulating Material
 - A 9514 Rigid Foam Urethane Heat Insulating Material

1.03 MATERIALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Samples: Three 300 mm by 300 mm pieces of each type and thickness of insulation proposed for use.

- B. Manufacturer's literature indicating the manufacturer's recommended installation instructions and recommended precautions for fire protection.
- C. Manufacturer's certification of compliance with each delivery.

1.04 PRODUCT HANDLING

- A. Deliver materials to jobsite in manufacturer's original unopened packaging.
- B. Identify contents with name of manufacturer, brand name, thermal value and applicable standards.
- C. Store materials in an area protected from weather, moisture and open flame or sparks.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Adhesive: Shall be as recommended by the insulation manufacturer for each intended application. Adhesive used in fire-rated assemblies shall be flame-resistant.
- C. Insulation

1. Rigid Insulation:

- a. Polystyrene shall be extruded foam board or moulded foam bead board with a density of 24 Kg/m³ and meet the requirements of ASTM C 578. Insulation shall have a flame spread rating of 25 or less and smoke developed 25-80 when tested in accordance with ASTM E 84.
- b. Polyurethane shall be self-extinguishing with a density of 24 Kg/m³ to 37 Kg/m³, a composite facing of either organic felts or fiberglass and shall meet the requirements of ASTM C 591. Flame spread rating shall be 75 or less when

tested in accordance with ASTM E 84. This insulation must not be left exposed in the completed installation.

- c. Cellular glass shall be completely inorganic with no binders or fillers with an average density of 136 Kg/m³ and meet the requirements of ASTM C 552. The insulation shall have a flame spread rating of 5 and smoke developed 0 when tested in accordance with ASTM E 84.

D. Vapor Barrier

Vapor barrier for use where insulation has no attached vapor barrier shall be polyethylene film, 200 microns thick.

E. Mechanical Fasteners

- 1. As recommended by the insulation manufacturer.
- 2. Minimum length, 13 mm longer than insulation thickness.

F. Bituminous Primer: As recommended by the insulation manufacturer.

G. Bitumen: As recommended by the insulation manufacturer.

PART 3: EXECUTION

3.01 INSPECTION

- A. Examine areas to receive insulation to insure work of preceding trades is complete.
- B. Check wall surfaces to receive insulation to ensure they are in uniform plane; and free from mortar chips, debris, grease, oil or other items detrimental to installation.
- C. The Contractor shall correct any unsatisfactory conditions prior to start of work.

3.02 INSTALLATION

- A. General: Insulation shall be installed on the cold side of electrical outlets, ducts, pipe, vents and other utility equipment. Widths of insulation shall be butted snugly. The insulation shall be cut to fit angles, corners or irregular spaces. Adjoining pieces of insulation shall be closely butted except at expansion joints.

B. Board Insulation:

1. Between metal furring of masonry or concrete walls:
Cut and place insulation to fit snugly between furring members. Secure insulation in place by means of flanges of metal furring and by metal clips or adhesives as recommended by the manufacturer. Maintain 19-mm minimum air space between insulation and masonry or concrete wall.
2. Concrete Roof Slab:
 - a. Adhesive application: Apply adhesive as recommended by the insulation manufacturer.
 - b. Bituminous Application:
 - (1) Prime concrete surface and allow to dry.
 - (2) Dip back face and adjacent edges of insulation board in hot asphalt and apply to primed surface.
 - c. Abut each piece of insulation against adjoining pieces, except at expansion joints.
 - d. Fit insulation closely around penetrations.
 - e. Stagger vertical joints.

3.03 VAPOR BARRIER

- A. Polyethylene film vapor barrier shall be installed in accordance with the recommendations of the insulation manufacturer. Joints between adjoining widths of vapor barrier shall be sealed with tape.

3.04 CLEAN-UP

- A. Remove Adhesive splatters and smears.
- B. Remove debris from area and leave in clean condition.

END OF SECTION

111 - BUILT-UP BITUMINOUS ROOFING

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	111 - 1
1.02 APPLICABLE CODES AND STANDARDS	111 - 1
1.03 SUBMITTALS	111 - 2
1.04 QUALITY CONTROL	111 - 3
1.05 PRODUCT HANDLING	111 - 3
1.06 JOB CONDITIONS	111 - 3
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	111 - 4
2.02 MATERIALS	111 - 4
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION AND SURFACES	111 - 5
3.02 PREPARATION	111 - 6
3.03 APPLICATION	111 - 6
3.04 WALKWAYS	111 - 9
3.05 FIELD TESTS	111 - 10
3.06 CLEANING	111 - 10
3.07 PROTECTION FROM TRAFFIC	111 - 10
LAST PAGE	111 - 10

111 - BUILT-UP BITUMINOUS ROOFINGS

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and application of a 20-year bondable type, built-up bituminous roofing system applied over concrete decks, cementitious roof decks or rigid insulation as shown on the Contract Drawings. The Contractor shall furnish all labor, materials, tools and equipment necessary to complete the Work.
- B. Related Work Specified Elsewhere:
1. Section 022 CAST-IN-PLACE CONCRETE
 2. Section 105 METAL ROOF DECK
 3. Section 108 ROUGH CARPENTRY

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. ASTM - American Society for Testing and Materials
- C 208 Insulating Board (Cellulosic Fiber), Structural and Decorative, Spec. for.
 - C 578 Preformed, Block-Type Cellular Polystyrene Thermal Insulation, Spec. for.
 - C 591 Rigid Preformed Cellular Urethane Thermal Insulation, Spec. for.
 - D 41 Asphalt Primer Used in Roofing, Damp-proofing, and Waterproofing, Spec. for.
 - D 226 Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing, Spec. for.
 - D 249 Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules, Spec. for.
 - D 312 Asphalt Used in Roofing, Spec. for.
 - D 1863 Mineral Aggregate Used on Built-Up Roofs, Spec. for

- D 2626 Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing, Spec. for.
- D 2822 Asphalt Roof Cement, Spec. for.
- D 2829 Sampling and Analysis of Built-Up Roofs, Spec. for.

B. JIS - Japanese Industrial Standards

- A 6005 Asphalt Roofing Felts (Fibre Base) (Saturated Bitumen Felts)
- A 6006 Asphalt Roofing Felts (Fibre Base) (Self-finished Bitumen Felts)
- A 6007 Standard Roofing

1.03 SUBMITTALS

The following shall be submitted to the Engineer for review:

A. Certificates:

1. Submit prior to fabrication, delivery or installation:
 - a. That materials and components furnished conform requirements of the contract specifications.
 - b. That materials furnished are compatible for the deck indicated, each one to the other and to adjacent related work.
 - c. That materials are suitable for the climatic conditions of the Site.

B. Samples, Shop Drawings and Manufacturer's Literature:

Submit prior to fabrication, delivery, or installation:

1. Samples as requested by the PJKA of the following:
 - a. Felt: 300 mm long by width of roll.
 - b. Insulation: Descriptive data.
 - c. Asphalt primer: 1 liter

- d. Asphalt: 2.5 Kg.
 - e. Nails, staples, and fasteners as requested.
2. Latest edition of acceptable roofing system manufacturer's roofing and base flashing specifications with complete installation instructions.
 3. List of materials proposed for use.
 4. Shop Drawings for all flashings and penetration required.

1.04 QUALITY CONTROL

The Contractor shall be responsible for the quality of all materials and workmanship and as such, shall develop and submit a Quality Control Program for review. The program shall cover those items intended for shop inspection, field supervision and tests and the procedures for carrying out same.

1.05 PRODUCT HANDLING

- A. Deliver materials in manufacturers' original, unopened containers and rolls with labels intact and legible.
- B. Deliver materials requiring fire resistance classification to the job site with labels attached and packaged as required by labeling service.
- C. Deliver materials in sufficient quantity to allow continuity of work.
- D. Handle rolled goods so as to prevent damage to edge or ends. Rolled goods shall be stored on end.
- E. Store roofing materials indoors on raised platforms.
- F. Provide continuous protection of materials against wetting and moisture absorption.
- G. Wet materials are not to be used and shall be removed from job site.
- H. Store emulsions at temperatures above 4 degrees.

1.06 JOB CONDITIONS

- A. Environmental Requirements:

1. Apply roofing in dry weather.
- B. Protection:
1. Protect paving and building walls adjacent to hoist and kettles prior to starting work.
 - a. Lap suitable protective material at least 150 mm.
 - b. Secure protective coverings against wind.
 - c. Leave protective covering in place for duration of roofing work.
 2. Restore to original condition or replace work or materials damaged during handling of bitumens and roofing materials.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
 - B. The selected roofing system shall be, to the maximum extent possible, from one manufacturer.
 - C. Listed materials, when part of an acceptable roofing system shall meet the requirements of the material standards as specified.
 - D. The Contractor shall comply with the acceptable roofing system manufacturer's recommendations for component roofing system materials not listed in this specification.
- E. BITUMEN
1. Primer for concrete decks: In accordance with ASTM D 41.
 2. Asphalt:
 - a. Low Slope: In accordance with ASTM D 312, Type II.

b. Steep: In accordance with ASTM D 312 Type III.

F. FELTS

1. Asphalt Saturated Organic Felt, No. 15: In accordance with ASTM D 226, 6.8 Kg., plain.
2. Base Sheet: Asphalt saturated and coated organic felt, in accordance with ASTM D 2626, Type II.
3. Cap Sheet: Asphalt Roll Roofing No. 90, in accordance with ASTM D 249.

G. INSULATION

1. Extruded Polystyrene Board:
2. In accordance with ASTM C 578, Type II, Grade 2.
 - a. Size: As shown on the Contract Drawings.
3. Urethane Board
4. In accordance with ASTM C 591, Type II, Grade 2.
 - a. Size: As shown on the Contract Drawings.

H. CANTS AND EAVE STRIPS

1. Preformed Fiberboard: In accordance with ASTM C 208.
2. Cant Dimensions:
Maximum vertical height above roof plane, 100 mm.
3. Eave Strip: As shown on the Contract Drawings.

I. FASTENERS

Shall be as recommended by the roofing system manufacturer.

PART 3: EXECUTION

3.01 INSPECTION AND SURFACES

- A. Verify that work of other trades which penetrates roof deck or requires men and equipment to traverse roof deck has been completed.
- B. Examine surfaces for inadequate anchorage, foreign material, moisture, and unevenness which would prevent the execution and quality of application of the built-up roofing system as specified.

C. Deck Dryness Test:

1. Test for dryness before applying roofing as follows:

a. Foaming:

- (1) Heat 0.5 liters of specified bitumen to between 178 degrees and 204 degrees.
- (2) Pour on surface to receive roofing felts.
- (3) If bitumen foams, deck is not dry enough to roof.

b. Stripability:

- (1) Cool bitumen poured on deck to ambient temperature.
- (2) Strip from surface.
- (3) If any portion strips clean from deck or insulation, surface is not dry enough to roof.

2. Should rain occur during application re-test for dryness before continuing roof application.

D. Do not proceed with application of built-up roofing system until surface is dry and all defects are corrected by the Contractor

3.02 PREPARATION

Apply Asphalt primer to concrete or cementitious deck surface at rate of 4 liters per 10 sq. meters and allow to dry thoroughly.

3.03 APPLICATION

A. Vapor Barrier:

1. Install on deck prior to installing insulation.
2. Install base sheet as follows:

- a. Coat surface of primed deck with steep asphalt at the rate of 10 Kg. per 10 sq. meters and while hot, embed therein one layer of base sheet. Lap each sheet 100 mm over the preceding sheet. Lap ends 150 mm and seal with steep asphalt.

- b. Broom in each sheet to ensure proper embedment.
3. Turn up on vertical surfaces to height of insulation.

B. Insulation:

1. Install in accordance with the requirements of the manufacturer of the roofing system for amount, method and type of bitumen. Mechanical fasteners are not to be used.
2. Do not rupture vapor barrier during installation of insulation.
3. Install no more insulation at one time than will be protected from wetting or other damage by the elements by installation of roofing membrane on the same day or prior to rain or dew.
4. Stagger joints in each layer when more than one layer is used.
5. Solid mop with hot asphalt between layers when more than one layer is used.
6. Lay with edges in moderate contact but do not force into place.
7. Stagger end joints or tape joints of insulation board.
8. Install temporary water cut-offs at completion of each day's work and remove upon resumption of work.

C. Built-Up Roofing:

1. Install in accordance with accepted roofing manufacturer's specification for a 3-ply roof and as specified below. If the roofing manufacturer's specifications differ significantly from that specified below, the manufacturer's specifications shall be followed, except that specified minimum requirements shall prevail.
2. Maximum bitumen temperature in kettle:
 - a. Asphalt: Types II and III, 246 degrees.
 - b. Discard bitumen heated above specified maximum.
3. Minimum bitumen temperature at time and point of application:

- a. Asphalt: Types II and III, 177 degrees.
 - b. Do not reheat bitumen.
4. Provide thermostatic controls and visible thermometer on kettle and maintain in working order and keep calibrated.
 5. Minimum rate of asphalt application:
 - a. Between layers: 11 Kg. per 10 sq. meters.
 - b. Top coat: 27 Kg. per 10 sq. meters.
 6. Mopping:
 - a. Solid mop heated bitumen under and between felts.
 - b. Provide complete uniform coating. Felt shall not touch felt.
 7. Lay felts parallel to long dimensions of roof.
 8. Broom or press felts into heated bitumen providing tight, smooth laminations without wrinkles, buckles, kinks, or fishmouths.
 9. Maximum brooming-in distance behind felt laying shall be 1.8 meters.
 10. complete application of roofing system without pockets or blisters.
 11. Complete installation of built-up roofing system, including aggregate surfacing up to line of termination of day's work.
- D. Composition Base Flashing:
1. Install in accordance with requirements of roofing system manufacturer.
 2. Install where roofing system abuts vertical surfaces.
 3. Do not extend base flashing more than a nominal 450 mm nor less than a nominal 200 mm above level of roof surface.
 4. Nail base flashing at top edge with hardened nails through metal disc for concrete or with roofing nails through metal discs or with solid cap head for masonry mortar joints or nailing strip.
 5. Install counterflashing immediately or seal top edge of base flashing with a trowel coat of plastic cement.

3.04 FIELD TESTS

A. Number of Tests:

1. Two (2) for the first 925 sq. meters or less plus one (1) for each additional 925 sq. meters or less.
2. Additional samples shall be taken when deficiencies are found.

B. Remove test samples for on-site examination.

1. Size of samples: 100 mm by 900 mm taken perpendicular to long dimension of felts.
2. Examine for compliance with roofing specifications, entrapped moisture, skips in bitumens between layers, and presence of harmful foreign materials.
3. Weigh to determine total amount of bitumen used.
 - a. Minimum weight of interply bitumen: minus 15% of correct weight for area of test sample.
 - b. Weight of felts in accordance with appropriate ASTM as specified in Article 2.04 - FELTS.
4. Comply with ASTM D 2829 for samples removed from site for laboratory testing.

C. Correction of Deficiencies:

1. Inter-ply bitumen below minimum tolerance:
 - a. Determine extent of underweight area.
 - b. Apply additional layer of acceptable felt in solid mopped bed of hot bitumen.
2. Free water or harmful foreign materials present between layers:
 - a. Remove affected area.
 - b. Rebuild roof in clean, dry condition.

D. Repair test cut areas immediately.

1. Replace acceptable test samples after on-site evaluation.

- a. Flood test cut area with hot bitumen.
 - b. Tamp test sample into position.
2. When test sample cannot be used in repair of test cut area:
- a. Flood test cut area with hot bitumen.
 - b. Rebuild test area with cut felts of same type as roof system.
3. Cover repaired area with 3 layers of felt.
- a. Solid mop each layer into place in hot bitumen.
 - b. Overlap test cut area 75 mm on all sides with first layer.
 - c. Lap each succeeding layer 75 mm on all sides over layer below.

3.05 CLEANING

Remove bitumens from surfaces other than those requiring bituminous roof coatings.

3.06 PROTECTION FROM TRAFFIC

- A. All foot and wheel traffic shall be prohibited from all finished roofs.
- B. If access is required to finished roofs at other than established walkways, the Contractor shall place approx. 25-mm thick by 550-mm wide flat boards to protect the finished roof.

END OF SECTION

112 - WOOD DOORS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	112 - 1
1.02 APPLICABLE CODES AND STANDARDS	112 - 1
1.03 SUBMITTALS	112 - 2
1.04 PRODUCT HANDLING	112 - 2
1.05 TOLERANCES	112 - 3
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	112 - 3
2.02 MATERIALS	112 - 3
2.03 FABRICATION	112 - 5
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION	112 - 9
3.02 INSTALLATION	112 - 9
3.03 ADJUSTMENT AND CLEANING	112 - 9
LAST PAGE	112 - 9

112 - WOOD DOORS

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and installation of wood doors and accessories in the location and quantities shown on the Contract Drawings. Wood frames are also included when required by the Door Schedule. The Contractor shall furnish all labor, materials, tools and equipment required to complete the work.
- B. Related Work Specified Elsewhere:
1. Section 116 HOLLOW METAL DOORS AND FRAMES
 2. Section 115 GLAZING
 3. Section 123 PAINTING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. NWMA - National Woodwork Manufacturers Association
- NWMA 1.S.1 Series for Wood Flush Doors
- B. NEMA - National Electrical Manufacturers Association
- LD-3 High-Pressure Decorative Laminates
- C. ANSI - American National Standard Institute
- A135.4 Specification for Basic Hardboard
- D. U.L. - Underwriter's Laboratories, Inc.
- 120 lDO Fire Doors
- E. NFPA - National Fire Protection Association
- NFPA No. 80 Standard for Fire Doors and Windows
- F. JIS - Japanese Industrial Standards

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Copies of complete manufacturer's technical specifications including detailed installation instructions and instructions for installation of hardware.
- B. Shop Drawings indicating the following:
 - 1. Elevations of each door type
 - 2. Door and frame details
 - 3. Typical and special details of construction including lights, louvers and glazing details
 - 4. Label requirements
 - 5. Finish hardware preparation in accordance with hollow metal frame shop drawings and schedule, hardware schedule and templates furnished by the Contractor before doors are fabricated.
- C. Samples:
 - 1. Three 300-mm x 300-mm sections of door showing internal construction and edge detail.
 - 2. Three 300-mm x 300-mm sections of each face material proposed unless included in above samples.
 - 3. Full size samples or a full cross-section as may be required by the Engineer.

1.04 PRODUCT HANDLING

- A. Delivery: Deliver plastic laminated doors in manufacturer's original unopened protective material or container, clearly marked with manufacturer's name, size and door number.
- B. Storage:
 - 1. Stack flat on 3 pieces 500-mm x 100-mm lumber, laid singly 300 mm from each end and one across center.
 - 2. Under bottom door and over top of stack provide plywood or corrugated cardboard to protect door surface. Provide corrugated cardboard between doors when stacked.
 - 3. Store doors in area where there will be no great variations in heat and humidity.

4. Doors shall be protected from direct sunlight.
- C. Handling: Do not drag doors across one another or on the floor.
- 1.05 TOLERANCES
- A. Allowable Tolerance for Fabrication of Doors:
1. Size, Prefit: Plus or minus 1 mm overall dimensions.
 2. Maximum warp: 3 mm in any 1050-mm by 2100-mm section of the door.
 3. Squareness: The length of a diagonal measurement on the face of the door from the upper right corner to the lower left corner shall be within 3 mm of the length of a diagonal from the upper left corner to the lower right corner.
 4. Factory finish thickness: Minimum 0.025 mm, cured.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Except as otherwise specified, all flush wood doors shall meet the requirements of NWMA I.S.I.
- C. Wood Veneer: Quality grade shall be Premium for doors having a stain or natural finish and Sound Grade for doors to be painted.
- D. Species: Shall be natural birch, red birch, white birch, red oak, white oak, walnut or Philippine mahogany (Meranti) and shall be rotary or plain sliced for natural finish and douglas fir or lauan for painted doors.
- E. Laminated Plastic Faces: Minimum thickness of 1.6 mm meeting the requirements of NEMA LD-3.

F. Hardboard Faces: Shall meet or exceed the minimum performance requirements of "tempered, S2S, 3-mm thick hardboard" in accordance with ANSI A 135.4, except that the modulus of rupture shall not be less than 44300 KN/M².

G. Adhesives: All adhesives shall be waterproof, melamine fortified urea type.

H. Core:

1. Solid wood core shall be glued block or stile and rail construction. Core blocks shall be of Douglas Fir, Ponderosa Pine, White Pine or other wood species whose average specific gravity is at least 0.32 and no greater than 0.45 at 12 percent moisture content and their average dimensional stability and average strength properties are at least equal to one of those species listed. The wood blocks shall be of one species in any one core.

2. Particle board Solid Core: Shall be Mat-Formed particle board generally made with Urea-formaldehyde resin binders with a density of 593 Kg/m³ and shall be used for interior application only. The particle board shall have the following strength classifications:

- Modulus of Rupture (min. avg.)	5,735 Kg/cm ²
- Modulus of Elasticity (min. avg.)	10,550 Kg/cm ²
- Internal Bond (min. avg.)	1.40 Kg/cm ²
- Linear Expansion (max. avg.)	0.30 percent
- Screw Holding-Face (min. avg.)	57.0 Kg

3. Mineral Solid Core:

a. Minimum density shall be 256 Kg/m³ and maximum density 448 Kg/m³.

b. Moisture absorption by weight, maximum of 10 percent when core is in equilibrium with 90 percent relative humidity and 21 degrees C.

I. Fire Rated Doors: Shall have a solid mineral core and meet the requirements of Underwriters' Laboratories 120 IDO or other Engineer-approved testing laboratory for the class of fire rating shown on the Door Schedule. Edge bands shall be of kiln-dried hardwood, birch or maple only, treated with a fire retardant.

J. Metal door frames shall be in accordance with Section 116, Hollow Metal Doors and Frames.

K. Wood frames when required by the Door Schedule shall be of the manufacturer's standard material and as detailed on the Contract Drawings.

2.03 FABRICATION

A. Moisture Content: 12 percent maximum at time of fabrication for all wood materials.

B. Solid Core:

1. Glue block core: Core blocks 64 mm maximum width bonded together with end joints staggered in adjacent rows.

a. Bond face panels to core.

b. Stile and rail edge bands, minimum 13 mm width, bonded to core.

2. Stile and Rail Core: Core blocks 64-mm maximum width, bonded together, end joints staggered in adjacent rows.

a. Stile and rail blocks run parallel and in direction of longitudinal dimension of stile and rail.

b. Core blocks run parallel and vertical to door height.

c. Bond edge bands, 13 mm minimum width, to core blocks.

d. Bond face panels to core.

3. Particleboard Core:

a. Stiles 28 mm minimum width when not glued to core and 22 mm minimum width when glued to core.

b. Top and bottom rails, 28 mm minimum width.

4. Mineral Core:

a. Stile and rail, frame 28 mm minimum width, bonded to core.

b. Bond core materials into one rigid full core thickness.

c. Bond face panels to core.

C. Face Panels:

1. Face panels of two or more veneer plies, total minimum thickness 2 mm, before sanding.
2. Bond hardwood veneer to core construction for three-ply stile and rail core construction or to horizontal cross banding for five- or seven-ply construction.

D. Light Openings:

1. Molding and glass stops same hardwood as face veneers.
2. Maximum opening area, except for fire rated doors; including louvers, not over one-half door height or 40 percent of door face area, 125 mm minimum from door edge.

E. Louvers:

1. Cut openings in doors for installation of metal louvers and install wood beads of same hardwood as face veneers.
2. Maximum opening area, except for fire rated doors; including light openings, not over one-half door height or 40 percent of leaf area, installed 125 mm minimum from door edge.

F. Fire Rated Doors:

1. B Label, 1 1/2-hour rated doors shall be solid core construction with side edge bands 13 mm minimum width, top edge band 13 mm minimum width, and bottom edge band 38 mm minimum width.
2. B Label, 1-hour rated and C Label, 3/4-hour rated doors shall be solid core construction with side edge bands 19 mm minimum width, top edge band 13 mm minimum width, and bottom edge band 61 mm minimum width.
3. B Label, 1 1/2-hour rated doors shall have fire retardant treated cross banding.

4. Faces shall be as specified in Paragraph 2.02.C.

5. Vision Panels:

- a. B Label, 1 1/2-hour rating: Total maximum area to be 0.06 m², 300 mm maximum length in single dimension and 125 mm minimum to edge of door for single leaf doors of maximum size 1.2 m by 2.4 m.

- b. B Label, 1-hour rating: Total maximum area to be 0.06 m², 300 mm maximum length in single dimension, 125 mm minimum to edge of door for single-leaf doors of maximum size 1.2 m by 3 m. For pair of doors, 0.06 m² maximum open area per each door, maximum size of pairs 2.4 m by 2.4 m.
 - c. C Label, 3/4-hour rating: Total maximum area to be 0.77 m², 750 mm maximum dimension in width or 1000 mm maximum dimension in height and 125 mm minimum to edge of door from vision panel cut-out.
 - d. 20-minute and 30-minute rated doors (smoke control doors) may have vision panels when so tested in accordance with Underwriters Laboratories or other Engineer-approved testing laboratory requirements for such rating.
 - e. Glass shall be wired glass in accordance with Section 115, GLAZING, and shall be installed only in approved metal frames.
- 6. Metal Louvers, maximum dimension 600 mm by 600 mm, 200 mm minimum distance to bottom of door and 125 mm minimum distance from edge. Louvers in fire rated doors shall have U.L. approved fusible links. Louvers in combination with vision panels or light openings are not permitted in fire rated doors.
 - 7. Provide 0.90 mm thick (approx. 20 gauge) formed metal edge and 1.2 mm thick (approx. 18 gauge) formed stile astragal, attached at 300 mm on center for pairs of doors.
 - 8. Furnish each fire rated door with rating agency metal label indicating fire rating, fastened to hinge stile edge of door.

G. Factory Preparations:

- 1. Prefitting:
 - a. Standard clearance allowances of 3 mm at top, 3 mm at each side and 19 mm from bottom to decorative floor covering.
 - b. Bottom clearance allowance of doors with threshold, 6 mm from bottom of door to top of threshold.
 - c. Clearance of meeting stiles of pairs of doors, width and height, plus or minus 3 mm.

2. Premachining:

- a. Bevel on vertical edges of single door or meeting stiles of pairs of doors shall be 3 mm in 50 mm.
- b. Bevel on hinge side of fire doors shall be 1.6 mm in 50 mm.
- c. Locate hinge mortise as per reviewed shop drawings. Mortise shall be 0.8 mm larger in height and width, then hinge and with sufficient depth to provide a flush surface when installed.
- d. Locate locks mortise from top of door to center line of strike.
- e. Mortise for face plates shall be 0.4 mm larger in width and height and with sufficient depth to provide a flush surface when installed.
- f. Lock Clearances:
 - (1) Mortise integral locks, 1.6 mm overall height and width and 3 mm in depth.
 - (2) Unit, mono, or slot-type locks, 6 mm overall.
 - (3) Bored lock, 1.6 mm clearance for bore diameter for latch bolt.
 - (4) Bored lock, 3 mm clearance for bore diameter for lock case.

H. Prefinishing:

1. All doors with plastic laminated faces shall be factory finished.
2. All other doors shall be thoroughly sanded on all surfaces with 3/0 or 5/0 sandpaper. The grade of sandpaper will depend on the wood species of the veneer. This final sanding shall remove all scuffs, handling marks, and effects of moisture exposure. A sealing coat shall be applied and the doors left ready for final finishing at the jobsite.

PART 3: EXECUTION

3.01 INSPECTION

The Contractor shall verify that door frames are of the type required for each door and that they are installed as required for proper installation of doors. Fire rated doors shall be installed in corresponding labeled fire rated frames.

3.02 INSTALLATION

- A. Doors shall be installed in strict conformance with the door manufacturer's written instructions.
- B. Do not install doors in frames which would hinder the operation of the doors.
- C. Fire Rated Doors:
 - 1. Shall be installed in accordance with NFPA 80 recommendations and only in pressed steel frames.
 - 2. Maximum Clearances:
 - a. 3 mm between door and frame
 - b. 19 mm between door bottom and the floor surface regardless of the existence of a raised sill or threshold.
 - c. 3 mm between doors for pairs of doors.
- D. Install all finish hardware as recommended by the hardware manufacturer.

3.03 ADJUSTMENT AND CLEANING

- A. The Contractor shall replace or rehang doors which are hinge bound and do not swing or operate freely.
- B. The Contractor shall replace refinished doors damaged during handling or installation.
- C. The Contractor shall refinish or replace job finished doors damaged during handling or installation.

END OF SECTION

113 - ALUMINUM WINDOWS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	113 - 1
1.02 APPLICABLE CODES AND STANDARDS	113 - 1
1.03 DESIGN CRITERIA	113 - 2
1.04 SUBMITTALS	113 - 2
1.05 PRODUCT HANDLING	113 - 3
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	113 - 3
2.02 MATERIALS	113 - 3
2.03 ALUMINUM WINDOWS	113 - 3
2.04 SASH	113 - 4
2.05 WEATHERSTRIPPING	113 - 4
2.06 HARDWARE	113 - 4
2.07 FINISHING	113 - 4
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION	113 - 4
3.02 INSTALLATION	113 - 5
3.03 ADJUST AND CLEAN	113 - 5
LAST PAGE	113 - 5

113 - ALUMINUM WINDOWS

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing and installation of aluminum windows and accessories in the locations and quantities shown on the Contract Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the work.

B. Related Work Specified Elsewhere:

1. Section 115 GLAZING
2. Section 129 CAULKING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. ASTM - American Society for Testing and Materials

- E 283 Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors
- E 330 Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads
- E 331 Water Penetration of Exterior Windows, Curtain Walls, and Doors by the Uniform Static Air Pressure Difference

B. AAMA - Architectural Aluminum Manufacturers Association

- 608.1 Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

C. JIS - Japanese Industrial Standards

- A 1513 General Rule for Test Method of Windows and Doors
- A 1514 The Method of Dew Condensation for Windows and Doors

- A 1515 The Method for Wind Resistance of Windows and Doors
- A 4710 Test Method of Total Thermal Resistance for Windows and Doors
- A 4706 Steel and Aluminum Sliding Windows and Doors
- A 4707 Steel and Aluminum Windows (Projected Windows)

1.03 DESIGN CRITERIA

A. Allowable Tolerances:

1. Hollow extrusions: ± 0.25 mm
2. Size tolerances: Dimensions within 1.6 mm

B. Source Quality Control:

1. Air Infiltration Test: Window units when tested in accordance with ASTM E 283 shall have a maximum infiltration of $0.000024 \text{ m}^3/\text{sec.}/\text{m}$ crack length.
2. Water Penetration Test: Window units when tested in accordance with ASTM E 331 shall have no water penetration for 15 minutes when window is subjected to rate of flow of $0.203 \text{ m}^3/\text{sec.}/\text{m}^2$ with a differential pressure across window unit of $0.3059 \text{ Kg}/\text{m}^2$.
3. Wind Load Test: Window units when tested in accordance with ASTM E 330 to a minimum $1.4683 \text{ Kg}/\text{m}^2$ positive and negative load for 10 seconds shall have a maximum deformation of frame or sash member 0.4 percent of span length with no damage to fasteners or hardware.
4. All operable windows shall be designed so that the exterior glazed surfaces can be readily cleaned from the inside.
5. Sliding windows shall be designed so that an accumulation of dust and sand does not impair operation and the tracks can be easily cleaned.
6. All operable windows up to a height of four stories shall be equipped with rust-proof insect screens, removable from the inside.

1.04 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Shop Drawings: Drawings shall include a complete window schedule, elevations of each type of window and anchorage details for each different wall condition. Head, Jamb and Sill details shall be full size.
- B. Samples: Three samples of corner assembly for each type of window showing joints, glazing frames and accessories.
- C. Three copies of technical data showing that the finish proposed is suitable for the environmental condition of the Jobsite.

1.05 PRODUCT HANDLING

- A. Protection: Windows shall be individually wrapped or crated to avoid aluminum to aluminum contact during shipping.
- B. Storage: Windows shall be stored in a vertical position above ground and in a dry area.

PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.
- B. All aluminum windows shall be the product of a manufacturer regularly engaged in the manufacture of aluminum windows. Windows shall be of the type and size indicated on the Drawings. Each window unit shall include subframe, frame, sash, weather-stripping, applicable hardware, anchors and where indicated, mullions. All windows shall be assembled at the factory and suitable for receiving single or double glazing as indicated on the Window Schedule.

2.02 MATERIALS

Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 ALUMINUM WINDOWS

Window members shall be extruded aluminum 6063-T5 alloy. Main frame and sash members shall have a nominal wall thickness of 3 mm. All frames shall be carefully machined and fit to hairline joinery, mechanically fastened in such a manner as to develop the strength of the joined members or heli-arc welded on the unexposed surfaces. Watertight

joints shall be provided at all corners. All screws, fasteners, and accessories shall be non-corrosive materials compatible with aluminum.

2.04 SASH

All sashes shall be carefully machined and fit to hairline joinery mechanically assembled with screws. Sashes shall be equipped with adjustable rollers. Sashes shall be equipped with appropriate glazing stops and ready to receive glazing.

Glazing shall be in accordance with Section 115 Glazing.

2.05 WEATHERSTRIPPING

All window units shall be weatherstripped. Weatherstrip material (plastic, woven, or metallic) must be compatible with aluminum.

2.06 HARDWARE

- A. Horizontal sliding windows shall be provided with a heavy-duty, finger-touch, spring-loaded positive lock latch. The sliding panel shall be equipped with wheel bearing, sintered oilite bronze wheel on a stainless shaft, in a heavy-walled nylon housing. Rollers shall be adjustable.
- B. Other types of windows shall be provided with appropriate hardware such as sweep locks and keepers, hinges, pawl handles, cam handle and strike and pivots. All hardware shall be designed for the function of the window, and provide a positive closure. Hardware shall be aluminum, stainless steel or white bronze as appropriate.

2.07 FINISHING

After fabrication, any fabricating oils, scratches and tool marks shall be removed leaving the surfaces free from discoloration, blemishes and defects. Aluminum surfaces shall first be given a medium matte finish by caustic soda etching or by mechanical methods. Finish coating shall be an electrolytically deposited color anodic finish in accordance with AAMA 608.1. Coating shall be designation A 44 and shall be 0.7 mil (18 microns) or thicker.

PART 3: EXECUTION

3.01 INSPECTION

- A. The Contractor shall assure that window openings conform with dimensions and tolerances shown on the Contract Drawings.
- B. Unsatisfactory conditions shall be corrected by the Contractor prior to installation.

3.02 INSTALLATION

- A. Comply with manufacturer's instructions for installation of units, hardware and other components.
- B. Set units plumb, level, and true to line, without warp or rack of frames or sash.
- C. Anchor frames solidly to surrounding construction to prevent distortion or misalignment.
- D. Apply protective coating to separate aluminum from galvanically incompatible materials.

3.03 ADJUST AND CLEAN

- A. Adjust movable units to operate smoothly and to be weather tight when closed.
- B. Lubricate hardware and moving parts.
- C. Clean aluminum surfaces and remove excess sealants.
- D. Remove debris from work site.
- E. Leave window units in closed position to protect against sand, dust and elements.
- F. Glazed opening shall be marked during construction.

END OF SECTION

114 - FINISH HARDWARE

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	114 - 1
1.02 APPLICABLE CODES AND STANDARDS	114 - 1
1.03 SUBMITTALS	114 - 1
1.04 PRODUCT HANDLING	114 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	114 - 3
2.02 MATERIALS	114 - 3
<u>PART 3: EXECUTION</u>	
3.01 GENERAL	114 - 6
3.02 INSTALLATION	114 - 6
3.03 INSTRUCTIONS AND ADJUSTMENT	114 - 7
3.04 RESPONSIBILITY	114 - 7
LAST PAGE	114 - 7

114 - FINISH HARDWARE

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing and installation of finish hardware in the locations indicated on the Contract Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.

B. Related Work Specified Elsewhere:

1. Section 116 HOLLOW METAL DOORS AND FRAMES
2. Section 112 WOOD DOORS
3. Section 113 ALUMINUM WINDOWS

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted to the Engineer for review and approval in advance of their use.

A. ANSI - American National Standards Institute

- A 156.1- Butts and Hinges
- A 156.2- Locks & Lock Trim
- A 156.3- Exit Devices
- A 156.4- Door Control Closers
- A 156.6- Architectural Door Trim

B. NFPA - National Fire Protection Association

- 80- Standard for Fire Doors and Windows
- 101- Code for Safety to Life from Fire in Buildings and Structures

1.03 SUBMITTALS

A. Certificates of Compliance and Test Reports: Submit for approval concurrently with hardware list, certificates from manufacturer certifying that hardware conforms to requirements specified herein. Accompany certificates with certified copies of reports of tests required in referenced

publications for hardware items specified. Conduct testing either in manufacturer's plant and certify by an independent testing laboratory or in an independent laboratory within 4 years of submittal of reports for approval. Accompany test reports on previously tested hardware with certificates from manufacturer certifying that previously tested hardware is of same type, quality, manufacturer, and make as that proposed for this project. Certificates certifying that proposed hardware items appear in current applicable BHMA directory of certified products may be submitted in lieu of test reports.

- B. Hardware List and Catalog Cuts: Before any builder's hardware is delivered to jobsite, submit for approval a hardware list, in quadruplicate, listing each item of builders' hardware accompanied by manufacturer's catalog cuts for each different item of hardware. Submit hardware list in the following form:

<u>Hardware Item</u>	<u>Reference Publication Type No.</u>	<u>Mfrs. Name and Catalog No.</u>	<u>UL Mark (If fire-rated and listed)</u>	<u>BHMA Finish Designation</u>
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- C. Hardware Schedule: After approval of hardware list and certificates and before hardware is delivered to jobsite, submit for approval a hardware schedule in triplicate. Schedule shall include for each item quantities, manufacturer's catalog numbers, descriptive information and location and hardware set identification, corresponding reference publication type number to manufacturer's catalog number, list of abbreviations, key-control symbols indicating keying system, and UL mark (if fire rated and listed).
- D. Keying System Submission: Before locks are delivered to jobsite, submit complete keying system for approval by the Engineer.

1.04 PRODUCT HANDLING

- A. Delivery and Marking: Deliver items of hardware to jobsite in their original individual containers, complete with necessary appurtenances including screws, keys, and instructions. Mark each individual container with manufacturer's name and catalog number as they appear in hardware schedule.

B. HANDLING AND STORAGE

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, properly marked or labeled so as to be readily identifiable with the permanent

hardware schedule. Care shall be taken to prevent damage of any material during handling. Each change key shall be tagged or otherwise identified with the door for which its cylinder is intended.

PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be procured, when available, from an in-country manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.
- B. All modifications in hardware required by reason of construction characteristics shall be such as to provide the specified operative or functional features.

Hardware, latchsets, and locksets for labeled doors shall conform to Underwriters' Laboratories, Inc., requirements for the label specified. Hardware for application on metal shall be made to standard templates.

All items of hardware performing the same function shall be by the same manufacturer. All locksets of the complex shall be single manufacturer's production and the cylinders shall be interchangeable.

All hardware items in toilets, except butt hinges and door closers, shall be furnished in wrought aluminum equivalent in weight and thickness to same hardware items hereinafter specified to be one of wrought or cast bronze.

Hardware shall have the following standard finishes:

- a. Aluminum satin anodized
- b. Dull Chrome
- c. Steel and Iron as hereinafter specified

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Butt Hinges

All butt hinges shall be stainless steel.

All butt hinges for exterior doors shall be provided with nonremovable stainless steel pins.

Where fire-rated doors and frames are indicated on drawings, butt hinges shall meet Underwriters' Laboratories, Inc., requirements for label to be provided on door.

C. Door Closers

All closers shall be surface type. Closers for outswinging exterior doors shall have parallel arms. Where there is less than 178 mm (7 in.) clearance between a closer-equipped door and intersecting wall when the door is opened 90 degrees, the closer shall also be provided with parallel arms. Closers shall have aluminum lacquer finish. Door closers for fire-rated doors shall meet Underwriters' Laboratories, Inc., requirements for label to be provided on door. Closers shall be provided with hold-open feature. Closers shall be sized as recommended by manufacturer for use intended.

D. Door Pulls on Plates

Door pulls on plates shall be stainless steel or other material approved by PJKA. Grip shall be of stainless steel.

E. Door Silencers

Three silencers shall be provided for each pressed steel frame for single doors, and two silencers for each pressed steel frame for pairs of doors.

F. Door Stops

Door stops of stainless steel shall be supplied wherever an item of hardware on an opened door, or the door itself, might contact a wall or other part of the building construction, including ducts, pipes, and radiators. Where the wall-type stop cannot be used to practical advantage, stainless steel floor stops, as applicable, shall be supplied.

G. Extension Lever Flush Bolts

Extension lever flush bolts shall be steel. The bottom bolt shall be provided with dustproof strike steel. Flush bolts shall be provided for the inactive leaf of all pairs of doors.

H. Dummy Trim

Dummy knobs and trim shall be provided on both sides of inactive leaf of all pairs of doors, except pairs of doors with panic hardware. Dummy knobs and trim shall match locksets on active door leaf.

3. Key Cabinet

Contractor shall furnish a key control system of 150-key capacity. The combination Hook and Label Pockets shall be solidly welded to the cabinet panels. The system shall include printed key-gathering envelopes: Reserve-Pattern Key Tags with self-locking key clip requiring no tools for assembly; Key Receipts and Receipt Holders; and 3-part visible Card Index.

PART 3: EXECUTION

3.01 GENERAL

Unless otherwise specified below, mount hardware units at heights per the recommended locations for Builder's Hardware by BHMA--JIS.

3.02 INSTALLATION

A. Butt Hinges

Butt hinges required on doors shall be installed as follows:

Top hinge 127 mm (5 in.) from jamb rabbet to top edge of barrel.

Bottom hinge 254 mm (10 in.) from bottom edge of barrel to finished floor.

Third hinge centered between top and bottom hinges.

Where fourth hinge is required, space middle hinges equally between top and bottom hinges.

B. Extension Lever Flush Bolts

Extension lever flush bolts shall be installed in the edge of the door and located so that the trip mechanism will be about 1.829 m (6 ft) from the floor for the bottom bolt. Strikes shall be secured with machine screws.

C. Kick Plates

Kick plates shall be installed on the push side of the door.

D. Key Cabinet

Key cabinet shall be mounted on wall where directed by the Engineer. Method of fastening shall be as recommended by the manufacturer of the cabinet for type of wall to receive cabinet.

E. Door Pulls

Door pulls shall be installed so that the middle of the grip will be 1.143 m (45 in.) above the finished floor.

F. Push Plates

Push plates shall be installed so that the center line of the plate will be 1.143 m (45 in.) above the finished floor.

3.03 INSTRUCTIONS AND ADJUSTMENT

After installation of the finish hardware, the Contractor shall instruct the Engineer's personnel in proper adjustment and maintenance of the hardware and finishes during all final adjustments.

Approximately six months after the initial acceptance of hardware in each area, the Contractor, accompanied by the representative of the latch and lock manufacturer, shall return to the project and readjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Engineer's personnel in recommended additions to the maintenance procedures. Clean and lubricate operational items wherever required. Replace hardware items which have deteriorated or failed because of faulty design, materials, or installation of hardware units. Prepare a written report of current and predictable problems of substantial nature in the performance of the hardware.

3.04 RESPONSIBILITY

The approval, review, or inspection, whether general or detailed, by the Engineer of the various items called for in this Specification, shall not relieve the Contractor of the responsibility for performing the work in accordance with this Specification, the drawings, and the Contract Documents.

END OF SECTION

115 - GLAZING

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	115 - 1
1.02 APPLICABLE CODES AND STANDARDS	115 - 1
1.03 SUBMITTALS	115 - 1
1.04 PRODUCT HANDLING	115 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	115 - 2
2.02 MATERIALS	115 - 2
2.03 GLASS	115 - 2
2.04 GLAZING ACCESSORIES	115 - 3
<u>PART 3: EXECUTION</u>	
3.01 PREPARATION	115 - 3
3.02 INSTALLATION	115 - 4
3.03 CLEANING AND PROTECTION	115 - 5
LAST PAGE	115 - 5

115 - GLAZING

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the products, materials, execution and workmanship of the glazing and all associated accessories. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.

B. Related Work Specified Elsewhere:

1. Section 116 HOLLOW METAL DOORS AND FRAMES
2. Section 113 ALUMINUM WINDOWS
3. Section 112 WOOD DOORS

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. ASTM - American Society for Testing and Materials:

- C 162 Definition of Terms Relating to Glass and Glass Products.

B. ANSI - American National Standards Institute:

- Z97.1 Performance Specification and Methods of Test for Safety Glazing Material Used in Buildings.

C. JIS - Japanese Industrial Standards

- R 3201 Sheet Glass
- R 3202 Float and Polished Plate Glass
- R 3203 Figured Glass
- R 3204 Wired Glass
- R 3206 Tempered Glass

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Three samples of each type glass proposed, 300 mm x 300 mm, glazing compounds and sealants and glazing accessories.
- B. Copies of the manufacturer's literature containing technical and installation information.
- C. Certification from the manufacturer stating that all glass delivered to the site is in conformance with the provisions of the specification.
- D. Shop drawings showing sections and details of glass installation at framing members such as head, mullions, transoms, jambs and sills.

1.04 PRODUCT HANDLING

- A. Glass: Glass shall be securely and safely crated for delivery, handling and storage. Cushions shall be provided at edges of glass to prevent damage. Glass faces shall be protected from scratches and abrasions. Glass shall be stored in a dry, well-ventilated location, carefully protected at all times from soiling, atmospheric condensation and other moisture. Damaged or defective glass shall be replaced with new glass at no additional cost. Each piece of glass shall be delivered with factory labels intact, indicating glass type, quality and thickness. Labels shall not be removed until installation has been accepted.
- B. Glazing materials: Sealing materials shall be delivered in manufacturer's unopened containers, fully identified with trade name, color, size, hardness, type, class and grade. Store all glazing and sealing materials where they will be free from damage and in strict accordance with the manufacturer's recommendations.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 GLASS

- A. All glass shall bear the label of its manufacturer and shall conform in all respects with the requirements of this specification and the following:

1. Float glass, window or sheet and heat absorbing glass shall conform to the requirements of DD-G-451C, 297.1 and JIS R 3202 and shall be of glazing quality.
 2. Safety tempered glass shall meet the requirements of DD-G-1403B, 16CFR 1201-I, II, 297.1 and JIS R 3206.
 3. Wired glass shall be polished both sides with diamond pattern stainless steel wire mesh and shall meet the requirements of JIS R 3204.
- B. Glass thickness shall be as recommended by the manufacturer for the intended use and location on the building. Panel sizes shall be as shown on the Contract Drawings.

2.04 GLAZING ACCESSORIES

- A. Glazing gaskets: Glazing gasket channels and beads of flexible vinyl or neoprene for all glass to be framed in aluminum shall be the standard products furnished by the door or window manufacturers to fit their frames and the glass thickness detailed.
- B. Setting Blocks: Setting blocks shall be neoprene or EPDM with a Shore 'A' (or equivalent scale) hardness of 80-90 durometer. Setting blocks shall be 1.6 mm less than full rabbet width and high enough to provide minimum edge clearance for glass.
- C. Tapes: Tapes shall be dense Neoprene gasket with a Shore A durometer hardness of 65-75 as required for specific glazing.
- D. Glazing Compounds: Glazing compound shall be as recommended by the glass manufacturer for the intended application. In no case shall glazing be performed with any oleo-resinous or oil-base compounds, nor shall any glazing sealant be diluted or thinned with any solvent.

PART 3: EXECUTION

3.01 PREPARATION

- A. Glass sizes shall be determined from actual field measurements of frames to receive glass. Make proper allowances for expansion, contraction and movement and provide for proper bedding and bite.
- B. Identify glass furnished by type when it is delivered to Premises.
- C. Examine all surfaces to receive the parts of the work specified herein. Application or installation of materials shall constitute acceptance of the related construction.

- D. Review of the glazing procedure and schedule, including the method of delivering and handling glass, applying glazing materials, installing gaskets and removable stops, shall be the responsibility of the Contractor.

3.02 INSTALLATION

- A. Employ glaziers who have had previous experience with the materials and systems being applied. Use tools and equipment recommended by the glass manufacturer.
- B. Measure all openings and cut glass accurately to fit each opening with minimum edge clearances. If glass is to be cut to size at project site deliver each piece to project at least 50 mm larger (in both dimensions) than required, so as to facilitate the cutting of clean-cut edges without the necessity of seaming or nipping. Tempered glass shall not be seamed, nipped, or abraded at the job site.
- C. Clean glazing stops and rebates to receive glazing materials of all obstructions and deleterious substances which might impair the work. Remove protective coatings which may cause adhesion failure or interfere with bond of sealants. Comply with manufacturer's instructions for final wiping of surface immediately before application of primer and glazing compounds or tapes. Wipe metal surfaces with zylol or toluol.
- D. Prime surfaces to receive glazing compounds in accordance with the manufacturer's recommendations, using recommended primers.
- E. Inspect each piece of glass immediately before installation. Pieces which have significant impact damage at edges, scratches or abrasions of faces, or any other evidence of damage shall not be installed.
- F. Locate setting blocks at the quarter points of sill, but no closer than 152 mm to corners of glass. Use blocks of proper size to support the glass in accordance with manufacturer's recommendations.
- G. Provide spacers for all glass to separate glass from stops, except where continuous gaskets or tape are required. Locate spacers 914 mm on center maximum inside and out, with a minimum of two (2) spacers per edge of glass. Provide thickness equal to sealant or compound thickness shown. Provide required amount for minimum of 9 mm bite on glass at all 4 edges.
- H. Set glass in a manner which produces greatest possible degree of uniformity in appearance. Face all glass, which has dissimilar faces, with matching faces in the same direction. Set all glass with bow (if any) to exterior.

- I. Glazing materials from different sources shall not be used in the same joint system unless the manufacturer of each material has stated in writing that his material is fully compatible with the other material.
- J. Use masking tape or other suitable protection to limit coverage of glazing materials to the surfaces intended for sealants.
- K. Butt or lap ends of sealant tape in accordance with the manufacturer's recommendations.
- L. Tool exposed surfaces of glazing materials to provide a slight wash away from the glass. Install exposed tapes and gaskets with a slight protrusion above stops in the final compressed condition.
- M. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by the manufacturers.
- N. In wired glass installations the wire pattern shall match in line that of adjacent panes.

3.03 CLEANING AND PROTECTION

- A. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Warning markings which may stain glass, glazing material, or frames shall not be applied directly to glass.
- B. Remove and replace glass which is broken, cracked, chipped, or damaged in any way and from any source, including weather, vandalism and accidents during the construction period.
- C. Maintain glass in a reasonably clean condition during construction so that it will not become stained and will not contribute to the deterioration of glazing materials.
- D. Wash and polish glass on both faces, not more than 4 days prior to initial acceptance. Comply with instructions and recommendations of the glass manufacturer and glazing materials manufacturer for cleaning in each case.

END OF SECTION

116 - HOLLOW METAL DOORS AND FRAMES

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	116 - 1
1.02 APPLICABLE CODES AND STANDARDS	116 - 1
1.03 SUBMITTALS	116 - 2
1.04 PRODUCT HANDLING	116 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	116 - 2
2.02 MATERIALS	116 - 3
2.03 PRESSED METAL FRAMES	116 - 3
2.04 HOLLOW METAL DOORS	116 - 5
2.05 HOLLOW METAL TRANSOMS	116 - 6
2.06 DOOR LOUVERS	116 - 7
2.07 HARDWARE PREPARATION	116 - 7
2.08 FIRE RATED UNITS	116 - 7
2.09 SHOP FINISH	116 - 8
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	116 - 8
3.02 SURFACE HARDWARE PREPARATION	116 - 8
LAST PAGE	116 - 8

116 - HOLLOW METAL DOORS AND FRAMES

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing and installation of hollow metal doors and frames, anchors and accessories in the location and quantities shown on the Contract Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the work.

B. Related Work Specified Elsewhere:

1. Section 112 WOOD DOORS
2. Section 115 GLAZING
3. Section 123 PAINTING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. ANSI - American National Standards Institute:

- A 115.1 Specification for Door and Frame Preparation for Mortise Door Locks for 1 3/4 inch doors (43.75 mm)
- A 151.1 Performance Test for Standard Steel Doors, Frames, Anchors, Hinge Reinforcings and Exit Device Reinforcings

B. ASTM - American Society for Testing and Materials:

- E 152 Methods of Fire Tests of Door Assemblies

C. NFPA - National Fire Protection Association

- 80 Standard for Fire Doors and Windows

D. JIS - Japanese Industrial Standards

- A 4702 Steel and Aluminum Doors

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Shop Drawings indicating the following:
1. Elevations of each door and frame type
 2. Profiles and thicknesses of metal
 3. Wall conditions and all anchorages
 4. Typical and special details of construction
 5. Label requirements
 6. Finish hardware location, reinforcing and preparation
 7. Specification for surface preparation and shop priming
 8. All other pertinent and necessary information
- B. Samples: Three 300-mm x 300-mm sections of door showing internal construction, edge detail and reinforcement for butts; three 300-mm x 300-mm "L" sections of frame showing corner detail and two 300-mm lengths of removable stop.

1.04 PRODUCT HANDLING

- A. Deliver, store and handle hollow metal work in a manner to prevent damage and deterioration.
- B. Provide packaging such as cardboard or other containers, separators, banding, spreaders and paper wrappings to protect hollow metal items.
- C. Store doors upright, in a protected dry area, at least 25 mm or more above ground or floor and at least 6 mm between individual pieces.
- D. All doors and frames shall have a metal tag with the door number thereon.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 PRESSED METAL FRAMES

- A. Pressed metal frames, including glazing stops and reinforcement, shall be of various profiles to suit conditions detailed on the Contract Drawings, and shall be constructed of new prime quality, hot-rolled carbon steel. Exterior frames may be fabricated from zinc-coated sheet chemically treated after fabrication for optimum paint adhesion.
- B. Pressed metal shall be of the following minimum thickness and sizes:
1. Exterior pressed metal frames - 1.87 mm (approx. 14 gauge).
 2. Interior pressed metal frames for single leaf openings - 1.5 mm (approx. 16 gauge).
 3. Interior pressed metal frames for double leaf openings - 1.87 mm (approx. 14 gauge).
 4. Frames for labeled openings - in accordance with certifying laboratory or agency requirements.
 5. All pressed metal frames for fixed glass settings adjacent to and in conjunction with door frames, shall be the same thickness as frames.
 6. Frames for independent interior glazed units shall be 1.5 mm (approx. 16 gauge).
 7. Frames indicated on the Contract Drawings to be lead lined shall receive lead linings arranged to provide effective lead insulation between the partition and the door, and equal to that specified for the partition.
 8. Wall anchors - same thickness and material as frame.
 9. Removable glazing beads - 1.2 mm (approx. 18 gauge) for interior and 1.5 mm (approx. 16 gauge) galvanized steel for exterior.
 10. Frame splines - same thickness and material as frames.

11. Hinge reinforcement - 4.76 mm by 40 mm x 250 mm.
 12. Strike reinforcement - 4.76 mm by 40 mm x 100 mm.
 13. Closer and holder reinforcement - 3.4 mm (approx. 10 gauge) by the required length and width.
- C. Frames shall have all construction joints welded full depth and width, or weld equivalent splice plates on unexposed faces of frames. Exposed surfaces of welded joints shall be dressed to produce invisible connections. Reinforcements and stiffeners shall be welded to inside surfaces of frames.
- D. The finished work shall be strong and rigid, neat in appearance and free from warp and buckle. Molded members shall be clean cut, straight and true. Mitres shall be well formed and in true alignment. Fastenings shall be concealed where practicable.
- E. Provide 0.76 mm thick steel plaster guards or motor boxes, welded to the frames at the back of all finish hardware cutouts and reinforcements. To be of same material as frame.
- F. All single door frames shall be punched and provided with three (3) rubber silencers. All double door frames shall be punched to receive two (2) silencers similarly provided. Ship silencers loose for installation after final painting.
- G. Pressed metal frames for labeled doors shall be constructed and anchored in strict accordance with certifying laboratory or agency requirements and bear an applicable label.
- H. Anchors:
1. Adjustable anchors for frames in masonry walls shall be "T"-shaped steel. The frame leg is to be the full width of jamb depth less 3 mm by jamb face width less 3 mm. The stem of the anchor shall be 75 mm wide, corrugated or perforated for mortar bond and extend at least 250 mm into the masonry. Each jamb for openings up to and including 1500 mm high shall be provided with two (2) anchors, and an additional anchor shall be provided on each jamb for each 750 mm of height or fraction thereof.
 2. Frame in concrete walls shall be anchored by means of expansion shields and flat-head machine screws. Screw heads shall be counter-sunk in soffit of jamb. Machine screws shall be 9 mm-diameter by minimum 44-mm long malleable iron or steel expansion shell. Reinforce jamb at each expansion screw location with 4.76 mm thick by 38-mm wide steel fitting into inside of stop and welded to backbends. Anchors to be

located not more than 150 mm from top and bottom of each jamb with intermediate anchors spaced at a maximum of 650 mm on center.

3. Frames set at grade shall be furnished with an angular base anchor of steel at each jamb 38 mm by 38 mm by jamb depth less 3 mm. Jamb leg to be furnished with two (2) holes for power driven attachment to floor.

I. Frame openings to receive glass, decorative panels or insulated hollow metal panels shall be provided with removable channel beads. Beads shall be fastened to frames with Philips oval head self-tapping machine screws, spaced approximately 230 mm on center. Drill and dimple in the factory. Use stainless steel screws for exterior beads. Beads shall be fitted at the factory and delivered attached to frames.

J. All pressed metal frames are to be provided with metal spreaders.

2.04 HOLLOW METAL DOORS

A. Interior hollow metal doors shall be fabricated of 1.2-mm thick (approx. 18 gauge) cold-rolled stretcher-level sheet steel, free from rust, scale, pits and surface defects.

B. Exterior hollow metal doors shall be fabricated of 1.5-mm thick (approx. 16 gauge) zinc-coated bonderized sheet steel.

C. Construction:

1. Doors shall have continuous internal reinforcing channels or Z-shaped members of 1.5-mm thick (approx. 16 gauge) steel, full height of door, spaced not more than 150 mm on center and spot welded to face sheets 75 mm on center.

2. Doors with continuous truss inner core, full height and width, spot welded to face sheets 75 mm on center both vertically and horizontally are also acceptable.

3. Provide 0.6-mm thick (approx. 24 gauge) stile channels and 1.87-mm thick (approx. 14 gauge) horizontal stiffener channels at top and bottom of doors welded to face sheets.

4. All hollow portions of doors shall be filled completely with mineral rock wool or equal.

5. Exposed joints shall be fully welded, filled and ground smooth.

6. Interlocking joints or seams are not approved on faces or edges.

7. Provide single swing doors with not more than 3 mm clearance at jambs and heads and not more than 6 mm clearance at meeting edges of air of doors (3 mm on fire rated doors).
 8. Doors shall have a 3 mm in 50 mm bevel on the strike side.
- D. Construction and core materials of labeled doors shall meet NFPA 80 requirements.
 - E. Exterior doors shall have flush top and bottom caps sealing against water, to be same gauge and material as face sheets.
 - F. Undercut doors a maximum of 19 mm at bottom except toilet compartment doors which shall be undercut a minimum of 30 mm.
 - G. Provide reinforcement for finish hardware as follows:
 1. Reinforcement for butts shall be 4.76 mm thick by 230 mm long and 6 mm narrower than the thickness of the door.
 2. Reinforcing plates for closers, holders, stops and checks shall be 4.76 mm thick by template requirements as to length and width.
 3. Reinforcement for locks and escutcheons shall be box type of 1.87-mm thick (approx. 14 gauge) steel, with spring leaf contracts for lock cases.
 4. Reinforcement for exit devices and mortised or surface applied hardware shall be minimum 2.6 mm thick and by template requirements as to length and width.
 - H. Glazed openings shall be provided with removable 1.2-mm thick (approx. 18 gauge) glazing beads of same material as doors. Construction and installation shall be the same as specified under Pressed Metal Frames.
 - I. Door panels shall be free from buckles, twists or other imperfections. Panels having a buckle exceeding 1.5 mm, as determined by a straight edge applied to the face of the panel, shall not be used.
- 2.05 HOLLOW METAL TRANSOMS
- A. Shall be constructed as detailed on the Contract Drawings.
 - B. Construction of the panels shall be as for Hollow Metal Doors.
 - C. Provide additional reinforcing in pressed metal frames to receive oval head Philips type sheet metal screws.

2.06 DOOR LOUVERS

- A. Provide manufacturer's standard frameless-type, sight-proof (and light-proof where called for) 1.5-mm thick (approx. 16 gauge) steel louvers, of sizes indicated on the Contract Drawings.
- B. Louvers shall have steel channel frames which shall be fully concealed behind face sheets of doors.
- C. There shall be no overlapping of face sheets with louver blades on frames.
- D. Louvers for exterior doors shall be provided with insect screens mounted on the inside and shall include provisions for a sand trap.

2.07 HARDWARE PREPARATION

- A. Hollow metal doors and pressed metal frames shall be prepared at the manufacturer's plant for all hardware in accordance with templates furnished and shall be drilled and tapped to receive hardware as indicated on the hardware templates.
- B. Mortise, reinforce, drill and tap for all mortised and concealed hardware.
- C. Hardware locations shall be as shown on the Shop Drawings and shall conform to standards established by the National Builders Hardware Association, The Steel Door Institute, The National Builders Hardware Manufacturer's Association, and adopted ANSI standards.
- D. Preparation shall conform to ANSI A 115.1 and A 151.1.

2.08 FIRE RATED UNITS

- A. Where specified or indicated, provide fire-rated hollow metal doors and pressed metal frames bearing the appropriate label of a certified testing laboratory or agency.
- B. Ratings shall be "A", "B" or "C" as prescribed and listed with such laboratory or agency.
- C. Ratings shall be tested in accordance with ASTM E 152.
- D. Provide an overlapping metal astragal on pairs of doors except when the doors are equipped with approved rim type exit hardware and provided with a removable mullion.

2.09 SHOP FINISH

- A. Fill door edges with mineral filler to conceal seams.
- B. Chemically treat non-galvanized, non-bonderized metal surfaces with a phosphate compound to assure maximum paint adherence.
- C. Thoroughly clean all metal surfaces of all rust, scale, grease, rough spots and other foreign matter which may prevent proper paint adhesion.
- D. Apply dip or spray coat of rust-inhibitive metallic oxide zinc chromate or synthetic resin primer on all surfaces of frames and on all exposed surfaces of doors and panels. Primer shall be baked-on in accordance with manufacturer's recommendations for developing maximum hardness and resistance to abrasion.
- E. Labeled doors and panels shall be primed on interior surfaces as per certifying laboratory or agency requirements.
- F. Primed surfaces shall be smooth and suitable to receive the finish coats.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Install frames level, plumb and square with anchors and inserts accurately located. Use only metal shims to level frames.
- B. Metal spreaders on frames to be set in concrete are to remain in place. Metal spreaders on frames set at finish floor level are not to be removed until frames are securely anchored in place with permanent anchors.
- C. The Contractor shall furnish and install steel channel reinforcement from floor to slab above when double leaf doors exceed 2.0 m in width on gypsum wallboard or metal stud and plaster walls. The Contractor shall furnish and install the required reinforcing angles to support lead lined frames.
- D. Install doors in a manner to achieve the intended functional operation and appearance.

3.02 SURFACE HARDWARE PREPARATION

Do all drilling and tapping of doors and frames as required for surface applied hardware.

END OF SECTION

117 - METAL LOUVERS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	117 - 1
1.02 RELATED WORK SPECIFIED ELSEWHERE	117 - 1
1.03 APPLICABLE CODES AND STANDARDS	117 - 1
1.04 DESIGN CRITERIA	117 - 1
1.05 SUBMITTALS	117 - 2
1.06 PRODUCT HANDLING	117 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	117 - 2
2.02 MATERIALS	117 - 2
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	117 - 3
3.02 CLEANING AND PROTECTION	117 - 3
LAST PAGE	117 - 3

117 - METAL LOUVERS

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and installation of metal louvers and accessories in the locations and quantities shown on the Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 129 Caulking

1.03 APPLICABLE CODES AND STANDARDS

- A. ASTM - American Society for Testing and Materials
- E 330 Structural Performance of Exterior Windows, Louvers, Curtain Walls, and Doors Under the Influence of Wind Loads
- B. AAMA - Architectural Aluminum and Galvanized Steel Manufacturers Association
- 608.1 Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum

1.04 DESIGN CRITERIA

A. Allowable Tolerances:

1. Hollow extrusions: ± 0.25 mm
2. Size tolerances: Dimensions within 1.6 mm

B. Source Quality Control:

1. Wind Load Test: Louver units when tested in accordance with ASTM E 330 to a minimum 0.147 Kg/cm^2 positive and negative load for 10 seconds shall have a maximum deformation of frame or sash member $4/10\%$ of span length with no damage to fasteners or hardware.
2. All removable and fixed louvers shall be designed so that the exterior surfaces can be readily cleaned from the inside.
3. All removable and fixed louvers shall be equipped with rust-proof insect screens, removable from the inside.

1.05 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Shop Drawings: Drawings shall include a complete louver schedule, elevations of each type of louver and anchorage details for each different wall condition. Head, Jamb and Sill details shall be full size.
- B. Samples: Three samples of corner assembly for each type of louver showing joints, frames and accessories.
- C. Three copies of technical data showing that the finish proposed is suitable for the environmental conditions of the Jobsite.

1.06 PRODUCT HANDLING

- A. Protection: Louvers shall be individually wrapped or crated to avoid contact during shipping.
- B. Storage: Louvers shall be stored in a vertical position above ground and in a dry area.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Galvanized metal louvers shall be the product of a manufacturer regularly engaged in the manufacturing of louvers. Whenever substitute products are to be considered, supporting technical literature, samples, drawings and/or catalog cuts must be submitted in order to make a valid comparison of the products involved.
- C. Louvers shall be stationary louvers. Depth of louvers shall be 100 mm. Blades shall be set on 45 degree slope, spaced 100 mm on center, with 19-mm leg top and bottom. Each blade shall have center baffle and return band for weather protection. Louvers shall be fabricated throughout with 16-gauge galvanized steel.

- D. Equip louvers with 18 by 14 mesh bronze insect screen mounted in folded U-type frame and attached to exterior face of louvers with sheet metal screws.
- E. Louvers shall be bonderized, followed by baked-on epoxy primer and a final finish of two coats high grade alkyd area enamel baked on at 250 degrees F. for 1/2 hour in color selected by the Engineer from manufacturer's color chart.
- F. Louvers shall be designed and constructed to fit into openings in concrete or masonry at locations where shown on the Drawings.

PART 3: EXECUTION

3.01 INSTALLATION

- A. All louvers shall be installed in accordance with the manufacturer's approved shop drawings. All necessary fastenings and closures shall be provided to make a complete installation.

3.02 CLEANING AND PROTECTION

- A. Upon completion of the louver installation, all louvers shall be clean of all dirt and grime and any excess caulking material.

END OF SECTION

118 - LATH AND PLASTER

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	118 - 1
1.02 APPLICABLE CODES AND STANDARDS	118 - 1
1.03 SUBMITTALS	118 - 2
1.04 PRODUCT HANDLING	118 - 2
1.05 ENVIRONMENTAL CONDITIONS	118 - 2
1.06 PROTECTION	118 - 3
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	118 - 3
2.02 MATERIALS	118 - 3
2.03 FURRING AND LATHING	118 - 3
2.04 PLASTERING MATERIALS	118 - 4
2.05 OTHER MATERIALS	118 - 5
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION	118 - 5
3.02 INSTALLATION	118 - 5
LAST PAGE	118 - 9

118 - LATH AND PLASTER

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and installation of all internal and external cement plaster, metal lath, and accessories. The Contractor shall furnish all labor, materials, tools and equipment necessary to complete the Work as indicated on the Drawings.
- B. Related Work Specified Elsewhere:
1. Section 129 CAULKING
 2. Section 127 GYPSUM WALLBOARD SYSTEMS
 3. Section 119 CERAMIC WALL TILE
 4. Section 123 PAINTING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. ASTM - American Society for Testing and Materials
- C 150 Specification for Portland Cement
 - C 35 Specification for Inorganic Aggregates for Use in Gypsum Plaster
 - C 206 Specification for Finishing Hydrated Lime
- B. ANSI - American National Standards Institute
- A42.4 Specification for Interior Lathing and Furring.
- C. JIS - Japanese Industrial Standards
- R 5210 Portland Cement

- R 5504 Wire Laths
- R 5505 Metal Lath
- A 6902 Plastering Lime
- A 6903 Dolomite Plaster
- A 6904 Gypsum Plaster

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Manufacturer's specifications and installation instructions for each plaster accessory required.
- C. If requested, two finished samples of plaster on lath measuring 300 mm x 300 mm

1.04 PRODUCT HANDLING

- A. Deliver, handle and store all materials in such a manner as to prevent damage, store above ground and in a dry place.
- B. Portland cement, lime and sand, if bag, shall be delivered in their original sealed bags. Each bag shall bear the name of the manufacturer, type of cement, lime or sand (aggregate), minimum weight and approximate volume.
- C. Accessories shall be bundled or delivered in their original containers bearing the name of the manufacturer and item identification.

1.05 ENVIRONMENTAL CONDITIONS

- A. All plaster work shall be done with the air temperature between 13 degrees C and 35 degrees C. Temperature shall be maintained in a uniform range above 13 degrees C for an adequate period prior to application of plaster, while plastering is being done, and until plaster is dry.
- B. In cold weather, heat shall be provided by the Contractor and shall be well distributed in all areas, with deflection or protective screens used to prevent concentrated or irregular heat on plaster areas near heat source.
- C. In hot weather, no plastering shall be done when the temperature is above 35 degrees C unless the Contractor provides cooling to maintain a uniform temperature below 35 degrees C.

- D. Ventilation shall be provided to properly dry plaster during and subsequent to its application.
- E. If glazed sashes are not in place and the building is subject to hot dry winds or temperature differentials from day to night of 11 degrees C or more, openings shall be screened with cheese cloth or similar materials. Set-retarding agents may be used if recommended by the plaster manufacturer. The use of the retarding agents is subject to review by the PJKA.

1.06 PROTECTION

Finished door and window frames and other surfaces which do not receive a plaster finish shall be protected during plaster application.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 FURRING AND LATHING

- A. Furring Materials: Rolled steel channels, minimum weight per 300 meters of not less than 135 kg for 19 mm size and 215 kg 40 mm, all galvanized.
- B. Hat-Sections: Rolled steel furring channels 22 mm deep, galvanized.
- C. Attachments and Fasteners:
 - 1. Hangers: Galvanized wire, rod or rigid steel of the type and minimum size required to comply with the requirements of ANSI A42.4 for the maximum areas to be supported.
 - 2. Wire Ties: Soft annealed galvanized steel wire, not less than 1.5 mm (16 gauge) for tying furring channels to runner channels and not less than 1.2 mm (18 gauge) for other ties.

3. Clips: Galvanized steel wire or sheet metal devices designed for attachment of furring members to supports or to each other.

D. Metal Lath:

1. Metal lath for Exterior Stucco Walls: Self-furring lath for exterior Portland cement plaster with staggered indentations horizontally and vertically to hold the body of the lath not less than 6 mm away from base material, galvanized.
2. Metal lath for Plaster and Stucco Soffits and Ceilings: Expanded herringbone mesh pattern with 9.5-mm V-shaped ribs running lengthwise at 110-mm intervals, galvanized.
2. Metal Lath for Interior Plaster vertical Furring: Expanded diamond mesh pattern, galvanized.

E. Plaster Accessories:

1. Corner Beads: Not less than 0.45 mm (26 gauge), galvanized steel for interior use and zinc coated for exterior use, formed with a bead not exceeding 5 mm radius, with 50-mm wide expanded flanges.
2. Casing Beads: Not less than 0.6 mm (24 gauge), galvanized steel for interior use and zinc coated for exterior use. Minimum 50-mm wide expanded flanges.
3. Expansion Control Joints: Galvanized, bellows type with expansion flanges. In soffits use vent type control joints.

2.04 PLASTERING MATERIALS

- A. Cement: Portland cement shall conform to ASTM C 150, Type I.
- B. Aggregate: Natural or manufactured sand conforming to the requirements of ASTM C 35.
- C. Lime: Shall be hydrated finishing lime conforming to the requirements of ASTM C 206, Type S. Lime shall not be used on exterior plaster.
- D. Water: Shall be potable, clean and free from deleterious amounts of oils, salts, alkali, organic matter and other harmful materials.

2.05 OTHER MATERIALS

Other materials such as wall and ceiling access panels in plaster shall be furnished and installed as indicated on the Drawings.

PART 3: EXECUTION

3.01 INSPECTION

- A. Prior to all plaster work, carefully inspect the installed work of all other sections and verify that all such work is complete to the point where plastering may properly commence.
- B. Verify that lath and plaster may be installed in accordance with the reference codes and standards and the design requirements.
- C. Do not install plaster work over any work, including mechanical and electrical which require inspection, until such inspections have been made and all work is certified to be complete.
- D. Ensure that all required and necessary insulation has been installed to building surfaces, pipes and other items.
- E. Examine construction, grounds, and accessories to insure that finished plaster surfaces will be true to line, level, and plumb, without requiring additional thickness of plaster. Maximum variation of surface to receive plaster shall be 6 mm in 1.2 m from the required plane when measured with a straight edge.

3.02 INSTALLATION

- A. Plaster Mixes: Accurately measure ingredients and proportion successive batches alike in strict conformance with manufacturer's recommendations for the type of plaster being used.
- B. Installation of Suspended Furring Systems;
 - 1. Provide complete suspension systems using components of the sizes and located at the spacings required by ANSI A 42.4.
 - 2. Suspend hangers from building structure above only.
 - 3. Secure to concrete by wire-tying to cast-in-place hangers which have been installed prior to placing of concrete. Advise concrete installer of specific requirements for placement of wire hangers or inserts.

4. Isolate furring from abutting structure, as required to avoid transfer of loads and deflections into the furring system.
5. Alter spacing, splay hangers to avoid obstructions. Offset horizontal forces of splayed hangers by counter-splaying.
6. At control or expansion joints, provide extra hangers as required to support discontinuous runners.
7. Locate cross-furring perpendicular to main runners and not more than 50 mm from parallel walls.
8. At control or expansion joints, provide discontinuous lap in main runners occurring over joints. Do not bridge joints with cross-furring where joints run perpendicular to furring. Where joints run parallel to furring, provide furring to support each side of joint.
9. Expansion or Control Joint Spacing: Install where shown or as required to control surface cracks.
10. Suspension Systems for Metal Lath Applications: Where 40-mm cold-rolled steel channels are used for carrying channels (main runners), provide not lighter than 2.0-mm (8-gauge) wire hangers. Space hangers and main hangers so that each hanger supports not more than 1.0 square meter of ceiling area. If other runners and hangers are used, comply with the applicable requirements of ANSI A42.4 for sizes and spacing of components used in the work, unless otherwise shown. Space 19-mm channel cross-furring not to exceed the maximum span requirements of ANSI A42.4 for the type and weight of metal lath to be supported in the work.

C. Installation of Metal Lath:

1. Use metal lath of the type and weight required to comply with the maximum support spacing requirements of ANSI A42.4 for the various applications required in the work. Provide intermediate metal furring supports to reduce distance between supports to maximum permissible spans, if required.
2. Attach lath to supports in accordance with the requirements of ANSI A42.4 for the kinds of supports shown.
3. Do not bridge control or expansion joints with the lath.

4. Metal lath may be attached to metal studs simultaneously with gypsum sheathing.

D. Installation of Accessories:

1. Attach plaster accessories to plaster bases of substrates with galvanized fasteners spaced not more than 200 mm on center. Use not less than 1.2-mm (18 gauge) wire ties for attachment to metal lath.
2. Set beads level, plumb, and true to line with a tolerance of not more than 3 mm in 3 meters from level.
3. At plaster terminations, provide casing beads with integral closure.
4. Install wall and ceiling access panels as shown on the Drawings.

E. Installation of Plaster:

1. Prepare surfaces to receive plaster by cleaning and removing loose material and other deleterious substances which might impair the work and in accordance with the plaster manufacturer's recommendations. Masonry surfaces shall be wet down before plaster is applied. Concrete surfaces shall be plastered with bond plaster.
2. Mechanically mix plaster materials, do not hand mix except where small amounts are needed which require less than one bag of plaster material.
3. Plaster shall consist of three-coat work on lathed surfaces, two-coat work on masonry, and two-coat on exterior work.
4. Plaster flush with metal frames and other built-in metal items or accessories which act as a plaster ground.
5. Grounds and Screeds: Wherever permanent grounds are too far apart to serve as guides for rodding, install plaster screeds and establish true surface of screeds, with rod before screeds are set.
6. Do not use materials which are caked or lumpy, or are contaminated with foreign materials.
7. Size batches for complete use within a maximum of one (1) hour after mixing and to set within a maximum of four (4) hours, except during hot, dry

weather, reduce maximum placing time as required to prevent premature stiffening of plaster. Do not retemper stiffened plaster with additional water.

8. Apply 3-coat plaster over all metal reinforcing, consisting of first (scratch coat), second (Brown coat) and finish coats as further specified. Minimum total thickness shall be 19 mm measured from back of lath.
9. Exterior Application: Shall consist of two-coat work, brown coat and finish coat. Maximum total thickness shall be 16 mm measure from the face of masonry or concrete. Lime shall not be used on exterior plaster.
10. Apply first basecoat with sufficient material and pressure to form full keys through metal reinforcing and to embed reinforcing. After first coat is firm, scratch (score) in one direction only, to provide mechanical bond for second coat.
11. Apply second basecoat with sufficient material and pressure to ensure tight contact with first basecoat. Bring surface to a true, even plane by rodding, and float to a uniformly rough surface. Fill defects and scratches with plaster.
12. Finish Coat Application:
 - a. Apply finish coat to 3 mm nominal thickness to base coat, scratch-in tight and double back to uniform surface and uniform thickness.
 - b. Remove trowel marks and surface imperfections by drawing-up or laying down the surface with light trowel pressure when plaster has stiffened.
 - c. Water trowel to densify and polish the surface.
 - d. For a floated finish, when plaster has stiffened, float with a wood float to produce a surface free from slick spots or other blemishes.

F. Moisture Retention, Curing:

1. Dampen previous plaster coats which have dried out prior to time for applications for next coat.

2. The Contractor is responsible for determining the most effective procedure for curing and time lapse between application of coats based on climatic and job conditions.
- G. Cutting and Patching: Cut, patch, repair and point-up plaster as required or necessary to accommodate other work. Repair cracks and indented surfaces. Point-up surfaces around items which are built into or penetrate plaster surfaces. Repair or replace the work to eliminate blisters buckles, craze cracking, dry out, efflorescence, sweat-outs, and similar imperfections.
- H. The maximum variation of the finished plaster surface, in any direction, shall be 3 mm in 3 m when measured with a 3 m long straight edge placed on any plane surface or edge.

END OF SECTION

119 - CERAMIC WALL TILE

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	119 - 1
1.02 APPLICABLE CODES AND STANDARDS	119 - 1
1.03 SUBMITTALS	119 - 2
1.04 PRODUCT HANDLING	119 - 2
1.05 ENVIRONMENTAL CONDITIONS	119 - 2
1.06 EXTRA WORK	119 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	119 - 3
2.02 MATERIALS	119 - 3
2.03 CERAMIC TILE	119 - 3
2.04 SETTING MATERIALS	119 - 3
2.05 GROUTING MATERIALS	119 - 4
2.06 SEALANTS	119 - 4
2.07 PROTECTIVE MATERIALS	119 - 4
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION OF SURFACES	119 - 4
3.02 INSTALLATION	119 - 5
3.03 CLEANING	119 - 6
3.04 PROTECTION	119 - 6
LAST PAGE	119 - 6

119 - CERAMIC WALL TILE

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing and installation of all ceramic wall tile and related accessories. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.

B. Related Work Specified Elsewhere:

1. Section 118 LATH AND PLASTER
2. Section 124 CERAMIC MOSAIC TILE

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. ANSI - American National Standards Institute:

- A108.1 Installation of Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile, and Paver Tile, with Portland Cement Mortar.
- A108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
- A118.1 Specification for Dry-Set Portland Cement Mortar.
- A118.4 Specification for Latex-Portland Cement Mortar.
- A42.4 Specification for Interior Lathing and Furring.

B. ASTM - American Society for Testing and Materials:

- C 144 Specification for Aggregate for Masonry Mortar.

- C 150 Specification for Portland Cement
- C 206 Specification for Finishing Hydrated Lime
- C 207 Specification for Hydrated Lime for Masonry Purposes.

C. JIS - Japanese Industrial Standards

- R-5210 Portland Cement
- R-5209 Ceramic Tiles

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Three full-size samples of each pattern and color of wall tile proposed. Three full-size samples of each trim and special shapes.
- B. Copies of manufacturer's technical information and installation instructions for all required materials, except bulk materials.

1.04 PRODUCT HANDLING

- A. Deliver all products in the manufacturer's original unopened containers with grade seals unbroken and labels intact.
- B. Store all containers above ground and in a dry place.

1.05 ENVIRONMENTAL CONDITIONS

The Contractor shall provide adequate lighting during the work.

1.06 EXTRA STOCK

The Contractor shall furnish an extra supply of tile equal to 2% of each type and color used in the work. This extra supply is over and above the normal allowance for breakage and waste and is to be furnished to the Engineer at initial acceptance of the work. No separate payment will be made for this extra stock. The tile shall be provided in clean, marked containers.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 CERAMIC TILE

- A. Tile shall be "Standard Grade" cushion edge units. Size shall be 100 mm x 100 mm x 6 mm thick with a glazed finish. Color and pattern shall be as shown on the Finish Schedule.
- B. Trim shall be of size, color, pattern and glaze to match field tile. Internal corners shall be square and external corners shall be bullnose. Wainscot cap shall be bullnose except where glazed tile wall surface is flush with finished wall above. Where tile work projects from jamb, head or sill of openings provide bullnose tile. Base shall be coved.

2.04 SETTING MATERIALS

- A. Portland Cement Mortar:

1. Portland Cement: ASTM C 150, Type 1
2. Sand: ASTM C 144
3. Hydrated lime: ASTM C 206 or ASTM C 207, Type S
4. Water: Clean and Potable
5. Mortar bed reinforcement: Metal lath, flat expanded type, ²ANSI A42.4, galvanized, minimum weight 1.4 Kg/m².
6. Waterproof cleavage membrane; Asphalt-saturated organic felt, 6.8 Kg., plain; coal-tar-saturated organic felt; Reinforced asphalt paper, duplex type or polyethylene sheeting, minimum thickness 0.1 mm.

- B. Dry-set mortar: Conforming to ANSI A118.1.
- C. Latex-Portland cement mortar: Conforming to ANSI A118.4.

2.05 GROUTING MATERIALS

- A. Commercial Portland cement grout: As recommended by the tile manufacturer, color white or pre-mixed color as indicated on the Finish Schedule. Color shall be obtained by the use of inert pigments.
- B. Dry-set grout: As recommended by the tile manufacturer, color white or pre-mixed color as indicated on the Finish Schedule. Color shall be obtained by the use of inert pigments.
- C. Latex-Portland cement grout: Special latex emulsions with grout, replacing, all or part of water according to manufacturer's directions.

2.06 SEALANTS

Sealants for control joints in wall shall be white, fungicidal one-part silicone rubber.

2.07 PROTECTIVE MATERIALS

Neutral liquid celaner or heavy-duty, non-staining construction paper with compatible masking tape.

PART 3: EXECUTION

3.01 INSPECTION OF SURFACES

A. Inspection:

1. Examine surfaces to receive ceramic tile, setting beds and accessories before commencing work for the following:
 - a. Deviations beyond allowable tolerances of surfaces to receive tile.
 - 1) Portland cement mortar method: Maximum variation in vertical surfaces; 8 mm in 2.4 m.
 - 2) Dry-set, latex-Portland and cement mortar: Maximum variation in vertical surfaces; 3.2 mm in 2.4 m.
2. The Contractor shall correct all non-conforming surfaces before proceeding with the work.

B. Conditions of surfaces to receive tile:

1. Surfaces to be firm, dry, clean and free of oily or waxy films.
2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile to be installed prior to proceeding with tile work.

3.02 INSTALLATION

- A. Installation shall be in accordance with TCA Handbook for Ceramic Tile Installation and as stated herein.
- B. Conventional Portland cement mortar (ANSI A 108.1): For use over masonry, wood frame, metal studs, etc.
 1. Apply waterproof membrane over unstable surfaces such as wood, or steel wall framing, gypsum plaster, gypsum block or gypsum wallboard. Membrane to be turned-up a minimum of 150 mm at floor/wall intersection.
 2. Apply self-furring or self-supported metal reinforcing in middle of setting bed.
 3. Expansion joints shall be installed as shown on the Contract Drawings, but not over 4.8 meters on centers in both directions.
 4. Apply setting bed 6 mm to 18 mm thick, consisting 1 part (vol.) portland cement, 4 to 5 parts sand and 1/2 part hydrated type S lime. Setting bed may be applied to scratch or scratch and leveling coats of cement plaster after they have dried for 24 hours, or if the on-float-coat method is used, directly to the reinforcing mesh.
 5. While the setting bed is still plastic, trowel or dust on a 0.75 mm to 1.5 mm thickness of neat cement paste (float method) or apply to back of tile (buttering method), and set tile firmly on bed. Soak glazed wall tile before setting. Determine joint width by strings, pegs, or spacers.
 6. Beat tile into mortar. Cut through setting bed horizontally or vertically every 425 mm to 600 mm.
 7. Grout, clean, and prevent too rapid drying. Damp cure for three days.
- C. Dry-set portland cement mortar (ANSI A 108.5): For use on concrete block, concrete, gypsum wallboard, scratch coat and other sound masonry surfaces.

1. Float mortar over backing, using flat side of trowel, to a minimum thickness of 1.5 mm.
2. Comb mortar with notched trowel 10 minutes prior to tile application.
3. Soaking porous tile is unnecessary but may be done if desired or if conventional portland cement grout is to be used.
4. Press tile into bed, tap and beat into place. Ribbed-back tile will require application of mortar to back of tile to obtain full contact. If mounted tile is used, soak off paper, using as little water as possible, before initial set.
5. Grout and clean. Damp-cure for at least three days.

3.03 CLEANING

- A. Clean tile surface as thoroughly as possible on completion of grouting.
- B. Remove all grout haze, observing both tile and grout manufacturer's recommendations as to use of acid and chemical cleaners.
- C. Rinse tilework thoroughly with clean water before and after chemical cleaners. do not allow acid or chemical solutions to enter floor drains.
- D. Polish surface of tilework with soft cloth.

3.04 PROTECTION

- A. Apply to all clean completed tile walls a protective coat of neutral cleaner solution, 1 part cleaner to 1 part water.
- B. Just before initial acceptance of tilework, rinse protective coat of neutral cleaner from all tile surfaces.

END OF SECTION

120 - SUSPENDED ACOUSTICAL CEILINGS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	120 - 1
1.02 APPLICABLE CODES AND STANDARDS	120 - 1
1.03 DESIGN CRITERIA	120 - 2
1.04 SUBMITTALS	120 - 2
1.05 PRODUCT HANDLING	120 - 3
1.06 ENVIRONMENTAL REQUIREMENTS	120 - 3
1.07 MAINTENANCE MATERIAL	120 - 3
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	120 - 4
2.02 MATERIALS	120 - 4
2.03 SUSPENSION SYSTEMS	120 - 4
2.04 ACOUSTICAL UNITS	120 - 5
<u>PART 3: EXECUTION</u>	
3.01 CONDITION OF SURFACES	120 - 6
3.02 INSTALLATION OF SUSPENDED ACOUSTIC CEILING SYSTEM	120 - 6
3.03 INSTALLATION OF SUSPENDED METAL PAN CEILING SYSTEM	120 - 7
3.04 CLENAING	120 - 8
LAST PAGE	120 - 8

120 - SUSPENDED ACOUSTICAL CEILINGS

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing and installation of all acoustical ceiling panels, suspension system, trim and accessories. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.

B. Related Work Specified Elsewhere:

1. Section 022 CAST-IN-PLACE CONCRETE
2. Section 105 METAL ROOF DECK
3. Section 110 BUILDING INSULATION

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. F.S. - Federal Specifications:

- SS-S-118 Sound Controlling Blocks and Board (Acoustical Tiles and Panels, Prefabricated)

B. ASTM - American Society for Testing and Materials

- E 84 Surface burning Characteristics of Building Materials
- C 635 Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
- C 636 Recommended Practice of Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- E 90 Laboratory measurement of Airborne Sound Transmission Loss of Building Partitions.

- C. JIS - Japanese Industrial Standards
- A 6302 Perforated Asbestos Cement Flat Sheets for Acoustic Use
 - A 6304 Soft Fibreboards for Acoustic Use
 - A 6306 Glass Wool Acoustic Materials
 - A 6307 Dressed Rockwool Boards for Acoustic Use

1.03 DESIGN CRITERIA

A. Tolerances:

1. Deflection: Suspension system components, hangers, and fastening devices supporting light fixtures, ceiling grilles, and acoustical units shall have a maximum deflection 1/360 of the span in accordance with ASTM C 635.
2. Fire Ratings: Acoustical ceiling system shall have a Flame Spread rating of 25 or less when tested in accordance with ASTM E 84.

1.04 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A.
1. Submit three full size samples of each type of acoustical material to illustrate color and range of appearance.
 2. Submit three 300-mm long samples of each suspension system member, moulding, and hanger.
 3. Submit three samples of pads and pad spacers for metalpan and perforated board tiles.
- B. Shop drawings, include the following:
1. Lay-out indication.
 2. Insert and hanger spacing and fastening details.
 3. Splicing method for main and cross runners.
 4. Change in level details.

5. Access door dimensions and locations.
 6. Acoustical unit support at ceiling fixture.
- C. Manufacturer's Literature: Literature indicating the manufacturer's recommendation for installation of suspension system.
- D. Certificates:
1. Furnish certification of fire endurance rating and flame spread index of fire rating organization.
 2. Furnish certification that materials and systems conform to specification requirements.

1.05 PRODUCT HANDLING

- A. Deliver materials in original, unopened protective packaging with manufacturer's labels indicating brand name, pattern, size, thickness and fire rating as applicable, legible and intact.
- B. Store materials in original protective packaging to prevent soiling, physical damage or wetting.
- C. Store cartons containing acoustical panels open at each end to stabilize moisture content and temperature.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Installation of acoustical work shall not begin until all wet work, such as plastering, concrete and terrazzo work, is completely dry. All windows and doors shall be in place and glazed.
- B. Humidity shall be not more than 75% in area where acoustical materials are to be installed, 25 hours before, during and 25 hours after installation. This requirement is for wood fiber and mineral fiber materials.
- C. The Contractor shall maintain a uniform temperature in the range of 12 degree C to 30 degree C prior to and during installation of materials.

1.07 MAINTENANCE MATERIAL

- A. Furnish extra materials equal to 2.5 percent of each type of acoustical material supplied.
- B. Furnish suspension system components in amount sufficient to install extra ceiling units equal to 1 percent of the original area.
- C. No separate payment will be made for extra material furnished in accordance with this sub-section.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 SUSPENSION SYSTEMS:

- A. Type shall be exposed or concealed "T" grid or "Z" spline for acoustical units and metal pan grid for metal pan ceilings. Structural classification shall as a minimum, be intermediate-duty in accordance with ASTM C 635. All components of system shall be from one manufacturer.
- B. Main, Cross, and Concealed Members: Commercial grade rolled steel, minimum thickness of 0.5 mm, prepainted white finish. Web design shall be double. Exposed flange 24 mm width.
- C. Edge molding, minimum 0.5-mm commercial grade rolled steel, channel or angle shaped, with minimum flange width of 24 mm.
- D. Hold Down Clips: Type as supplied by suspension system manufacturer which allow tile removal.
- E. Rough Suspension:
1. Hanger wire: Minimum 12 gauge (2.6 mm), galvanized soft-annealed, mild steel wire.
 2. Hanger rod: 5 mm diameter, threaded rod, for fixture support.
 3. Wire ties: 18 gauge (1.2 mm) galvanized annealed steel wire.
 4. Hanger clips: Pre-fabricated metal clamps for fastening to structure above.
 5. Carrying channels: 16 gauge (1.5 mm), 38 mm, cold rolled steel.

6. Turnbuckles: Type to suit hanger wire or rod.

F. Metal Pan Runner: Minimum 0.5 mm designed for snap-in type metal panel.

2.04 ACOUSTICAL UNITS:

A. Acoustical units shall meet the requirements of FS SS-S-118 as follows:

1. Type I, Cellulose-fiber composition, factory-painted finish, maximum of 25 flame rating, 0.75 or more light reflectance coefficient grade: Class 25, LR grade 1. Color white, fissured pattern, square edge.
2. Type III, Mineral fiber composition factory painted finish, maximum of 25 flame spread rating, 0.75 or more light reflectance coefficient grade: Class 25, LR Grade 1. Color white, fissured pattern, square edge or as indicated on the Contract Drawings.
3. Type IV, Plastic membrane-faced mineral composition, maximum 25 flame spread rating, 0.75 or more light reflectance coefficient grade: Class 25 LR Grade 1. Factory applied white polyester film finish, minimum of 0.04 mm thick, or white embossed polyvinyl chloride film 0.02 mm thick minimum and 0.08 mm thick maximum. Color white, smooth pattern, square edge.
4. Performance: Sound transmission coefficient 35-39 db in accordance with ASTM E 90.

B. Metal Pans:

1. Material shall be 24-gauge (0.6-mm) cold-rolled galvanized steel or 0.6-mm thick aluminum for 300-mm x 300-mm pans and 0.7-mm thick aluminum for 300-mm x 600-mm, 300-mm x 900-mm and 300-mm x 1200-mm pans.
2. Finish shall be white baked enamel finish for steel pan and white baked polyester for aluminum.
3. Pattern shall be regular perforated.
4. Sound absorbing material shall be mineral wool or fiberglass pad or blanket, enclosed in flame proof and dust proof wrapper. Minimum thickness shall be 38 mm and shall have a noise reduction coefficient minimum of 0.75. Pad support shall be galvanized steel wire or aluminum wire.

C. Size of acoustical units shall be as indicated on the Contract Drawings.

PART 3: EXECUTION

3.01 CONDITION OF SURFACES

- A. Examine areas scheduled to receive suspended acoustical units for unevenness, irregularities and dampness that would affect quality and execution of work.
- B. Mark access provisions as to size and location before beginning installation.
- C. Do not install acoustical ceilings over any work, including mechanical and electrical which require inspection, until such inspections have been made and all work is certified to be complete.

3.02 INSTALLATION OF SUSPENDED ACOUSTIC CEILING SYSTEM:

A. General;

Install materials in accordance with manufacturer's printed instructions, and in accordance with ASTM C 636 as applicable to acoustical ceilings.

B. Suspended ceiling installation:

- 1. The ceiling support system shall be laid out according to the reflected ceiling plans and details or according to approved shop drawings, and will be lined and levelled by an instrument or other field-approved device. Use turnbuckles for leveling.
- 2. Suspend ceiling hangers from building structural members only, and only as indicated on the Contract Drawings.
 - a. Secure to structure, including intermediate framing members by attaching to metal clips designed for the type of member involved, or where possible, by looping and wire-tying directly to members.
 - b. Secure to metal decking by wire-tying to hanger clips or slots. If slots are provided in metal decking which also acts as permanent formwork, install hangers before concrete is placed. Securing to metal decking shall be done only if detailed on the structural engineering drawings.
 - c. Space hangers not more than 1.2 meters on center along each member supported directly from hanger, until otherwise shown, and provide a hanger not more than 150 mm from ends of each member.

3. Cope exposed flanges of intersecting members so that flanges faces will be flush (cope flange of member supported by flange of other member).
4. Install edge moldings of the type indicated at edges of each acoustical panel ceiling area, and at locations where edge of tile would otherwise be exposed after completion of the work.
 - a. Secure moldings to building construction by fastening through holes drilled in vertical leg. Space holes not more than 75 mm from each end and not more than 400 mm on center, between end holes. Draw-up fasteners for tight set against vertical surfaces or shims. Provide shims wherever there are irregularities on the wall surface and caulk space between moulding and wall surface wherever shims are used.
 - (1) Masonry and concrete: Fasten with wood or machine screws into lead-shield type anchors drilled into construction.
 - (2) Hollow masonry: Fasten with toggle bolts or similar self-expanding screw anchors.
 - b. Miter corners of moldings accurately to provide hairline joints.
 - c. Level moldings with ceiling suspension system, to a level tolerance of 3 mm in 3.0 meters.
 - d. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise shown on the Contract Drawings.
 - e. Scribe and cut panels for accurate fit at borders and around work which penetrates ceiling.

3.03 INSTALLATION OF SUSPENDED METAL PAN CEILING SYSTEM:

A. General:

Install materials in accordance with manufacturer's printed instructions, and to comply with industry standards applicable to the work.

B. Ceiling systems shall be set true to lines and planes.

C. Carriers:

Carriers shall be spaced as required by the manufacturer for the ceiling design load proposed but not more than 1.2 meters on center and secured to support system at not more than 1500 mm on centers.

D. Additional Support:

Provide additional support to the structure at light fixtures or any other device which transmits weight of more than the maximum load carrying capacity of the main runner member according to ASTM C 635. If the suspension system is not designed to carry the weight of light fixtures, diffusers, fans, etc., they shall be self-supported. The ceiling system shall not support any other work such as ducts, cable trays, etc.

E. Trim:

Provide trim at all edges that butt adjoining surfaces and provide plugs at all open edges.

3.04 CLEANING

A. Clean soiled or discolored unit surfaces after installation.

B. Touch up scratches, abrasions, voids, and other defects in painted surfaces.

C. Remove and replace damaged, or improperly installed units.

END OF SECTION

121 - RESILIENT TILE FLOORING

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	121 - 1
1.02 APPLICABLE CODES AND STANDARDS	121 - 1
1.03 SUBMITTALS	121 - 1
1.04 PRODUCT HANDLING	121 - 2
1.05 ENVIRONMENTAL CONDITIONS	121 - 2
1.06 SPARE FLOOR TILE	121 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	121 - 2
2.02 MATERIALS	121 - 2
2.03 FLOOR COVERING MATERIAL	121 - 2
2.04 APPLICATION MATERIALS	121 - 3
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION OF SURFACES	121 - 3
3.02 PREPARATION	121 - 3
3.03 INSTALLATION	121 - 4
3.04 CLEANING AND PROTECTION	121 - 5
LAST PAGE	121 - 5

121 - RESILIENT TILE FLOORING

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and installation of all resilient tiles flooring and accessories for the areas indicated on the Finish Schedule. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.
- B. Related Work Specified Elsewhere:
- Section 022 CAST-IN-PLACE CONCRETE

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative code and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. U.S. - Underwriters Laboratory:
- Subject 992 Tested Method for Measuring the Flame propagating Characteristics of Flooring and Floor Covering Materials.
- B. NFPA - National Fire Protection Association:
- Standard 258 Test Method for Measuring the Smoke Generated by Solid Materials.
- C. JIS - Japanese Industrial Standards
- A 5705 PVC Floor Tiles

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Three samples of proposed resilient tile flooring, coved base and all accessories. Samples shall be marked with brand, size, gauge and color.
- B. Copies of manufacturer's technical information and installation instructions for all materials required. Include certification and other data as may be required to show compliance with these Specifications.

1.04 PRODUCT HANDLING

- A. Delivery: All flooring materials and adhesives shall be delivered in the manufacturer's original and sealed cartons. Each carton shall bear the date of manufacture.
- B. Storage: All materials shall be stored above ground and in a dry place.

1.05 ENVIRONMENTAL CONDITIONS

- A. Rooms to receive resilient tile flooring shall be at a temperature not lower than 21 degrees C for at least 48 hours previous to, during, and 48 hours after installation or until flooring has become thoroughly bonded to the subfloor.
- B. During cold weather flooring material shall be stored in a warm room, 21 degrees C, for at least 24 hours before installation.

1.06 SPARE FLOOR TILE

The Contractor shall furnish to the PJKA spare floor tile equal to 10% of total tile installed for each color and pattern. This spare supply is over and above the normal allowance for waste and is to be furnished to the PJKA at the initial acceptance of the work. No separate payment will be made for this extra material. Only full and sealed cartons shall be furnished.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 FLOOR COVERING MATERIAL

- A. Vinyl Tile: Tile shall be fabricated of polyvinylchloride with a 300 mm x 300 mm face size by 3 mm thick. Tile furnished shall have a flame-propagation index "FPI" of 4.0 or less when tested in accordance with UL 992 and smoke obscuration with a maximum specific optional density of 450 when tested in accordance with NFPA Standard 258. Color and pattern shall be as listed in the Finish Schedule.

- B. Vinyl Wall Base: Base shall be standard top-set, vinyl complying with FS SS-W-40, Type II with preformed internal and external corner pieces. Height shall be 100 mm and thickness 3 mm.
- C. Resilient Edge Strips: Strips shall be 3 mm thick, homogenous vinyl composition, tapered or bullnose edge, color to match flooring and not less than 25 mm wide.
- D. All tile or base material within a room or space shall be from the same run or lot to control variations in color and texture.

2.04 APPLICATION MATERIALS

- A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
- B. Adhesive: As recommended by tile manufacturer to suit material and substrate conditions.

PART 3: EXECUTION

3.01 INSPECTION OF SURFACES

Examine the areas and conditions under which resilient tile flooring and accessories are to be installed and do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Engineer.

3.02 PREPARATION

- A. Prior to laying tile, broom clean or vacuum surfaces to be covered and inspect subfloor. Oil, grease or other foreign matter shall be removed. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.
- B. Use leveling compound as recommended by tile manufacturer for filling small cracks and depressions in subfloors.
- C. All concrete subfloors shall be tested for alkali content. Cover the areas to be tested with an air-proof mat, similar to rubber, for 24 to 48 hours prior to test, then remove mat and place several drops of a 3% solution of phenolphthalein on the spots to be tested. If drops turn a shade of red, alkali is present.
- D. Neutralize alkali by saturating the surface of the concrete thoroughly with a water solution containing 10% muriatic or acetic acid. Acid solution should penetrate well and be allowed to dry. Do not remove the solution. To check results repeat the above test. If necessary, repeat neutralization.

- E. Perform moisture tests on concrete subfloors with a moisture meter to determine that concrete surfaces are sufficiently cured and the moisture content is within the limits specified by the tile manufacturer.
- F. Apply concrete slab primer, if recommended by tile manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.
- G. Check all material before starting installation for correctness of quantity, color and size. Check the shades of each color in cartons showing different dates of manufacture to assure matching when it is necessary to use tile from different runs. Do not install tile that is defective as to size, color or texture.

3.03 INSTALLATION

- A. Install tile after finishing operations, including painting, have been completed. Moisture content of concrete subfloors, building air temperature and relative humidity must be within limits recommended by tile manufacturer.
- B. Apply tile adhesive in strict compliance with manufacturer's recommendations. Cover only that area which can be covered by flooring material within the recommended working time of the adhesive. Butt flooring material tightly to vertical surfaces, thresholds, nosings and edgings. Scribe around obstructions to produce neat joints, laid tight, even and straight. Extend tile into toe spaces, door reveals and into closets and similar openings.
- C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on sub-floor. Use chalk or other non-permanent marking device.
- D. Install tile on covers for telephone and electrical ducts, and other such items as occur within finished floor areas.
- E. Maintain overall continuity of color and pattern with pieces of tile installed in these covers. Tightly cement edges to perimeter of floor around covers and to covers.
- F. Tightly cement tile to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.
- G. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown on the Contract Drawings.

H. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, or deformed tiles are not acceptable.

I. Accessories:

1. Apply base to walls, columns, pilasters, casework, and other permanent fixtures in rooms or areas where base is required. Install base in as long lengths as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.
2. On masonry surfaces, or other similar irregular surfaces, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
3. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at all unprotected edges of flooring, unless otherwise shown on the Contract Drawings.

3.04 CLEANING AND PROTECTION

- A. Remove any excess adhesive or other surface blemishes as recommended by the tile manufacturer. Damp mop and apply a light coat of floor polish immediately after installation of the floor taking care not to flood the floor. Do not scrub or thoroughly clean until 4 to 5 days after installation to allow adhesive to set properly.
- B. The floor shall be protected with undyed, untreated building paper or traffic controlled as necessary. Immediately prior to initial inspection, clean, wax and buff in accordance with the manufacturer's instructions.

END OF SECTION

122 - CARPETING

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	122 - 1
1.02 APPLICABLE CODES AND STANDARDS	122 - 1
1.03 SUBMITTALS	122 - 1
1.04 PRODUCT HANDLING	122 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	122 - 2
2.03 MATERIALS	122 - 2
2.03 CARPET	122 - 2
2.03 CUSHION	122 - 3
2.04 INSTALLATION MATERIALS	122 - 3
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION	122 - 4
3.02 INSTALLATION	122 - 4
3.03 CLEANING	122 - 5
LAST PAGE	122 - 5

122 - CARPETING

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and installation of all carpeting, carpet cushion when specified, and accessories including adhesives, nailing strips and edge strips, in the locations and quantities shown on the Finish Schedule. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.
- B. Related Work Specified Elsewhere:
1. Section 022 CAST-IN-PLACE CONCRETE
 2. Section 121 RESILIENT TILE FLOORING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. ASTM - American Society for Testing and Materials
- E 84 Surface Burning Characteristics of Building Materials

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Samples:
1. Carpet: Three pieces 450 mm by 675 mm of each type, color and pattern.
 2. Cushion, when required: Three pieces 300 mm by 300 mm.
 3. Tackless Strips and Edge Strips: Three pieces each, 150 mm long.
- B. Shop Drawings: Drawings shall include the following:

1. Dimension of carpeted areas.
 2. Pattern direction
 3. Seam diagram
 4. Location of edge strips.
- C. Manufacturer's literature giving installation instructions, including allowable temperature range and complete maintenance and cleaning instructions.
- D. Test Reports or Certificates from the manufacturer to verify that the carpeting meets the requirements of the specification for fire hazard classification and static control.

1.04 PRODUCT HANDLING

- A. Deliver all carpeting and accessories in manufacturer's original, protective packaging.
- B. Store carpeting and accessories as recommended by the manufacturer, above ground and in a dry place.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 CARPET

- A. Construction shall be either tufted as follows:
 1. Tufted
 - a. Gauge: 3 mm
 - b. Stitches per 25 mm: 8 minimum
 - c. Pile Height: 10.0 mm minimum
 - d. Face Fiber: 80 percent acrylic, 20 percent nylon

- (1) Ply: 3
- (2) Dyeing Method: Manufacturer's standard and dyed from single dye lot.
- e. Face Weight: 1.4 kg per square meter minimum
- f. Backing:
 - (1) Primary: Synthetic
 - (2) Back Coating: Latex, 678 g. per square meter.
 - (3) Secondary: Jute
- g. Total Weight: 2.88 kg. per square meter, approximate.

B. Flame Spread:

All carpeting shall achieve a flame spread rating of Class B when tested in accordance with ASTM E 84. Smoke density shall be 120 or less.

C. Static Electricity Generation:

- 1. The maximum electrostatic charge shall be 3.0 kilovolts at 20 percent relative humidity and 21 degrees C when tested in accordance with AATCC Test Method 134.
- 2. Control fiber may be stainless steel, aluminum, copper or other metal, blended with the carpet fiber.

D. Minimum Width: 4 meters

E. Color and Pattern: Shall be as shown on the Color Schedule and approved by the Engineer.

2.03 CUSHION

Cushion shall be provided only where required and shall be either of the following:

A. Felt

- 1. Thickness: 6 mm, approximate

2.04 INSTALLATION MATERIALS

A. Tackless Nailing Strips (Stretched Carpet Installation Only):

- 1. Exterior grade plywood stripping with angular pins, design to grip and hold stretched carpet from below.

2. Carpet width less than 6 meters, 2 rows of pins, carpet width of 6 meters or more, 3 rows of pins.

PART 3: EXECUTION

3.01 INSPECTION

A. Examination: Examine surfaces scheduled to receive carpeting for:

1. Holes, debris or other defects that will adversely effect the execution and quality of work.
2. Deviations beyond carpet manufacturer's allowable tolerance for carpet substrate.

B. Condition of Surfaces:

1. The Contractor shall correct all unsatisfactory conditions prior to start of work.
2. Do not install carpet over concrete substrate until concrete has cured for a minimum of 30 days.
3. Do not install carpet until masonry, plastering and painting is completed.
4. Install carpet within the allowable temperature range stated by the carpet manufacturer.

3.02 INSTALLATION

A. Carpet With Cushion

1. Stripping:

- a. Install tackless strips at perimeter of rooms, in doorways and openings.
- b. Install stripping with prenailed steel pins or by nailing at 150 mm on center.

2. Cushion

- a. Install cushion in largest possible lengths, using minimum number of sections.
- b. Spot-cement cushion to subfloor to prevent rolling and shifting.
- c. Remove bubbles and slightly stretch cushion.
- d. Lay out cushion seams at right angles to carpet seams so that carpet seams do not occur directly over cushion seams.

3. Carpet

- a. Install carpet in accordance with seam diagram.
- b. Install carpet with pile inclination in one direction only.
- c. Fit carpet neatly into breaks and recesses, against bases, around penetration, under saddles and thresholds and around permanent cabinets and equipment.
- d. Seaming:
 - (1) Sew, tape, or sew and tape seams as directed by carpet manufacturer.
 - (2) Trim seams
 - (3) Coat cut edges with seam adhesive
 - (4) Match carpet pattern at seams.
- e. Stretch carpet drum tight in length and breadth by use of knee kickers and/or power stretchers in accordance with the carpet manufacturer's recommendations.

B. Edge Strips:

Install edge strips, moldings, binder bars and carpet grippers in accordance with manufacturer's written instructions.

3.03 CLEANING

- A. Remove spots and smears of adhesive from carpet immediately with solvent recommended by the carpet manufacturer.
- B. Upon completion, vacuum carpet with a commercial beater bar type vacuum cleaner.
- C. After each area of carpet has been installed, protect from soiling and damage by covering with heavy-duty, non-staining construction paper, taped in place. Just before final acceptance remove protective paper and revacuum the carpet with a commercial beater bar type vacuum cleaner.
- D. Remove all debris from each area.

END OF SECTION

123 - PAINTING

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	123 - 1
1.02 APPLICABLE CODES AND STANDARDS	123 - 1
1.03 SUBMITTALS	123 - 2
1.04 MOCK-UPS	123 - 2
1.05 QUALITY CONTROL	123 - 3
1.06 MAINTENANCE MATERIAL	123 - 3
1.07 PRODUCT HANDLING	123 - 3
1.08 ENVIRONMENTAL CONDITIONS	123 - 3
1.09 PROTECTION	123 - 4
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	123 - 4
2.02 MATERIALS	123 - 5
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION	123 - 6
3.02 SURFACE PREPARATION	123 - 6
3.03 APPLICATION	123 - 7
3.04 MECHANICAL AND ELECTRICAL EQUIPMENT	123 - 8
3.05 INSPECTION BY CONTRACTOR	123 - 8
3.06 REPAIR OF DAMAGE PAINT SYSTEM	123 - 9
3.07 CLEANING	123 - 10
LAST PAGE	123 - 10

123 - PAINTING

PART 1: GENERAL

1.01 DESCRIPTION

- A. **Work Included:** This section covers the surface preparation, field priming and field painting of all wood, plaster, concrete and metal surfaces, (both interior and exterior) as called for in the Finish Schedule. In addition, all surfaces, Scheduled or not, and with materials or systems not specifically listed, shall be coated equal to those of like surfaces or systems of similar service. Piping, tanks, equipment and machinery shall be painted when called for in the Finish Schedule or in their respective Sections of these Specifications. Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.
- B. **Surfaces Not To be Painted:** The following surfaces shall not be painted: Stainless steel, aluminum, bronze, copper, lead, brass, factory pre-finished surfaces and insulated surfaces. In addition surfaces of steel members which are to have concrete cast against them or are to be fully embedded in concrete shall not be painted.
- C. **Shop-Primed Equipment:** Final field painting or touch-up of manufacturer's shop-primed or shop-painted equipment shall not be done until operational testing has been completed and certified.
- D. **Related Work Specified Elsewhere:**

Section 129 CAULKING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. **S.S.P.C. - Steel Structure Painting Council**
- SP 1 Solvent Cleaning
 - SP 3 Power Tool Cleaning
 - SP 6 Commercial Blast Cleaning

- SP 10 Near-White Blast Cleaning
- B. JIS - Japanese Industrial Standards
 - K 5400 Testing Methods for Organic Coating
 - K 5511 Ready Mixed Paints
 - K 5516 Ready Mixed Paint (Synthetic Resin Type)
 - K 5626 Zinc Dust Anticorrosive Paint
 - K 5627 Zinc Chromate Anticorrosive Paint
 - K 5663 Synthetic Resin Emulsion Paints

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Schedule of surfaces to receive paint, type of paint proposed and manufacturer's literature, including instructions for surface preparation, product application and recommended dry film thickness. If requested, the Contractor shall furnish written proof of the suitability for the material he proposes to use, with specific references to the climatic conditions in Indonesia.
- B. Three sets of color charts for all paints shown on the Painting Schedule.

After review of color selection, submit three 300-mm x 300-mm samples of each color. When possible, apply finished on identical type materials to which they will be applied. Identify each sample as to finish, color name and number, sheen name, gloss units and batch number.

- C. Three copies of suppliers' factory Quality Control program containing details of suppliers program for testing, monitoring and reporting to the Engineer, for review on the quality of materials being supplied for use in the Work.
- D. Three copies of the Contractor's on-site Quality Control program outlining the procedures proposed to be used for the execution and testing of the work as required by the Specification.

1.04 MOCK-UPS

In addition to the requirements for submitting color samples, the Contractor shall, prior to proceeding with paint application, provide mock-ups or field samples, of each substrate to be painted. The mock-ups or field samples shall be painted to demonstrate method of

application, finish texture, color and quality of workmanship. The size and location of the mock-ups or field samples shall be determined by the Engineer.

1.05 QUALITY CONTROL

The Contractor shall provide the necessary Quality Control Program to ensure he meets fully his responsibilities and obligations for quality control of surface preparation and application of protective coatings and paint-systems, wherever the execution is performed.

1.06 MAINTENANCE MATERIAL

- A. Upon completion of the work, submit to the PJKA a minimum of 3 one-gallon containers or the equivalent in liters of each type and color of paint used. No separate payment will be made for this material.
- B. Containers shall be unopened, tightly sealed and clearly labelled with type of paint, color and location or locations used.

1.07 PRODUCT HANDLING

- A. Deliver paint materials in sealed original labelled containers, bearing manufacturer's name, type of paint, brand name, color designation, date of manufacture and instructions for mixing and/or thinning.
- B. Provide adequate, enclosed and well-ventilated storage facilities separate from storage of other building materials. Store paint materials at a minimum ambient temperature of 7 degrees C.
- C. Containers of paint or components shall not be opened except for immediate use. Materials older than the manufacturer's recommended or extended shelf life shall not be used and shall be removed from the site.
- D. Take all necessary measures to prevent fire hazards and spontaneous combustions.

1.08 ENVIRONMENTAL CONDITIONS

- A. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless the moisture content of surfaces is below the following maximum:

- 1. Plaster: 12%
- 2. Masonry, concrete, and concrete block: 12%

3. Wood (interior): 15%

4. Wood (exterior): 15%

B. The Contractor shall read and follow carefully the label instructions on each container in regard to minimum and maximum allowable surface temperatures for each specific product prior to application. In general no coating shall be applied when the substrate surface temperature is below 10 degrees C or above 48 degrees C. No painting shall be done above 90% relative humidity. No exterior painting shall be done during conditions of blowing sand.

C. Provide adequate and continuous ventilation during interior application. If required, provide sufficient heating facilities to maintain temperatures above 10 degrees C for 24 hours before, during and 48 hours after application for coatings.

D. provide adequate lighting on surfaces during application.

E. No interior work shall be done until the building is enclosed and weathertight.

1.09 PROTECTION

A. Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection to the satisfaction of the Engineer.

B. Provide sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation areas.

C. Place cotton waste, cloths and materials which may constitute a fire hazard in closed metal containers and remove from site daily.

D. Remove all electrical plates, surface hardware, fittings and fastenings, prior to paint application. These items are to be carefully stored, cleaned and re-installed on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish. Items which it is not practical to remove shall be taped over. Do not use any tape containing chlorides on stainless steel surfaces.

PART 2: PRODUCTS

2.01 GENERAL

A. All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

B. ACCEPTABLE MANUFACTURERS

1. All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.
2. All coating materials (paints) shall be furnished by a manufacturer, regularly engaged in the manufacture of coatings for industrial application. All coatings shall be the manufacturer's best-grade for the intended substrate.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Coating materials are listed herein by generic type (vehicle) for various substrates. All materials proposed will be subject to review and acceptance by the Engineer.
- C. Coating accessory materials such as linseed oil, shellac, turpentine and other materials not specifically indicated herein but required to achieve the finished specified shall be of high quality and of the manufacturer of the coating material.
- D. Coatings shall be ready-mixed, except for field catalyzed coatings. Pigments shall be fully ground maintaining a soft paste consistency, capable of being readily and uniformly dispersed to a complete homogeneous mixture for brush, roller or airless spray application, as recommended by the manufacturer.
- E. Coatings shall have good flowing properties and be capable of drying or curing free of streaks, runs or sags.
- F. Colors, texture and degree of gloss shall be as shown on the Finish Schedule. Tint prime and intermediate coats approximately to the shade of the final coat but with sufficient variation to distinguish them from the preceding coat. Use products of the same manufacturer for succeeding coats. Where red lead primer is used, subsequent coats may be the product of another manufacturer.
- G. If ferrous metals are shop primed, the Contractor shall make every effort to determine the type of primer used. If this is not possible or the primer is not compatible with the proposed finish coat, a barrier coat as recommended by the coating manufacturer may be required prior to application of finish coat.

PART 3: EXECUTION

3.01 INSPECTION

The Contractor shall examine all substrates, adjoining construction and the conditions under which the work will be done. Do not proceed with the work until all unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. General:

1. Prepare surfaces to receive paint; thoroughly clean off substances that may interfere with proper adhesion of paint. Paint dry surfaces only.
2. Fill dents, cracks, hollow places, open joints and other irregularities with a filler suitable for the purpose and, after setting, sand to a smooth finish.
3. Prime surfaces not more than 8 hours after cleaning or as recommended by the coating manufacturer.

B. Metals:

1. Cleaning: Clean bare metal of oil, grease, soil, salts and contaminants by solvent cleaning in accordance with SSPC-SP 1. Remove loose rust and loose mill scale by power tool chipping, descaling, sanding, wire brushing and grinding in accordance with SSPC-SP 3. Surfaces to receive organic zinc rich primers shall have surface preparation in accordance with SSPC-SP 6 or SSPC-SP 10 as recommended by the coating manufacturer.
2. Shop-Primed Ferrous Surfaces: Remove oil, grease, soil, salts and contaminants by solvent cleaning in accordance with SSPC-SP 1. Exercise care to prevent damage to shop coat. Touch-up abraded or marred shop coats with paint used for priming.
3. Galvanized Surfaces: Remove water-soluble dirt and chemicals with water and detergent; solvent-soluble contaminants with solvent. Rinse, allow to dry, then power or hand abrade to remove oxides.

C. Concrete and Masonry:

1. Concrete shall be free from dirt, loose or excess mortar, efflorescence or any film left from incompatible form oils or concrete curing compound. If form oils or incompatible curing compounds are used, the surface shall receive a sweep sandblast. Patch cracks and other blemishes too large to be covered by paint.

2. Masonry shall be free from dirt, loose or excess mortar, efflorescence and thoroughly dry. Patch cracks and other blemishes too large to be covered by block filler.

D. Plaster Work - Gypsum and Keene's

1. Plaster must be hard and dry. Test plaster surfaces with a moisture meter and do not proceed with painting until the moisture content satisfies the recommendation of the respective paint manufacturer.
2. Remove grit, mildew, loose particles and repair surface irregularities before paint is applied. Repair cracks and holes with patching plaster, properly keyed to the existing plaster and sandpaper smooth.
3. Primer plaster surfaces. Spackle imperfections in the plaster that become visible after the prime coat is applied. Make flush with adjoining surface, and spot prime with the prime coat material. If the prime coat does not dry to a uniform sheen over the entire surface, the areas that indicate suction shall be spot primed before applying succeeding coats.

E. Woodwork:

1. Sand smooth and remove loose edges, splinters or splinters and then brush to remove dust. All sanding shall be done with the grain, and never across it.
2. Clean knots, pitch streaks or visible sap spots and treat with knotting sealer. Prime or stain surfaces followed by caulking and filling of nail holes, seams and joints with compounds which match the finish color. Sand surfaces smooth with No. 00 sandpaper and remove dust.
3. Paint fire-retardant treated wood with one coat of moisture resistant sealer immediately after installation.

3.03 APPLICATION

- A. Mixing: Mix materials thoroughly; strain if necessary, before using. Two component products shall be mixed with a power mixer and only in mixing pails placed in suitably sized non-ferrous or oxide resistant metal pans. Do not adulterate ready-mixed materials except in accordance with the manufacturer's printed instructions. Coatings shall be applied by brush, roller or airless spray as recommended by the manufacturer for each specific coating.

B. Application: Apply materials with care, in strict conformance with the manufacturer's recommendations and at a uniform rate that will produce the manufacturer's recommended Wet Film Thickness (W.F.T.) and Dry Film Thickness (D.F.T.) W.F.T. shall be checked periodically with a wet film gauge. Coating shall show no runs, holidays, sag, crawls or other defects. Finish surface shall be uniform in sheen, color and texture.

1. Allow coats to dry thoroughly before succeeding coats are applied; allow a minimum of 24 hours between applications on any one surface unless otherwise specified by the coating materials manufacturer.
2. Sandpaper under coats on interior metal thoroughly and uniformly to provide a smooth, even surface for finish coats.
3. Block filler on concrete block shall be applied by brush, squeegee, trowel or roller being careful to force the material into pores in order to produce a relatively smooth finish.

3.04 MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to the mechanical and electrical sections for painting and finishing requirements and color coding.
- B. Remove grilles, covers, and access panels on mechanical and electrical equipment from location and paint separately.
- C. Top coat primed equipment to color selected in their respective sections of the specifications or on the Finish Schedule.
- D. Prime and paint bare pipes, conduits, boxes, bare ducts, hangers, brackets, collars and supports where indicated on the Finish Schedule.
- E. Remove and replace or mask identification plates, gauges, sight glasses, etc. before applying any paint.
- F. Paint exposed conduits and electrical equipment occurring in finished areas when noted on Finish Schedule. Color and texture to match adjacent surfaces.

3.05 INSPECTION BY CONTRACTOR

The following particular requirements shall be carried out by the Contractor:

- Checking blast cleaned surfaces:

Regular millscale detection tests shall be carried out using the "Copper Sulphate" method of test.

- Checking wet film thickness:

Wet film thickness gauges of an approved type shall be provided for each painter to check the rate of paint application.

- Checking dry film thickness:

The thickness of the built-up dry film after each paint coat applied to steel or other magnetic surfaces shall be measured systematically, with a dry film thickness gauge.

- Holiday detection on steel and iron surfaces:

The Contractor shall use a suitable P/JKA approved methods of detecting pinholes in the coating system after trials on test plates.

The sweep voltage on high-voltage dc equipment shall not exceed half the voltage required to spark through the complete paint system specified.

3.06 REPAIR OF DAMAGED PAINT SYSTEM

- A. Areas of paint on steelwork which have been damaged shall be mechanically wire brushed to clean bare metal and the edges of the undamaged paint smoothed with sandpaper to a gentle bevel.
- B. After the bare metal is exposed, it shall be cleaned to remove all corrosion, by blast cleaning if necessary, and be thoroughly cleaned, free from all salt or oil deposits and completely dry before painting.
- C. The paint system shall then be applied to bring the areas up to the original thickness and standard as the undamaged areas, each coat of new paint over-lapping the existing coat by at least 50 mm.
- D. Areas of paint on which weld spatter, concrete or other adherent matter has fallen shall be cleaned or washed free of the adherent material immediately and any repair or making good of the affected surface to its original standard shall be carried out before the area is over-coated with paint.
- E. Where epoxy coatings are damaged, suitable repair material supplied by the manufacturer of the original coating shall be applied in accordance with the manufacturer's instructions.
- F. All paint applied in repairing damaged paintwork shall be on fully prepared and thoroughly clean and dry surfaces.

3.07 CLEANING

- A. As work proceeds and upon completion, promptly remove paint where spilled, splashed or spattered.
- B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.
- C. Upon completion of work, leave premises neat and clean, to the satisfaction of the Engineer.

END OF SECTIION

124 - CERAMIC MOSAIC TILE

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	124 - 1
1.02 APPLICABLE CODES AND STANDARDS	124 - 1
1.03 SUBMITTALS	124 - 2
1.04 PRODUCT HANDLING	124 - 2
1.05 ENVIRONMENTAL CONDITIONS	124 - 2
1.06 EXTRA WORK	124 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	124 - 3
2.02 MATERIALS	124 - 3
2.03 CERAMIC MOSAIC TILE	124 - 3
2.04 SETTING MATERIALS	124 - 3
2.05 GROUTING MATERIALS	124 - 4
2.06 SEALANTS	124 - 4
2.07 PROTECTIVE MATERIALS	124 - 4
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION OF SURFACES	124 - 4
3.02 INSTALLATION	124 - 5
3.03 CELANING	124 - 6
3.04 PROTECTION FROM CONSTRUCTION DIRT	124 - 7
3.05 PROTECTION FROM TRAFFIC	124 - 7
LAST PAGE	124 - 7

124 - CERAMIC MOSAIC TILE

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing and installation of all ceramic mosaic tile and related accessories. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.

B. Related Work Specified Elsewhere:

1. Section 118 LATH AND PLASTER
2. Section 119 CERAMIC WALL TILE

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. ANSI - American National Standards Institute:

- A108.1 Installation of Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile, and Paver Tile, with Portland Cement Mortar.
- A108.4 Installation of Ceramic Tile with Water-Resistant Organic Adhesives.
- A108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
- A118.1 Specification for Dry-Set Portland Cement Mortar.
- A136.1 Organic Adhesives for Installation of Ceramic Tile, Type 1 and Type 2.
- A42.4 Specification for Interior Lathing and Furring.

B. ASTM - American Society for Testing and Materials:

- C 144 Specification for Aggregate for Masonry Mortar.

- C 150 Specification for Portland Cement
- C 206 Specification for Finishing Hydrated Lime
- C 207 Specification for Hydrated Lime for Masonry Purposes
- C 171 Specification for Sheet Materials for Curing Concrete

C. JIS - Japanese Industrial Standards

- R 5210 Portland Cement
- R 5209 Ceramic Tiles

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following item for review before commencing work:

- A. Three sample panels approximately 300mm x 300mm of each pattern and color of tile proposed. The samples shall be representative of the complete tile system.
- B. Copies of manufacturer's technical information and installation instructions for all required materials.

1.04 PRODUCT HANDLING

- A. Deliver all products in the manufacturer's original unopened containers with grade seals unbroken and labels legible and intact.
- B. Store all containers above ground and in a dry place.

1.05 ENVIRONMENTAL CONDITIONS

- A. The Contractor shall provide adequate ventilation when using organic grouts.
- B. The Contractor shall provide adequate lighting during the work.

1.06 EXTRA STOCK

The Contractor shall furnish an extra supply of tile equal to 2 percent of each type and color used in the work. This extra supply is over and above the normal allowance for breakage and waste and is to be furnished to the PJKA at initial acceptance of the work. No separate payment will be made for this extra stock. The tile shall be provided in clean, marked containers.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be procured, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 CERAMIC MOSAIC TILE

- A. Tile shall be "Standard Grade" ceramic mosaic with cushion edges. Tile shall be made by the dust-pressed process of natural clay composition and 6 mm to 9 mm thick. Tile for use on floors subject to wetting shall be impervious with water absorption of 0.5 percent or less. Tile for areas not subject to wetting may be vitreous with water absorption of 0.5 to 3 percent. All floor tile shall be non-slip.
- B. Where tile work projects from sill of openings provide bullnose tile. Base shall be coved. Curbs shall have a bullnose and cove for a smooth rounded surface.

2.04 SETTING MATERIALS

A. Portland Cement Mortar:

1. Portland Cement: ASTM C 150, Type 1
2. Sand: ASTM C 144
3. Hydrated lime: ASTM C 206 or ASTM C 207, Type S
4. Water: Clean and Potable
5. Mortar bed reinforcement: Metal lath, flat, expanded type, ANSI A42.4, galvanized, minimum weight 1.4 Kg/m².
6. Waterproof cleavage membrane: Polyethylene sheeting (ASTM C 171), minimum thickness 0.1 mm.

B. Dry-set mortar: Conforming to ANSI A118.1.

C. Organic adhesives: Conforming to ANSI A136.1, Type II.

2.05 GROUTING MATERIALS

A. Commercial Portland cement grout: As recommended by tile manufacturer, white or pre-mixed color. Color shall be obtained by the use of inert pigments.

B. Latex-Portland cement grout: Special latex emulsions with grout, replacing all or part of water according to manufacturer's directions.

2.06 SEALANTS

Sealants for control joints shall be fungicidal one-part silicone rubber. Color shall match color of grout.

2.07 PROTECTIVE MATERIALS

Neutral liquid cleaner or heavy-duty, non-staining construction paper with compatible masking tape.

PART 3: EXECUTION

3.01 INSPECTION OF SURFACES

A. Inspection:

1. Examine surfaces to receive ceramic mosaic tile, setting beds and accessories before commencing work for the following:

a. Variations of surface to be tiled shall fall within the maximum variations shown below:

	Floors
1) Portland Cement Mortar Method	6 mm in 3 m
2) Dry-Set or Latex Portland Cement Mortar	6 mm in 3 m
3) Organic Adhesive	1.5 mm in 0.9 m

2. The Contractor shall correct all non-conforming surfaces before proceeding with the work.

B. Conditions of surfaces to receive tile:

1. Surfaces to be firm, dry, clean and free of oily or waxy films.

2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile to be installed prior to proceeding with tile work.

3.02 INSTALLATION

- A. Layout: Patterns shall be laid out to permit setting of tile with a minimum of cutting. Floors shall be laid out from one side and end, with adjustments made at opposite walls. Dimensions shall be controlled to avoid setting tile smaller than one-half (1/2) size.
- B. Laying Tile: Floor tile shall be installed as shown on the Contract Drawings. For all floor tile areas, straight edges shall be set to the lines established and reset at suitable intervals to keep the joints parallel over the entire area. Tile shall be laid to the straight edges. The tile layout shall eliminate cut tile to the greatest extent possible. Fractional changes in dimensions without varying the uniformity of joint widths will be permitted. Where required, tile shall be cut with a suitable cutting tool and rough edges shall be rubbed smooth. Cut tile misfits shall be replaced with properly cut tile. Tiles that are out of true plane or misplaced shall be removed and reset. Damaged or defective tile shall be replaced.
- C. Conventional Portland cement mortar (ANSI A 108.1): For use over masonry, concrete, etc.
1. Apply waterproof membrane over unstable surfaces such as gypsum plaster, all suspended slabs and all floors with floor drains. Membrane to be turned up a minimum of 150 mm at floor/wall intersection.
 2. Apply self-furring or self-supported metal reinforcing conforming to ANSI A42.4 in middle of setting bed. Metal reinforcing is not required on masonry or concrete surfaces.
 3. Expansion joints shall be installed as shown on the Contract Drawings, but not over 4.8 meters on centers in both directions.
 4. Apply setting bed 6 mm to 18 mm thick, consisting of 1 part (vol.) Portland cement, 4 to 5 parts sand and 1/2 part hydrated type S lime. Setting bed may be applied to scratch or scratch-and-leveling coats of cement plaster after they have dried for 24 hours, or if the on-float-coat method is used, directly to the reinforcing mesh.
 5. While the setting bed is still plastic, trowel or dust on a 0.75 mm to 1.5 mm thickness of neat cement paste (float method) or apply to back of tile (buttering method), and set tile firmly on bed. Determine joint width by strings, pegs, or spacers.
 6. Beat tile into mortar. Cut through setting bed horizontally or vertically every 425 mm to 600 mm.

7. Grout, clean, and prevent too-rapid drying. Damp cure for three days.
- D. Dry-set portland cement mortar (ANSI A 108.5): For use on concrete block, concrete, scratch coat and other sound masonry surfaces.
1. Float mortar over backing, using flat side of trowel, to a minimum thickness of 1.5 mm.
 2. Comb mortar with notched trowel 10 minutes prior to tile application.
 3. Soaking porous tile is unnecessary but may be done if desired or if conventional Portland cement grout is to be used.
 4. Press tile into bed, tap and beat into place. Soak off mounting paper, using as little water as possible, before initial set.
 5. Grout and clean. Damp-cure for at least three days.
- E. Organic Adhesive (ANSI A 108.4): For use over all flat and reasonably smooth non-dusting surfaces such as cement plaster.
1. Apply underlayment recommended by manufacturer, if surface needs leveling.
 2. Apply primer sealing coat to backing material or underlayment when recommended by manufacturer.
 3. Set tile using the float method which consists of spreading adhesive over the backing surface with a special trowel, notched as recommended by the manufacturer and pressing tile into it.
 4. Carefully remove all adhesive from face of tile, using only solvents recommended by adhesive manufacturer.
 5. Grout may be dry-set grout, commercial waterproof grout, flexible grout or non-staining grout.

3.03 CLEANING

- A. Clean tile surface as thoroughly as possible on completion of grouting.
- B. Remove all grout haze, observing both tile and grout manufacturer's recommendations as to use of acid and chemical cleaners.
- C. Rinse tilework thoroughly with clean water before and after chemical cleaners. Do not allow acid or chemical solutions to enter floor drains.

D. Polish surface of tile work with soft cloth.

3.04 PROTECTION FROM CONSTRUCTION DIRT

A. Cover all tile floors with heavy-duty, non-staining construction paper, masked in place.

B. Just before initial acceptance of tilework, remove paper from all tile surfaces.

3.05 PROTECTION FROM TRAFFIC

A. Prohibit all foot and wheel traffic from using newly tiled floors for at least 7 days except as stated in paragraph "B" below.

B. Where use of newly-tiled floors with cement-type grout is unavoidable, use shall be permitted 3 days after the installation, only if minimum of 25-mm thick and 550-mm wide flat boards are placed in walkways and wheelways.

END OF SECTION

125 - QUARRY TILE

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	125 - 1
1.02 APPLICABLE CODES AND STANDARDS	125 - 1
1.03 SUBMITTALS	125 - 2
1.04 PRODUCT HANDLING	125 - 2
1.05 ENVIRONMENTAL CONDITIONS	125 - 2
1.06 EXTRA WORK	125 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	125 - 2
2.02 MATERIALS	125 - 3
2.03 SETTING MATERIALS	125 - 3
2.04 GROUTING MATERIALS	125 - 3
2.05 SEALANTS	125 - 3
2.06 PROTECTIVE MATERIALS	125 - 4
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION OF SURFACES	125- 4
3.02 INSTALLATION	125 - 4
3.03 CLEANING	125 - 6
3.04 PROTECTION FROM CONSTRUCTION DIRT	125 - 6
3.05 PROTECTION FROM TRAFFIC	125 - 6
LAST PAGE	125 - 6

125 - QUARRY TILE

PART 1: GENERAL

1.01 DESCRIPTION

A. Work Included: This section covers the furnishing and installation of all quarry tile and related accessories. The Contractor shall furnish all labor, materials, tools and equipment required to complete the Work.

B. Related Work Specified Elsewhere:

- | | | | |
|----|---------|-----|--------------------------|
| 1. | Section | 102 | MASONRY WORK - GENERAL |
| 2. | Section | 118 | LATH AND PLASTER |
| 3. | Section | 127 | GYPSUM WALLBOARD SYSTEMS |
| 4. | Section | 119 | CERAMIC WALL TILE |
| 5. | Section | 124 | CERAMIC MOSAIC TILE |

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. ANSI - American National Standards Institute:

- | | | |
|---|--------|--|
| - | A108.1 | Installation of Glazed wall Tile, Ceramic Mosaic Tile, Quarry Tile, and Paver Tile, with Portland Cement Mortar. |
| - | A118.1 | Specification for Dry-Set Portland Cement Mortar. |
| - | A42.4 | Specification for Interior Lathing and Furring. |

B. ASTM - American Society for Testing and Materials:

- | | | |
|---|-------|---|
| - | C 144 | Specification for Aggregate for Masonry Mortar. |
| - | C 150 | Specification for Portland Cement. |
| - | C 206 | Specification for Finishing Hydrated Lime. |

- C 207 Specification for Hydrated Lime
for Masonry Purposes.

- C 171 Specification for Sheet Materials
for Curing Concrete

C. JIS - Japanese Industrial Standards

- R 5210 Portland Cement

1.03 SUBMITTALS

The Contractor shall submit the Engineer the following items for review before commencing work:

A. Three full-size samples of each pattern and color of quarry tile proposed. The samples shall be representative of the complete tile system

B. Three copies of manufacturer's technical information and installation instructions for all required materials.

1.04 PRODUCT HANDLING

A. Deliver all products in the manufacturer's original unopened containers with grade seals unbroken and labels legible and intact.

B. Store all containers above ground and in a dry place.

1.05 ENVIRONMENTAL CONDITIONS

A. Temperature shall be a minimum of 10 degrees C during tilework and for 7 days after completion.

B. The Contractor shall provide adequate lighting during the work.

1.06 EXTRA STOCK

The Contractor shall furnish an extra supply of tile equal to 2 percent of each type and color used in the work. This extra supply is over and above the normal allowance for breakage and waste and is to be furnished to the Engineer at the completion of the work. No separate payment will be made for this extra stock. The tile shall be provided in clean, marked containers.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

B. QUARRY TILE

1. Tile shall be "Standard Grade" units Tile. Tile shall be unglazed with non-slip surface for floors and have a water absorption of 0.5 percent or less.
2. Internal corners shall be square and external corners shall be bullnose. Where tile work projects from sill of openings provide bullnose tile. Base shall be coved. Curbs shall have a bullnose and cove for a smooth rounded surface.

2.03 SETTING MATERIALS

A. Portland Cement Mortar:

1. Portland Cement: ASTM C 150, Type 1
2. Sand: ASTM C 144
3. Hydrated lime: ASTM C 206 or ASTM C 207, Type S
4. Water: Clean and Potable
5. Mortar bed reinforcement: Metal lath, flat expanded type, ANSI A42.4, galvanized, minimum weight 1.4 kg/m².
6. Waterproof cleavage membrane: Polyethylene sheeting (ASTM C 171), minimum thickness 0,1 mm.

B. Dry-set mortar: Conforming to ANSI A118.1.

2.04 GROUTING MATERIALS

A. Commercial Portland cement grout: As recommended by the tile manufacturer, white or pre-mixed color. Color shall be obtained by the use of inert pigments.

B. Dry-set grout: As recommended by the tile manufacturer, white or pre-mixed color. Color shall be obtained by the use of inert pigments.

2.05 SEALANTS

Sealants for control joints shall be fungicidal one-part silicone rubber. Color shall match color of grout.

2.06 PROTECTIVE MATERIALS

Neutral liquid cleaner or heavy-duty, non-staining construction paper with compatible masking tape.

PART 3: EXECUTION

3.01 INSPECTION OF SURFACES

A. Inspection:

1. Examine surfaces to receive quarry tile, setting beds and accessories before commencing work for the following:

a. Variations of surface to be tiled shall fall within the maximum variations shown below:

	Floors
1) Dry-Set Mortar	6 mm in 3 m

2. Do not proceed with installation work until unsatisfactory conditions are corrected.

B. Conditions of surfaces to receive tile:

1. Surfaces to be firm, dry, clean and free of oily or waxy films.

2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile to be installed prior to proceeding with tile work.

3.02 INSTALLATION

A. Layout: Patterns shall be laid out to permit setting of tile with a minimum of cutting. Floors shall be laid out from one side and end, with adjustments made at opposite walls. Dimensions shall be controlled to avoid setting tile smaller than one-half (1/2) size.

B. Laying Tile: Floor tile shall be installed as shown on the Drawings. For all floor tile areas, straight edges shall be set to the lines established and reset at suitable intervals to keep the joints parallel over the entire area. Tile shall be laid to the straight edges. The tile layout shall eliminate cut tile to the greatest extent possible. Fractional changes in dimensions without varying the uniformity of joint widths will be permitted. Where required, tile shall be cut with a suitable cutting tool and rough edges shall be rubbed smooth. Cut tile misfits shall be replaced with properly cut tile. Tiles that are out of true plane or misplaced shall be removed and reset. Damaged or defective tile shall be replaced.

- C. Conventional Portland cement mortar (ANSI A 108.1): For use over masonry, concrete wood frame, metal studs, etc.
1. Apply waterproof membrane over unstable surfaces such as gypsum plaster, all suspended slabs and all floors with floor drains. Membrane to be turned-up a minimum of 150 mm at floor/wall intersection.
 2. Apply self-furring or self-supported metal reinforcing conforming to ANSI A42.4, in middle of setting bed. metal reinforcing is not required on masonry or concrete surfaces.
 3. Apply setting bed 6mm to 20mm thick, consisting 1 part (vol.) portland cement, 4 to 5 parts sand and 1/2 part hydrated type S lime. Setting bed may be applied to scratch or scratch and leveling coats of cement plaster after they have dried for 24 hours, or if the on-float-coat method is used, directly to the reinforcing mesh.
 4. While the setting bed is still plastic, trowel or dust on a .75mm to 1.5mm thickness of neat cement paste (float method) or apply to back of tile (buttering method), and set tile firmly on bed. Determine joint width by strings, pegs, or spacers.
 5. Beat tile into mortar. Cut through setting bed horizontally or vertically every 425mm to 600mm.
 6. Grout, clean, and prevent too rapid drying. Damp cure for three days.
- D. Dry-set Portland cement mortar (ANSI A 108.5): For use on concrete block, concrete block, concrete, scratch coat and other sound masonry surfaces.
1. Float mortar over backing, using flat side of trowel, to a minimum thickness of 1.5mm.
 2. Comb mortar with notched trowel 10 minutes prior to tile application.
 3. Soaking porous tile is unnecessary but may be done if desired or if conventional portland cement grout is to be used.
 4. Press tile into bed, tap and beat into place. Ribbed-back tile will require application of mortar to back of tile to obtain full contact.

5. Grout and clean. Damp-cure for at least three days.

3.03 CLEANING

- A. Clean tile surface as thoroughly as possible on completion of grouting.
- B. Remove all grout haze, observing both tile and grout manufacturer's recommendations as to use of acid and chemical cleaners.
- C. Rinse tilework thoroughly with clean water before and after chemical cleaners. Do not allow acid or chemical solutions to enter floor drains.
- D. Polish surface of tilework with soft cloth.

3.04 PROTECTION FROM CONSTRUCTION DIRT

- A. Cover all tile floors with heavy-duty, non-staining construction paper, taped in place.
- B. Just before final acceptance of tile work, remove paper from all tile surfaces. Wax and buff polish in accordance with the tile manufacturers directions prior to final acceptance.

3.05 PROTECTION FROM TRAFFIC

- A. Prohibit all foot and wheel traffic from using newly tiled floors for at least 7 days, except as stated in Paragraph "B" below.
- B. Where use of newly tiled floors with cement type grout is unavoidable, use shall be permitted 3 days after the installation, only if minimum of 25-mm thick and 550-mm wide flat boards are placed in walkways and wheel ways.

END OF SECTION

126 - TILE ROOFING SYSTEM

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	126 - 1
1.02 CODES AND STANDARDS	126 - 1
1.03 SUBMITTALS	126 - 1
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	126 - 1
2.02 MATERIALS	126 - 1
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	126 - 3
LAST PAGE	126 - 3

126 - TILE ROOFING SYSTEM

PART 1: GENERAL

1.01 DESCRIPTION

The work includes designing and furnishing all materials, equipment, labor and supervision required to install clay roofing tile as shown on the drawings, as specified herein and as is evidently necessary to complete the work.

1.02 CODES AND STANDARDS

Within this Section of the Specification, wherever reference is made either directly or indirectly to United States (U.S.) Codes and Standards, corresponding Indonesian and Japanese Codes and Standards may be used subject to acceptance by the Engineer.

1.03 SUBMITTALS

The Contractor shall submit to the Engineer for review and acceptance, three (3) samples of each type and color of clay roofing tile proposed for use, including special pieces such as caps, copings, etc. Samples shall demonstrate material thickness, weight, finish, pattern, color, etc. and shall be accompanied by descriptive data of the physical properties, chemical resistance of the tiles as well as a list of successful installations. Colors shall be as selected by the Engineer.

PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.
- B. All sloping roof areas on the Airport Station and Kota Intan Station and other buildings, as indicated on drawings, shall be clay roofing tile in pattern and color as shown on drawings.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Tiles. - Tiles shall be noncombustible, smooth, fire-flashed clay flat interlocking tiles manufactured by a firm normally engaged in the manufacturer of such items, having

a proven record of successful installations, and acceptable to the Engineer. Raw materials shall be a fine blend of shales and clays, with tiles formed by an extrusion process and surface treated for texture, color and glazing prior to firing at approximately 1050 degree C (1925 degree F). Tiles shall pass the Class A burning-brand fire test and shall conform to the International Conference of Building Officials (ICBO) requirements for strength and permeability.

- C. Nails. - Nails for tiles shall be non-corrosive, 3-mm (11-gauge), ring-shank, with slight penetration through underside of plywood deck.
- D. Felt. - Cover all pitched roofs under tile with best quality asphalt-impregnated roofing felt weighing not less than 19.5 Kg/10.0 m² (40lb/100 ft²), doubled on rough surfaces, hips, valleys and ridges. Lay to straight lines parallel to ground level, lapping 64 mm (2.5 in) horizontally and 152 mm (6 in) vertically, fastening all edges with large-headed galvanized nails on 152-mm (6-in) centers. Carry felt 152 mm (6 in) up all vertical surfaces and 102 mm (4 in) over gutter and valley metal.
- E. Wood Strips. - Apply on hips and ridges 25-mm (1-in) wood stringers of proper height to carry hip roll and ridge and 25-mm x 51-mm (1-in x 2-in) strips for end bands.
- F. Flashing. - Line all valleys with 0.5-mm (26-gauge) stainless steel at least 508 mm (20 in) wide for short valleys, at least 610 mm (24 in) wide for long valleys with 6-mm (1/4-in) edge turned over and fastened with stainless steel clips. Lap joints shall be a minimum of 102 mm (4 in). Extend all flashing up vertical surfaces 76 mm (3 in) and under tile 102 mm (4 in) with required counterflashing plugged, pointed, and secured. Extend gutter metal up roof to a point higher than outer edge of gutter.
- G. Mortar. - Mortar for filling the openings of cut valley tiles shall comprise 1 part Portland cement mortar, 4 parts sand, and colored to nearest match of the tile color.
- H. Plastic Cements. - Plastic cement for gable rakes, hip rolls, ridges, stringers and other conditions shall be non-running, heavy body plastic cement composed of asbestos fibers, asphalt and other mineral ingredients to meet the requirements of ASTM D2822 and Federal Specification SS-C-153 (Type 1).
- I. Sealant. - Used in exposed areas shall be silicone and shall meet the requirements of ASTM D1002 or ASTM E42.

PART 3: EXECUTION

3.01 INSTALLATION

Install flat interlocking tile at a minimum pitch of 102 mm (4 in) rise in 305 mm (12 in) run. Roof deck shall be clean, smooth and dry when roof tiles are applied. Apply tiles in straight lines parallel to ground level, lapped 76 mm (3 in) vertically. Fasten each tile with proper nailing, using 1, 2, or 3 nails as required in each tile or fitting.

END OF SECTION

127 - GYPSUM WALLBOARD SYSTEMS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	127 - 1
1.02 APPLICABLE CODES AND STANDARDS	127 - 1
1.03 SUBMITTALS	127 - 1
1.04 PRODUCT HANDLING	127 - 2
1.05 ENVIRONMENT CONDITIONS	127 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	127 - 2
2.02 MATERIALS	127 - 2
2.03 FRAMING AND FURRING MEMBERS	127 - 2
2.04 GYPSUM WALLBOARD	127 - 4
2.05 FASTENERS	127 - 4
2.06 JOINT TREATMENT	127 - 4
2.07 ACCESSORIES	127 - 4
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	127 - 5
3.02 ADJUSTMENT AND CLEANING	127 - 6
LAST PAGE	127 - 7

127 - GYPSUM WALLBOARD SYSTEMS

PART 1: GENERAL

1.01 DESCRIPTION

- A. Work Included: This section covers the furnishing and installation of gypsum wallboard and related accessories to metal studs or furring channels for ceilings (suspended) for all areas indicated on the Drawings. The Contractor shall furnish all labor, materials, tools and equipment required to complete the work.
- B. Related Work Specified Elsewhere:
1. Section 119 CERAMIC WALL TILE
 2. Section 123 PAINTING

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. ASTM - American Society for Testing and Materials
- C 36 Gypsum Wallboard
 - C 442 Gypsum Backing Board
 - C 475 Joint Treatment for Gypsum Wallboard Construction
 - C 645 Non-Load (Axial) Bearing Steel Studs, Runners (Tracks) and Rigid Furring Channels for Screw application of Gypsum Board.
- B. JIS - Japanese Industrial Standards
- A 6901 Gypsum Boards

1.03 SUBMITTALS

The Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Certificates: Furnish manufacturer's certification that materials meet or exceed specification requirements.

- B. Manufacturer's Instructions: Furnish manufacturer's printed instructions for installation of the assemblies.

1.04 PRODUCT HANDLING

A. Delivery and Handling:

1. Deliver materials to the jobsite with manufacturer's labels intact and legible.
2. Handle materials with care to prevent damage in accordance with the manufacturer's instructions.
3. Deliver fire-rated materials bearing testing agency label and required fire classification numbers.

- B. Storage: Store materials inside, under cover, stacked flat, off floor and in accordance with the manufacturer's instructions.

1.05 ENVIRONMENT CONDITIONS

The Contractor shall provide adequate ventilation during and following joint-treatment application. Under slow drying conditions additional drying time shall be allowed between coats of joint treatment. Installed materials shall be protected from drafts during hot, dry weather.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 FRAMING AND FURRING MEMBERS

A. Channels:

1. General: Channels shall be formed steel and shall be galvanized or coated with the manufacturer's standard protective coatings. Steel studs, ceiling and rigid furring channels shall meet the requirements of ASTM C 645.

2. Ceiling channels shall be not less than 0.5 mm nominal thickness with 30 mm flanges and channel web sized to nest with comparable steel studs hereinafter specified.
3. Furring channel shall be not less than 0.5 mm nominal thickness, "C" or hat-shaped in section with 30-mm-minimum width crown for wallboard attachment. Crown of hat-shaped type shall be 19 mm deep minimum and brim shall be formed with 13 mm flanges stiffened with 3-mm folded or other equivalent edge. Flanges may be 9-mm when 3-mm stiffened edge is upturned 90 degrees from the brim. Crown shall be slightly sloped for nesting channels. Approximate weight of furring channels shall be 125 kg. per 300 meters.
4. Main carrying channel shall be of a minimum of 38 mm hot-or cold-rolled steel channel. Hot-rolled channel shall weigh not less than 227 kg per 300 meters. Cold-rolled channel shall be not less than 1.5 mm nominal thickness (16 gauge) with flanges at least 13 mm wide.
5. Resilient furring channels shall be not less than 0.5 mm nominal thickness (26 gauge). Channel shall be hat-shaped, Z-shaped or have other modified channel shape with minimum 13 mm leg or legs to provide furring projection, minimum 35 mm crown or surface to provide wallboard mounting surface and minimum 13-mm flange or flanges with folded edge for channel mounting. Leg or legs shall be perforated or expanded to provide resilience. Approximate weight of resilient furring channels shall be 90 kg per 300 meters.

B. Hangers and Tie Wires:

1. Hangers supporting main runner channels shall be soft steel wire not less than 4 mm nominal diameter (8 gauge) and shall be zinc coated. Flat steel hangers, 25 mm by 5 mm, with zinc coating, may be substituted for the wire hangers.
2. Tie wires for splicing stud furring or securing stud furring to main runner channels or to structural members shall be double strands of galvanized annealed steel of not less than 1.2 mm nominal diameter (18 gauge). Tie wire for splicing hat-shaped furring channels or securing hat-shaped furring channels to main runner channels or to structural members shall be galvanized steel of not less than 1.2 mm nominal diameter (18 gauge).

2.04 GYPSUM WALLBOARD

- A. Regular gypsum wallboard shall meet the requirements of ASTM C 36, of thickness as shown on the drawings, and with tapered or beveled edges.

2.05 FASTENERS

- A. Screws shall be self-drilling, self-tapping, bugle head, for use with power-driven tool and shall be of the type recommended by the gypsum wallboard manufacturer for the intended application, such as wallboard to sheet metal or wallboard to wallboard.
- B. Length of screws for base-layer application shall be 25 mm minimum, face layer of two-layer application, 40 mm minimum and wallboard to wallboard in multiple application, 35 mm minimum.

2.06 JOINT TREATMENT

- A. Joint reinforcing tape shall be performed, not less than 47 mm nor more than 56 mm wide and be not more than 0.30 mm thick. The tensile strength in cross direction shall be not less than 5N/1 mm.
- B. Joint compound shall be as recommended by the gypsum wallboard manufacturer for the intended application and in conformance with ASTM C 475.

2.07 ACCESSORIES

Metal trim features for wallboard shall be formed from zinc-coated steel not less than 0.43 mm nominal thickness for corner beads and 0.39 mm thickness for other trim. Metal trim shall be in the following shapes and sizes:

- A. Corner beads shall be angle-shaped with 3-mm bead at apex of the angle and with wings 25 mm or 30 mm wide as required to properly lap wallboard edge and perforated or expanded nailing or screwing, or with combination metal and paper wings bonded together, not less than 30 mm wide. All beads shall be suitably designed to receive joint treatment.
- B. Angle edge trim for use at perimeter of wallboard ceilings which about partitions of walls not having a wallboard finish shall be angle-shaped with wings not less than 20mm wide. Concealed wing shall be perforated for nailing or screwing and exposed wing edge folded flat.

PART 3: EXECUTION

3.01 INSTALLATION

A. Framing, Suspended Ceilings:

1. Attach screw furring channels spaced not more than 600mm on center perpendicular to main channels spaced a maximum of 1200 mm on center, with double-strand tie wire in accordance with the manufacturer's recommendations or as shown on the Drawings.

B. Wall board - General

1. Use wallboard of maximum lengths to minimize end joints and stagger end joints when they occur.
2. Locate end joints as far as possible from center of ceiling.
3. Abut wallboards without forcing and neatly fit ends and edges of wallboard.
4. Support ends and edges of wallboard panels on framing or furring members except for face layer of double layer.
5. Gypsum wallboards shall be cut by scoring and breaking, or by sawing, working from the face side. Where wallboard meets projecting surfaces, it shall be neatly scribed.

C. Wallboard Application

1. Double Layer Installation:

2. Base Layer:

Ceiling:

- a) Apply backing board or wallboard base layer (perpendicular) with long dimension at right angles to framing members.
- b) Apply wallboard face layer parallel to framing members.
- c) Minimum offset of face layer joints from parallel joints in base layer shall be not less than 250mm.

D. Joint System:

1. Joint compound and topping compound shall be mixed in accordance with printed instructions contained on the package.
2. A uniformly thin layer of joint compound shall be applied over the joint approximately 100 mm wide. The tape shall be centered over the joint and embedded

into the compound leaving sufficient joint compound under the tape to provide proper bond. Ceiling angles shall be reinforced with tape folded to conform to the angle and embedded into the compound.

3. After compound is thoroughly dry, approximately 24 hours, the tape shall be covered with a coat of joint compound or topping compound spread over the tape and approximately 65 mm on each side of the tape, and feathered out at the edge. After thoroughly dry, another coat of joint compound or topping compound shall be applied with a light, uniform crown over the joint. This coat shall be smooth and the edges feathered approximately 75 mm beyond the preceding coat.
4. All inside corners shall be coated with at least one coat of joint compound or topping compound with the edges feathered out.
5. All screw head dimples shall receive three coats. This may be applied as each coat is applied to the joints.
6. Flanges of wallboard corner beads shall be concealed by at least two coats of compound. The first coat shall be joint compound and the second coat may be joint compound or topping compound, feathered out approximately 225 mm on both side of the exposed metal nose.
7. Allow each application of compound to joints and fasteners to dry, then sand if necessary. Caution shall be used to avoid roughing of the wallboard paper. All wallboard and treated areas shall be smooth and ready for decoration.

3.02 ADJUSTMENT AND CLEANING

- A. When face paper is punctured drive new screw approximately 38 mm from puncture and fill damaged surface with compound.
- B. Ridging:
 1. Do not repair ridging until condition has fully developed, approximately six months after installation.
 2. Sand ridges to reinforcing tape without cutting through tape and fill concave areas on both sides of ridge with topping compound.
 3. After fill is dry, blend in topping compound over repaired area.

C. Fill cracks with compound and finish smooth and flush.

END OF SECTION

128 - MARBLE WORK

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	128 - 1
1.02 APPLICABLE CODES AND STANDARDS	128 - 1
1.03 SUBMITTALS	128 - 1
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	128 - 1
2.02 MATERIALS	128 - 2
2.03 FINISHES	128 - 3
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	128 - 3
3.02 DELIVERY AND STORAGE	128 - 4
3.03 PROTECTION AND REPAIRING	128 - 4
3.04 CLEANING	128 - 4
LAST PAGE	128 - 4

128 - MARBLE WORK

PART 1: GENERAL

1.01 DESCRIPTION

The Contractor shall furnish all the design, provide the construction drawings, furnish and install all the materials as specified herein, and as are evidently necessary to complete the work.

1.02 APPLICABLE CODE AND STANDARDS

In general, Technical Specifications either cite or imply United States codes and standards and typical designs for equipment and typical designs are acceptable providing that they in no way detract from the quality, safety, operability, or durability of the equipment and materials furnished. Alternate codes and standards will not be acceptable for Performance Testing.

A. ASTM - American Society for Testing and Materials:

- C-33 Specification for Concrete Aggregates
- C-150 Specification for Portland Cement
- C-207 Specification for Hydrated Lime for Masonry.

B. JIS - Japanese Industrial Standards

- R-5210 Portland Cement

1.03 SUBMITTALS

Before starting the work, the Contractor shall submit to the Engineer for his approval, samples of suitable size to represent approximately the shade, marking, and characteristics of the marble named. These samples shall show the finishes required. Samples shall be labelled properly on the back with the name of the building, kind of marble, finish, and name of Contractor.

PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

- B. All marble shall be of good quality, sound and free from defects that would impair its strength, durability, or appearance. All marble shall be of the variety intended for the particular application involved, as specified herein and indicated on the drawings. All marble shall conform to or be within the range of approved samples and be finished in accordance with the characteristics and working qualities set forth in the latest editions of the "Handbook for the use of Interior marble" and the "Handbook for the use of Exterior marble" as issued by the Marble Institute of America (M.I.A.). Care shall be taken in the marble selection to produce as harmonious an effect as possible. Patching, filling and reinforcement, where permitted under the M.I.A. Group Classification, shall be carefully performed to conform to the general character and finish of the marble.

2.02 MATERIALS

- A. Material to be used under this section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Cement for setting exterior marble shall be waterproof nonstaining Portland Cement.
- C. Interior marble work setting material of Plaster of Paris, Portland Cement and White Portland Cement shall meet the requirements of the ASTM Standards.
- D. Hydrated Lime shall be ASTM C207, Type "S".
- E. Sand shall be clean, sharp, and free from soluble salts or organic matter.
- F. Water shall be clean and fresh, free from deleterious amounts of acid, alkalies, organic materials and other impurities.
- G. Mortar for parging and setting all marble shall be mixed in the proportion of one part (1) non-staining Portland Cement to three parts (3) sand and one-fifth part (1/5) hydrated lime, all thoroughly dry-mixed and then water added mixing continued until a plastic freely-working mix is obtained. Mortar shall be mixed only in such quantities as are needed for immediately use. Retempering of mortar will not be permitted.
- H. Anchors and Cramps for exterior marble setting shall be of wrought iron, galvanized after cutting and bent into shape.
- I. Anchors and Cramps, Soffit. - Hangers and other special items for the setting of exterior marble shall be bronze.

- J. For setting of interior marble, anchors shall be of brass wire and dowels shall be of aluminum or brass rod.
- K. For special anchors, shelf angles, etc., see detailed drawings.

2.03 FINISHES

- A. Interior standing marble shall have a polished finish. Interior floor marble shall have a boned finish. All exposed surfaces of exterior marble shall have a fine sand finish.
- B. All exposed face and top joints of exterior marble previously raked to a 20-mm (3/4-in) minimum depth shall be pointed immediately upon removal of the protective covering. Pointing shall be done with a mortar similar to the setting mortar, but with only enough water added to make a stiff putty. Joints shall be thoroughly wetted, and the pointing mortar solidly packed into the joints, completely filling them. The form of the pointing shall be as directed by the Engineer.

PART 3: EXECUTION

3.01 INSTALLATION

- A. All work shall be executed by skilled workmen in strict accordance with the approved shop drawings. All joints shall be cut true and square, plane surfaces shall be true and flat without elevations or depressions, mouldings, and bases shall have continuous lines unbroken at joints. External angles shall be butt-jointed with the joint on the side least exposed to view.
- B. All marble shall be installed in a workmanlike and substantial manner and in accordance with the approved settings drawings. All cutting, fitting and drilling required for the accommodation of the work of other trades shall be done accurately, neatly, and carefully.
- C. Floor fill under marble floors shall be brought to within 6 mm (2-1/2 in) of the finished floor line. Contractor shall provide a setting of Portland Cement and sand, mixed dry for tamping, and the marble tile shall be tamped upon such bed to proper level. The marble tile shall be lifted and the setting bed sprinkled with dry cement, the tile wet on the back and replaced on its bed and tamped into final position. Marble floors shall be closed to traffic for at least 24 hours after setting, after which the joints between tiles may be grouted. Any excess grout must be removed immediately from the surface of the marble.
- D. Standing marble shall be set with spots of Plaster of Paris and secured by the use of an adequate number of brass wire anchors tooled into holes in the edges of the marble slabs

and inserted in plaster-filled holes in the backing wall. Edges of wall slabs shall be buttered with Plaster of Paris as they are set, to completely fill the joints between adjoining slabs, and any excess of such filling shall immediately be removed from the surface of the marble.

- E. Exterior marble stones, when ready for setting, shall be cleaned on all sides and all dirt or other foreign matter removed from all surfaces. Fiber brushes may be used for this purpose but wire brushes may not be used. Stones set in masonry or against concrete shall be parged with mortar. All stones shall be set in a full bed of mortar, plumb and accurately in position, true to line, with vertical joints full of mortar and with all joints uniform and of indicated width. All anchors shall be built securely into the masonry or securely attached to the structure, and all anchor holes shall be filled with mortar. All joints shall be raked out to a depth of at least 20 mm (3/4 in) for later pointing. Joints shall be a minimum of 5 mm (3/16 in) wide. No marble shall be set more than two courses in advance of masonry.

3.02 DELIVERY AND STORAGE

Marble shall be transported, handled and stored with proper equipment, and in a manner to prevent soiling, staining and damage. Any damaged, broken, or permanently stained marble shall be replaced at the Contractor's expense.

3.03 PROTECTION AND REPAIRING

- A. After setting, all marble work liable to staining or damage shall be protected with an adequate type of covering approved by the Engineer. Any paper or wood used in connection with such protection shall be free of coloring matter and be of an approved non-staining type. This protection shall be kept in position and in repair, and shall be removed only at the direction of the Engineer.
- B. Any defect or stain or blemish discovered during the pointing and/or cleaning processes shall be repaired under the direction of the Engineer, and any stones found damaged beyond acceptable repair, shall be removed entirely and replaced with new and perfect material.

3.04 CLEANING

After completion of the marble work and on instruction from the Engineer, the marble shall be cleaned down to remove any dirt or mortar, and any stains or defacements. No wire brushes, acids, nor any solutions which might damage the marble or its finish may be used. Care shall be taken to assure that cleaning operations for adjacent materials do not damage the marble work.

129 - CAULING

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	129 - 1
1.02 RELATED WORK	129 - 1
1.03 APPLICABLE CODES AND STANDARDS	129 - 1
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	129 - 2
2.02 MATERIALS	129 - 2
<u>PART 3: EXECUTION</u>	
3.01 CAULING SCHEDULE	129 - 3
LAST PAGE	129 - 3

129 - CAULKING

PART 1: GENERAL

1.01 DESCRIPTION OF WORK

Furnish all materials and perform all operations required for caulking as shown on final construction drawings, as specified herein and as are evidently necessary to provide weathertight construction.

1.02 RELATED WORK

Sealing of roofing metal work; and other specialized sealant application may be found specified in other Sections of the Specification.

1.03 APPLICABLE CODES AND STANDARDS

Within this Section of the Specification, wherever reference is made either directly or indirectly to United States (U.S.) Codes and Standards, corresponding Indonesian and Japanese Codes and Standards may be used subject to acceptance by the Engineer.

A. ASTM - American Society for Testing and Materials:

- D 1751 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
- D 1752 Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
- D 1667 Specification for Flexible Cellular Materials
- D 3574 Testing flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams

B. JIS - Japanese Industrial Standards:

- A 5751 Oil Based Caulking Compounds for Building
- A 5757 Sealing Compounds for Sealing, Glazing and Caulking in Building
- A 5758 Sealing Compounds for Sealing and Glazing in Building

PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.
- B. Materials shall be applied in strict accordance with the manufacturer's instructions and recommendations for their use. Joints shall be dry and free from loose material. The work includes use of the manufacturer's recommended primers where required for the surfaces to be caulked. Surfaces to be caulked. Surfaces adjacent to the joints shall be protected from staining resulting from the caulking operations. Joints shall be completely filled to the indicated bead depth, backed where necessary with joint backing. Finished joints shall be continuous and weathertight, neatly finished. Color of sealant shall closely match the color of adjacent concrete, mortar joints or metal, blending therewith in appearance. Caulking shall be performed before any finish painting of the surfaces.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Material Manufacturer. - All materials for use in caulking work shall be the products of firms normally engaged in the manufacture of such items, having a proven record of successful installation, and acceptable to the Engineer.
- C. Polysulfide Caulking (One Part). - Shall be gun-grade non-sag one-part polysulfide sealant. Joint, backing where required, shall be closed-cell polyethylene joint backing, oversized to compress into joint. Depth of sealant shall be equal to joint width in joints 13 mm (1/2 in) wide and smaller; and in joints wider than 13 mm (1/2 in) shall be one-half of joint width or 13 mm (1/2 in), whichever is greater. Primer where required shall be as recommended by the sealant manufacturer.
- D. Silicone Caulking. - Shall be gun-grade non-sag one-part silicone construction sealant. Joint backing, where required, shall be closed-cell polyethylene joint backing, oversized to compress into joint. Depth of sealant shall be one half of joint width. Primer, where required, shall be as recommended by the sealant manufacturer.

PART 3: EXECUTION

3.01 CAULKING SCHEDULE

Caulking, except where otherwise specifically noted on drawings, shall be as follows:

<u>Joint</u>	<u>Caulking Type</u>
Window, door and louver frames.	Silicone Caulking
Exposed steel wall columns.	Polysulfide Caulking
Masonry control joints.	Silicone Caulking
Expansion joints.	Silicone Caulking
Pipe sleeve exterior walls.	Silicone Caulking
Miscellaneous non-moving joints.	Polysulfide Caulking
Miscellaneous joints subject to movement	Silicone Caulking

END OF SECTION

130 - TERRAZZO WORK

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	130 - 1
1.02 APPLICABLE CODES AND STANDARDS	130 - 1
1.03 SUBMITTALS	130 - 1
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	130 - 1
2.02 MATERIALS	130 - 2
2.03 REINFORCEMENT	130 - 3
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	130 - 3
3.02 TERRAZZO FLOORS	130 - 4
3.03 TERRAZZO BASE	130 - 5
3.04 CLEANING AND PROTECTION	130 - 5
3.05 SURFACE FINISH	130 - 5
LAST PAGE	130 - 5

130 - TERRAZZO WORK

PART 1: GENERAL

1.01 DESCRIPTION

Furnish all materials, equipment, labor and supervision, and perform all operations required to install terrazzo floors and base as shown on final construction drawings, as specified herein, and as are evidently necessary to complete the work.

1.02 APPLICABLE CODE AND STANDARDS

Within this Section of the Specification, wherever reference is made either directly or indirectly to Indonesian Codes and Standards, corresponding United States (U.S.) and Japanese Codes and Standards may be used subject to acceptance by the Engineer.

- A. ASTM - American Society for Testing and Materials:
- C-33 Specification for Concrete Aggregates.
 - C-150 Specification for Portland Cement/
- B. JIS - Japanese Industrial Standards
- R-5210 Portland Cement.
 - A-5411 Terrazzo Tiles

1.03 SUBMITTALS

Samples shall be submitted to the Engineer for approval, ground polished and treated as specified by the terrazzo work. Additional samples shall be submitted, if required, until final approval by the Engineer. Samples furnished as follows:

Terrazzo Panels - 216 mm x 279 mm (8-1/2 in x 11 in).

Division Strips - Two 279 mm (11 in) lengths.

PART 2: PRODUCTS

2.01 GENERAL

- A. All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

- B. All materials for terrazzo work shall be the products of firms normally engaged in the manufacture of the specified items, having a proven record of successful installations, and acceptable to the Engineer. Materials and workmanship shall be of the type and quality to carry out and insure the architectural treatment desired and shall conform to the applicable specifications of the National Terrazzo and Mosaic Association, Inc., Leesburg, Va., USA.
- C. Grinding. - The rough grinding of terrazzo floors and all grindings of terrazzo bases shall be completed in advance of finished plastering of rooms and spaces. Terrazzo topping of floors or borders shall be installed before the grinding of bases. All grinding and rubbing shall be done in the wet.
- D. Cutting and Fitting. - Cutting, drilling and fitting required to receive the work of other trades are included in the work under this Section of the Specifications.
- E. Protection. - The walls and surfaces of the finished work of other trades shall be thoroughly protected from damage and soil during the installation, grinding and washing of the terrazzo. No residue from grinding, boning or cleaning of terrazzo work shall be emptied into plumbing fixtures, soil or sewer lines.
- F. Guarantee. - Terrazzo work shall be guaranteed for a period of one year from the acceptance of the work against defects caused by the use of inferior materials or by faulty workmanship.

2.02 MATERIALS

- A. Material to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. Cement. - Standard brand of white Portland cement, ASTM C-150, Type II. White cement and mineral colors shall be used as required to produce the specified effect.
- C. Sand. - Clean, washed, siliceous masonry sand ASTM C-33 passing 6-mm (1/4-in) mesh screen.
- D. Marble Chips. - Approved colors and kind, free from dirt, dust or foreign substances. No. 1 chips passing a 6-mm (1/4-in) mesh and retained on a 3.2-mm (1/8-in) mesh; No. 2 chips passing a 9.5-mm (3/8-in) screen and retained on a 6-mm (1/4-in) mesh; No. 1 and No. 2 chips shall be used in equal proportion.
- E. Terrazzo Types. - Color, sizes and composition of material shall be as selected by the Engineer.

- F. Coloring Material. - Shall be the best quality of mineral pigment of high purity, sun proof and lime proof with a specific gravity similar to that of Portland Cement. The material shall be ground to the fineness required to produce the desired effects. The material shall not exceed 5% by weight of the amount of cement used.
- G. Cleaning Compound. - Compound used for cleaning of terrazzo work shall be an approved neutral chemical cleaner free from acids and strong alkalies or other materials that will affect the color or otherwise damage the terrazzo.
- H. Water. - Fresh, clean and free from injurious quantities of acid, alkali, sewage and organic matter.
- I. Metal Dividers. - White metal or aluminum 32 mm (1-1/4 in) deep with top to show not less than 3.2 mm (1/8 in) thickness. Dividers shall be fabricated with proper anchoring features.
- J. Edging Strips. - As specified for dividing strips, where terrazzo floors adjoin resilient or other floor surfacings, edging strips shall be formed with a rabbet of depth required to accommodate the thickness of the flooring to be installed.

2.03 REINFORCEMENT

- A. All terrazzo members, whether self-supporting or non-self-supporting, cast-in-place or precast, shall be provided with at least a minimum reinforcement as required for shrinkage control and temperature stresses, except when other more extreme conditions control. All reinforcement shall be galvanized after fabrication.
- B. Self supporting members shall be designed and reinforced for their actual loading conditions. Precast members shall also be designed to sustain loads occurring during handling and transportation.
- C. Isolation Membrane. - Isolation membrane shall be 100-micron polyethylene sheeting.
- D. Sealer. - Sealer shall be a penetrating type, specially prepared for use on terrazzo, producing a slip-resistant surface.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Workmanship. - Work shall be executed only by mechanics skilled in the trade and under the continuous supervision of a competent foreman. The best quality of work only will be accepted.

- B. Inspection. - Sub-floor surface that is to receive a terrazzo surface shall be inspected, and if found unsatisfactory, the installation of the terrazzo shall not be started until the defective surface has been made satisfactory.
- C. Preparation for Bonded Terrazzo. - Surface of concrete base slab shall be smooth, dry, firm and free from high spots, and depressions, and shall be thoroughly cleaned of all loose material, plaster, oil, grease and other foreign matter. concrete shall be well saturated with water, all excess water removed, then thoroughly slushed and broomed with neat cement immediately ahead of placing the underbed.
- D. Preparation for Sand Cushion Terrazzo. - Surfaces to receive a sand cushion terrazzo shall be covered with a layer of sand not less than 6 mm (1/4 in) thick and a layer of asphalt felt or equivalent polyethelene sheet with all joints lapped at least 51 mm (2 in). Temporary wood grounds or forms required for the work shall be installed.
- E. Division Strips. - Field and borders formed as detailed by metal strips, set straight to lines with tight fitted joint intersections enclosing each unit of the pattern. Tops of all strips shall show on finished surface of floor. Panels of floor work shall in no case exceed 914 mm x 914 mm (3 ft x 3 ft) and in general shall not be larger than 610 mm x 610 mm (2 ft x 2 ft). Borders, except as otherwise shown, shall be approximately 254 mm (10 in) wide, divided in lengths not over 1.5 m (5 ft). Borders or the border portion of terrazzo bases shall be continued in a straight line past small recesses.
- F. Edging Strips. - Edging strips shall be placed at doorways between terrazzo and other types of flooring and along edges of all terrazzo bases or borders adjoining other types of floor finishes or floor coverings. Edging strips at doorways shall be placed in line with the stops of doors.

3.02 TERRAZZO FLOORS

- A. Underbed. - Shall be made of one part Portland cement and four parts sand spread not less than 35 mm (1-3/8 in) thick at any point and brought to a level not less than 16 mm (5/8 in) below the finished floor. Dividing strips shall be installed when bed is in a semi-plastic state.
- B. Terrazzo Topping. - Shall consist of 90 kg (200 lbs) of marble granules to 45 kg (100 lbs) of white Portland cement, mixed dry, water added after mixing to make a mixture plastic but not flowing. The mix shall then be placed in the spaces formed by the dividing strips and rolled into a compact mass by means of heavy stone or metal rollers until all the superfluous cement and water is extracted; after which, it shall be hand troweled to an

even surface, disclosing the lines of the strips on a level with terrazzo filling. The finished surface shall show a minimum of 80% marble granules.

- C. Curing. - Flooring shall be cured for at least six days, using nonstaining wet sand, paper and mats.
- D. Surfacing. - When the floors have set sufficiently hard, they shall be wet machine rubbed, using No. 24 grit or fine abrasive for the initial rubbing. Surface then resurfaced with No. 80 grit, after which a light grouting of neat cement of same kind and color as the matrix shall be applied to the surface filling all voids. The grouting shall remain until the time of the wet cleaning.
- E. Finishing. - Terrazzo shall have the grouting coat removed in the wet by machines using a stone not coarser than No. 80 grit. This wet cleaning or fine stoning shall not take place sooner than 72 hours after the surface has been grouted.

3.03 TERRAZZO BASE

- A. Installed in spaced as indicated on final construction drawings, coved at floor to 19 mm (3/4 in) radius. Base divided approximately every 1.2 m (4 ft) by metal coved dividers. Walls back of base brought to a line 10 mm (3/8 in) back of finished face of base, into which base dividers are set. Surfacing and grouting of base in all respects as specified for floors, finished by very fine stone to a "bright" finish.

3.04 CLEANING AND PROTECTION

Surface shall be thoroughly cleaned with a cleaner used in accordance with manufacturer's directions, removing all scum and laitance, and protected from damage by suitable and acceptable coverings until the completion of the construction. The walls and surfaces of the finished work of other trades shall be thoroughly protected from damage and soiling during the installation, grinding and washing of the terrazzo. No residue from grinding, honing or cleaning of terrazzo shall be emptied into plumbing fixtures, sanitary or drainage lines.

3.05 SURFACE FINISH

Terrazzo shall be allowed to dry thoroughly and given an application of sealer applied and machine buffed in accordance with the manufacturer's directions, leaving all terrazzo in a clean and satisfactory condition or as approved otherwise.

END OF SECTION

131 - CENTRAL AIR CONDITIONING EQUIPMENT

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	131 - 1
1.02 QUALITY ASSURANCE	131 - 1
1.03 SUBMITTALS	131 - 1
<u>PART 2: PRODUCTS</u>	
2.01 AIR CONDITIONING UNITS	131 - 1
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	131 - 4
LAST PAGE	131 - 4

131 - CENTRAL AIR CONDITIONING EQUIPMENT

PART 1: GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide central air conditioning equipment as indicated on the Drawing and specified herein.
- B. Related Work Specified Elsewhere:
 - Section 144 BASIC MATERIALS AND METHODS

1.02 QUALITY ASSURANCE

- A. Construction Standards:
 - 1. Unit fans shall be tested and performance rated in accordance with the JIS standards.
 - 2. Unit coils shall be certified and labeled.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Submit descriptive literature, on equipment specified.
- B. Shop Drawings:
 - 1. Shop drawings shall include the following:
 - a. Fan and coil performance and certification
 - b. Dimensional data
 - c. Unit arrangements and installation methods
- C. Maintenance Manuals:
 - 1. Submit maintenance and operating manuals.

PART 2: PRODUCTS

2.01 AIR CONDITIONING UNITS (HORIZONTAL DRAW-THRU UNITS)

- A. Assembly:
 - 1. Units shall be factory assembled, (except for control valves); complete with cabinet, drip pan, fan, motor and drive assembly, coils (as scheduled), filters (if scheduled) access sections, and vibration isolation mounts or hangers (whichever is appropriate per Drawings).

2. Units shall be horizontal draw-through type, size and capacity as scheduled on the Drawings; furnished complete with all accessories required.

B. Cabinets:

1. Construct unit cabinets with galvanized steel panels and frame members. The fan and coil sections shall be insulated with a minimum 25 mm thick, 50 kg density, neoprene coated, glass fiber insulation.
2. Provide with removable panels for access into interior of unit.
3. Coil condensate pans shall be double pan construction with minimum 25-mm thick, 50 kg density glass fiber insulation, fully protected between inner and outer, galvanized steel panels. Interior of condensate pan shall have corrosion-resistant mastic coating and built-in pitch to assure positive condensate removal. Provide drain connections at each end of the condensate pans.
4. Suspended models shall be constructed in such a manner as to facilitate removal of the coils through either end, or through the bottom of the coil section with the condensate pan removed. Floor mounted models shall permit coil removal from either end, or through the top of the coil section.
5. Finish cabinets in prime coat only.

C. Motors:

1. Quiet operating type having characteristics and accessories as shown on drawings.
2. Motor horsepower shall be as scheduled on the Drawings. All pump motor speeds shall be 1750 rpm or lower.
3. Factory test motors with fans operating.
4. Provide motor base of the pivoted adjustable type having acoustical isolation.

D. Fans:

1. Units shall be equipped with statically and dynamically balanced fan assembly with forward curved centrifugal fans, with ratings based on tests conducted in accordance with current AMCA Standards (Bulletin 210). Outlet velocities shall not exceed 370m/min for units operating against external static

pressures up to 15 mm; and 430 m/min for units operating against external static pressures of 20 mm and greater.

2. Multiple fan units shall be equipped with adjustable outlet volume control dampers to allow balanced volume from each fan.
3. Shaft and bearing assemblies shall consist of high carbon steel shaft suspended between two self-aligning ball bearing pillow blocks. Fan shaft shall be sized to operate at least 10% below its critical speed. Grease fittings shall be extended to the exterior of the unit casing.

E. Refrigerant Coils:

1. Coils shall have number of rows and capacity as scheduled on the Drawings. Coils shall be ARI certified.
2. Coils shall have 15 mm OD copper tubes designed for use with refrigerant R22. Coils shall be all copper construction with aluminum fins, completely dehydrated and sealed with a dry nitrogen holding charge.
3. In units containing stacked, horizontal airflow coils, coils shall be provided with intermediate drain troughs to carry condensate from upper coils sections directly to the condensate pan.

F. Access Sections:

1. Furnished where shown on the Drawings and required. Construct of galvanized steel panels and frame members. Panels shall be gasketed and hinged for access to the section.

G. Filter Sections:

1. Shall be constructed of galvanized panels and frame members, containing flat or angle type filters with areas not less than that scheduled on the Drawings. Filters supplied as integral section of the air handling unit are preferred.
2. All air handled by the unit shall pass through the filters before it contacts either the heat transfer elements or the fans. Face velocity shall not exceed 150 m/min.
3. Provide Filter access through hinged filter doors, arranged for end access.
4. Provide 50-mm thick throwaway glass fiber type filters during construction and for final usage.

PART 3: EXECUTION

3.01 INSTALLATION

A. Air Conditioning Units:

1. Air conditioning units shall be floor mounted on 100 mm raised concrete housekeeping pads and supported from building structural frame using vibration isolators. Provide all supporting steel, anchors, etc., required to properly support the unit.

B. Filters:

1. Replace throwaway filters just prior to building acceptance and after the system has been balanced.

END OF SECTION

132 - WASTE-HANDLING EQUIPMENT

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	132 - 1
1.02 APPLICABLE CODES AND STANDARDS	132 - 1
1.03 QUALITY ASSURANCE	132 - 1
1.04 SUBMITTALS	132 - 1
1.05 PRODUCT HANDLING	132 - 1
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	132 - 2
2.02 MATERIALS	132 - 2
2.03 INCINERATOR BODY	132 - 2
2.04 STACK	132 - 3
2.05 FORCED AIR SUPPLY SYSTEM	132 - 3
2.06 CONTROL SYSTEM	132 - 4
2.07 FINISHES	132 - 4
2.08 OTHER MATERIALS	132 - 4
<u>PART 3: EXECUTION</u>	
3.01 VERIFICATION IN FIELD	132 - 4
3.02 INSTALLATION	132 - 5
LAST PAGE	132 - 5

132 - WASTE-HANDLING EQUIPMENT

PART 1: GENERAL

1.01 DESCRIPTION

Work Included: This section includes, but is not limited to the furnishing and installation of a dust collector self-containing smoke consuming incinerator as shown and detailed on the Contract Drawings or Shop Drawings. The Contractor shall furnish all labor, materials, tools and equipment necessary to complete the Work.

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for Engineer review and approval in advance of their use.

JIS - Japanese Industrial Standards

G 3101 Hot-Rolled Steels for General Structures

G 3132 Hot-Rolled Carbon Steel Strip for Pipe and Tubes

1.03 QUALITY ASSURANCE

This product shall comply with manufacturer's and Contractor's specifications. Performance shall be assured by manufacturer's guarantee.

1.04 SUBMITTALS

Contractor shall submit to the Engineer the following items for review before commencing work:

- A. Shop Drawings: Submit Shop Drawings indicating placement and assembly details and dimensions if these are not indicated on the Contract Drawings.
- B. Certificates: Environmental Protection rating
- C. Samples: Submit samples of cement, metals and paint when requested by the Engineer.

1.05 PRODUCT HANDLING

A. Delivery and Handling

- 1. Deliver materials to the jobsite with manufacturer's labels intact and legible.

2. Handle materials with care to prevent damage in accordance with the manufacturer's instructions.
- B. Storage: Store materials under cover and in accordance with the manufacturer's instructions.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.
- B. The incinerator shall be delivered assembled. Product specifications shall be checked by the Engineer and features shall be as follows:

1. The waste-burning incinerator shall effectively dispose of all types of waste products without causing undue air pollution. High-temperature combustion and control of combustion temperatures shall cause complete combustion, resulting in a smaller quantity of fly ash and a cleaner exhaust. An air curtain shall be formed by jet air heads located on the charging port, making operation with an open charging port possible. The fire grate shall be adjustable to obtain the best combustion effect.

The incinerator shall consist of a central primary combustion chamber and a dry-type double cyclone located in the rear. The air supply to the air headers shall come from the air jet nozzles located on the front charging-port frame.

2.03 INCINERATOR BODY

- A. Furnace walls: 150-mm thick heat-resistant stone and alumina cement
- B. Casing: SS41, 2.0 mm TH. minimum
- C. Cyclone: Caster 13
- D. Heat-resistant ceiling: 245 mm thick heat-resistant stone and alumina cement

- E. Ceiling cover: SS41, 4.5 mm TH.
- F. Heat-insulating baseboard: heat-resistant stone and Portland cement
- G. Charging-port door
 - 1. Casing: SS41, 4.5 mm TH.
 - 2. Lining: heat-resistant stone and alumina cement
 - 3. Opening: 500 mm x 600 mm.
- H. Fire grate: heat resistant castings, 1.15 m² in area
- I. Ash removal port: heat-resistant castings
- J. Firing port: heat-resistant castings
 - 1. Lining: heat-resistant stone and alumina cement
- K. Combustion chamber: 1.70 m³ minimum
- L. Dimensions
 - 1. Capacity: 84 kg/h
 - 2. Size: approximately 1.50 m wide x 2.35 m deep x 1.75 m high
 - 3. Gross weight: approximately 7.80 tons

2.04 STACK

- A. Body: SS41, 3.0 mm minimum with aluminized inner and outer surfaces, approximately 7.70 m high x 350 mm inner diameter
- B. Supports:
 - 1. Pole: STK 46.8 mm diameter x 2.3 mm wall thickness
 - 2. Bands: FB 50 mm x 6 mm

2.05 FORCED AIR SUPPLY SYSTEM

- A. Maximum wind quantity: 15/14 m³/min.
- B. Maximum wind pressure: 85/110 mm Aq

C. Motor: 220-V, single-phase, with an output of 0.4 Kw

2.06 CONTROL SYSTEM

A. Internal control system: Through the use of a thermocouple, magnetic valves shall automatically open and close to control furnace temperature by a water-spraying system.

B. Automatic blower switch-off: The temperature regulator shall automatically switch off the blower when furnace temperature falls.

C. Control board

1. Input: 220-V, single-phase.

2. Board: approximately 450 mm wide x 300 mm wide x 220 mm deep, outdoor waterproof type

3. Heat regulator control: shall consist of two units, one with 2 positions indicated and a scale of 0°C-1200°C, and the other with a scale of 0°C-400°C and no positions indicated.

D. Operating board

1. Thermocouple: CA 1.6 mm, approximately 15 mm in diameter x 500 mm long

2.07 FINISHES

A. Walls shall have a gray heat-resistant paint finish.

B. Other areas shall have rust-inhibiting paint with a finish coat of silver heat-resistant paint.

2.08 OTHER MATERIALS

All other materials such as anchors and fasteners, not specifically described but required for a complete and proper installation as indicated on the Contract Drawings, shall be new, suitable for the intended use, and subject to review by the Engineer.

PART 3: EXECUTION

3.01 VERIFICATION IN FIELD

Examine substrates, adjoining construction and conditions under which the work is to be installed. The Contractor shall correct all unsatisfactory conditions before proceeding with the Work and shall coordinate the Work with other trades.

3.02 INSTALLATION

- A. Requirements: Verify placement and dimensions of product as shown on Shop Drawings or Contract Drawings.
- B. Assemble and install product according to Shop Drawings and manufacturer's instructions.

END OF SECTION

133 - FURNITURE

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	133 - 1
1.02 QUALITY STANDARDS	133 - 1
1.03 PRODUCT HANDLING	133 - 1
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	133 - 1
2.02 MATERIALS	133 - 1
2.03 FURNITURE DESCRIPTIONS	133 - 1
<u>PART 3: EXECUTION</u>	
3.01 REQUIREMENTS	133 - 2
3.02 PRODUCT LIST	133 - 2
LAST PAGE	133 - 9

133 - FURNITURE

PART 1: GENERAL

1.01 DESCRIPTION

- A. Submit shop drawings, brochures, catalogs, specifications, or physical samples of all items as scheduled herein which shall fully describe that which the Contractor proposes to furnish.
- B. The Engineer will review submittals for compliance with the design intent of the contract document and will return submittals not acceptable with comments. In the event a submittal is returned, the Contractor may resubmit in consideration of the Engineer's comments.

1.02 QUALITY STANDARDS

- A. The furniture will be standard in design and harmonious with the general architectural design.
- B. The manufacturer shall have a proven history in the manufacture of the same or similar products and shall be approved by the Engineer.

1.03 PRODUCT HANDLING

- A. Furniture is to be delivered at the site when the location has been declared ready by the Engineer.
- B. Items must be properly marked as to manufacturer.
- C. All damaged items shall be replaced by the Contractor at no expense to the Engineer.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 FURNITURE DESCRIPTIONS

The Contractor shall provide items as identified on the Product List.

PART 3: EXECUTION

- A. All items shall be assembled and installed in accordance with manufacturer's standards and located as shown on the Architect's drawings.
- B. Items, after being placed, will be cleaned and adjusted so that all parts are operating properly.
- C. The Engineer shall be provided with maintenance instructions.
- D. The Contractor shall remove all shipping and installation materials from the premises.

3.02 PRODUCT LIST

A Indoor Furniture

(1) DESKS

- D-1. Double pedestal desk: 160 x 70 x 70 cm high w/back panel & center drawer, Pedestal consisted of a file drawer & 2 drawers w/locking mechanism, Melamine laminated top, chrome-plated legs & drawer pull,
- D-2. Double pedestal desk: 140 x 70 x 70 cm high Same Specification as D-1
- D-3. Single pedestal desk: 120 x 70 x 70 cm high w/back & side panels and w/center drawer, Pedestal consisted of a file drawer & 2 drawers w/locking mechanism, Melamine laminated top, chrome-plated legs & drawer pull.
- D-4. Work desk: 120 x 90 x 70 cm high Melamine laminated top, Baked enamel finished steel legs & 4 drawers w/lock
- D-5. Work desk: 120 x 45 x 70 cm high Melamine laminated top, Baked enamel finished steel legs & 2 drawers w/lock

(2) CHAIRS

- C-1. Swivel arm chair: 63 x 69 x 91-100 cm high Chrome-plated steel five-star legs on castors w/rocking mechanism, height adjustable,

Fabric upholstered

- C-2. Swivel arm chair: 623 x 67 x 91-100 cm high
Same Specification as C-1
- C-3. Swivel chair: 47 x 42.5 x 88-97 cm high
Chrome-plated steel leys on castors,
w/footrest,
revolving type,
Vinyl leather upholstered seat & back
- C-4. Swivel chair: 46 x 43.5 x 75-86 cm high
Chrome-plated steel five-star legs on castors,
height adjustable,
Fabric upholstered seat & back
- C-5. Guest Chair: 49 x 59 x 74.5 cm high
Chrome-plated steel square pipe legs,
Seat & Back: Urethane foam padded on hardboard
- C-6. Stacking chair: 39 x 38 x 72 cm high
Chrome-plated steel round pipe legs,
Seat & Back: Urethane foam padded on molded
plywood,
upholstered by vinyl leather
- C-7. Conference chair: 44.5 x 39.5 x 74 cm high
Chrome-plated steel round pipe legs,
Seat & Back: Urethane foam padded on steel
plate,
upholstered by vinyl
- C-8. Dining chair: 45.4 x 54.5 x 81 cm high
Stainless steel pipe legs,
Seat & Back: Urethane foam padded on
hardboard,
upholstered by vinyl leather

(3) BOOK CASES

- B-1. Book case: 88 x 40 x 179 cm high
Baked enamel finished steel body, w/4 shelves,
Sliding steel doors w/lock
- B-2. Book case: 88 x 40 x 179 cm high
Baked enamel finished steel body, w/4 shelves,
Sliding glass doors w/lock
- B-3. Book case: 88 x 40 x 96.8 cm high
Baked enamel finished steel body on base,
Upper part: Double sliding glass doors w/2
shelves,
Lower part: " " steel " w/2
shelves

B-4. Book case: 88 x 38 x 179 cm high
Baked enamel finished steel body w/2 drawers &
3 shelves,
Swinging doors

(4) FILING CABINETS

F-1. Filing cabinet: 45.6 x 62 x 140 cm high
Baked enamel finished steel body,
Four drawers w/locking mechanism

F-2. Lateral file: 96 x 46 x 112 cm high
Baked enamel finished steel body,
Three drawers w/locking mechanism

(5) MAGAZINE RACK

MR-1. Magazine rack: 45 x 60.5 x 40 cm high
Chrome-plated steel square tubular frame
Smoked vinyl chrolide resin shelves

(6) LOCKERS

L-1. Coin locker: 84 x 45.5 x 179 cm high
Baked enamel finished steel body,
8 openings

L-2. Locker for one person: 45.5 x 51.5 x 179 cm
high
Baked enamel finished steel body w/lock,
Accessories: 2 shelves, hanger pipe, mirror,
umbrella stand, towel horse,
hook

L-3. Locker for two persons: 60.8 x 51.5 x 179 cm
high
Same Specification as L-2

L-4. Locker for three persons: 90 x 51.5 x 179 cm
high
Same Specification as L-2

L-5. Clean locker: 88 x 51.5 x 179 cm high
Baked enamel finished steel body, swinging
doors
Accessories: 4 shelves, 6 hooks, 5 towel
hangers, 3 baskets

L-6. Cupboard: 60 x 45 x 179 cm high
Baked enamel finished steel body,
Separated into 2 parts: 3 shelves for upper
part,
2 shelves for lower
part, hinged door
for each

(7) SHELVES

- SH-1. Shelves: 215 x 183.5 x 90 cm high
Baked enamel finished steel frames & shelves
100 kg load allowable per shelf
- SH-2. Shelves: 215 x 185 x 45 cm high
Baked enamel finished steel frames & shelves
300 kg load allowable per shelf
- SH-3. Shelves: 215 x 185 x 60 cm high
Baked enamel finished steel frames & shelves
300 kg load allowable per shelf

(8) TABLES

- T-1. Table: 120 x 75 x 68 cm high
Melamine laminated top,
Chrome-plated steel round pipe legs, w/shelf
- T-2. Dining table: 120 x 75 x 70 cm high
Melamine laminated top, vinyl-chloride resin
edge,
Baked enamel finished steel tubular support,
Chrome-plated steel plate legs w/adjusters
- T-3. Dining table: 180 x 75 x 70 cm high
Melamine laminated top, vinyl-chloride edge,
Chrome-plated steel round pipe supports,
Chrome-plated steel plate legs w/adjusters
w/shelf
- T-4. Conference table: 150 x 60 x 70 cm high
Melamine laminated top,
Baked enamel finished square pipe foldable
legs, w/shelves
- T-5. Folding table: 180 x 60 x 70 cm high
Plywood top, clear lacquer finish,
Baked enamel finished square pipe legs
- T-6. Center table: 124 x 60 x 40 cm high
Polyurethane finished wooden frame w/glass top
- T-7. Side table: 64 x 60 x 40 cm high
Same Specification as T-6
- T-8. Center table: 120 x 60 x 45 cm high
Melamine laminated top,
Chrome-plated steel pipe legs

(9) TELEPHONE STAND & SERVICE TABLES

- TS-1. Service table: 90 x 36 x 70 cm high
Melamine laminated top, side & back panels &
shelves,

- Chrome-plated pipe legs w/adjusters
- TS-2. Service table: 75 x 45 x 80 cm high
Melamine laminated top, vinyl-chloride resin
edge,
Chrome-plated steel pipe legs
- TS-3. Telephone stand: 40 x 40 x 73 cm high
Melamine laminated top, teak color finish,
Chrome-plated steel pipe legs

(10) COUNTER

- CO-1. Counter: 156 x 55 x 95 cm high
Melamine laminated top,
Baked enamel finished steel front & side
panels,
w/adjusters

(11) COAT HANGER

- CH-1. Coat hanger: 68 x 52 x 169 cm high
Baked enamel finished pipe frame & shelf,
Chrome-plated pipe legs & hanger bar

(12) WHITEBOARD

- W-1. Whiteboard: 180 x 90 cm high
Both sides use, stand-type,
Epoxy resin finished steel board,
Baked enamel finished steel legs w/castors

(13) SOFAS & EASY CHAIRS

- SO-1. Sofa: 186 x 78 x 75 cm high
Fabric upholstery, padded w/urethane foam,
ABS resin legs
- SO-2. Easy chair: 83 x 78 x 75 cm high
Same Specification as SO-1
- SO-3. Corner chair: 66 x 66 x 71 cm high
Chrome-plated steel pipe legs jointed by ABS
resin,
Seat & Back: Urethane foam padded on wooden
frame, upholstered by fabric
- SO-4. Armless chair for 2 persons: 116 x 66 x 71
(SH38) cm high
Chrome-plated steel pipe legs jointed by ABS
resin,
Seat & Back: Fabric upholstery on urethane
foam
- SO-5. Armless chair for 3 persons: 174 x 66 x 71
(SH38) cm high

Same Specification as SO-4

(14) BENCH

- BE-1. Bench: 171 x 42 x 65 (SH41) cm high
Consisted of 4 molded F.R.P. seats,
Baked enamel finished steel legs on both sides
(to be fixed on the floor)
- BE-2. Bench: 179 x 39.5 x 38.5 cm high
Molded nylon resin seat,
Aluminum legs

(15) MISCELLANEOUS

- M-1. Smoking stand: 20.8 x 20.8 x 60 cm high
Epoxy powder coated steel body,
Stainless steel removable top
- M-2. Waste basket: 46.5 x 52 x 90 cm high
Polyethylene coated punching metal cylindrical
body, tilting type, Baked enamel finished round
pipe legs
- M-3. Foldable dust cart: 57 x 55 x 78 cm high
Uni-chrome plated round pipe frame,
Waterproof nylon bag
- M-4. Foldable handcart: 48 x 59.5 x 110 cm high
Baked enamel finished steel frame,
120 kg load allowable,
Weight: 12 kg
- M-5. Handcart: 62 x 92 x 85 cm high
Steel panel allowable 300 kg load,
w/handle,
Weight: 25 kg
- M-6. Step ladder: 56.2 x 180 cm high
Aluminum,
Weight: 6.1 kg and 100 kg load allowable
- M-7. Step ladder: 47.9 x 120 cm high
Aluminum,
Weight: 4.3 kg and 100 kg load allowable

B. Outdoor Furniture

(1) BENCHES

Type A Bench
Dimensions: 1,800W x 620D x 770H (400SH)
m/m
Seat: Redwood
Seat Supports: t9 m/m pressed steel plate,
with baked enamel finish.

Legs: 75 x t2.3 m/m Rectangular steel tube,
with baked enamel finish.

Type B

Bench
Overall Dimensions: 1,720W x 535D x 810H
(435SH) m/m

Seat width: 430 m/m

Seat: Molded FRP.

Horizontal Supports: o34 x 3.2 m/m tubular
steel, with baked
enamel finish.

Brackets: t6 m/m pressed steel plate, with
baked enamel finish.

Clamps: t3.2 m/m pressed steel plate, with
galvanized finish.

Pedestals: 38 x 9 m/m steel flat bar, with
baked enamel finish.

Type C

Bench
Overall Dimensions: 1900W x 500D x 740H
(400SH) m/m.

Seat Width: 480 m/m (center to center).

Seat: Molded FRP.

Horizontal Supports: o34 x 3.2 m/m tubular
steel, with baked
enamel finish.

Pedestals: 38 x 9 m/m steel flat bar, with
baked enamel finish.

(2) WASTE BASKETS

Type A

Waste Basket

Dimensions: 375W x 375D x 760H m/m

Body: Lauan, with antiseptic treatment (CCA
treatment), and clear lacquer finish.

Legs: 38 x 6 m/m steel flat bar, with baked
enamel finish.

Type B

Waste Basket

Dimensions: 400W x 400D x 650H m/m

Body: t2.3 m/m pressed steel plate, with
galvanized finish and baked enamel
finish.

Basket: o6 m/m wire steel, with galvanized
finish and baked enamel finish.

(3) SMOKING STAND

Type A

Smoking Stand

Dimensions: 375W x 375D x 760H m/m

Body: Lauan, with antiseptic treatment (CCA
treatment), and clear lacquer finish.

Ashtray: t1.6 m/m stainless steel plate, with
hair-line finish.

Saucer: t2.0 m/m aluminum alloy, with alumite
treatment.

Legs: 38 x 6 m/m steel flat bar, with baked enamel finish.

Type B

Smoking Stand

Dimensions: 156W x 156D x 650H m/m

Body: 156 x 156 x t4.5 m/m pressed steel plate, with galvanized finish and baked enamel finish.

Ashtray: Cast aluminum alloy.

(4) SHELTER

Bus Shelter

Overall Dimensions: 4,920W x 2,300D x 2,670H
m/m

Roof: Molded FRP.

Support Poles: 125 x 125 x 6.5 x 9 m/m H-shape steel column, with baked enamel finish.

Vertical Support: 125 x 125 x 6 x 9 m/m CT-shape steel.

Support Beam: 150 x 50 x 3.2 m/m steel.

Foundation Base: t16 m/m stamped steel plate.

Foundation: Reinforced concrete, with foundation-bolts (4 x W3/4).

Note: With (SF-00910L) or without (SF-00910) lighting equipment

END OF SECTION

134 - FANS (SUPPLY, RETURN, AND EXHAUST)

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	134 - 1
1.02 QUALITY ASSURANCE	134 - 1
1.03 SUBMITTALS	134 - 1
<u>PART 2: PRODUCTS</u>	
2.01 CENTRIFUGAL FANS BACKWARD INCLINED	134 - 1
2.02 CENTRIFUGAL FANS FORWARD CURVED	134 - 2
2.03 CENTRIFUGAL FANS AIRFOIL	134 - 3
2.04 TUBULAR CENTRIFUGAL	134 - 3
2.05 PROPELLER FANS	134 - 4
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	134 - 4
LAST PAGE	134 - 4

134 - FANS (SUPPLY, RETURN, AND EXHAUST)

PART 1: GENERAL

1.01 DESCRIPTION

- A. Provide fans as indicated on the Drawings and specified herein.
- B. Work Includes:
 - 1. Supply air, return air, exhaust air fan units.
- C. Work Not Included:
 - 1. Fan units which are on integral part of a heating, or air conditioning unit.
- D. Related Work Specified Elsewhere:
 - 1. Section 144 Basic Materials and Methods
 - 2. Section 140 Ductwork, Hangers, and Accessories

1.02 QUALITY ASSURANCE

- A. Fan performance ratings shall be in accordance with the Air Moving and Conditioning Association (AMCA) Standards, or JIS Certified Rating Seal.

1.03 SUBMITTALS

- A. 1. Submit Product Data for each fan specified, to include fan performance curves, and electrical characteristics.
- B. Submit Operating and Maintenance Manuals.

PART 2: PRODUCTS

2.01 CENTRIFUGAL FANS - BACKWARD INCLINED

- A. Fan shall be a factory assembled and tested unit complete with fan wheel, fan shaft, bearings, drive, motor and accessories as specified below. Capacity shall be as scheduled on the Drawings.
- B. Fan wheel shall be non-overloading type, with backward inclined blades combined with a heavy back plate and spun wheel cone, statically and dynamically balanced.
- C. Fan housings shall have a spun inlet cone matching fan wheel cone. Housing shall be heavy gage welded steel construction with slip joint discharge connection or discharge flange connection. Outdoor units shall have

weather covers for motor and drive constructed of heavy gage metal, provided with ventilation slots, and finished in weather resistance enamel. Covers shall be easily removable for inspection and service.

- D. Bearings shall be self-aligning, frictionless ball bearing, pre-lubricated and sealed.
- E. Fan shafts shall be turned, ground, and polished steel. Fan impeller and driving pulley shall be secured to the shaft with keys and set screws.
- F. Fan shall have V-belt drive with adjustable pitch motor pulleys up through 10 HP. Pulleys shall be cast steel sized for a 1.2 service factor.
- G. Motors shall be ball bearing drive, mounted in compartment isolated from air stream. Motor HP and electrical characteristics shall be as scheduled on the Drawings.

2.02 CENTRIFUGAL FANS - FORWARD CURVED

- A. Fan shall be a factory assembled and tested unit complete with fan wheel, fan shaft, bearings, drive, motor and accessories as specified below. Capacity shall be as scheduled on the Drawings.
- B. Fan wheel shall have die formed forward curved blades and venturi style spun inlet cone; statically and dynamically balanced.
- C. Fan housings shall have a spun inlet cone matching fan wheel cone. Housing shall be heavy gage welded steel construction with slip joint discharge connection or discharge flange connection. Outdoor units shall have weather covers for motor and drive constructed of heavy gage metal, provided with ventilation slots and finished in weather-resistant enamel. Covers shall be easily removable for inspection and service.
- D. Bearings shall be self-aligning, frictionless ball bearing, pre-lubricated and sealed.
- E. Fan shafts shall be turned, ground, and polished steel. Fan impeller and driving pulley shall be secured to the shaft with keys and set screws.
- F. Fan shall have V-belt drive with adjustable pitch motor pulleys up through 10 HP. Pulleys shall be cast steel sized for a 1.2 service factor.
- G. Motors shall be ball bearing drive, mounted in compartment isolated from air stream. Motor HP and electrical characteristics shall be as scheduled on the Drawings.

2.03 CENTRIFUGAL FANS - AIRFOIL

- A. Fan shall be a factory assembled and tested unit complete with fan wheel, fan shaft, bearings, and accessories as specified below. Units shall be single or double width having capacities as scheduled on the Drawings.
- B. Fan wheel shall have die cut airfoil blades welded to steel back plate and spun wheel inlet cone. Double width, double inlet units shall be constructed as an integral assembly; statically and dynamically balanced.
- C. Fan housings shall have a spun inlet cone matching fan wheel cone. Housing shall be heavy gage welded steel construction with slip joint discharge connection or discharge flange connection.
- D. Bearings shall be self-aligning, pillowblock, anti-friction bearings with lubrication fittings and pressure relief feature.
- E. Fan shafts shall be turned, ground, and polished steel. Fan impeller and driving pulley shall be secured to the shaft with keys and set screws.
- F. Outlet dampers shall have center pivot, single motion or opposed blades, suitable for manual or automatic operation; permanently lubricated graphite bronze bearings.
- G. Fans shall have variable inlet vanes suitable for manual or automatic operation, rigidly constructed with friction-free bearings.

2.04 TUBULAR CENTRIFUGAL

- A. Fan shall be a factory assembled and tested unit complete with fan wheel, fan shaft, bearings, drive, motor and accessories as specified below. Capacity shall be as scheduled on the Drawings.
- B. Fan wheel shall be die-formed airfoil blades welded to a heavy back plate and spun wheel cone; statically and dynamically balanced.
- C. Fan housings shall have a spun inlet cone matching fan wheel cone. Housing shall be heavy gauge welded steel construction with discharge flange connection.
- D. Bearings shall be ball or roller anti-friction type and shall be equipped with extended lubrication lines to grease fittings outside of the fan housings. Shafts shall operate at no more than 70% of the first critical speed.

- E. Accessories for fans shall be as indicated on the schedule on the Drawings, and may consist of belt guards, weather proof covers, bolted access doors, quick opening access doors, inlet and outlet flanges, adjustable volume inlet vanes, and other accessories as scheduled.
- F. Fan shall have V-belt drive with adjustable pitch motor pulleys. Pulleys shall be cast steel sized for a 1.2 service factor.
- G. Motors shall be ball bearing drive, mounted on an adjustable platform outside the air stream. Motor HP and electrical characteristics shall be as scheduled on the Drawings.

2.05 PROPELLER FANS

- A. Fan shall be designed for heavy duty service, for mounting in either horizontal or vertical position; have cast aluminum airfoil propellers. Fan shall have a welded steel frame, direct or belt drive as scheduled, and finished in baked on enamel.
- B. Motors shall be ball bearing drive, mounted in compartment isolated from air stream. Motor HP and electrical characteristics shall be as scheduled on the Drawings.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Mounting:
 - 1. Floor mounted units shall be securely mounted with cadmium plated hardware on anti-vibration insulators. Provide all supporting steel, mounting curbs, anchors, etc. required to properly support the unit.
 - 2. Suspended units shall be independently suspended from building structure using vibration isolators.
 - 3. Rigidly anchor roof mounted units to roof curbs using cadmium plate hardware.
- B. Connections
 - 1. Final connections to ductwork shall be made using flexible connectors. Install 12 mm mesh bird screen, discharge of weather hood downstream from discharge shutter.
 - 2. Install anti-backdraft dampers in all exhaust fans.

END OF SECTION

135 - INSULATION FOR MECHANICAL

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	135 - 1
1.02 QUALITY CONTROL	135 - 2
1.03 DEFINITIONS	135 - 2
1.04 SUBMITTALS	135 - 3
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	135 - 3
2.02 MATERIALS	135 - 3
2.03 PIPE INSULATION	135 - 3
2.04 DUCT INSULATION	135 - 4
2.05 ACCESSORIES	135 - 4
<u>PART 3: EXECUTION</u>	
3.01 INSPECTION AND TESTING	135 - 4
3.02 PIPE INSULATION SCHEDULE	135 - 5
3.03 PIPING APPLICATIONS	135 - 5
3.04 DUCT INSULATION SCHEDULE	135 - 6
3.05 DUCT, PLENUM, AND BREECHING APPLICATIONS	135 - 7
LAST PAGE	135 - 7

135 - INSULATION FOR MECHANICAL

PART 1: GENERAL

1.01 DESCRIPTION

A. Provide insulation as indicated and specified.

B. Work Included:

1. The following piping systems shall be insulated:

- a. domestic cold water systems
- b. horizontal soil, waste, and storm sewer piping above grade, within buildings, except as omitted in paragraph C below
- c. underside of roof drains

2. The following duct systems shall be insulated:

- a. low-pressure supply and return air ductwork (both exposed and concealed)
- b. fresh air intake and air relief ductwork
- c. air mixing plenums
- d. air conditioning plenums, housings, and cold sections that are not factory insulated
- e. range-hood ductwork

C. Work Not Included:

1. The following piping systems shall not be insulated:

- a. vertical soil, waste, and storm sewer piping
- b. horizontal soil, waste, and storm sewer piping located within utility and crawl spaces
- c. plumbing vents
- d. underground soil, waste, and storm sewer piping

2. The following ductwork systems shall not be insulated:

a. exhaust ductwork

D. Existing Insulation:

1. Existing insulation that is removed or damaged in the progress of the Work shall be replaced with new insulation, and jacket, and finished to match the existing.

1.02 QUALITY CONTROL

- A. Piping shall be tested before insulation is applied.
- B. All insulation, jacket or facing, and adhesive used to adhere jacket or facing to the insulation, (installed indoors), shall have fire and smoke hazard ratings not exceeding flame spread of 25, and smoke developed of 150. Accessories such as adhesives, mastics, cements, tapes and cloths for fittings shall have similar component ratings.
- C. Installer's Qualifications:
 1. Use only installers regularly engaged in the business of insulating mechanical systems.
- D. Application details shall be in accordance with the insulating material suppliers' recommendations except where a higher standard is specified herein.

1.03 DEFINITIONS

- A. "Concealed" refers to insulation:
 1. above ceilings
 2. enclosed in equipment casings or metal enclosures
 3. in partitions, pipe shafts, or furred spaces
 4. in unfinished spaces, providing that it is at least 2.5 m above floor, and further providing that it is at least 1.25 m from any equipment.
- B. "Exposed" refers to insulation in view, in finished spaces.
- C. "Exterior" refers to outdoors.
- D. "Interior" refers to indoors.

1.04 SUBMITTALS

- A. Provide submittals identified in the following paragraphs:
1. Submit product data on insulation materials, mastics, adhesives, and accessories defining insulation values, installation methods, flames spread/smoke develop ratings, and certificates indicating that the insulation materials meet the specified requirements.
 2. Submit samples of each type of insulation material specified in this Section. Samples shall be as follows:
 - a. Pipe insulation: mean pipe diameter, 150 mm long
 - b. Duct insulation: 300 mm square by listed thickness
 - c. Equipment insulation: 300 mm square by listed thickness
 - d. Breeching insulation: 300 mm square by listed thickness

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from an in-country manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 PIPE INSULATION

- A. Flexible Unicellular Pipe Covering (Type P-2)
1. (Fiberglass)
 - a. Wall Thickness: 15 mm
 - b. Class: JIS A 9505

2.04 DUCT INSULATION

A. Internal, Mineral Fiber-Blankets (Type D-2):

1. Fiberglass

- a. Form B; faced rolled
- b. Class: JIS 9505 density: 32K
- c. Thickness: 25 mm

B. Internal, Thermal and Acoustical (Type D-3):

1. Fiberglass

- a. Class: JIS 9505 density: 40K
- b. Thickness: 50 mm

2.05 ACCESSORIES

A. Sealants:

- 1. Sealants, mastics, and adhesives shall be of the same manufacturer as the insulation, unless specified otherwise.

PART 3: EXECUTION

3.01 INSPECTION AND TESTING

A. Inspection:

- 1. Prior to all Work of this Section, carefully inspect the installation of the materials and equipment to be insulated to verify that all such Work is complete to the point where this installation may properly commence.
- 2. Verify that all insulation may be installed in accordance with all governing codes and regulations, the original design and the manufacturer's written instructions.
- 3. Verify that equipment surfaces are thoroughly clean and dry.

B. Tests:

- 1. Do not install insulation until specified tests have been conducted on the system to be insulated and results approved by the Engineer.

3.02 PIPE INSULATION SCHEDULE

A. Low Temperature Applications (60 degrees C and below):

1. Systems include:
 - a. domestic cold water piping
 - b. horizontal sanitary waste and storm water piping and the underside of roof drains
 - c. condensate pan drain lines
 - d. refrigerant suction and hot gas bypass lines
2. Insulate piping 250 mm and smaller with 15-mm thick Type P-2 insulation.

3.03 PIPING APPLICATIONS

A. General:

1. Any insulation which is not installed in accordance with these specifications, or shows evidence of leaking, sagging, buckling, or sweating shall be replaced in its entirety, using new materials, at no additional cost to the Engineer.
2. All vapor jackets shall have butt and longitudinal joints overlapped (minimum 50 mm overlap) and sealed with adhesive.
3. Insulation which has been damaged is considered defective (dented, torn, loose or defective joints, not waterproofed, leaking, etc.), and shall be replaced entirely with new materials.
4. Vapor barrier jacket shall be applied with a continuous, unbroken vapor seal.
5. All end joints on pipe insulation shall have a 45 degree miter, and vapor seal.
6. Water piping within walls and pipe or utility chases shall be insulated.
7. Hangers shall be installed on the outside of insulation. A steel pipe covering shield or steel saddle, as specified above, shall be installed around the lower 1/3 circumference of the insulation. On metal-jacketed insulation, install hanger around outside of jacket and provide wooden insert at hanger points the same thickness as insulation and 300 mm long, installed inside vapor barrier and metal jacket. Wooden insert shall cover entire circumference of pipe.

8. All insulation shall be preformed to fit the diameter of the pipe or fitting, and shall be applied with longitudinal joints in staggered positions with all end joints tightly butted.
9. All insulation shall be continuous through walls, floors, partitions, and ceilings (except fire rated construction, or where specifically indicated otherwise).
10. Anchors and guides in contact with low temperature piping shall be insulated and vapor barrier maintained.

B. Fittings:

1. Fittings in piping covered with Type P-2 insulation shall be insulated with mitered sections of the same material used to cover the pipe.
2. Removable portions of valves, strainers, etc., shall be insulated in a manner to allow the removable parts to be removed for servicing without disturbing the insulated body.
3. Concealed fittings in smaller than 100-mm piping shall be insulated with a fiber glass blanket, 16 kg/cubic meter density, wrapped firmly under compression to a thickness equal to the adjoining insulation, secured with #20-gauge galvanized annealed steel wire, and given a smoothing coat of an insulating and finishing cement. Exposed fittings in piping smaller than 100 mm and all fitting valves and flanges for pipe sizes 100 mm and larger shall be insulated with mitered segments of the molded insulation, secured with #20 gauge galvanized annealed steel wire, and finished with smoothing coat of an insulating and finishing cement. The above shall be vapor sealed with a layer of glass cloth embedded between two 106-mm thick coats of "Foster 30-35" or equivalent. Lap the sealed glass cloth at least 50 mm on itself and adjoining insulation.

3.04 DUCT INSULATION SCHEDULE

A. Interior Duct Applications:

1. Concealed supply and return air ducts shall be externally insulated with Type D-2 insulation.
2. Ducts shall be internally insulated with Type D-3 insulation where indicated.

3.05 DUCT, PLENUM, AND BREECHING APPLICATIONS

A. Interior ducts and Plenums:

1. Cover all joints on external insulation with 75-mm wide foil-reinforced kraft tape.
2. All insulation shall be installed with edges tightly butted. Any insulation which is not installed in accordance with these specifications, or shows evidence of leaking, sagging, buckling, or sweating shall be replaced in its entirety, using new materials, at no additional cost to the Engineer.
3. All insulation shall be continuous through wall and ceiling openings and sleeves, except at fire or smoke walls or ceilings.
4. Vapor barrier jackets shall be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces shall be adequately insulated and vapor-sealed to prevent condensation.
5. Secure insulation tightly to the ductwork with all circumferential joints butted and all longitudinal joints overlapped a minimum of 50 mm. Secure insulation to ductwork by using mechanical fasteners which do not pierce the duct and by adhesive tape applied the ductwork with 100-mm wide strips at 300 mm on center around the duct. Fasteners shall be adhered to the ductwork with adhesive and shall be installed on 300-mm centers in both circumferential and longitudinal directions. On circumferential joints, secure the 50-mm flange of the facing using 14-mm flare-door staples applied 150 mm on center and tape with minimum 75-mm wide foil reinforced kraft tape. On longitudinal joints, secure the overlap using 14-mm flare-door staples applied 150 mm center and tape using minimum 75-mm wide foil reinforced Kraft tape.
6. Internal insulation shall be installed using mechanical fasteners which do not pierce duct. Fasteners shall be adhered to ductwork with adhesive and shall be installed as required to hold insulation firmly against duct surface (maximum 300-mm centers). All joints shall be covered with manufacturer's recommended sealer. The spray coated surface shall be installed to face the air stream and all leading edges shall be covered with metal nosing strip.

END OF SECTION

136 - PLUMBING FIXTURES AND TRIM

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	136 - 1
1.02 APPLICABLE CODES AND STANDARDS	136 - 1
1.03 SUBMITTALS	136 - 1
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	136 - 1
2.02 MATERIALS	136 - 1
2.03 WATER CLOSETS	136 - 2
2.04 URINALS	136 - 2
2.05 LAVATORIES	136 - 2
2.06 SINKS	136 - 2
2.07 SERVICE SINKS	136 - 3
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	136 - 3
LAST PAGE	136 - 5

136 - PLUMBING FIXTURES AND TRIM

PART 1: GENERAL

1.01 DESCRIPTION

- A. Provide PLUMBING FIXTURES AND TRIM as indicated.

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced code and standards and are submitted for the Engineer review and approval in advance of their use.

- A. Uniform Plumbing Code
- B. Heating, Air-Conditioning and Sanitary Standard in Japan (HASS)

1.03 SUBMITTALS

- A. In compliance with requirements established in the General Requirements provide submittals identified in following paragraphs.

1. Submit Shop Drawings.
2. Submit product data for each type plumbing fixture and trim. Identify fixture type on submittal data.
3. Submit maintenance and operating instructions.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 WATER CLOSETS

A. General:

1. Eastern Water Closet

Eastern Water closets shall be provided. Hand washing hose shall be flexible metallic with chrome plated fittings with a 19 mm self closing valve.

2. Western Water Closet

Western Water Closets shall be floor mounted flushometer type complete with elongated siphon jet action bowl. Trim shall be chromium plated brass. Toilet seats shall be the open front type, solid white plastic with high rise seat hinges. No seat cover is required in public areas.

3. Water Flow for each water closet shall require no more than 14 liters per flushing.

2.04 URINALS

A. General:

1. Urinals shall be floor-mounted, flushometer type vitreous China with extended shields. There shall be an integral flush spreader.

2. Urinals shall require no more than 2 liters per flushing.

2.05 LAVATORIES

A. General:

1. Lavatories shall be self-rimming type, vitreous-or porcelain-lined ware with front overflow. Unit shall be suitable for pullman type installation with 2 clamp assemblies mounted in a cabinet top or equal with back splash and apron. Faucets shall be as indicated.

2. All faucets shall have maximum 0.15 liters/sec. flow.

2.06 SINKS

A. General:

1. Sink (Tea Kitchen)

Kitchen sinks shall be 60-liter stainless-steel type with double bowl, countertop type, self rimming, flush fitting deck. It shall have 4 holes for use with spray-type hose faucet.

2. Faucets

Faucets for kitchen sinks shall be single level type with swing spout, hose and spray attachment and shall have chrome and stainless steel finish, with a 20 cm centerset spread. Max. flow 0.15 liters/sec.

2.07 SERVICE SINKS

A. General:

1. Fixture: Minimum 610-mm x 510-mm vitreous china service sink with 300-mm high back, wall hanger, perforated-grid, chrome-plated strainer and 75-mm cast iron, acid-resisting, enameled inside adjustable "P" trap standard with cleanout.
2. Faucet: Rough chrome plated double sink supply with 12 mm female flange, adjustable supply arms, integral stops; adjustable wall brace; pail hook, 19 mm hose connection, plus vacuum breaker.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Set plumbing fixtures tight, level, and rigid on proper grounds. Use setting compound under all setting surfaces.
- B. Provide required trim including supplies, loose-keyed stops, wastes, traps, floor and wall escutcheon plates.
- C. Protect fixtures after they are set. Thoroughly clean them at the completion of the project.
- D. General Plumbing Criteria:
 1. Headers supplying flush valve fixtures shall run full-size to last fixture.
 2. Shut-off valves shall be supplied in the furring for each fixture or to banks of two or more fixtures, where required for proper system control, entrances of buildings and to all equipment and controls.
 3. Concealed valves shall be provided with access plates.
 4. Install unions on one side of all valves, equipment connections and elsewhere as shown or required for ease of service and/or installation, unless flanges are indicated.

5. All unions shall be accessible.
6. Minimum branch pipe size shall be 20 mm nominal.

E. Rough-in:

1. Final connections to plumbing fixtures, unless otherwise noted shall be:

	COLD WATER	WASTE	VENT
Water Closet (Flushometer Type)	25 mm	100 mm	75 mm
Water Closet (Tank Type)	12 mm	100 mm	75 mm
Urinal	75 mm	75 mm	50 mm
Lavatories and Sinks	12 mm	38 mm	38 mm
Service Sinks	12 mm	75 mm	38 mm

- F. Caulk around all plumbing fixtures with white silicone epoxy type, non-hardening compound, where fixtures meet floor or wall as required to present a finished appearance. See Section on Sealants and Caulking.

G. WATER TANKS

Water tanks shall be constructed of unsaturated polyester reinforced with glass fiber (herein called F.R.P.) prefabricated panel as shown on the drawings.

Unsaturated polyester resin shall have excellent waterproofing and weather resisting characteristics and not be harmful to health and water quality.

The tank shall be provided with fittings for connections of water-filling pipe, water-supply pipe, drain pipe, overflow pipe, vent pipe, electrode and ripple proof baffle board, manhole and FRP or steel ladders. Vent and overflow pipe shall be provided with plastic insect screen. Water tanks shall be of type and size as shown on the drawings and shall be as approved by the Engineer.

1. The reservoir foundation shall have sufficient bearing surface to support the weight of tank, when full, filled with water and without any distortion at the bottom plate of the reservoir. Piping shall be properly supported to avoid the piping loads depending upon the reservoirs. Piping shall be connected to reservoir by flexible joints except over-flow pipe, vent pipe and blow-off pipe.
2. The tank foundation shall have sufficient bearing surface to support the weight of tank, when filled with water and without any distortion at the bottom plate of the tank, and shall be mounted on the base in a manner sufficiently strong to resist wind loads and

other impacts. Piping shall be properly supported to avoid the piping loads depending upon the tank. Piping shall be connected to tank by flexible joints except overflow pipe, vent pipe and blow off pipe.

END OF SECTION

137 - FIRE EXTINGUISHERS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	137 - 1
1.02 QIALITY ASSURANCE	137 - 1
1.03 SUBMITTALS	137 - 1
1.04 JOB CONDITIONS	137 - 1
<u>PART 2: PRODUCTS</u>	
2.01 FIRE EXTINGUISHERS	137 - 1
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	137 - 1
LAST PAGE	137 - 2

137 - FIRE EXTINGUISHERS

PART 1: GENERAL

1.01 DESCRIPTION

- A. Provide fire extinguishers, as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

- A. Codes and Standards:

- 1. Comply with all local Standards or equivalent goods.

1.03 SUBMITTALS

- A. Submit Product Literature on fire extinguishers, cabinets, and accessories.
- B. Submit certificates from the manufacturer as evidents that the products meet these specifications and the referenced standards.

1.04 JOB CONDITIONS

- A. Fire extinguishers shall not be used for the requirements of temporary facilities or for construction fire protection.
- B. All fire extinguishers shall be left in a fully charge condition and inspected and approved by the local authorities at the completion of the project.

PART 2: PRODUCTS

2.01 FIRE EXTINGUISHERS

- A. Dry Chemical extinguishers shall be 10-pound capacity; red enameled housing, squeeze handle with pull pin, discharge nozzle, complete with hanger bracket.
- B. Carbon Dioxide extinguishers shall be proper type for Class B and Class C fires, steel and red enamel finish tank, 5-kg capacity, squeeze handle with pull pin, discharge nozzle, wall mounting bracket.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Extinguishers shall be mounted at a height of 1500 mm to the top above finished floor.

- B. Fire extinguisher cabinets shall be set true and level at a height or 1500 mm above finish floor.

END OF SECTION

138 - DIFFUSERS, REGISTERS AND GRILLES

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	138 - 1
1.02 SUBMITTALS	138 - 1
<u>PART 2: PRODUCTS</u>	
2.01 DIFFUSERS	138 - 1
2.02 REGISTERS	138 - 1
2.03 GRILLES	138 - 1
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATIONS	138 - 2
LAST PAGE	138 - 2

138 - DIFFUSERS, REGISTERS AND GRILLES

PART 1: GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide diffusers, registers and grilles as indicated on the Drawings and specified herein.
- B. Related Work Specified Elsewhere:
 - 1. Section 140 Ductwork, Hangers, and Accessories.

1.02 SUBMITTALS

- A. Product Data:
 - 1. Submit descriptive literature for each type diffuser, register, and grille specified.

PART 2: PRODUCTS

2.01 DIFFUSERS

- A. Type D-1: ANEMO-type (C-2)
- B. Type D-2: Size and capacity as shown on Drawings: VHS-type (Universal Register)
- C. Type D-3: SL-type (Slit Type Register)
 - 1. Size and capacity as shown on Drawings;

2.02 REGISTERS

- A. Type R-1: HS-type (Universal Register)
 - 1. Size and capacity as shown on Drawings;

2.03 GRILLES

- A. Type G-1: OAG-type (Outside Air Inlet Grille)
 - 1. Size and capacity as shown on Drawings;
- B. Type G-2: EAG-type (Exhaust Air Grille)
 - 1. Size and capacity as shown on Drawings;

PART 3: EXECUTION

3.01 INSTALLATIONS

A. Diffusers:

1. Diffusers locations as shown on the Drawings are approximate. Installations shall be in accordance with Architectural reflected ceiling plan.

B. Registers and Grilles:

1. Registers and grilles installed in walls shall be set level and true.
2. Register and grilles installed in grid type acoustical ceilings shall center in ceiling tile. Installation shall be in accordance with Architectural reflected ceiling plan.

END OF SECTION

139 - AIR COOLED CONDENSING UNIT

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	139 - 1
1.02 SUBMITTALS	139 - 1
<u>PART 2: PRODUCTS</u>	
2.01 SYSTEM UNITS	139 - 1
2.02 CONDENSING UNITS	139 - 2
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	139 - 4
3.02 CONNECTIONS	139 - 4
3.03 START-UP SERVICE	139 - 4
LAST PAGE	139 - 4

139 - AIR COOLED CONDENSING UNIT

PART 1: GENERAL

1.01 DESCRIPTION OF WORK

A. Provide air cooled condensing units as indicated on the drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Section 144 BASIC MATERIALS AND METHODS

2. Section 143 REFRIGERANT PIPING SYSTEMS

1.02 SUBMITTALS

A. Submit product data defining size, arrangement, capacities, materials, accessories furnished, etc. for specified equipment.

B. Submit shop drawings defining piping arrangements, pipe sizes, and valving requirement as recommended by the manufacturer for proper operation of unit.

PART 2: PRODUCTS

2.01 SYSTEM UNITS

A. Assembly:

1. Unit shall be completely factory pre-assembled, pre-piped, and pre-wired; consisting of compressor, condenser coil, condenser fan and motor, refrigerant receiver, sight glass, charging valve, unit controls and a holding charge of refrigerant R22. Unit shall be designed for thru-the-wall, out-door mounting and shall have a minimum refrigerating capacity and characteristics as shown on the Drawings.

B. Casing:

1. Casing shall be low silhouette type constructed of minimum 16-and 18-gauge zinc-coated steel; exterior surfaces phosphatized, painted with epoxy primer, and finished with baked on enamel. Supporting channel, fan and motor base and motor mount shall have a heavy zinc coating. Coil frame shall be minimum 12-gauge zinc coated steel. Provide removable access panels for proper access to all controls and parts requiring maintenance. Provide for water drainage. Compressor shall be mounted in a separate compartment.

C. Condenser Fan and Drive:

1. Condenser fans and drives shall be axial flow propeller fans having zinc plated or aluminum statically and dynamically balanced blades and permanently lubricated ball bearings. Fans shall be powered by weatherproof, permanently lubricated ball bearing heavy-duty motors with built-in thermal overload protection; shafts ground and polished steel protected with Cosmoline film.

D. Refrigerant Compressor:

1. Compressor shall be hermetic type mounted on steel base. Units shall be forced-feed lubrication with filters, magnetic plugs, centrifugal cleaning, suction screen inlet, mufflers, crankcase heater and liquid line filter-dehydrator, and enclosed in a sound attenuating compartment on rubber-in-shear isolators. motors shall be suitable for voltage fluctuations of plus or minus 15% of nameplate voltage and shall have two thermostats located directly in motor winding.

E. Condensing Coil:

1. Condensing coil shall be designed specifically for air condensing; constructed of 9 mm trade size diameter seamless copper tubing and heavy-duty aluminum fins mechanically bonded to the tubes; factory tested at 28.42 kg/cm² air pressure under water and vacuum dehydrated at 80 degrees C.

F. Controls:

1. Control box containing all controls shall be mounted on exterior of casing with controls directly accessible when access panel is opened; controls factory pre-wired complete with magnetic contractor for both compressor and condenser fan motor, three-phase compressor overload protection, high and low pressure cutouts, oil pressure switch and non-recycling pumpdown control relay, crankcase heater relay, low ambient control, condenser fan interlock, etc., as required.

2.02 CONDENSING UNITS

A. Assembly:

1. Unit shall be completely factory pre-assembled, pre-piped and pre-wired consisting of compressor, condenser coils, condenser Fan and motor, refrigerant receiver, sight glass, charging valve, unit controls and a holding charge of Refrigerant R22. Unit shall be designed for outdoor mounting and have minimum

refrigerating capacity as shown on the Drawings. Motor characteristics and accessories shall be as shown on the Drawings.

B. Case:

1. Casing shall be low-silhouette type; constructed of minimum 14-and 16-gauge zinc-coated steel. Exterior surfaces shall be phosphatized, painted with primer, and finished with baked on enamel. Fan and motor base, and motor mount shall have a heavy zinc coating. Coil frame shall be minimum 12-gauge zinc coated steel. Provide removable access panels for proper access to all controls and parts requiring maintenance. Furnish condenser fan guard.

C. Condenser Fan and Motor:

1. Condenser fans and drives shall be axial flow propeller fans, with zinc plated or aluminum statically and dynamically balanced blades, permanently lubricated ball bearings and V-belt drives. Fans shall be powered by weatherproof, permanently lubricated ball bearing, heavy duty, fan motors with built-in thermal overload protection. Shafts shall be ground and polished steel protected with Cosmoline film.

D. Compressors:

1. Compressors shall be hermetic type mounted on minimum 10 gage steel base, complete with foam breaker, spring loaded cylinder heads, nonflexing ring plate valves, forced-feed lubrication with filters, magnetic plugs, removable heads, cylinder liners, crankcase openings, cylinder unloaders for steps of capacity modulation as shown on the Drawings. Provide rubber-in-shear isolators, motor suitable for voltage fluctuations of plus or minus 15% of nameplate voltage, two thermostats located directly in motor winding, and crankcase heater.

E. Condenser Coils:

1. Condensing coil shall be designed specifically for air condensing, constructed of 15 mm trade size diameter seamless copper tubing and heavy-duty aluminum fins mechanically bonded to the tubes, factory tested at 28.42 kg/cm² air pressure under water vacuum dehydrated at 80 degrees C, two circuit design with coil return bends protected by a galvanized steel cover.

F. Controls:

1. Control box containing all controls shall be mounted on exterior of casing with controls directly accessible when hinge cover panel is open. Controls shall be factory pre-wired complete with magnetic contactor for both compressor and condenser fan motor, compressor overload protection in each phase line, high and low pressure cutouts, oil pressure switch and non-recycling pumpdown control relay, automatic non-recycling pumpdown, low ambient control, condenser fan interlock, etc. as required.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Mounting details shall be as shown on the Drawings.
- B. Units shall be mounted using vibration control devices.

3.02 CONNECTIONS

A. Piping:

Refrigerant piping shall be as specified in Section H and in accordance with manufacturers published installation diagram.

B. Electrical:

1. Refer to Section 145 for electrical characteristics.

3.03 START-UP SERVICE

- A. provide the services of a factory authorized service representative to inspect the installation and connection and provide initial start-up service. Services shall include a complete operational check of the system to insure proper operation; and instructions to the Owners maintenance personnel on the proper maintenance and operating procedures.

END OF SECTION

140 - DUCTWORK, HANGERS, AND ACCESSORIES

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	140 - 1
1.02 APPLICABLE CODES AND STANDARDS	140 - 1
1.03 DEFINITIONS	140 - 2
1.04 SUBMITTALS	140 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	140 - 2
2.02 MATERIALS	140 - 2
2.03 SEALANTS	140 - 3
2.04 HANGERS	140 - 4
2.05 ACCESSORIES	140 - 4
<u>PART 3: EXECUTION</u>	
3.01 LOW-PRESSURE DUCT INSTALLATIONS	140 - 5
3.02 HANGERS AND SUPPORTS	140 - 7
3.03 DUCT ACCESSORIES	140 - 9
3.04 TESTING	140 - 9
LAST PAGE	140 - 9

140 - DUCTWORK, HANGERS, AND ACCESSORIES

PART 1: GENERAL

1.01 DESCRIPTION OF WORK

A. Work Includes:

1. Provide ductwork as indicated on the Drawings.

B. Related Work Specified Elsewhere:

1. Section 134 Fans

2. Section 138 Diffusers, Registers and Grilles

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

A. American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE), Guide and Data Books

B. National Fire Protection Association (NFPA):

1. Standard 90A: Standard for Installation of Air Conditioning and Ventilating Systems, 1976

2. Standard 90B; Standard for Installation of Warm Air Heating and Air Conditioning Systems, 1976

3. Standard 101: Code For Safety to Life From Fires in Buildings and Structures, 1976

C. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):

1. Low-Pressure Duct Construction Standards, Fifth Edition, 1976

2. High-Pressure Duct Construction Standards, Third Edition, 1975

D. Heating, Air-Conditioning and Sanitary Standard in Japan (HASS)

1.03 DEFINITIONS

A. Duct Velocity Classification:

1. Duct Velocity Classification shall be in accordance with Table 1-1, SMACNA, Low-Pressure Duct Construction Standards.

1.04 SUBMITTALS

A. Shop Drawings:

1. Submit five sets of sheet metal shop drawings. Shop drawings shall include the following minimum information:
 - a. Ductwork layout on floor plans to scale
 - b. Fire damper installations and locations
 - c. Access door installations and locations
 - d. Duct Sizes and fabrication methods
 - e. Volume dampers, motorized dampers, turning vanes, and extractor installation, fabrication and locations

B. Record Drawings:

1. Submit project record drawings.
2. Drawings shall be marked to indicate the actual, "AS INSTALLED" conditions, and shall include duct sizing and routing. Dimension locations of ducts from column lines. Pay particular attention to concealed duct locations.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

A. Rectangular:

1. Ducts shall be fabricated from #1 finished cold-rolled galvanized sheet steel with smooth inside and shall be of sizes as shown on the Drawings. Dimensions as shown are inside measurements indicating free area required. Make allowances for internally insulated ductwork.
2. Minimum rectangular duct sheet metal gauges shall be as follows:

<u>Dimension of Longest Side</u>	<u>Gauge</u>
Up through 300 mm	26
325 mm through 762 mm	24
787 mm through 1300 mm	22
1325 mm through 2130 mm	20
2155 mm through 3050 mm	18

B. Round:

1. Round ducts shall be factory-fabricated zinc-coated steel of spiral lockseam construction.
2. Round duct fittings shall be factory-fabricated zinc-coated steel for 45 degrees or conical take-off from the main trunk. Fittings shall be minimum 20 gauge.
3. Minimum round duct sheet metal gauges for low-pressure ductwork shall be as follows:

<u>Duct Diameter</u>	<u>Gauge</u>
Up through 200 mm	26
255 mm through 558 mm	24
583 mm through 900 mm	22
925 mm through 1270 mm	20

C. Special Usage:

1. Ductwork shall be stainless for ducts exposed below ceiling and aluminum above ceiling. Stainless steel ductwork shall be minimum #16 gauge 302 stainless steel with #4 finish on exterior side. Aluminum ductwork shall have wall thickness equivalent to #16 gauge.

2.03 SEALANTS

A. Material:

1. Sealants for joints shall be as recommended by the duct manufacturer.

2.04 HANGERS

- A. Strap hangers shall be strips of galvanized steel strap sized as scheduled herein.
- B. Hanger rods shall be hot-rolled steel rods and where installed in corrosive atmosphere where rod shall be electro-galvanized; all-thread rod sized as scheduled herein.

2.05 ACCESSORIES

A. Fire Dampers:

- 1. Fire dampers for LP ducts shall be JIS listed and labeled as a unit to permit mounting without collars or sleeves for vertical or horizontal installations; minimum 22 gauge vertically-stacked steel blades with interlocking joints; fusible link set at 70 degrees C; minimum 22 gauge one-piece roll-formed galvanized steel frame of all welded construction; suitable for connecting rectangular or round low pressure ductwork.
- 2. Combination fire and smoke dampers shall have JIS listed and labeled fire damper, minimum 21 gauge steel vertically stacked blades with rolled edge, 60-mm blade width, electrically-operated smoke release, fusible link set for 70 degrees C, stainless steel spring, 38 mm x 38 mm steel sleeve and having a rust-inhibitor coating.

B. Flexible Connections:

- 1. Flexible duct connections shall be JIS listed neoprene coated double glass fabric, connections exposed to weather or other moisture conditions shall have a rubber exterior finish.

C. Instrument Ports:

- 1. Instrument ports shall be die cast collar cap; neoprene gasket, raised base to depth of insulation.

D. Access Doors:

- 1. Access doors for LP rectangular ductwork shall have 25- mm thick insulation, 22-gauge, galvanized steel door attached to 22-gauge, galvanized steel frame having 15-mm notch knock-over edges, continuous aluminum hinge, cam lock latch, 12 mm wide gasket.
- 2. Access doors for round or flat oval low- or high-pressure ductwork shall be a complete duct section-access door combination assembly, constructed of minimum 20-gauge galvanized steel, all welded construction. Diameter of access section shall be

same as the duct in which they are installed, shall have pressure sensitive release for manual or emergency vacuum release, double wall, galvanized steel, insulated door having handle, chain retainer, and gasket.

E. Volume Dampers:

1. Duct volume dampers shall be minimum 20 gauge, galvanized iron, welded to a 10 mm square steel operating rod set in end bearings; complete with key operated regulator having dial indications. Regulators on insulated ducts shall have raised base to depth of insulation.

F. Turning Vanes:

1. Duct turning vanes shall be dual radius type secured to steel side pieces, length as required for duct size, constructed in accordance with SMACNA Standards Plate 22 (Low Velocity).

G. Air Extractors:

1. Air extractors shall be hinged paddle type which shall operate from outside of the duct, complete with operating rod having locking device.

PART 3: EXECUTION

3.01 LOW-PRESSURE DUCT INSTALLATIONS

A. Fabrication:

1. All ductwork shall be fabricated and installed in accordance with the recommendations of the latest edition of ASHRAE Guide and Data Books and SMACNA Low Velocity Duct Construction Standards.
2. All rectangular sheet metal ducts over 450 mm in width shall be cross broken. Reinforcing angle and stiffeners shall be provided where required to prevent sagging, buckling, vibration, sound transmission, etc.
3. Range Hood Exhaust Duct:
 - a. Install ducts without forming dips or traps which may collect residues.
 - b. Provide an access panel at each change in direction of the duct and at maximum intervals of 2 meters for purposes of inspection and cleaning. Access panel shall be at the sides and large enough to permit cleaning. In

horizontal sections, the lower edge of the access panel shall be not less than 38 mm from the bottom of the duct.

- c. Where ducts pass through partitions or walls of combustible material, the material shall be cut away to provide a clearance to the duct not less than 450 mm, unless protection is provided as specified below. The clearance may be reduced to that indicated below when the combustible material is protected as follows:

<u>Type Of Protection</u>	<u>Clearance</u>
6-mm asbestos millboard spaced out 25 mm on noncombustible spacers	300 mm
28-gauge sheet metal on 6-mm asbestos millboard	300 mm
28-gauge sheet metal spaced out 25 mm on noncombustible spacers	225 mm
28-gauge sheet metal on 3-mm asbestos millboard spaced out 25 mm on noncombustible spacers	225 mm
6-mm asbestos millboard on 25-mm mineral wool bats reinforced with wire mesh or equivalent	150 mm
22-gauge sheet metal on 25-mm mineral wood bats reinforced with wire mesh or equivalent	75 mm

4. Combustible material as pertaining to materials adjacent to or in contact with ducts, means material made of a surface with wood, compressed paper, plant fibers, or other material that will ignite and burn. Such material shall be considered as combustible even though flame-proofed, fire-retardant treated, or plastered.
5. Radius type elbows fabricated with inside radius equal to width of duct.
6. Maximum angle of transition of 20 degrees for diverging air flow and 309 degrees for contracting air flow.

B. Joints:

1. Dissimilar metals shall have a heavy coat of zinc primer applied at connection point to keep surfaces from direct contact with each other.
2. All joints shall be made airtight and sheet metal joints shall be sealed with Minnesota Mining and Manufacturing type 800 sealant (or equal) after fabrication and assembly. Round sheet metal duct joints shall be slip joints secured with sheet metal screws. joints for rectangular sheet metal ducts shall be standing seam for traverse joints, inside groove seam for longitudinal joints, and Pittsburgh seam for corner joints.
3. All seams and joints for range hood exhaust ductwork shall be liquidtight continuous external weld.

C. Lintels:

1. Furnish and install lintels over all ducts that pass through load bearing walls and for all ducts over 300 mm wide passing through all masonry walls. Lintel size shall be sufficient to support loads above.
2. Connections with flexible duct to trunk ducts and terminal boxes shall be sealed and connected in strict accordance with flexible duct manufacturer's written instructions.

3.02 HANGERS AND SUPPORTS

A. Fabrication:

1. All ductwork hangers and supports shall be fabricated and installed in accordance with the recommendation of the latest edition of ASHRAE Guide and Data Books and SMACNA Duct Construction Standards.

B. Supports:

1. Secure strap hangers to rectangular ducts less than 1220 mm wide with sheet metal screws. Extend strap hanger a minimum of 25 mm across the bottom of the duct from each side and attach with at least one screw. Quantity of screws in the side of the duct shall be sufficient to adequately anchor duct to strap hanger.
2. Attach hanger rods for rectangular duct 1220 mm wide and larger to duct using angle iron trapeze across bottom of duct.

3. Secure strap hangers to round ducts by using straps the same size as the hanger which is wrapped around the duct and secured to hanger.
4. Install attachments to ductwork around the outside of the vapor barrier. Vapor barrier shall be protected from puncture by the use of an 18-gauge sheet metal shield installed around the lower 1/3 circumference of round duct and across the bottom of rectangular duct between lower attachment and vapor barrier. Shield shall extend minimum of 150 mm on each side of lower attachment.
5. All hangers shall be securely anchored to the building structure using cadmium plated hardware.

C. Hanger Sizing:

1. Hangers and lower attachments shall be of adequate sizes and spacing to carry the weight of the ductwork and insulation without sagging or droop, but in no case shall be less than as scheduled below.

a. Rectangular Ductwork:

<u>Duct Width (mm)</u>	<u>Hanger Type</u>	<u>Hanger Size (mm)</u>	<u>Trapeze Angle Size (mm)</u>	<u>Maximum Spacing (mm)</u>
Up to 1193	Strap	25 x 16 GA.		3000 O.C.
1229 through 1524	Rod	9	38 x 38 x 3	3000 O.C.
1550 through 2133	Rod	9	50 x 50 x 3	1828 O.C.
2160 through 2438	Rod	9	50 x 50 x 5	1828 O.C.
2463 through 3048	Rod	9	50 x 50 x 6	1828 O.C.

NOTE: For ducts over 3048 wide, see special hanging and support details on the Drawings.

b. Round Ductwork

<u>Duct Diameter (mm)</u>	<u>Hanger Type</u>	<u>Hanger Size (mm)</u>	<u>Maximum Spacing (mm)</u>
Up to 457	Strap	25 x 15 GA.	3000 O.C.
482 to 914	Strap	25 x 12 GA.	3000 O.C.
939 to 1270	Strap	38 x 12 GA.	3000 O.C.

NOTE: For ducts over 1270 in diameter, see special detail on the Drawings.

c. Flexible Ductwork

<u>Duct Diameter (mm)</u>	<u>Hanger Type</u>	<u>Hanger Size (mm)</u>	<u>Maximum Spacing (mm)</u>
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Up to 457 Strap 25 x 15 GA. 300 O.C.

NOTE: For ducts over 457 in diameter, see special details on the Drawings.

3.03 DUCT ACCESSORIES

A. Fabrication:

1. All ductwork accessories shall be fabricated and installed in accordance with the recommendation of the latest edition of ASHRAE Guide and Data Books and SMACNA Duct Construction Standards.

B. Accessories:

1. Volume dampers shall be installed where shown on the Drawings and elsewhere as required to provide for proper air distribution and balancing.
2. Fire and smoke dampers shall be installed in all ducts passing through fire or smoke rated walls and ceilings and elsewhere as shown on the Drawings.
3. Flexible connections shall be provided for every duct connection to equipment and as elsewhere shown on the Drawings. Connection shall be of sufficient length of eliminate vibration transmission.
4. Access doors shall be provided in ducts downstream from fire dampers for access to fire damper operating mechanisms.
5. Instrument ports shall be provided on both the inlet and discharge sides of air supply fans and elsewhere as shown on the Drawings.
6. Anti-backdraft dampers shall be installed below each exhaust fan and relief vent at roof in a position accessible from the roof.
7. Air extractor shall be used at each 90 degrees take-off from supply ducts and elsewhere shown on the Drawings.
8. Turning vanes shall be installed in each supply duct at 90-degree (square) elbows and elsewhere shown on the Drawings. Field fabricated turning vanes are not acceptable.

3.04 TESTING

- A. No testing required for low-pressure systems.

END OF SECTION

141 - POTABLE WATER PIPING SYSTEM

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	141 - 1
1.02 APPLICABLE CODES AND STANDARDS	141 - 1
1.03 SUBMITTALS	141 - 1
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	141 - 2
2.02 MATERIALS	141 - 2
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATIONS	141 - 2
LAST PAGE	141 - 3

141 - POTABLE WATER PIPING SYSTEM

PART 1: GENERAL

1.01 DESCRIPTION

- A. Provide a complete potable water supply system as indicated on the Drawings and specified herein.
- B. Work includes:
 - 1. Cold water supply and specialties.

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. American National Standards Institute (ANSI):
 - 1. B16.22: Wrought Copper and Bronze Solder-Joint Pressure Fittings
- B. American Standard for Testing and Materials (ASTM):
 - 1. B32: Solder Metal, Spec. for,
 - 2. B88: Seamless Copper Water Tube, Spec. for,
- C. American Water Works Association (AWWA):
 - 1. B300 Series Standards: Disinfection
- D. Japanese Industrial Standard (JIS)
 - 1. JIS G 3452 - Galvanized Steel Pipe

1.03 SUBMITTALS

- A. Submit Product Data on each item of equipment and all materials specified.
- B. Submit maintenance and operating instructions on all items of equipment.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

A. Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

B. Piping:

1. Pipe shall be galvanized steel pipe JIS G 3452 or ASTM A-53 Type F with fittings.

C. Accessories:

1. Flexible pipe connectors shall have a stainless steel bellows with a woven flexible bronze wire reinforcing protective jacket. Connectors shall be minimum of 300 mm in length with thread male or flanged ends as required for proper installations. Sweat end connections are not acceptable. Connectors shall be rated for 10 kg/cm² water working pressure, 120 degrees C operating temperature and suitable for up to maximum 20 mm misalignment.

2. Shock absorbers shall be elastomer bellows type, with stainless steel shell, glycerine hydraulic displacement fluid and pressurized argon pneumatic displacement cushion. Shock absorbers shall be individually sized as required for equipment served.

PART 3: EXECUTION

3.1 INSTALLATIONS

A. Supplies and Trim:

1. All supplies, hardware, trim, traps, etc. to fixtures and equipment shall be chrome plated brass if exposed to view.

B. Air Chambers:

1. Air chambers shall be furnished and installed at the top of all cold domestic water risers, at the end of each water header in utility spaces, at the end of each branch line and at the top of all branches to fixture. Shock absorbers shall be installed at each

solenoid valve or piece of equipment that has a quick closing type valve. Air chambers shall be a minimum of two pipe sizes larger than the terminating pipe and shall be equipped with an accessible drain valve and air recharging petcock.

D. Vacuum Breakers:

1. Vacuum breakers shall be furnished and installed on all faucets and valves which have provisions for hose connections and water supplies to equipment or devices that have inlets below the overflow rim.

E. Underground Piping:

1. No underground or underslab water piping within building shall be permitted unless specifically shown otherwise on the drawings and approved by the Engineer.

END OF SECTION

142 - SANITARY AND STORM SEWER SYSTEMS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	142 - 1
1.02 QUALITY ASSURANCE	142 - 1
1.03 APPLICABLE CODES AND STANDARDS	142 - 1
1.04 SUBMITTALS	142 - 1
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	142 - 2
2.02 MATERIALS	142 - 2
2.03 PIPING MATERIALS	142 - 2
2.04 MANHOLES	142 - 2
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION OF PIPE	142 - 3
3.02 CLEANING PIPES	142 - 3
3.03 TESTING	142 - 4
3.04 UNDERGROUND STRUCTURES	142 - 4
LAST PAGE	142 - 4

142 - SANITARY AND STORM SEWER SYSTEMS

PART 1: GENERAL

1.01 DESCRIPTION

- A. Provide sanitary and storm systems as indicated on the Drawing specified herein.

1.02 QUALITY ASSURANCE

- A. Allowable Tolerances:

1. Rate of leakage for any gravity line section or sections or for total length of pipe lines may not be greater than 5 liters per mm of pipe diameter per km per 24 hours.
2. Force mains: Zero leakage in 30 minutes at 150 percent of the maximum pressure that the pump or ejector is capable of developing.

1.03 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they given an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

- A. American Standards for Testing and Materials (ASTM):

A74-75: Cast Iron Soil Pipe and Fittings Spec For,
Recommended Practice For,

- B. Japanese Industrial Standard (JIS)

1. G 3452 Steel Pipe
2. B 2301 Pipe Joints
3. B 1201 Pipe Joints
4. G 5525 Cast Iron Drainage Pipes

- C. Heating, Air Conditioning and Sanitary Standards (HASS) 210

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit shop drawings for precast concrete manholes.
- B. Product Literature:
 - 1. Submit product literature for all pipe and accessories required for the storm systems.
 - 2. Submit product literature for all manhole covers, steps, and catch basin covers required for the sewer systems.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

2.03 PIPING MATERIALS

- A. Cast Iron Soil Pipe and Fittings:
 - 1. Pipe and fittings: ASTM A74, JIS G 5525 or HASS 210; extra heavy or service weight.
 - 2. Joints: Neoprene gaskets: lead and oakum caulked.
- B. Galvanized Steel Pipe and Fittings (For Vent and Drain Piping)
 - 1. Pipe and Fitting: JIS G 3452
 - 2. Joints: JIS B 2301-2302

2.04 MANHOLES

- A. Concrete Base: Precast or cast-in-place, at Contractor's option. Use concrete which will attain a 28-day compressive strength of not less than 214 kg/cm².
- B. Precast Concrete Manholes: with integral steps; sized as indicated.

PART 3: EXECUTION

3.01 INSTALLATION OF PIPE

A. General:

1. Inspect pipe before installation to detect defects. Mark defective materials with white paint and promptly remove from the site.
2. Lay pipe beginning at the low point of a system, true to the grades and alignment indicated with unbroken continuity of invert.
3. Place bell ends of pipe or the groove end of concrete pipe facing upstream.
4. Install gaskets in accordance with manufacturer's recommendations for the use of lubricants, cements, and other special installation requirements.
5. Place outside lap of corrugated metal pipe facing upstream, and longitudinal laps at the side.

B. Cast Iron Soil Pipe:

1. After inspection and at least 48 hours before installation, apply a high-build bituminous coating to external surfaces. Apply in a single coat in accordance with manufacturer's recommendations to attain a dry-film thickness of not less than 12 mils.

C. Joint Adaptors:

1. Make joints between cast iron pipe and other types of pipe with standard manufactured cast iron adapters and fittings. Provide dielectric insulation at connections of dissimilar metals and where shown on the Drawings.

D. Roof Drain Connections:

1. Connect roof drains to storm drain.
2. Grout joints between cast iron pipe and concrete pipes thoroughly with cement mortar to make watertight joint.

3.02 CLEANING PIPES

- A. Clear the interior of pipe of dirt and other material as the Work progresses. Maintain a swab or drag in the line and pull past each joint as it is completed.
- B. Flush lines between manholes if required to remove collected debris.

3.03 TESTING

- A. Perform an exfiltration test of the pipe between consecutive manholes. The test shall be performed by filling the pipe with water to a height of 600 mm above the top of the pipe at the upstream manhole and allowing the pipe to remain filled for a period of 72 hours prior to checking the leakage. The allowable leakage shall not exceed 5 liters per mm of pipe diameter per km in a 24 hour period. If local codes are more stringent, they shall supersede the above test.

3.04 UNDERGROUND STRUCTURES

A. Masonry Construction Manholes:

1. At Contractor's option, use either sewer brick or concrete masonry units to construct masonry manholes.
 - a. Mix mortar with only enough water for workability. Retempering of mortar will not be permitted. Keep mortar mixing and conveying equipment clean. Do not deposit mortar upon, or permit contact with, the ground.
 - b. Lay masonry in mortar so as to form full bed with ends and side joints in one operation, and with full bed and vertical joints, not more than 15 mm wide. Protect fresh masonry from freezing and from too rapid drying.
 - c. Apply a 12 mm thick mortar coating on both interior and exterior wall surfaces.
 - d. Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops 75 mm above finish surface, unless otherwise indicated.
 - e. Use an epoxy bonding compound where manhole steps are mortared into masonry walls.

END OF SECTION

143 - REFRIGERANT PIPING SYSTEM

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	143 - 1
1.02 QUALITY ASSURANCE	143 - 1
1.03 SUBMITTALS	143 - 1
<u>PART 2: PRODUCTS</u>	
2.01 PIPE AND FITTINGS	143 - 1
2.02 VALVES	143 - 2
2.03 SPECIALTIES	143 - 2
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATIONS	143 - 3
3.02 TESTING	143 - 4
LAST PAGE	143 - 4

143 - REFRIGERANT PIPING SYSTEM

PART 1: GENERAL

1.01 DESCRIPTION

- A. Provide refrigerant piping systems as indicated on the Drawings and specified herein.
- B. Relate Work Specified Elsewhere:
 - 1. Section 144 BASIC MATERIALS AND METHODS
 - 2. Section 139 AIR COOLED CONDENSING UNITS

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American National Standards Institute (ANSI):
 - a. B9.1: Mechanical Refrigeration, Safety Code For (ASHRAE 15)
 - 2. American Standards For Testing And Materials (ASTM):
 - a. B75: Seamless Copper Tubing
 - 3. Japanese Industrial Standard (JIS)

1.03 SUBMITTALS

- A. Submit product literature for materials specified.
- B. Submit shop drawings for piping systems and sizing and valving arrangements.
- C. Submit test results.

PART 2: PRODUCTS

2.01 PIPE AND FITTINGS

- A. Precharged Tubing:
 - 1. Refrigerant pipe shall be Type K streamlined soft temper cleaned and dehydrated copper tubing supplied with refrigerant charge and pressure tight plugs for each length.

B. Rigid Tubing:

1. Refrigerant pipe shall be Type K streamlined hard temper cleaned and dehydrated copper tubing supplied with nitrogen charge and pressure tight plugs for each length.

C. Fittings:

1. Pipe fittings shall be streamlined pattern wrought copper.
2. Unions shall be wrought copper, with minimum 19.6 kg/cm² working pressure, female pattern, brass to brass seat, ground joint, and solder to solder connections.
3. Flanges shall be wrought copper, with minimum 19.6 kg/cm² working pressure, tongue-and-groove raised ground face, and bolt holes spot faced.
4. Gaskets shall be of a material suitable for the fluid, temperature and pressure for which they will be used.

2.02 VALVES

- A. Manual shut-off valves shall be packed type, with backseating construction, solder connections, wing type cap also serving as a stem wrench, and brass body minimum 29.4 kg/cm² working pressure.
- B. Throttling valve shall have solder connections; seal cap; forged brass body, and minimum 33.32 kg/cm² working pressure.
- C. Pressure relief valves shall have provisions for attaching vent line, sealed, sized as required for application.
- D. Check valves shall provide positive seal against reverse flow, with spring loaded mechanism, neoprene seats, brass body, minimum 29.4 kg/cm² working pressure, and sized as required for application.
- E. Solenoid valves shall be normally closed type, holding coil voltage as required, with manual lift stem, solder connections.

2.03 SPECIALTIES

- A. Liquid and moisture indicators shall be single port type, with forged brass body, reversible color moisture indicator, minimum 33.32 kg/cm² working pressure, leak-proof, solder connections, and self-cleaning molded sight glass with brass safety cap.

- B. Strainers shall be Y-pattern, with cast bronze body, monel wire cloth screen of mesh as recommended by manufacturer, and cleanout plug.
- C. Vibration eliminators shall have seamless tin bronze or stainless steel core, high tensile bronze braid converging, solder connections, pressure tested, dehydrated, with synthetic covering, minimum 33.32 kg/cm² working pressure, and minimum length of 175 mm.
- D. Driers shall be combination filter-drier type, with angle type solder connections, heavy steel body, neoprene gasketed removable flange, spring loaded core, replaceable non-dusting and non-channeling molded desiccant briquettes, sintered bronze outlet filter, and minimum 33.32 kg/cm² working pressure.

PART 3: EXECUTION

3.01 INSTALLATIONS

- A. All refrigerant piping installations shall conform with ANSI B9.1. or equal standards (JIS).
- B. Reduction in pipe sizes shall be made using eccentric reducer couplings installed with the level side up.
- C. Manual shut-off valves shall be installed on each side of strainers and driers, in liquid and suction lines at evaporator coils, and elsewhere as shown on the Drawings.
- D. Each drier shall have a 3 valve full by-pass connection.
- E. Each gauge shall have a cap seal type throttling valve.
- F. All pressure relief valves shall have full size vent extended to the outside of the building.
- G. Joints shall be made using a brazing compound containing silver alloys having a melting point of 520 degrees C or higher.
- H. Strainers shall be installed immediately ahead of each expansion and solenoid valve, evaporator pressure regulator, back pressure valve, compressor suction valve, and as elsewhere shown on the Drawings.
- I. Liquid-moisture indicators shall be installed ahead any expansion valves.
- J. Gauges shall be installed on both the suction and discharge of the compressor.
- K. Vibration eliminators shall be used for all inlet and discharge final connections to compressors and other vibration producing equipment.

3.02 TESTING

A. Preparation:

1. Remove all expansion valves and install a temporary bypass.

B. Test:

1. Charge system to 19.6 kg/cm² using dry nitrogen.
2. Test all joints with a Halide torch Record all test results
3. After the results of the pressure tests have been approved, release test pressure freely to the atmosphere and mechanically evacuate the system to a minimum of 560 mm Hg vacuum and maintain for 24 hours with no leaks. Disconnect the vacuum pump prior to vacuum leak test.
4. Record and report the test results.
5. After test results have been approved by the Engineer, fully charge the system with the specified refrigerant.
6. All leaking joints shall be disassembled and remade using new materials. Retesting shall be conducted on all portions failing the tests.

END OF SECTION

144 - BASIC MATERIALS AND METHODS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	144 - 1
1.02 SUBMITTALS	144 - 1
1.03 QUALITY CONTROL	144 - 1
<u>PART 2: PRODUCTS</u>	
2.01 PIPES	144 - 1
2.02 GENERAL DUTY VALVES AND SPECIALTIES	144 - 1
2.03 HANGERS AND SUPPORTS	144 - 3
2.04 SLEEVES	144 - 7
2.05 SEALANTS	144 - 8
2.06 EQUIPMENT FOUNDATIONS AND HOUSEKEEPING PADS	144 - 8
2.07 THERMOMETERS	144 - 8
2.08 GAUGES	144 - 9
<u>PART 3: EXECUTION</u>	
3.01 GENERAL PIPING INSTALLATIONS	144 - 10
3.02 VIBRATION CONTROL	144 - 14
3.03 EXPANSION CONTROL	144 - 15
3.04 ACCESSIBILITY	144 - 15
3.05 MECHANICAL CUTTING AND PATCHING	144 - 16
3.06 WELDING	144 - 16
LAST PAGE	144 - 16

144 - BASIC MATERIALS AND METHODS

PART 1: GENERAL

1.01 DESCRIPTION

- A. Provide basic materials as indicated and specified.
- B. Materials and methods included in this Section are of a general nature, and apply to most systems and installations in this Contract. Refer to individual system sections for materials and methods specifically required for the respective systems.

1.02 SUBMITTALS

- A. Provide submittals identified in following paragraphs.
 - 1. Submit Shop Drawings defining the following:
 - a. Foundations, bases, inertia pads, and house-keeping pads
 - b. Expansion loops, anchors, and pipe guide supports
 - 2. Submit Product Data for each item specified in this Section.
 - 3. Submit welder's certificates for all welders on the project.

1.03 QUALITY CONTROL

- A. Reference Standards:
 - 1. Refer to individual materials for specified reference standards.

PART 2: PRODUCTS

2.01 PIPES

- A. Refer to individual piping system sections for required pipe and fitting materials.

2.02 GENERAL DUTY VALVES AND SPECIALTIES

- A. General:
 - 1. Valve ratings shall exceed respective system operating pressures.

2. All valves shall be line size, except control valves or calibrated orifice flow indicating valves, which shall be sized to achieve proper flow control and mid-range flow readings, respectively.
3. Valves and specialties specified in this Section are of a general nature and are appropriate for most systems. For special use valves and specialties refer to the individual system sections.

B. Gate Valves:

1. Valves for 50 mm size and smaller shall be ASTM B61 bronze or ASTM B30 copper alloy 908 body, rising stem, double wedge disc, rated at 14.7 kg/m² water working pressure, threaded inlet and outlet, and shall be capable of being repacked while under pressure.
2. Valves for 63 mm size and larger shall be rising stem, outside screw and yoke type with cast or ductile iron body and bronze or brass trim. Ductile iron shall conform to ASTM A536, Grade 60-40-18 and cast iron to ASTM A126, Class B, Valve spindles shall be stainless steel complying with the following Chemical and strength requirements: Cr 25%, Ni 4.5%, Mo 1.3-1.8%; Yield strength 420N/mm²; Min. tensile strength 650 N/mm² and Elongation 20%. Valve shall have solid wedge bronze or brass disc, steel hand wheel, and flanged inlet and outlet. Valve shall be rated for 1.5 MPa water working pressure and have the capability of being repacked while under pressure.
3. The rubber on wedges and in sealing rings etc. shall be of a synthetic quality which can withstand storage in the local climate for at least five years and shall be suitable for the water qualities specified.

C. Globe Valves:

1. Valves for 50 mm size and smaller shall be rising stem type, with bronze or brass disc, bronze or brass body ASTM B61 and trim, steel handwheel screwed in inlet and outlet, 8.8 kg/cm² steam working pressure, and be capable of being repacked while under pressure.
2. Valves for 63 mm and larger shall be rising stem type, with outside screw and yoke, flanged inlet and outlet, iron body and bronze or brass trim, bronze or brass disc, steel handwheel 8.8 kg/cm² steam working pressure, and be capable of being repacked while under pressure.

D. Check Valves:

1. Valves for 50-mm size and smaller shall be horizontal swing check, Y-pattern type with a bronze body and trim. Valve shall have bronze or brass disc, threaded inlet and outlet, and shall be rated for 14 kg/cm² water working pressure.
2. Valves for 63-mm size and larger shall be horizontal swing check type, non-slam design having iron body and bronze or brass trim. Valve shall have bronze or brass disc, and flanged inlet and outlet and shall be rated for 14 kg/cm² water working pressure.

E. Unions:

1. Unions in steel pipe shall be malleable iron and have female pattern, brass to iron seat, and ground joint. Unions shall be rated for minimum of 9.8 kg/cm² water working pressure.
2. Unions in copper piping shall be cast bronze, and have female pattern, brass to brass seat, ground joint, threaded end connections for 50 mm and smaller, and flanged connections for larger than 50₂ mm. Unions shall be rated for minimum of 9.8 kg/cm² water working pressure.

F. Strainers:

1. Strainers shall be Y-pattern having ASTM A278 Class 30 semi-steel body with screwed end connections for 50 mm and smaller, flanged connections for 63 mm and larger. Strainers shall have #20 grade 18-8 stainless steel screen and tapped blowoff plug. Strainers shall be rated for 14.7 kg/cm² water working pressure.

2.03 HANGERS AND SUPPORTS

A. Pipe hangers, Upper Attachments:

1. Individual or continuous present concrete inserts
2. Beam clamps and anchor bolts may be used for steel construction
3. Self-drilling expansion shells for 75 mm pipe and smaller may be used in existing concrete structures. See special details for larger piping.

B. Hanger Rods:

1. Galvanized solid steel, all thread rods, with lock-nuts.

C. Pipe Hangers, Lower Attachments:

1. Lower attachments for individual runs of pipe shall be as follows, unless indicated otherwise:
 - a. Steel piping up to 125 mm: steel clevis
 - b. Steel piping 150 mm and larger, not subject to thermal expansion: steel clevis
 - c. Steel piping 150 mm and larger, subject to thermal expansion: pipe roller support
 - d. Copper tubing, all sizes: copper-plated steel clevis, except where hanger is installed around the outside of insulation, not in contact with pipe, where steel clevis hangers may be used
 - e. Cast iron pipe, all sizes: steel clevis

D. Vertical Pipe Supports:

1. At intermediate floors use extension pipe clamps.
2. At tops of risers, use hangers as specified above.
3. At bases of risers, use stiff-leg pipe support immediately adjacent to elbow. For cast-iron soil or storm riser use solid concrete block.

E. Trapeze Hangers:

1. Where numerous pipes are run in parallel to one another, they may be supported from a trapeze type hanger arrangement. Roller supports shall be used to support each run of piping on trapeze hangers to permit independent movement of individual pipes.
2. Piping supports shall consist of channels, fittings, pipe brackets, pipe rollers, pipe clamps, post bases, stud nuts, etc., as required to properly support and hang piping.

F. Anti-Vibration Hangers And Supports:

1. Suspension Hangers:

- a. Combination type shall have a double-deflection neoprene element in series with a steel coil spring with deflection of 8 mm. Steel coil spring shall be selected from a 25 mm static deflection series with a minimum additional travel of 12 mm. Spring diameter shall be large enough to permit 15-degree angular misalignment of the rod connecting the hanger to the upper attachment without rubbing the hanger box.

2. Supports, General:

- a. Required types of springs and spring deflections for isolators supporting various pieces of equipment are scheduled on plans or tabulated in specifications.
- b. All isolators for a single piece of equipment shall have equal spring deflection.
- c. All springs shall be selected for additional 50% capacity before springs are fully compressed.
- d. Sheet neoprene pad, type E-1: minimum 8-mm thickness, shall be bonded to underside of baseplate to serve as noise breaker. Pad area shall be selected for 7.85 to 4.27 kg/cm² loading.
- e. Isolators installed outdoors shall be designed to provide restraint due to wind loads of 0.014 kg/cm² without failure.
- f. Springs designed for minimum ratio of horizontal to vertical stiffness of 1.0 and minimum ratio to spring OD to spring operating height of 0.8.
- g. All base-mounted isolators shall have bolt holes in bases and anchored to structure with restraining bolts. Isolate bolts from base with neoprene grommets and neoprene washers.

3. Freestanding Springs - Type S-1:

- a. Springs shall be adjustable, freestanding open spring mounting, complete with combination leveling and equipment bolts.

4. Recessed Static Spring - Type S-2:

- a. Same as described under S-1, except installed in steel or cast iron housing suitable for recessing in concrete inertia base or steel base. Side access with removable cover plate. Spring assembly must be easily replaceable.

5. Enclosed Isolator - Type S-3:

- a. Adjustable open spring isolator with housing to include vertical resilient limit stops to prevent spring extension when weight is removed. Provide 12 mm clearance around restraining bolts, with neoprene grommets and

washer, to prevent restraint bolt from short-circuiting isolation. Limit stops out of contact during normal operation.

G. Isolator Pads:

1. Pad Type E-1:

- a. Pad mounting consisting of two layers approximately 5 mm ribbed or waffled neoprene pads bonded to 16-gauge galvanized steel separator plate. Pad must be furnished with sufficient area for proper loading as follows:

- 1) Durometer: 40
- 2) Loading: 4.2 kg/cm^2
- 3) Static Deflection 1 mm

- b. Provide neoprene grommet and washer to prevent restraint bolt from short-circuiting isolation.

2. Pad Type E-2:

- a. Cone shaped mounting made from neoprene. Steel baseplate shall be provided with ribbed neoprene nonskid pad. Mounting holes in baseplate shall be provided with threaded insert at top of mounting for attached equipment. All metal parts shall be completely covered with elastomeric material. Mounting shall be designed for approximately 6-mm static deflection and loaded so that deflection does not exceed 15% of full height of mounting. Provide neoprene grommets and washers to prevent restraint bolts from short-circuiting isolation.

H. Inertia Bases:

1. Construction: Use structural beam or channel members to form perimeter framing. Beam depth shall be as required for weight and size. Size to support equipment without overhanging structural members that form perimeter of framing. Use 196 kg/cm^2 concrete fill meeting the specifications for cast-in-place concrete. Cutout in center may be permitted to adjust weight, providing structural steel members frame the interior section. Total mass of the base shall be minimum of 1.0 times and not more than 1.5 times the mass of the equipment supported.

2. Mounting: Secure base to floor or structure using springs Type S-2. Provide preset embedded anchor bolts and pipe sleeves as required to accept supported equipment.

I. Hanger and Support Rust-Proofing:

1. Materials exposed to weather shall have steel parts zinc-electroplated, PVC coated, plus coating of neoprene or bitumastic paint. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel.

2.04 SLEEVES

A. General:

1. Sleeves for all pipes passing through floors, walls, partitions (except where floors and walls are a part of a fire-rated assembly), concrete beams, girders, and any other building construction shall be provided in types as scheduled below, and of adequate diameter to allow minimum of 19 mm clearance all around between sleeve and pipe. When pipe is insulated, insulation shall pass continuously through sleeve with 19 mm clearance between insulation and sleeve.
2. Pipes passing through fire-rated walls, partitions, or floor shall be installed in sleeves as specified above. Space between pipe and sleeves, however, shall be sealed, smoke-tight, with a fire-proof compound and insulation shall not pass through the sleeve as specified above.

B. Pipe Sleeves:

1. ANSI Schedule 40 for Galvanized steel pipe when installed in:
 - a. concrete or masonry walls and concrete bases
 - b. beams with poured concrete fireproofing
 - c. concrete floors and mechanical equipment room floors
 - d. concrete floors with metal under deck (tack weld to deck)
2. 18-Gauge Galvanized Steel when installed in:
 - a. plaster or dry wall
 - b. beams or girders with sprayed-on fireproofing (tack weld to beam or girder)

c. air plenums

2.05 SEALANTS

A. Sealing of Sleeves:

1. All sealant materials shall be a single compound, primerless, non-sagging type in neutral color, or other color approved by the Engineer where exposed to view.
2. Polysulfide: One part, gun grade
3. Acrylic Latex: One-part, gun grade, paintable, with a temperature range from -17 to +82 degrees C
4. Butyl: One-part, gun grade, suitable for both horizontal and vertical joints

B. Primers:

1. Quick-drying, clear, approved by sealant manufacture.

C. Bracket Rods:

1. Closed-cell polyethelene or urethane foam, polyvinyl chloride, or closed-cell neoprene, circular in cross section, and of size to assure that they will stay in place under pressure of applying sealant.

2.06 EQUIPMENT FOUNDATIONS AND HOUSEKEEPING PADS

A. Provide excavation, dowelling, anchor bolts, etc., and construct the foundations of 196 kg/cm² concrete as detailed on the Drawings, and in conformance with the equipment manufacturer's instructions. Chamfer all corners 25 mm at 45 degrees. Provide steel reinforcing rods or mesh as required. Minimum reinforcement shall be one layer of 12 mm x 12 mm 10/10 wire mesh unless otherwise indicated.

B. Surfaces for setting vibration isolators shall be true and level with each other. Use steel shims as necessary.

2.07 THERMOMETERS

A. Construction:

1. Front-reading red mercury glass bulb, angle stem adjustable 360 degrees, one piece triangular brass case, 175 mm scale, rattle-proof glass front, brass well and bulb assembly, scale for Celsius

B. Ranges:

1. Cold liquids -20 to 50 degrees C
2. Hot liquids 0 to 150 degrees C

C. Construction:

1. Thermometers shall be 125-mm diameter, adjustable angle, bi-metal, dial type, Celsius reading. The face of the instrument shall be adjustable to any angle, function shall be bi-metallic movement, dampened by silicone to reduce pointer vibration and increase speed of response, it shall be capable of being calibrated.

D. Materials:

1. Case: 125 mm diameter, stainless steel
2. Ring: removable, stainless steel, with gasketed window
3. Window: glass, 3 mm thick clear
4. Dial: white face, black numerals and marks
5. Pointer: black
6. Stem: Type 304 stainless steel
7. Connection: Type 204 stainless steel with 19-mm NPT separable socket
8. Accuracy: within 1% of scale range

E. Ranges:

1. Cold liquids -20 to 50 degrees C
2. Hot liquids - 0 to 150 degrees C

2.08 GAUGES

A. Construction:

1. Vacuum, pressure, or compound type to suit the service in which installed, copper-alloy bourdon tube with brass tip and socket, stainless steel and monel movement, 1/2% accuracy within the scale range, black steel case and mounting ring, glass crystal, integral calibration screw, with range to suit service, normal operating pressure at midpoint of scale, integral safety blowout plug.

B. Accessories:

1. Needle Valves: brass body, seat, stem, and knurled handle, threaded end connections, graphite packing, maximum operating pressure 135.3 kg/cm², maximum operating temperature 232 degrees C
2. Pigtails: black iron, threaded
3. Snubbers: porous brass

PART 3: EXECUTION

3.01 GENERAL PIPING INSTALLATIONS

A. General:

1. Installation instructions contained in this Section pertain to most systems. For specific requirements for installation of each system, refer to individual system specification sections.

B. Piping:

1. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, etc. unless otherwise indicated.
2. Install all piping free of sags or bends and with ample space between piping to permit proper insulation.
3. Install piping at right angles or parallel to building walls. Diagonal or bent piping will not be permitted.
4. Install piping tight to slabs, beams, joints, etc. where possible and such that any removable ceiling panels may be removed for access above ceilings.
5. Protect all piping from entrance of dirt or other foreign materials during the construction period. At the completion of the Project, all dirt and foreign matter in piping shall be completely removed.
6. Piping passing through exterior building walls shall be caulked weathertight.
7. Provide drain lines from all relief valves and condensate pans and run drain line full size to the nearest floor or equipment drain.
8. All water piping shall have drain valves at low points in mains, risers, and branch lines and same shall be provided with a 19-mm drain valve with threaded hose connection.

9. Water piping shall be securely anchored to insure proper direction of expansion and contraction.
10. Expansion loops shall be provided as indicated and required, and shall be cold sprung.
11. Horizontal piping shall slope uniformly without sags or humps to provide for complete drainage of systems and elimination of air.
12. High points in closed piping systems shall be vented by manual air vents. Drainage piping shall slope as required by code or as indicated. Slope water piping up in the direction of flow 12 mm per 500 mm.
13. Piping shall be cut accurately to measurements established at the site, worked into place without springing or forcing, and shall clear all windows, doors and other openings. Cutting or other weakening or building structure to facilitate piping installation is not permitted. Install to permit free expansion and contraction without damage.
14. Swing joints at runouts to equipment and risers. Provide expansion loops at all other points for flexible piping systems.
15. Drain piping from pump glands, condensate drain pan etc., to spill over open sight drains, floor drains, or other acceptable discharge points terminating drain line with plain end (unthreaded) pipe.
16. Provide necessary temporary connections, valves, oversize flushing connections, pumps, etc., as required to properly clean and test systems.
17. Coordinate piping installations with ductwork, structure, lighting, electrical conduit and all other materials and equipment.
18. Use flexible pipe connectors for all inlet and discharge final connections to pumps (except in line pumps) and other vibration producing equipment.
19. Provide flanges on all valves, apparatus, and equipment having 60 mm and larger connections.
20. Reduction in pipe sizes (except in drainage pipe) shall be made using eccentric reducer couplings installed with the level side up on water piping.
21. Provide unions adjacent to each valve, at the final connection to each piece of equipment or plumbing fixture having 50-mm and smaller connections and where otherwise indicated.

22. Wherever wells are installed in piping for thermometers, pressure gauges, probes, etc., pipe size shall be increased by one pipe diameter to accommodate same.
23. Provide air chambers at the top of all hot and cold domestic water risers, at the end of each water header in utility spaces, at the end of each branch line, and at the top of all branches to fixtures. Provide shock absorbers at each solenoid valve or piece of equipment that has a quick closing type valve. Air chambers shall be a minimum of two pipe sizes larger than the terminating pipe and shall be equipped with an accessible drain valve and air recharging petcock or installed at least 600 mm above fixture to permit recharging by draining air chamber.

C. Valves And Specialties:

1. Valves shall be installed where indicated.
2. Strainers shall be installed ahead of each control valve, pressure reducing and regulating valve, solenoid valve, etc., and equipment as indicated.
3. Floor plans and flow diagrams are intended to be complimentary since not all valves can be shown on the floor plans. In general, flow diagrams and details show valving arrangement and floor plans show locations when possible.
4. Use fittings for all changes in direction and all branch connections and take-offs from mains. Use commercially available fittings for all changes in direction and branch connections having changes in pipe sizes of one pipe size.
5. All water valves which regulate flow shall be globe type and valves that are either "open" or "closed" shall be gate, ball or butterfly type as indicated.
6. Provide shut-off valves in each supply branch from mains and at each supply connection to equipment; provide a balance valve at each return branch to mains and at each return connection from equipment.
7. Connect dissimilar piping materials using dielectric unions or insulating flanges.

D. Hangers and Supports:

1. Approved hangers and stiff leg supports shall be installed in quantity and size as required to carry the weight of pipe, contents, and insulation and shall be arranged to prevent vibration transmission to the building and allow for pipe movement.

2. Hangers on insulated piping shall be installed on the outside of the insulation.
3. Hanger spacing shall be as required for proper and adequate support of piping, but in no case shall be less than one hanger per 2.5 m.
4. Hangers shall be supplied with lock nuts in sufficient number and location to lock all rod adjustments permanently at the adjusted height. Two lock nuts shall be used unless the nut tightens against a threaded socket. Minimum rod diameters shall be as follows:

<u>NOMINAL PIPE SIZES</u>	<u>ROD DIAMETER</u>
12 mm through 50 mm	9 mm
60 mm and 75 mm	12 mm
100 mm and 125 mm	15 mm
150 mm	19 mm
200 mm through 250 mm	22 mm
300 mm	25 mm

5. Location of hangers shall be coordinated with light fixtures as shown on reflected ceiling plans. Piping shall not be supported from ductwork, duct supports, or other piping. Hanger rods shall not penetrate ductwork.
6. Provide all necessary supplementary steel for support and attachment of hangers, and pipe and duct supports in shafts and between building structural members. Steel shall be painted with one coat of rust-inhibiting primer.
7. Provide welded support at elbows in pump suction and discharge. Extend elbow support to pump foundation or base.
8. Piping at pumps, tanks, etc., shall be supported independently so that pipe weight will not be supported by equipment. Each piece of equipment shall be supported so that no stress is imposed on equipment connections by disconnecting joint at equipment after fabrication for inspection.
9. Provide anchors, guides, and bracing as indicated to prevent lateral movement.
10. Provide hanger for each section of pipe, located at shoulder of bell. Where excessive number of fittings are installed between hangers, provide additional hangers or reinforcing.
11. Rods for trapeze hangers supporting several pipes shall be sized for the equivalent load.

12. Hanger rods shall be attached to structural members of the building.
13. Provide additional hangers or anchoring devices necessary for support of piping at corners, tops of risers, etc.
14. Anchors shall consist of rigid members clamped or welded to the pipe to prevent pipe movement at that point. Attach anchors to structural members of the building.
15. Support risers at each floor level by means of approved clamp rests.

E. Joints:

1. Any leaking joints shall be completely disassembled and remade with new materials.
2. Caulked joints in drainage piping shall be made using spun oakum to within 25 mm of hub and the remaining space filled with poured pure pig lead and swedged.
3. Ends of all copper tubing and the interior of the cup of the fitting shall be thoroughly cleaned and polished prior to the application of the flux and solder. The flux shall not be used as a substitute for proper joint preparation.
4. All pipe shall be carefully reamed. Threaded pipe shall have full length clean cut threads.
5. All sockets and pipe ends of PVC shall be cleaned and solvent cement applied for full circumferential cover.

3.02 VIBRATION CONTROL

A. General:

1. All vibrating equipment and piping and ductwork connected to this equipment shall be isolated to eliminate transmission of noise and vibration.

B. Noise Criteria:

1. Each piece of mechanical equipment selected shall be evaluated for quietness. Particular care shall be taken to evaluate acoustical performance as well as mechanical function. Sound pressure level within spaces shall not exceed the NC curves indicated.

C. Piping Installations:

1. All piping 65 mm and larger specified with vibration isolation shall have anti-vibration hangers. Static deflections as follows:
 - a. First three hangers away from any spring isolated piece of equipment shall have same deflection as equipment isolators.
 - b. All others shall have 25-mm static deflection.
2. All piping 50 mm and smaller shall have isolators as follows:
 - a. First three hangers away from any spring isolated piece of equipment shall have hangers with same static deflection as equipment isolators.
 - b. For insulated piping outside equipment rooms isolators are not required.
3. Install temporary anchors as required to permit preadjustment of springs in risers and to fix direction of pipe movement and final operating deflection of springs.
4. Provide permanent limit stops to prevent excessive vertical motion in risers in event system is drained and to prevent excessive lateral motion.

3.03 EXPANSION CONTROL

A. General:

1. Absorb expansion in bends, swing joints, expansion loops, and offsets. All piping main, branches and runouts shall be installed to allow for free expansion and contraction without developing leaks or undue stressing of pipe or equipment.
2. All expansion loops shall be cold sprung.

3.04 ACCESSIBILITY

- A. Locate all equipment that must be serviced, operated, or maintained, in fully accessible positions. Minor deviations from the drawings may be allowed for better accessibility at the written approval of the Engineer.
- B. Allow ample space for removal of parts that may require replacement or service in the future.

- C. Extend all grease fittings to an accessible location.

3.05 MECHANICAL CUTTING AND PATCHING

- A. Contractor shall be responsible for all cutting, fitting, or patching of his Work which may be required to make its several parts come together properly and fit it to receive, or be received, by work of other trades. Cutting of structural members shall not be done without written approval of the Engineer.
- B. Any cost caused by defective or ill-timed work shall be borne by the Contractor, as determined by the Engineer. Contractor shall not endanger any work, persons, or construction by cutting, digging or otherwise.
- C. Place sleeves through all walls, floors, and ceilings during the initial construction where it is necessary for piping to go through. When this is not done, do all cutting and patching required for the installation of the Work. Any damage caused to the building by this cutting and patching, shall be corrected at no additional cost to the Engineer.
- D. Patching of all openings for new installations and all openings resulting from the removal or relocation of any installations shall be done by craftsmen skilled in the particular trade affected, with materials of like type adjoining openings, as approved by the Engineer.

3.06 WELDING

- A. All welding shall comply with the requirements of the ASME Boiler and Pressure Vessel code, and any other State or Local Codes and Ordinances covering these installations.

END OF SECTION

145 - ELECTRICAL

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	145 - 1
1.02 QUALITY ASSURANCE	145 - 1
1.03 ELECTRICAL CHARACTERISTICS	145 - 2
1.04 SHOP DRAWINGS PREPARATION	145 - 2
<u>PART 2: PRODUCTS</u>	
2.01 CONDUITS AND FITTINGS	145 - 3
2.02 CABLE TRYS	145 - 3
2.03 WIRES AND CABLES	145 - 3
2.04 BOXES	145 - 4
2.05 WIRING DEVICES	145 - 4
2.06 PANELBOARDS	145 - 6
2.07 FIRE ALARM SYSTEM	145 - 8
<u>PART 3: EXECUTION</u>	
3.01 VOLTAGE DROP	145 - 10
3.02 COLOR CODE	145 - 10
3.03 FIELD TEST	145 - 11
3.04 INSTALLATION OF CONDUIT SYSTEM	145 - 12
3.05 INSTALLATION OF CABLE TRAYS	145 - 14
3.06 INSTALLATION OF CABLES	145 - 16
3.07 INSTALLATION OF GROUNDING AND BONDING	145 - 19
3.08 INSTALLATION OF BOXES	145 - 22

145 - ELECTRICAL

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the design, furnishing, delivery, installation and testing of basic materials and methods. Other sections of those specifications for which the Contractor is responsible shall apply respectively to this work, unless otherwise modified herein. The Contractor shall perform all work in his area, whether specifically mentioned or not, to provide complete and functioning electrical systems.

1.02 QUALITY ASSURANCE

A. Procedures

Before purchasing materials or starting work, the Contractor shall prepare and obtain Engineer's approval. The procedure for calculation shall follow the 1981 (U.S.) National Electrical Code rules for Branch Circuit and Feeder Calculations or equivalent approved rules, except as modified herein.

B. Codes and Standards

The International Electrotechnical Commission (IEC) publications (and recommendations) shall be applied as a minimum regardless of any national standard which may normally have been utilized in the manufacture, design or installation of any equipment. Latest issues shall be used and are defined as the issues (including recently published case ruling, interpretation of standards, addenda) in force at the date of award of Contract.

C. The following standards, or corresponding local or Japanese Standards may be used subject to the Engineer's approval. In these instances the Contractor shall be required to demonstrate the equivalency of the standard used. Latest issues shall be used as defined above for IEC publications and recommendation.

- American Iron and Steel Institute (AISI)
- American National Standard Institute (ANSI)
- American Society of Mechanical Engineers (ASME)

- American Society of Testing and Materials (ASTM)
- Insulated Cable Engineers Association (ICEA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Instrument Society of America (ISA)
- National Association of Corrosion Engineers (NACE)
- National Board of Fire Underwriters (NBFU)
- National Electrical Code (NEC)
- National Electrical Manufacturers Association (NEMA)
- National Electric Safety Code (NESC)
- National Fire Protection Association (NFPA)
- Occupational Safety and Health Administration (OHSA)
- Japanese Standards and Codes (JIS, JEM, JEC)

1.03 ELECTRICAL CHARACTERISTICS

Standard voltages and ratings shall be as follows:

- Power System; 380V AC, 50HZ
 3-phase 3-wire
 220V AC, 50HZ 1-phase, 2 wire
- Lighting System; 1) 220V AC, 50 HZ
 1-phase, 2 wire

1.04 SHOP DRAWINGS PREPARATION

The contractor shall submit to the Engineer detailed, dimensioned shop drawings covering all items of equipment and devices, and brochures describing all lighting fittings accompanied by all technical data if required. No materials, devices and equipment shall be ordered or scheduled for production until such shop drawings, brochures, and technical data have been approved by the Engineer.

The following procedure shall be carried out when shop drawings, brochures, and technical data are required. The contractor shall submit 4 prints of shop drawings, brochures, or technical data for approval. A copy of such submitted document will be returned to the contractor with comments or revisions by the Engineer.

After the approval of the Engineer as to such submissions, the contractor may commence the action of purchasing the approved items.

PART 2: PRODUCTS

2.01 CONDUITS AND FITTINGS

- A. The Contractor shall provide all conduits and fittings for the electrical systems.
- B. Exposed conduits, and concealed conduits above grade in buildings, shall be hot-dip galvanized rigid steel, of the threaded joint type.
- C. The last short piece of conduit connecting to motors or other vibrating equipment (except where armored cable is used) shall be of flexible galvanized steel, with plastic jacket and watertight connectors or adaptors. Connection from junction boxes to recessed lighting fixtures shall be of flexible galvanized steel conduits.
- D. In areas of severe corrosive atmosphere steel conduit shall be provided with a PVC coating.

2.02 CABLE TRAYS

- A. The Contractor shall provide a complete cable tray system for electrical systems.
- B. The Contractor shall furnish and install cable trays, fittings, supports, covers, and accessories which are required for a complete installation.
- C. The tray system shall consist of ladder-type or the solid bottom-type.
- D. All trays designated for 600-V power cable shall be ladder-type trays.

2.03 WIRES AND CABLES

- A. Power cables shall have copper conductor, cross-linked polyethylene insulation and neoprene jacket.
- B. Power cables shall be 600-V class single-conductor, two-conductor, three-conductor or four-conductor.
- C. Control cable shall have multi-core copper conductor, cross-linked polyethylene insulation and neoprene jacket.
- D. Cable for lighting and single phase receptacle circuits shall be 600 V class, single copper conductor cables, cross-linked polyethylene insulated.

- E. Armor, where used, shall be tape or wire applied such that the cable is mechanically protected throughout its length. Direct buried cables shall be of armor construction.

2.04 BOXES

- A. Boxes shall be provided in the raceway systems whenever required for pulling of wires, grouping of cables, making connections and mounting of devices or fixtures. Boxes shall be hot-dip galvanized. Outdoor boxes shall be water-tight. Each box shall have the volume required by the relevant approved standards for the number of conductors enclosed in the box. Boxes for mounting lighting fixtures shall be not less than 100 mm (4 inches) except that smaller boxes may be installed as required by fixture configuration, as approved. Boxes shall be furnished with gasketed screw fastened covers.
- B. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. Boxes for use in masonry-block or tile walls shall be square-corner tile type, or standard boxes having square-cornered tile type covers. All boxes shall be gasketed. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided. In suspended ceilings, for those fixtures for which the ceiling-suspension system does not have sufficient strength to prevent visible deflection of the ceiling surfaces, fixture housings shall be supported by structural members.
- C. Boxes and supports shall be properly fastened to wood, concrete, steel, etc., as required.

2.05 WIRING DEVICES

- A. Lighting system

1. General purpose lighting system

The normal lighting systems shall be supplied from 220V ac distribution panels.

Control equipment shall be provided in conjunction with the emergency lighting system so that the emergency lighting is energized automatically when the ac voltage fails and de-energized automatically upon ac voltage recovery.

Lighting fixture shall be located so as to avoid interference with or concealment by ducts, trays, piping, etc.

Material and workmanship shall be in accordance with the latest relevant approved standards and governing authorities. All materials shall be new and of the best quality obtainable. Since no specific make of material, apparatus and/or equipment is mentioned, any first class product of a reputable manufacturer may be used provided such product conforms to the Specifications and has received acceptance by the Engineer.

2. Construction Features

Lighting Fixture and Lamps

Lighting fixtures shall be of the incandescent, metal halide, color corrected high pressure sodium or fluorescent types. Lamps of the proper type, wattage and voltage ratings shall be furnished and installed in each lighting fixture.

Lamps for lighting fixtures shall conform to the following:

Incandescent lamps shall be rated at 220 V, inside frosted, with a lamplife of 2,500 hours minimum.

Fluorescent lamps shall be warm tone, rapid-start.

High pressure sodium lamps shall be color corrected deluxe white type with a minimum lamp life of 24,000 hours for operation with the required ballasts.

Ballasts for fluorescent rapid-start lamps shall be high power factor, with built-in automatic resetting thermal protection, rated at 55 degrees C (131 degrees F) ambient temperature and designed for 220 V, 50 Hz, ac operation.

Ballasts for high pressure sodium lamps shall be constant wattage autotransformer type, high power factor, low line extinguishing voltage and low line starting current, rated at 55 degrees C (131 degrees F) ambient and designed for 240 V 50 Hz, ac operation.

Roadway and outdoor area lighting fixtures shall have built-in photocells.

Roadway and outdoor area lighting fixtures shall be installed on galvanized steel or aluminum poles. A heat shield shall protect each unit from the direct rays of the sun. The light distribution of each unit shall conform, using the available fixture refractor distribution adjustment, to the configuration of the respective roadway or area.

Fixture Types

Lighting fixtures shall be provided with a corrosion resistant finish on all interior and exterior parts. Fixtures in outdoor and process areas shall be vapor and moisture-proof.

The lighting fixtures shall be complete in every respect including lamp, control gear, and accessories such as gasket, mounting brackets, metal fittings for row lining or suspension from ceiling, metal frames for flush mounting, etc.

All office areas shall have recessed fluorescent lighting fixtures to blend with the ceiling. In non-suspended ceiling areas, surface mounted fixtures shall be used.

All staircases shall have normal and emergency lighting. Surface mounted enclosed fixtures shall be used. Three way switches shall be used for all the staircases.

Exit lights shall be incandescent consisting of adequate size box with the word "EXIT" in English and Indonesian. Normal ac and emergency dc supply shall be provided for all exit lights.

Surface mounted vapor tight fluorescent fixtures shall be used for kitchen area, showers, refrigerators, food storage and washing area.

B. General Purpose Receptacles

Receptacles shall be heavy duty general use type, with the following additional requirements.

1. Rating: Two-pole, three-wire 15-ampere, 220 V
2. Base and body: Fire-resistant non-absorptive thermosetting phenolic compound or equal.
3. For exterior locations, receptacles shall be mounted in watertight flush, cast-type outlet boxes with threaded hubs and equipped with gasketed cover and captive cap.
4. Toilets and outdoors shall have ground-fault (earth leakage) protection set a 15 mA.

2.06 PANELBOARDS

- A. Distribution panelboard shall be wall-mounted and shall be dead-front, circuit-breaker type with aluminum or copper buses. The panelboards shall be provided with main breaker

as shown on the Drawings and provided with number of branch breakers as required. There shall be a minimum of 20% spare branch breakers.

- B. The voltage rating, current rating, number of phases and wires shall be as shown on the Drawings. All distribution panelboards shall be provided with a full capacity neutral bus.
- C. All panelboards shall be provided with a separate grounding bar bonded to the enclosure.
- D. The panelboard enclosures shall be provided with hinged cover and lock. All locks shall be keyed alike. All outdoor panel boxes shall be watertight, dusttight and Boxes shall be made of galvanized steel sheet.
- E. Fronts shall be furnished with adjustable trim cramps for securing the front of the box.
- F. Panelboards shall be top and bottom feed. The box shall be of adequate size to allow gutter space for specified conductors on all sides.
- G. A transparent directory holder with metal frame shall be installed on the inside of the door.
- H. All panels shall have nameplates in English and Indonesian.
- I. Outside surfaces shall be primed, filled where necessary and given not less than two applications of synthetic undercoat. The exterior finish shall consist of lacquer, the color of which shall be selected by the Owner/Engineer. This painting shall be scratch-resistant and resistant to perspiration from the operator's hands. The painting shall be of such quality that damage of the paint during transport or erection can be readily repaired at site.
- J. Circuit Breakers
 - 1. Circuit breakers shall be of molded case type.
 - 2. Molded case circuit breakers shall be manually operated, quick-make, quick-break, trip free operating mechanism. The operating handle shall clearly indicate whether the breaker is in the "trip", "open", or "closed" position.
 - 3. Circuit breaker rating shall be selected in accordance with load served and the system prospective short circuit current.
 - 4. Circuit breakers shall be single or multi-pole as required. Multi-pole breakers shall have a common operating handle to operate all poles simultaneously to close or trip the breaker.

2.07 FIRE ALARM SYSTEM

A. General

1. Work Included

Furnish, install, connect and test a push-button operated, fire alarm system for each building as described herein and shown on the drawings, to enable each building to operate independently as a unit.

2. Quality Assurance

All units of the alarm system shall conform to recognized regulatory agencies for fire alarm use and the control panel shall bear a recognized standard of the country of origin.

The system shall be installed in accordance with requirements of the National Electrical Code (NEC), National Fire Code (NFC) of the National Fire Protection Association (NFPA) and Japanese Code.

3. Description of the System

Each building shall have an independent fire alarm system consisting of manual stations, including push button, bell and lamp as described herein and shown on the drawings. The system shall be a non-coded fire alarm system.

4. Operation

The fire alarm system of each building shall be so designed that the operation of a fire alarm manual station activates an audible alarm device.

B. Products

1. General

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

Furnish and install conduit, wire, outlet boxes, junction boxes, and all accessories necessary to erect a manual single-zone, non-coded fire alarm system as shown on the drawings and as specified. Any material or equipment necessary for the reliable operation of the system not specified or described herein shall be deemed part of the specification. The system shall consist of manually operated alarm stations and audible and visible signalling devices.

2. Manual Fire Stations

All manual fire stations shall be non-coded, breakglass, key restorable, push-button operation. Indoor and outdoor stations shall be similar in appearance, except outdoor stations shall be in watertight weatherproof enclosures. Manual Fire Stations shall be semi-flush mounted, diecast construction, raised white letters on a red background. Imprinted instructions shall be "PUSH BUTTON FOR FIRE ALARM".

Bells

The system alarm bells shall be 101-mm (4") bells. They shall be diecast, dustproof, 18-volt D.C., vibrating bells mounted in the manual fire-alarm station panel.

Indication Lamps

The system indicator lamps shall be red polycarbonate and shall light when the fire-alarm button is pushed. Indication Lamps shall be mounted in the manual Fire Alarm station panel.

3. Conduits and Wires

Wiring shall be in accordance with the installation of cable of this section. Minimum size of wire shall be 3.5 mm² copper. All wires shall be numbered and labelled. Under no circumstances install cables other than Fire Alarm cables in Fire Alarm Raceways.

C. Tests

After the installation is complete, the Contractor shall conduct operating tests. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. The tests shall be performed in the presence of the Engineer. All instruments and personnel required for the tests shall be provided by the Contractor. The Contractor shall file a letter of certification indicating that the system functions and conforms in accordance with these specifications and the drawings.

PART 3:

3.01 VOLTAGE DROP

Voltage drop shall be limited as follows:

<u>System</u>	<u>Maximum Allowable Voltage Drop</u>
Service feeders	2%
Branch feeders	2%
Branch circuits--general	3%
--motor starting	10%

3.02 COLOR CODE

- A. Wire and cable shall be factory color coded by integral pigmentation with a separate color for each phase and neutral conductor. The color code in the following tables shall be used throughout the electrical system.

For conductor sizes where factory integral pigmentation is not a standard and would require special mill runs, the use of paint or colored plastic tape will be permitted. When tape or paint is used for phase identification it shall be applied in boxes, panels, switchboards and other enclosures.

1. For 3-phase, 3 or 4-wire System

<u>Conductor</u>	<u>Color Code</u>
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Grounding	Green

2. For 1-phase, 2-wire System

<u>Conductor</u>	<u>Color Code</u>
Phase (Ungrounded)	Black and Red
Neutral	White

3.03 FIELD TEST

- A. Before the electrical facilities are placed in operation, all necessary tests and adjustments shall be made to ascertain that all equipment, devices, and wiring have been correctly installed, and they are in satisfactory working condition, and will operate as intended in compliance with this Specification.

At least, the following tests shall be performed:

1. Trial and adjustments on all motor-control equipment.
 2. Trial starts of all motors to determine correctness of connections for proper rotation.
 3. Tests on grounding system to determine continuity of connections and value of resistance to ground.
 4. Calibration and setting of relays in the metal-clad switchgear for proper coordination
 5. Measurement of insulation resistance of all electrical equipment
 6. Sequence and interlock test.
 7. Functional test of systems and equipment.
- B. All test instrumentation and equipment, materials, and consumables shall be provided by the Contractor.
- C. Electrical tests shall not be conducted under ambient weather conditions unsuitable for testing, such as excessively high humidity conditions and so forth. When conducting electrical tests, the Contractor shall record weather conditions including humidity, temperature, barometric pressure, and wind velocity.
- D. When a circuit is changed after the original test work is completed, the tested change shall be recorded on the original data record for the circuit.
- E. The following records shall be maintained and turned over to the Engineer at intervals specified by the Engineer.
1. Data sheet indicating calibration data and set points of all electrical and/or instrument components.
 2. Daily Log indicating all checkout and testing activities.
 3. Log and time sheets of all factory representatives under his supervision.

4. Updated component test schedule and startup progress schedule.
5. Log of abnormal circuits and lifted wires.
6. Completion work list.
7. Equipment and system release log (from construction to startup).
8. Record of system cleaning.
9. "As-Built" drawings (to be maintained for inspection during construction, and turned over to the Engineer at the termination of Contractor's work).

3.04 INSTALLATION OF CONDUIT SYSTEM

- A. Minimum trade sizes shall be 10 mm (3/4 inch) for exposed conduit and 25 mm (1 inch) for embedded conduit. Threads shall be cut with a sharp die of the correct type to produce ANSI standard conduit threads. All metallic conduits shall be made up into full-threaded fittings with a minimum of five-thread engagement. Standard threaded conduit unions shall be installed adjacent to boxes, cabinets, or devices having threaded hubs. Running threads will not be permitted.
- B. All risers shall be run in accessible locations. Conduit fittings, boxes, etc., shall be installed so as to be accessible for future maintenance work. Covers shall face away from walls, pipes, or equipment that would obstruct easy access to the box.
- C. All exposed conduit runs shall be installed parallel to the building walls and floors wherever possible except where pitch is required for proper drainage. Conduit shall be rigidly supported at intervals not to exceed 2,400-mm (8-ft.). Standard one-hole conduit straps of the proper size shall be used for a single conduit run. Multiple conduit runs shall be supported on formed channels with appropriate clamps or straps. Where fastened to structural steel, the conduit straps shall be held in place by beam clamps, Hilti conical (or equal) studs or by welding studs to the supporting member. Supports anchored to concrete or brick shall be expansion-type anchors or equal. Supports anchored to concrete blocks shall be held in place by self-aligning toggle bolts. All screws or bolts shall be hot-dipped galvanized for outdoor use or cadmium plated or equal for indoor use.

Conduit spacers shall be used for conduits running on flat surface where couplings would prevent the conduit from lying parallel to the surface throughout its entire length.

Conduits shall be kept away from all hot or wet pipes and surfaces. Conduits shall be kept at least 150-mm (6-in.) away from the insulation of high temperature steam lines.

- D. Metallic conduits shall be made electrically continuous for the entire run by securely connecting conduits to sheet metal boxes and enclosures by means of double bonding type lock-nuts. Conduit threads shall be coated with conductive thread lubricant. All terminal ends of conduits shall be provided with metallic bushings, insulating type with plastic insert. Exposed threads on outdoor conduit runs shall be painted with suitable coating approved by the Engineer at time of installation.
- E. Wherever a conduit enters or leaves a box or tray, it shall be permanently tagged on each side of the box or at the tray with a metal tag approved by the Engineer. All conduits must also be similarly tagged at both ends of each run. These tags shall be permanently identified with the identifying number of the cable or cables in the conduit run to which they are attached.
- F. Where conduits or sleeves pass through walls or floors, the Contractor shall install firestops or environmental seals.
- G. Conduits installed shall be free of burrs at the ends and of any other sharp edges throughout their entire length to eliminate any possibility of damage to wire insulation. Where damage to wires may occur by pulling same around bends in any conduit run, additional conduit fittings, boxes, or pulling sleeves shall be installed. Not more than three 90-degree bends or equivalent will be permitted in any conduit run between junction boxes or pull points.
- H. Heating of metallic conduits to make bends or welding of conduits shall not be permitted.
- I. Liquid-tight flexible conduits shall be used to connect instruments, motors, and for conduit connections to equipment that may be moved or disconnected for servicing. Liquid-tight flexible conduits shall be used for short sections where required for difficult runs or where vibrations or thermal movement is anticipated. Sufficient slack shall be provided to reduce the effects of vibration. All liquid-tight flexible conduit connections shall be UA Grade Anaconda "Sealtite" conduit or equal.
- J. Liquid-tight flexible conduits located outdoors and indoors where exposed to continuous or intermittent moisture shall be installed in such a manner that liquids tend to run off the surface and not drain toward the fittings. Flexible conduit connections to enclosures shall be made with an "O"-ring-gasket assembly fitting. The fittings shall be nylon insulated-throat type with nylon sealing gland and brass grounding ferrule.

- K. Conduits terminating in cabinets shall be neatly arranged and cut to exact measurement so that all ends will extend through the cabinet wall approximately the same distance. The ends of conduits connecting to panels, starters, and similar apparatus and devices shall be furnished with suitable conduit fittings as required in each case.
- L. Supports for conduits shall be provided by the Contractor. If the supports and conduits are of dissimilar metals, the conduits shall be insulated with one layer half-lapped PVC tape extending 25-mm (1-in.) past the clamp or contact surface of the dissimilar metals to prevent galvanic action.
- M. All exposed conduits shall be supported from building structural steel or anchored to concrete. Supporting the conduits from equipment or structural steel furnished by equipment manufacturers will not be permitted unless approved by the Engineer.
- N. Conduit fittings of proper size and type to provide the greatest accessibility to the conductors contained therein, and prevent damage thereto, shall be used throughout. Each conduit fitting shall be completed with proper cover and neoprene cover gasket. No conduit fitting installation will be considered complete until covers and gaskets have been properly installed on same. Junction boxes, or extra large body fittings, when approved by the Engineer shall be used as required.
- O. The Contractor shall furnish and install all reducers, bushings, and fittings necessary to complete conduit runs to motors, boxes, instruments, or other electrical devices.
- P. Metal conduits shall be thoroughly bonded and grounded.

3.05 INSTALLATION OF CABLE TRAYS

- A. Cable trays shall be installed in a neat and workmanlike manner with all runs parallel to the building walls and floors. Inside surfaces of trays shall be smooth and free from protrusions or sharp edges that could cause damage to cables.
- B. The distance from trays to column lines shown and the elevations given shall be maintained. Cable trays shall be kept not less than 150-mm (6-in.) away from the insulation of high-temperature steam lines.
- C. The Contractor shall perform all work necessary for field-assembly and install a complete cable tray system including field-cutting of factory-shipped sections of tray to length, bolting together and assembling field-cut lengths of straight tray and tray fittings, and hanging field-assembled tray in such a manner to ensure proper alignment and location.

- D. Cable tray cut in the field shall be cut square with a hacksaw and all edges of field-cut tray or tray fittings shall be filed smooth to remove any burrs which could damage cable jackets.
- E. End plates shall be installed at all open tray ends.
- F. The cable tray covers, cover-mounting brackets, and associated miscellaneous hardware shall be installed by the Contractor as soon as possible after all the cables have been installed in a tray.
- G. Where vertical trays run through floors or adjacent to walkways or platforms, tray covers shall be installed on all ladder-type trays on both the top and bottom of the tray for a span extending up from the finished floor, walkway or platform a distance of 2,440-mm (8-ft.). All solid-bottom trays shall have covers the full length of the run. Unless otherwise noted, covers for all trays installed outdoors shall be installed. The Contractor shall furnish and install all spacers required. Indoors, covers for solid-bottom trays shall be installed flush with the top of the tray.
- H. A cable-tray support system shall be provided. Tray supports shall be spaced at intervals not exceeding 2,400-mm (8-ft.) and not more than 610-mm (2-ft.) from the end of a tray run.

Where fittings occur in the tray run, supports shall be installed immediately adjacent to and on either side of the fitting.

- I. Supports shall be assembled with proper fittings and bolts and shall be mounted plumb and level and rigidly anchored. Supports shall be designed to permit horizontal and vertical adjustment of the trays wherever possible. All formed channel fittings, bolts, washers, nuts, and other support material, shall be hot-dip galvanized. Painted formed channels and painted formed channel fittings are not acceptable. Exposed surfaces of field cut and drilled material shall be filed smooth and painted with suitable coating approved by the Engineer.
- J. Hangers and support members may be attached to permanent structural steel by welding or by beam clamps. Where required, supports anchored to concrete shall be expansion-type anchors. Supports anchored to concrete blocks shall be attached with steel toggle bolts with self-aligning toggle heads. The electric arc method shall be used for welding support attachments to structural steel. Welds shall be parallel to the axis reduce of the structural members, and shall be intermittent overheating.
- K. After cables have been installed, the Contractor shall provide silicone foam fire stops in cable trays.

L. Cable tray systems shall be grounded and bonded.

3.06 INSTALLATION OF CABLES

A. Cable Installation

1. The Contractor shall provide complete, all cables as required.
2. Conduits shall be thoroughly cleaned.
3. All cables and wires shall be installed in a workmanlike manner. Cables shall be neatly trained, without interlacing, in all trays and boxes. Sufficient lengths of cable shall be pulled into equipment panels, boxes, etc., to permit a neat arrangement.
4. Where three single-conductor cables are used for one three-phase power feeder, all three conductors, i.e., A, B, and C phases, shall be bundled together and tied with plastic cable ties in pull boxes and cable tray. Bundles shall be tied at intervals of not greater than 3048-mm (10-ft) in cable tray. Where single-conductor power feeders are installed in conduit, the number of conductors of each phase of the feeder installed in the conduit shall be installed in the designated conduit.
5. Cables shall at all times be protected from mechanical damage and from moisture at the done in a manner that will not permit sharp bends over conduit bushings. The bending radius in any cable shall not be less than the minimum bending radius recommended by the cable manufacturer. Damaged or out-of-place cable shall be replaced at the Contractor's expense.
6. Wires shall not cross one another when they are pulled into the conduit, and care must be taken not to have the conductors pulled tight or kinked in conduits or boxes. Cables shall be installed with a minimum amount of crossover in the trays and shall not be pulled tightly around bends. Where cables in trays enter or leave via conduits, such conduits shall be rigidly affixed and supported at their ends by suitable brackets and conduit straps.
7. Where control wires from more than one conduit pass through a common pull box, the group of wires or cables from each conduit shall be bound together and each group shall be permanently tagged in the box.
8. Cables in long vertical rise conduits, or cable trays, must be supported by means of suitable clamps or grips furnished and installed by the Contractor in the vertical run as required for the type and size of the

cable. This is necessary to prevent damage to conductor insulation and/or cable jacket which might occur at the top of the run caused by snubbing of cables at bends at the top of the runs or stretching throughout the run due to the weight of the cable. It is also necessary to prevent putting a strain on terminals in equipment or boxes to which cables are connected. The number of such points of support shall be determined by the deadweight that each support may resist without damage to the cable insulation as determined for each specific cable. The Contractor shall, in general, follow the cable manufacturer's recommendations as to the number of such supports required per cable except that he shall in no case support more cable weight than such recommendations allow per support. Where cables of different sizes and types must be supported, he shall install such supports at uniform intervals in the run. All types and quantities of cable grips or clamps employed and their method of application shall be approved by the Engineer before installation.

9. Special care (as noted in the manufacturer's recommendations) shall be taken when handling and installing power cables in underground ducts.
10. The 600-V power and control cable, and 300-V instrumentation cable, where installed in cable tray, shall be installed only in the tray system designated for that respective type of cable.

B. Cable Termination and Splicing

1. The Contractor shall furnish all material and perform all labor required for the termination of all power control cables.
2. Permanent wire and cable connections shall be made with approved compression-type copper connectors. The terminal installation tool shall be of the proper mechanism type that automatically applies the preset correct pressure. Control cable connectors shall be of the preinsulated ring tongue compression type with nylon insulation and copper or bronze insulation grip. The terminal installation tool shall be of the ratchet-controlled type that automatically applies the preset correct pressure. Connectors shall be of the proper size to accommodate the conductors and shall be installed in the correct manner and with tools particularly made therefore by the connector manufacturer. Fork-tongue connectors shall not be permitted for permanent wire cable termination.

All cables shall be rung out to determine that they have been correctly installed. Immediately after ringing out, each cable shall be identified at each end and in exposed runs in junction boxes.

3. Cable and wire identification shall be based on the use of self-laminating wire and cable markers. Wire and cable markers used for identification shall not be less than 25-mm (1-in.) in length with lengthwise typewritten lettering.
4. Marking tape or other material stuck or glued to the exterior of switchgear, motor control centers, control panels, or other equipment for the purpose of recording cable pulling and termination status will not be permitted. Any markings placed in panels or other equipment for purpose of recording cable status shall be removed at the end of Contractor's cable pulling and terminating work. All panel surfaces shall be left in factory condition.
5. Cables shall be neatly trained, without interlacing, in all equipment, panels, boxes, instruments, and other devices. Sufficient lengths of cable shall be pulled to permit a neat arrangement. Multiconductor cable jackets shall be removed as required to train and terminate the conductors. Insulated conductors from which the jacket is removed shall be neatly trained in bundles and the bundles firmly but not tightly tied, using nylon ties. Special tools for properly installing and cutting the ties shall be furnished and used by the Contractor. Cable shall be clamped or secured in a manner to avoid tension to individual conductors or terminals. Where sufficient cable supports are not supplied with the equipment, supports shall be provided by the Contractor.
6. Splicing of 600-Volt cables shall be performed only upon written authorization from the Engineer. Splices shall be made with in-line compression splicing sleeves insulated with WCSF Raychem-Type heat-shrink tubing or equal, as approved by the Engineer. For splices in multiconductor cables, an overall heat shrink sleeve shall be installed, overlapping both cable jackets as recommended by the manufacturer.
7. All 600-V power cable shall be megger tested phase-to-phase and phase-to-ground prior to making final connections. Each cable shall be megger tested to all other conductors and to ground. Test voltage shall be 500 V with resistance readings taken each minute until three consistent readings are obtained. Minimum acceptable insulation resistance shall be one megohm. Megger data sheets shall be submitted to the Engineer for all megger-test results. All test equipment and labor shall be furnished by the Contractor.

8. Conductor insulation shall be squarely and evenly cut without nicking the wire strands. Control and instrument conductors and the smaller sizes of power cables shall be stripped with an approved mechanical wire-stripping tool. Larger size power cables shall be stripped with a sharp knife or stripping tool made specifically for that purpose. The length of conductor stripped shall be contiguous with the terminal connectors used. The insulated sleeves of control and electronic instrument cable connectors shall be long enough to overpass the conductor insulation.
9. Compression-type connectors shall not be used with solid conductor.

3.07 INSTALLATION OF GROUNDING AND BONDING

A. GENERAL

1. Work Included

This Section specifies furnishing, installing, connecting and testing of a complete grounding and bonding system.

B. PRODUCTS

1. General

- a. A complete grounding system shall be provided as shown on the drawings and as specified. The system shall satisfy all local codes and requirements.
- b. Equipment Ground: The grounded neutrals of the secondary distribution systems shall be supplemented by an equipment grounding system to properly safeguard the equipment and personnel. The equipment grounding systems shall be designed so all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in close proximity with electrical circuits operate continuously at ground potential and provide a low impedance path for possible ground fault currents. The systems shall comply with the National Electrical Code (NEC) the contract drawings and the specifications. The maximum equipment ground resistance shall be 5 ohms.
- c. The system ground and the equipment ground shall be connected to the common ground bus.

2. Ground Rods

- a. Ground rods shall be of copper-clad steel not less than 20 mm (3/4") in diameter and 3.0 m (10ft) long, driven full length into the earth. The copper-clad steel ground rod shall be manufactured by a fusion-weld process resulting in an electrolytic copper sheath homogeneously welded to an inner steel core. The thickness of the copper sheath shall be approximately 10% of the overall rod diameter. Copper-electroplated steel is not acceptable. If the resistance value of 5 ohms cannot be obtained by driven ground rods and water system, the Contractor will submit alternate methods to achieve the required result for approval by the PJKA.

3. Connectors

- a. The Contractor shall determine the number and size of pressure connectors to be provided on all equipment grounding bars required for the termination of equipment grounding conductors. In addition to the active circuits, the Contractor shall provide pressure connectors for all three-phase spares and spaces.

4. Jumpers

- a. Each electrical expansion fitting shall be provided with an external copper bonding jumper secured by approved grounding straps on each end of the fitting. Jumpers shall be flexible tin plated copper braided suitable for the required use.

5. Equipment Grounding Conductors

- a. Low voltage distribution systems shall be provided with a separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit with a three-phase protective device. The required grounding conductor shall be installed in the common conduit with the related phase and/or neutral conductors. Where there are parallel feeders installed in more than one raceway, each raceway shall have an insulated equipment ground conductor. Single-phase branch circuits required for 220-volt lighting, receptacles and motors shall consist of phase, neutral and ground conductors installed in common metallic conduit. Flexible metallic conduit equipment connections utilized in conjunction with the above single-phase branch

circuits shall be provided with suitable green insulated grounding conductors connected to approved grounding terminals at each end of the flexible conduit. All branch circuits installed in nonmetallic or flexible conduits shall be provided with a separate grounding conductor.

- b. All equipment grounding conductors shall be provided with green insulation equivalent to the insulation on the associated phase conductors. The related feeder and branch circuit grounding conductors shall be brazed to the grounding bar or connected with approved pressure connectors. A feeder serving several panelboards shall have a continuous grounding conductor which shall be connected to each related cabinet bar.
- c. The required equipment grounding conductors shall be sized in accordance with the National Electrical Code (NEC) and Japanese Standards.

6. Connection To Major Equipment

- a. Furnish and install in the same raceway with the associated phase and/or neutral conductors a green equipment ground conductor having the same type insulation and connected as described below. Each ground conductor shall be provided with spade tongue terminals or solderless pressure connectors to suit conditions.
 - 1) From equipment ground bus in switchboard to panelboards.
 - 2) From equipment ground bus in motor control center through conduit and flexible metallic conduit to ground terminal in connection box mounted on single- or three-phase motor install ground conductor size as herein specified. Where motor has separate starter and disconnect device, the ground conductor shall originate at the ground bar in the panelboard supplying these motors and be bonded to each starter and disconnect device enclosure also.

7. Test

- a. The completed equipment grounding system shall be subjected to a megger test at each service disconnect enclosure ground bar to insure that the ground resistance, without chemical treatment or other artificial means, does not

exceed five (5) ohms. Certified test reports of the ground resistance shall be submitted to the Engineer for approval.

- b. Necessary modification for compliance with the five (5) ohms value should be reflected in the contract price without additional expense to the Engineer.
- c. The Contractor shall provide means to minimize damage caused by lightning discharges to buildings and equipment in accordance with the National Fire Protection Association Code 78 and Japanese Code.

3.08 INSTALLATION OF BOXES

- A. All boxes shall be mounted plumb and level and shall be rigidly anchored. Boxes shall be spaced at least 20-mm (3/4-in.) from all walls to provide an air space between the box and the wall. Any continuous-run spacers shall be mounted vertically. Boxes mounted outdoors shall have fittings installed in the bottom for drainage and breathing, such as Crouse-Hinds type ECD or equal approved by the Engineer.

3.09 INSTALLATION OF PANELBOARDS

- A. The Contractor shall install all AC panelboards. Panelboards shall be mounted such that the height of the top operating handle will not exceed 1830-mm from the floor.

- B. The Contractor shall provide all steel shapes and appurtenances necessary for the support of the panelboards.

Where panelboards are installed and energized during plant construction, the Contractor shall place temporary covers over the openings at all times, except when work is being performed.

- C. The Contractor shall perform insulation resistance tests on all panel boards.

3.10 LIGHTING SYSTEM WIRING

- A. The wiring of lighting system shall be designed and installed in accordance with the National Electrical Code, Japanese Standard or equivalent regulation approved by the Engineer.

- B. Cabling and wiring in office buildings or like finished areas, shall be of the concealed type implemented by means of metal conduits embedded in walls. If suspended ceilings are provided for, then cabling and wiring may be performed within the suspended area by open type trays.

- C. Wiring shall be in accordance with the construction features of this section

3.11 HVAC SYSTEM WIRING

- A. Design, furnish and install a complete power wiring system for the HVAC Systems designed and provided as specified in accordance with the installation of cable in this section.

3.12 MOTOR CONNECTIONS

- A. The Contractor shall be responsible for electrical connection and testing of all motors installed under this Contract.

- B. The main feeders for 220 V motors shall be 600-V power cable which shall be terminated as specified in this Specification and in accordance with the following additional requirements:

1. Where the incoming feeder cable and the motor leads are No. 2/0 AWG or larger, the cable compression connectors on both shall be NEMA-standard two-hole connectors Burndy Type YA-2N, T & B 60,000 series or equal approved by the Engineer. Where connectors are not furnished or where unsuitable connectors are furnished with a motor, it shall be brought to the attention of the Engineer. The pads of incoming feeder cable connectors and motor lead cable connectors shall be joined together with two 12-mm (1/2-in.) stainless steel or Everdur bolts.
2. Where either the incoming feeder cable or the motor leads are smaller than No. 2/0 AWG, the compression connectors on both shall be one-hole connectors such as Burndy type YA or equal. The pads of incoming feeder cable connectors and motor lead cable connectors shall be joined together with one 6-mm (1/4-in.) stainless steel or Everdur bolt.
3. Where parallel feeders are connected to motor leads, extra care shall be taken to make sure that all conductors connected to the same motor lead are of the same phase and connected to the same phase bus at the SUS, motor control center or motor local starter.
4. All bolted joints shall be insulated with Raychem-Type MCK heat-shrink type motor termination kits, or equal as approved by the Engineer.

C. Tests

The Contractor shall perform the following tests on all motors:

1. Before motors are initially energized, the Contractor shall check to verify that motor bearings are properly lubricated. The Contractor shall perform all field lubrication as recommended by the motor manufacturer. Lubricant shall be furnished by the Contractor.
2. All motors shall be free to rotate as verified by rotating the rotors by hand. The Contractor shall check to make sure that motors have been properly aligned with the equipment being driven.
3. Check that frame grounding connections are properly made.
4. Determine phase connections on all motors prior to connecting and identify motor leads and cables.
5. Perform insulation resistance test on all motors in accordance with IEEE/ANSI standards.
6. Contractor shall bump the motor to determine the rotation. If the rotation is found to be incorrect, phase connections shall be changed to correct it.
7. After the motors are energized, the Contractor shall test the resistant temperature and other components, as applicable.
8. After completion of tests, make up permanent couplings to driven equipment.

3.13 FIRESTOPS AND ENVIRONMENTAL SEALS

- A. The Contractor shall design, furnish materials, and install firestops and/or environmental seals for all cable trays, conduits, and other electrical penetrations.
- B. The Contractor shall provide an environmental seal for all open-ended conduits entering the top and/or bottom of control panels, panelboards, etc. An environmental seal shall also be provided at all conduits passing from the outdoors to the inside of the buildings. Spare conduit sleeves shall not be filled with silicone foam but shall be plugged or capped with suitable metallic conduit plugs or pipe caps.
- C. The sealing material used shall be General Electric RTV silicone foam or equal approved by the Engineer.
- D. The fire rating of each electrical penetration shall be equivalent to the fire rating of the wall or floor concerned. If a wall or floor has no fire rating (including exterior wall), an environmental seal of 75-mm (3-in.) minimum depth shall be provided.

- E. The Contractor shall prepare and submit to the Engineer for approval installation drawings and documents showing the details of the Contractor's installation methods and/or procedures as well as the materials to be used.
- F. Before installing any firestops or environmental seals, the Contractor shall obtain written permission to proceed from the Engineer.

END OF SECTION

146 - CENTRIFUGAL PUMPS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	146 - 1
1.02 APPLICABLE CODES AND STANDARDS	146 - 1
1.03 GUARANTEE	146 - 2
<u>PART 2: PRODUCTS</u>	
2.01 GENERAL	146 - 2
2.02 MATERIALS	146 - 2
2.03 FABRICATION AND MANUFACTURE	146 - 2
<u>PART 3: EXECUTION</u>	
3.01 FIELD QUALITY CONTROL	146 - 4
LAST PAGE	146 - 4

146 - CENTRIFUGAL PUMPS

PART 1: GENERAL

1.01 DESCRIPTION

- A. Pumps shall be as indicated on the Drawings and as specified herein: The pumps shall be subjected to the following tests and inspections:
1. HYDROSTATIC TEST
 2. RUNNING AND ACCEPTANCE TEST
 3. SHOP INSPECTION
- B. Acceptance tests shall be carried out as specified in ISO/DIS 3555. The NPSH shall be tested according to the method described in ISO/DIS 3555, Clause 7.1.1.2. The acceptance and running tests shall be carried out in the presence of the Engineer.

1.02 APPLICABLE CODES AND STANDARDS

The following codes and standards are intended to provide an acceptable level of quality for materials and products. The Contractor may propose alternative codes and standards provided they give an equivalent degree of quality as the referenced codes and standards and are submitted for the Engineer review and approval in advance of their use.

The latest editions of the following standards shall apply:

- A. ANSI B15.1 Safety standards for mechanical power transmission apparatus
- B. American Society for Testing and Materials (ASTM)
ASTM A536 Ductile iron castings
- C. International Organization for Standardization (ISO)
ISO/DIS 3555 Centrifugal, mixed flow and axial pumps - Code for acceptance tests - Class B
- D. Japanese Industrial Standards (JIS)
JIS B 8313 Small type centrifugal pump
- E. Wherever the stipulations of this specification conflict with those of the above standard, this specification shall govern.

1.03 GUARANTEE

- A. The following characteristics shall be guaranteed:
1. Flow Rate
 2. Total Head
 3. Efficiency
 4. NPSH
- B. The guarantees shall cover the whole range from shut-off head to the lowest possible occurring head. The number of guarantee points at each curve shall be five.

PART 2: PRODUCTS

2.01 GENERAL

All goods and products covered by these specifications shall be, when available, from a local manufacturer. Procurement of all goods and products manufactured out-of-country must be approved by the Engineer.

2.02 MATERIALS

- A. Materials to be used under this Section shall generally conform to the Codes and Standards listed herein, and/or to equivalent international codes and standards, subject to the approval of the Engineer.

B. Coating

Steel structures, pumps, motors, gearboxes, etc., shall be coated in accordance with referenced standards.

2.03 FABRICATION AND MANUFACTURE

A. General

1. The pumps shall be of the horizontal spindle, centrifugal, double flow radial type. The casing shall be horizontally split with the suction and discharge nozzles located in the lower half of the casing. It shall be possible to dismantle the pump rotor without disconnecting the piping.
2. Each pump-motor unit shall be provided with a solid and robust cast or welded base plate on which both the pump and motor are to be mounted.

B. Description of Parts

1. Pump Casings

- a. Casings shall be made of nodular cast iron complying with ASTM A-536-67, Grade 60-40-18, or JIS G 5501.
- b. The pumps shall be equipped with drains and vents with copper pipes for draining and aerating the pumps to the floor drain. Waste oil shall be conducted to a waste oil collector located on the base plate.
- c. The dimensions of suction and discharge flanges and facings for the pumps shall have a nominal pressure of 10 kg/cm².

2. Impellers

- a. Impellers shall be as specified in JIS H 5111.
- b. Impellers shall be of bronze of the Cu 88%, Su 9%, Zn max 0.3% type.
- c. Wearing rings shall be renewable. All wearing rings shall be manufactured of bronze, as stated above for impellers.

3. Shafts, Bearings and Stuffing Boxes

- a. Shafts and shaft sleeves shall be as specified in JIS G 4303.
- b. Shafts shall be of stainless steel with the following chemical properties and tensile requirements:

Cr 25% Ni 4.5% Mo 1.3%
- c. Shaft sleeves shall be renewable sleeves of stainless steel or bronze as specified above.
- d. Stuffing boxes shall be of the conventional type and be water lubricated. Mechanical shaft seals of an approved design will be considered.

4. Couplings

- a. Pumps shall be directly coupled with a flexible coupling which shall be protected by a cover. The coupling shall be designed to permit the removal of impeller, shaft, bearings, etc.

5. Instrumentation

- a. Each pump-set shall be equipped with:
- b. Two Bourdon pressure gauges placed on the pumps so as to be easily readable and connected to the suction pipe and discharge pipe respectively. Each gauge installation shall be provided with a 10-mm block valve and a vent valve to facilitate zero checking and removal of the gauge.
- c. Temperature-indicating instruments mounted on the pump casing for surveillance of possible overheating of the pump due to operating against a closed valve caused by electrical and/or mechanical faults.
- d. Surge-pulse measuring equipment on pump and motor bearings for surveillance of bearing conditions. This equipment shall be adjusted and calibrated after erection to be able to compensate for possible hydraulic phenomena caused by the pumps during installation test pumping.

6. Electric Motors

See Section: Motors

PART 3: EXECUTION

3.01 FIELD QUALITY CONTROL

See Section: Basic Materials and Methods

END OF SECTION

147 - MOTOR STARTERS & MOTOR CONTROL CENTERS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	147 - 1
1.02 SUBMITTALS	147 - 1
1.03 QUALITY ASSURANCE	147 - 1
<u>PART 2: PRODUCTS</u>	
2.01 INDIVIDUAL MOTOR CONTROLS	147 - 1
2.02 MOTOR CONTROL CENTERS	147 - 3
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	147 - 5
LAST PAGE	147 - 5

147 - MOTOR STARTERS & MOTOR CONTROL CENTERS

PART 1: GENERAL

1.01 DESCRIPTION

- A. This section includes specifications for furnishing and installing motor control centers and individually mounted A.C. motor starters.

1.02 SUBMITTALS:

- A. Submit 5 copies of shop drawings for motor control centers in accordance with NEMA Standards ICS for Type 12, Type 4X or Type 4 construction as specified.

1.03. QUALITY ASSURANCE:

- A. Latest editions of the following applicable standards:
1. National Electrical Manufacturers' Association (NEMA)
 2. American National Standards Institute (ANSI)
 3. National Electrical Code (NEC)
 4. Japanese Industrial Standards (JIS)
Japanese Electrical Standards (JES)

PART 2: PRODUCTS

2.01 INDIVIDUAL MOTOR CONTROLS:

- A. General: Provide each motor which is not controlled from a motor control center with a suitable controller and device that will perform the functions as specified for the respective motors, unless the controller or devices are furnished under other sections of these specifications. Unless otherwise shown on the drawings or specified in other sections of these specifications, provide magnetic starters for motors over 3/4 hp, and manual starters for all motors 1/2 hp and smaller. Provide each motor with thermal-overload protection and polyphase motors with overload protection in each ungrounded conductor.
- B. Motor Disconnecting Means: When required by the National Electrical Code, provide each motor with a suitable disconnecting means under this section of the specification, even though not indicated on the drawings.
- C. Magnetic Starters: Conform to NEMA Standard ICS and sized as shown on the drawings. If not shown, size in accordance with the requirements of NEMA Standard ICS, and the National Electric Code, except that the minimum size is Size No. 1. Except where otherwise shown or specified, the

starters are for across-the-line starting. All starters must be equipped with thermal overloads in each ungrounded conductor and thermal overloads sized in accordance with nameplate rating of motor supplied.

D. Circuit Breakers:

1. Type - molded case with thermal magnetic trip.
2. Trip Setting - as shown on drawings; when not shown use maximum setting permitted by NEC.
3. Frame Size - not less than 100 amperes.
4. Interrupting capacity of 380-volt circuit breaker - not less than 25,000 amperes RMS symmetrical, unless a higher interrupting rating is shown on the drawings or specified.

E. Combination Starters: Use circuit breaker type, except where otherwise shown or specified. The circuit breakers and the magnetic starters are specified above. Provide the circuit breaker and starter with a common NEMA Type 1 enclosure except where otherwise shown or specified with the circuit breaker operable by an exterior handle indicating clearly the position of the breaker. Permit the handle to lock in the OFF position by means of padlocks.

F. Manual Starters: Full voltage, quickmake, quickbreak toggle switch type conforming to the requirements of NEMA Standard ICS, with thermal alloy overload protection.

G. Miscellaneous Control Devices: Use pushbuttons and selector switches of the heavy duty, oil-tight type, rated 600 volts a-c with double break contacts, silver-plated, and rated not less than 6 amperes continuous at 127 volts a-c. The pilot lights are of the filament bulb type with green pilot lights used for "ON" or "RUNNING" indication and red pilot lights used for "OFF" or any other "ALARM" or abnormal indication. Use terminal blocks rated at 10 amperes minimum with marking strips. Relays to be of type to perform the required function and rated in accordance with NEMA Standard ICS for Class B relays.

H. Enclosures: Provide NEMA Type 12 enclosures for all individual control devices installed in non-hazardous areas located indoors, NEMA Type 4 enclosure if located outdoors and NEMA Type 4X in marine and or chemical outdoor environments. Provide control devices located in hazardous areas with enclosures approved by the National Electrical Code for the class, group and division of hazard in which they are located.

2.02 MOTOR CONTROL CENTERS:

- A. General: NEMA Class II Type B free standing, self-supporting, self-contained, totally enclosed dead-front, dead-rear structures, constructed in accordance with NEMA Standard ICS. The motor control centers are vertical sections. Each section is 2286 mm high, and contains not more than six Size 1 starters or equivalent. Circuit breakers and motor starters are to be grouped in individual cubicles, as shown on the drawings, to form individual combination motor starter units. Each combination motor starter or circuit breaker is to be housed in an individual cubicle, except that two 100-ampere frame size circuit breakers may be mounted in one cubicle. Provide cubicles for size 3 and smaller combination starters and for 100- and 225-ampere frame with plug-in type circuit breakers, readily removable from the front, with suitable guides for accurate horizontal and vertical alignment and latching mechanism. Provide fixed cubicles for size 4 and larger combination starters and for 400-ampere frame and larger circuit breakers. Provide all cubicles with separate doors secured with the number of captive-type screws or latches required. Front mount cubicles only. Provide each motor starter unit with a control transformer as required. The control transformers and their corresponding fuses are to be mounted in their respective motor starter cubicles. Pushbuttons, selector switches, overload resets and indicator lights are to be door mounted or cubicle mounted, protruding through the door. Protrude circuit breaker operating handles through the cubicle door or provide with door mounted mechanical operators. Door to the cubicle cannot open unless the circuit breaker is open. Control relays are to be located in a separate compartment with a hinged door. Arrange the relays in such a manner that all relays pertaining to a system are grouped together.
- B. Enclosures: Motor control centers located indoors: NEMA Type 1 gasketed enclosure. Motor control centers located outdoors: NEMA Type 4 weatherproof, non-walk type enclosure or NEMA Type 4X when located in marine and/or chemical environments.
- C. Wiring: Class II, Type B in accordance with NEMA Standard
- D. Buses:
1. Power Bus: distributed by means of a continuous silver-plated copper bus rated as shown on the contract drawings. The buses are to be braced for 25,000 amperes RMS symmetrical fault currents. The horizontal bus is to be effectively isolated from all wiring troughs and other working areas. Phase Buses A, B, C, left to right, front to back, top to bottom, and clockwise when viewing the front of the equipment.

2. Ground Bus: Equip the motor control centers with a 6m x 50m equipment ground bus running the entire length of the structure and bonded to each vertical section. Provide ground bus with lugs and screw-type terminals for connection of ground conductors.
- E. Circuit Breakers: Conform to NEMA Standard AB 1. The breakers have molded cases with frame size, number of poles and trip ratings as indicated on the drawings. The circuit breaker mechanism is to be quick make, quick break and entirely trip free. Provide the breakers with inverse-time, thermal trip elements, and an instantaneous magnetic trip element on each pole. Use magnetic trip elements that are externally adjustable, and thermal trip unit interchangeable on 225-ampere frame size and higher. Operation of either trip element on any pole opens all poles of the breaker simultaneously. Interrupting capacity of the 480 volt circuit breakers is not less than 25,000 amperes RMS symmetrical minimum, unless a higher interrupting rating is shown on the drawings or specified.
 - F. Magnetic Starters: Conform to NEMA Standard ICS and sized as shown on the drawings. If not shown, the starters are to be sized in accordance with the requirements of NEMA Standard ICS, and the NEC except that the minimum size is not be less than Size No. 1. Except where otherwise shown or specified, the starters are for across-the-line starting. The starters have thermal overload in each ungrounded conductor, with the thermal overloads sized in accordance with nameplate rating of motor supplied and the National Electrical Code.
 - G. Miscellaneous Control Devices: Pushbuttons and selector switches are of the heavy duty, oil-tight type and rated 600 volts a-c with double break contacts, silver-plated, and rated not less than 6 amperes continuous at 120 volts ac. The pilot lights are of the filament bulb type with green pilot lights used for "ON" or "RUNNING" indication and red pilot lights used for "OFF" or any other "ALARM" or abnormal indication. Provide terminal block rated 10 amperes minimum with marking strips. Relays to be of type to perform the required function and shall be rated in accordance with NEMA Standard ICS for Class B relays.
 - H. Spaces: Spaces for future addition of motor starters consist of fully equipped removable plug-in cubicles of size shown on the drawings. Each space cubicle includes bus connectors, cubicle latch, and a blank hinged door.
 - I. Shop Testing: Shop test the motor control centers and their components in accordance with the requirements of the applicable NEMA Standards.

PART 3: EXECUTION

3.01 INSTALLATION:

A. Motor Starters and Motor Controls:

1. Furnish and install motor starters and motor controls with equipment where specified under other sections of this specification in accordance with the applicable local codes, manufacturers' instructions and meeting the requirements of NEC and the NESC.

END OF SECTION

148 - MOTORS

TABLE OF CONTENTS

<u>Article No. and Title</u>	<u>Page No.</u>
<u>PART 1: GENERAL</u>	
1.01 DESCRIPTION	148 - 1
1.02 QUALITY CONTROL	148 - 1
1.03 SUBMITTALS	148 - 1
<u>PART 2: PRODUCTS</u>	
2.01 MOTORS	148 - 1
<u>PART 3: EXECUTION</u>	
3.01 INSTALLATION	148 - 3
3.02 APPLICATION	148 - 3
LAST PAGE	148 - 4

148 - MOTORS

PART 1: GENERAL

1.01 DESCRIPTION

- A. Provide electric motors and accessories for all motorized equipment indicated.
- B. Furnish motor-starters, control devices, and disconnect switches, not specified as furnished or as integral part of the equipment installed under this Division.

1.02 QUALITY CONTROL

- A. All electric motors shall be JIS listed and labeled.

1.03 SUBMITTALS

- A. In compliance with the General Provisions, provide submittal defined in the following paragraphs:
 - 1. Submit Product Data on electric motors and accessories specified in this Section.

PART 2: PRODUCTS

2.01 MOTORS

- A. Provide motors of sufficient size for the duty to be performed and not exceeding the full-load rating when the driven equipment is operating at specified capacity under the most severe conditions likely to be encountered. Motors shall be suitable to operate the rated load at an ambient temperature of 40 degrees C. When electrically driven equipment furnished under other Sections of this Division, differs from that shown on the drawings, submit drawings for approval by the Engineer. Make the necessary adjustments to the wiring and conduit systems, disconnect devices, circuit protection devices, etc., required to accommodate the equipment actually installed.
- B. Voltage: Unless indicated otherwise, use motors designed for continuous duty at the following voltages:
 - 1. 220-volt, single-phase, 50-Hz - for motors less than 1/2 hp.
 - 2. 380-volt, three-phase, 50-Hz - for motors 1/2 hp to 200 hp. Motors 250 and larger shall be at 4000 V, 3 phase except for fire pump motors which shall be rated at 460 V, 3 phase.

3. Suitable for operation at variations of frequency and voltage of plus or minus 10% of nameplate rating without damage.

C. Motor Enclosures.

1. Motor enclosures for motors located indoors shall be drip-proof type with drain plugs or other openings for condensate drainage.
2. Enclosures for motors located outdoors shall be weatherproof type, totally enclosed, non-ventilated, or fan cooled type.
3. Enclosures for motors installed in hazardous areas shall be of group and class approved for the type of hazard in which they are located.

D. Service Factor:

1. Drip-proof Motors: 1.15
2. Totally Enclosed: 1.0

E. Insulation:

1. Class B, except as noted on the Drawings or specified herein.
2. Open Drip-proof Motors: Insulation system completely sealed and coated with abrasion resistant material such as polyurethane. Provide corrosion treatment on rotors, stators, end shields, and arc deflectors.

- F. Bearings: Provide motors up to 150 hp inclusive with grease-lubricated antifriction bearings. Use motors above 150 hp equipped with oil-ring lubricated split-sleeve bearings and split-end shields, unless the type of connection to load precludes the application of a sleeve bearing.

G. Special Requirements:

1. Provide motors driving forward curve centrifugal fans having a name-plate rating of not less than 15% above the actual fan horsepower at specified capacity if direct connected, and not less than 20% above if belt driven.
2. Provide motors driving backward curve centrifugal fans having a nameplate rating of not less than 5% above the actual fan horsepower at specified capacity if direct connected, and not less than 10% above if belt driven.

3. Provide motors driving centrifugal pumps having nameplate rating not less than the maximum brake horsepower required by the impeller furnished at any point on the pump curve.
4. Motor speeds shall be 1750 RPM maximum for single speed motors and 1200/1800 for 2 speed motors.

H. Accessories:

1. V-belts shall be heavy duty, oil, heat, and static dissipating type.
2. Sheaves shall be machine cast iron or steel with tapered key attachment to shaft. Drive sheave shall be adjustable type.
3. Belt guards shall be constructed of minimum 16 gauge steel which completely encloses all moving parts (sheaves, shafts, belts etc.). Face of guard may be solid sheet steel or expanded steel mesh: Guard shall be constructed to permit easy access to moving parts and shall have openings for shaft speed measurements without removing the guard.

PART 3: EXECUTION

3.01 INSTALLATION

A. Motors and Controls:

1. Install, align, and couple motors supplied as a separate item under this Section.
2. Alignment of all motors to be rechecked after all connections and drives have been installed and in operation for a minimum of 48 hours.
3. Wire motors and controls as specified under applicable mechanical and electrical sections of this Specification to provide proper operation of the connected equipment.

3.02 APPLICATION

A. Motors:

1. Motors shall be selected with torque characteristics which will satisfactorily accelerate the driven equipment.
2. Motors shall be selected such that the driven load will not require the motor to operate in the service factor range.

B. Drivers:

1. All belt drives shall have belt guards,
2. Drives shall be single or multiple belt as required to properly transmit load. Multiple belts shall be matched sets.
3. Drive sheaves shall be selected to allow an adjustment of plus or minus 20% from driven speed.

END OF SECTION

PART E

BILL OF QUANTITIES

SCOPE AND MEASUREMENT

SCOPE AND MEASUREMENT

TABLE OF CONTENT

<u>Article No. and Title</u>	<u>Page No.</u>
1. <u>SCOPE OF WORK</u>	
1.01 GENERAL	1
2. <u>MEASUREMENT FOR PAYMENT</u>	
2.01 GENERAL	2
<u>GROUP 1: SURVEYING</u>	
1.01 RIGHT-OF-WAY STAKE	3
<u>GROUP 2: GEOLOGICAL SURVEY</u>	
2.01 BORING INVESTIGATION	3
<u>GROUP 3: EARTH WORK</u>	
3.01 SAND MAT	3
3.02 EMBANKMENT	3
3.03 AGGREGATE SUBBALLAST	4
3.04 SODDING SLOPE PROTECTION	4
3.05 EXCAVATION OF EARTH SIDE DITCH	4
3.06 EXCAVATIONS	4
3.07 AGGREGATE SUBBASE (ASB-3)	5
3.08 SELECT STRUCTURE BACKFILL	5
3.09 REINFORCED CONCRETE PIPE	5
3.10 CONCRETE SLOPE PROTECTION	5
3.11 LEVELING CONCRETE	5
3.12 CONCRETE FOR STRUCTURES	6
3.13 REINFORCED CONCRETE	6

SCOPE AND MEASUREMENT

TABLE OF CONTENT (Cont'd)

<u>Article No. and Title</u>	<u>Page No.</u>
3.14 CONCRETE PAVEMENT	6
3.15 DEMOLITION OF EXISTING REINFORCED CONCRETE STRUCTURES	7
3.16 PROTECTIVE FENCE	7
3.17 CONCRETE REINFORCEMENT	7
<u>GROUP 4: BRIDGE WORK</u>	
4.01 EXCAVATIONS	8
4.02 AGGREGATE SUBBASE (ASB-3)	8
4.03 PRESTRESSED CONCRETE PILE	8
4.04 LEVELING CONCRETE	9
4.05 REINFORCED CONCRETE	9
4.06 CONCRETE REINFORCEMENT	9
4.07 PRESTRESSED CONCRETE GIRDER	10
4.08 FABRICATION AND DELIVERY OF THROUGH PLATE GIRDER	11
4.09 INSTALLATION OF THROUGH PLATE GIRDER	11
<u>GROUP 5: ROAD CONSTRUCTION WORK</u>	
5.01 EMBANKMENT	12
5.02 ASPHALT CONCRETE CONSTRUCTION	12
5.03 GUARD RAILING	12
5.04 SAFETY MARKINGS	13
5.05 ROADWAY SIGNS	13
5.06 CONCRETE CURBING	13

SCOPE AND MEASUREMENT

TABLE OF CONTENT (Cont'd)

<u>Article No. and title</u>	<u>Page no.</u>
<u>GROUP 6: ARCHITECTURAL WORK</u>	
6.01 AIRPORT TERMINAL STATION	14
6.02 KOTA INTAN STATION	14
6.03 SIGNAL CABIN	15
6.04 CROSSING WATCHMAN'S BOX	16
6.05 DUMP YARD	16
<u>GROUP 7: TRACK WORK</u>	
7.01 TRACK LAYING	17
7.02 TRACK SHIFTING	17
7.03 REMOVAL OF TRACK	17
<u>GROUP 8: ELECTRICAL WORK</u>	
8.01 IMPROVEMENT OF OVERHEAD LINE	18
8.02 CHANGE-OVER OF EXISTING SIGNALLING EQUIPMENT	18
LAST PAGE	18

END OF TABLE OF CONTENT

SCOPE AND MEASUREMENT

1. SCOPE OF WORK

1.01 GENERAL

- A. The scope of work under this Contract Package I includes the furnishing of all labor, supervision, tools and equipment, technical and professional services, materials, supplies and articles necessary for the construction of approximately 20 kilometers of railbed work for a single line railroad services as referred to "Cengkareng Airport Line" as part of Perusahaan Jawatan Kereta Api (PJKA) network.

The work consists of excavation and embankment construction up to and including aggregate subballast work; and includes providing bridges and viaducts with pilings; prestressed concrete work; concrete retaining walls, box culverts, drainage facilities; slope protection; and related work as shown or specified.

The work also includes architectural work, but not necessarily be limited to the construction of the Airport Terminal Station, Kota Intan Station, Signal Cabins, Crossing Watchman's Boxes, Dump Yard and Incinerator, including ventilation, air-conditioning, plumbing, furnishings, utilities, landscaping and site lighting.

The work also includes the laying of temporary track, shifting and removal of the existing track; improvement of overhead contact line and change-over of the existing signalling equipment at the specific locations as required.

- B. For convenience in reference and control, the total work under this Contract is subdivided into major categories and groups as follows:

Groups under Package I

- (1) Surveying
- (2) Geological Survey
- (3) Earthwork
- (4) Bridge Work
- (5) Roadway Construction Work
- (6) Architectural Work
- (7) Track Work
- (8) Electrical Work

2. MEASUREMENT FOR PAYMENT

2.01 GENERAL

This section defines how pay items, enumerated in Bill of Quantities, are measured for payment. All lump sum items may be paid based on progress payment.

Abbreviations:

The following abbreviations have been used in the Bill of Quantities:

<u>Abbreviation</u>	<u>Full Meaning</u>
C.M.	cubic meter
S.M.	square meter
L.M.	lineal meter
No.	number
M.T.	metric ton
L.S.	lump sum

Work shall be measured net.

Item No. Title and Description for Scope and Measurement

GROUP 1: SURVEYING

1.01 RIGHT-OF-WAY STAKE -shall consist of furnishing and installing cast-in-place reinforced concrete stakes of the size to be provided at the locations as indicated; shall include excavation, backfilling and compacting, and disposal of surplus excavation; and shall also include provision of wooden stakes to be installed for identification of the right-of-way limit prior to the required work.

- shall be measured by count of the individual number of right-of-way stakes of the respective types and sizes installed in the completed work.

GROUP 2: GEOLOGICAL SURVEY

2.01 BORING INVESTIGATION (STANDARD PENETRATION TEST) - shall consist of providing boring investigation, and the carrying out of related standard penetration tests and core sampling at an interval of every two meters at the respective locations as indicated.

- shall be measured by the lineal meters of the borehole depth, based upon dimensions taken at the theoretical centerline of the borehole.

GROUP 3: EARTH WORK

3.01 SAND MAT - shall consist of material of the type as specified; shall include locating, selecting, obtaining, loading, hauling, placing, watering, and compacting the material in place; and shall include subgrade preparation, excavation and disposal of surplus excavation material.

- shall be measured by the cubic meters of material actually placed in the completed work.

3.02 EMBANKMENT - shall consist of constructing embankment using material obtained from borrow sites; and shall include locating, selecting, obtaining, loading, hauling, placing, watering and comacting the borrow material in place; and shall include subgrade preparation.

- shall be measured by the cubic meters of borrow materials actually placed in the completed work.

Item No. Title and Description for Scope and Measurement

3.03 **AGGREGATE SUBBALLAST** - shall consist of suitable material of the type and for the depths and extent indicated; and shall include locating, selecting, obtaining, loading, hauling, placing, mixing and compacting the material in place.

- shall be measured by the cubic meters of aggregate material placed in the completed work.

3.04 **SODDING SLOPE PROTECTION** - shall consist of obtaining and furnishing materials in selected sizes for the layer depths and the locations indicated; and shall include subgrade preparation, and distributing, placing and stabilizing the material in place.

- shall be measured by the square meters of sodding materials placed in the completed work.

3.05 **EXCAVATION OF EARTH SIDE DITCH** - shall consist of all excavations necessary to provide ditches and related details. The work shall include all necessary general clearing off of work sites upon start of work, finishing off and dressing of the same upon completion of work, and subgrade preparation, and also include disposal of surplus excavation material.

- shall be measured by the cubic meters of material actually removed, based upon cross sectional grades measured before and after excavation and at the excavation sites.

3.06 **EXCAVATIONS** - shall consist of excavations and draining operation with or without any supporting materials such as wale, brace, sheet piling; and shall also include disposal of surplus excavation and backfilling. Various classes of excavation as required for the respective locations shall be:

- a. CLASS A: Without supporting materials.
- b. CLASS B: Forming a single sheet piling at one side.
- c. CLASS C: Forming a single sheet piling at two sides.
- d. CLASS E: Forming soldier piles (H-shaped steel beam) and wood lagging at two sides.

- shall be measured by the cubic meters of material actually removed to the lines and extent as indicated based upon cross sectional grades measured before and after excavation and at the excavation site.

Item No.	Title and Description for Scope and Measurement
3.07	<p>AGGREGATE SUBBASE (ASB-3) - shall consist of material of the type indicated; shall include locating, selecting, obtaining, loading, hauling and placing the material in place.</p> <p>- shall be measured by the cubic meters of the type of aggregate material placed in the completed work.</p>
3.08	<p>SELECT STRUCTURE BACKFILL - shall consist of obtaining and furnishing backfill and sealing materials in selected type for the layer depths, locations and extent indicated; and shall include loading, hauling, placing and compacting the material in place.</p> <p>- shall be measured by the cubic meters of the type of backfill material placed in the completed work.</p>
3.09	<p>REINFORCED CONCRETE PIPE (DIAMETER = 300 mm) - shall consist of reinforced concrete pipe of the types and sizes indicated; and shall include pipe and joint materials and installation; beddings when indicated; connections to structures when indicated; excavation, backfilling and compaction; and shall also include disposal of surplus excavation material.</p> <p>- shall be measured by the lineal meters of the types and sizes of reinforced pipe placed in the completed work, based upon dimensions taken at the theoretical centerline of the pipe barrel.</p>
3.10	<p>CONCRETE SLOPE PROTECTION - shall consist of cast-in-place concrete for covering the slope of the type, depth, location and extent indicated; and shall include obtaining, hauling, placing and compacting the material in place; and shall also include the drainage work during the construction.</p> <p>- shall be measured by the square meters of the class of concrete material placed in the completed work.</p>
3.11	<p>LEVELING CONCRETE - shall consist of furnishing Portland Cement Concrete of the class and the depth indicated; and shall include conveying, placing, consolidating, finishing and curing the concrete in place.</p>

Item No. Title and Description for Scope and Measurement

3.12 CONCRETE FOR STRUCTURES - shall consist of furnishing of concrete for various structures; and shall include conveying, placing, consolidating, finishing and curing the concrete in place; and falsework, formwork, construction joint treatment, weep holes for retaining walls; and related materials, work and operations; and shall include;

- a. Semi-gravity Type Retaining Walls
- b. Water Channels

- shall be measured by the cubic meters of the class of concrete material placed in the completed work.

3.13 REINFORCED CONCRETE - shall consist of furnishing of concrete for respective types of concrete structures; and shall include conveying, placing, consolidating, finishing and curing the concrete in place; and falsework, formwork, construction joint treatment, weep holes for retaining walls; and related materials, work and operation; and shall include:

- a. Retaining Walls
- b. Side Ditches
- c. Catch Basins
- d. Box Culverts
- e. Underground Passage

- shall be measured by the cubic meters of concrete for the respective structures of the types and sizes indicated and at the locations in the completed work.

3.14 CONCRETE PAVEMENT - shall consist of Portland Cement Concrete and base course for the concrete pavement of the class, type and depth indicated; and shall include conveying, placing, consolidating, finishing and curing the concrete in place; and obtaining, hauling, spreading and compacting the material in place; and shall also include excavation, backfilling and compaction; and disposal of surplus excavation material.

- shall be measured by the square meters of the class of paving concrete material placed in the completed work.

- | <u>Item No.</u> | <u>Title and Description for Scope and Measuremen</u> |
|-----------------|---|
| 3.15 | <p>DEMOLITION OF EXISTING REINFORCED CONCRETE STRUCTURES - shall consist of breaking up and removal of the objectionable existing reinforced concrete structures at the locations and to the extent indicated, from within the limits of work; and shall also include disposal of removed material.</p> <p>- shall be measured by the cubic meters of material actually removed at the demolition site.</p> |
| 3.16 | <p>PROTECTIVE FENCE - shall const of a comlete fence assembly of the type, size and locations indicated; shall include barbed wires and terminal posts and concrete bases; shall also include installation; excavation, backfill and compacting and disposal of surplus excavation material.</p> <p>- shall be measured by the lineal meters of barbed wires fencing placed in the completed work, based upon measurements taken to post centerline.</p> |
| 3.17 | <p>CONCRETE REINFORCEMENT - shall consist of furnishing reinforcing steel bars of the grade and in the sizes indicated; and shall include fabrication and erection; and shall include:</p> <ul style="list-style-type: none"> a. Box Culverts b. Underground Passage c. Girders d. Viaduct Foundations e. Viaduct Slab, Beams and Columns f. Retaining Walls g. Side Ditches h. Catch Basins i. Abutment Foundations j. Pier Foundations k. Pier Walls and Columns <p>- shall be measured by the metric tons of steel bar materials placed in the completed work.</p> |

Item No. Title and Description for Scope and Measurement

GROUP 4: BRIDGE WORK

4.01 EXCAVATIONS - shall consist of structural excavations and draining operation with or without any supporting materials such as wale, brace, sheet pile; and shall also include disposal of surplus excavation and backfilling. Various classes as required for the respective locations shall be:

- a. Class A: Without supporting material
- b. Class B: Forming a single sheet piling at two sides
- c. Class C: Forming a single sheet piling at four sides
- d. Class F: Forming double sheet piling

- shall be measured by the cubic meters of material actually removed to the lines and extent as indicated, based upon cross sectional grades measured before and after excavation and at the excavation site.

4.02 AGGREGATE SUBBASE (ASB-3) - shall consist of material of the type indicated; shall include locating, selecting, obtaining, loading, hauling and placing the material in place.

- shall be measured by the cubic meters of the type of aggregate material placed in the completed work.

4.03 PRESTRESSED CONCRETE PILE - shall consist of providing prestressed concrete piles of the type or types and in the size(s) and depth(s) indicated; placed at the locations and to the lines, grades, details and extent shown on the drawings; and shall include:

- a. 350 mm Diameter, A
- b. 350 mm Diameter, B
- c. 500 mm Diameter, A
- d. 500 mm Diameter, B

- shall be measured by the lineal meters of pile of the respective types and sizes placed in the completed work, and based upon dimensions taken at the theoretical centerline of the pile.

Item No.	Title and Description for Scope and Measurement
4.04	<p>LEVELING CONCRETE - shall consist of furnishing Portland Cement Concrete of the class and the depth indicated; and shall include conveying, placing, consolidating, finishing and curing the concrete in place.</p> <p>- shall be measured by the cubic meters of the class of concrete material placed in the completed work.</p>
4.05	<p>REINFORCED CONCRETE - shall consist of furnishing for reinforced concrete structures; and shall include conveying, placing, consolidating, finishing and curing the concrete in place, and falsework, formwork, construction joint treatment and operations; and shall include:</p> <ul style="list-style-type: none"> a. Abutment Foundations b. Abutment Walls c. Pier Foundations d. Pier Walls and Columns e. Girders f. Viaduct Foundations g. Viaduct Slabs, Beams and Columns <p>- shall be measured by the cubic meters of concrete for the respective structures of the types and sizes indicated and at the locations placed in the completed work.</p>
4.06	<p>CONCRETE REINFORCEMENT - shall consist of furnishing reinforcing steel bars of the grade and in the sizes indicated; and shall include fabrication and erection; and shall include but not be necessarily limited to:</p> <ul style="list-style-type: none"> a. Box Culverts b. Underground Passage c. Girders d. Viaduct Foundations e. Viaduct Slabs, Beams and Columns f. Retaining Walls g. Side Ditches h. Catch Basins i. Abutment Foundations j. Pier Foundations k. Pier Walls and Columns <p>- shall be measured by metric tons of steel reinforcing bars for the respective structures of the types and sizes indicated and at the locations placed in the completed work.</p>

Item No.	Title and Description for Scope and Measurement
4.07	<p>PRESTRESSED CONCRETE GIRDER - shall consist of prestressed concrete work, prestressing work, concrete reinforcement work and miscellaneous items as follows:</p>
	<p>1) Prestressed Concrete Work - shall consist of furnishing Portland Cement Concrete of the classes and for the uses indicated for prestressed concrete structures, and for the prestressed portions of composite type concrete structures; and shall include delivery, conveying, placing, consolidating, finishing and curing the concrete in place; falsework and formwork; and shall include:</p>
	<ul style="list-style-type: none"> a. Span 20 M b. Span 25 M (A) c. Span 25 M (B) d. Span 26 M e. Span 28 M f. Span 30 M (A) g. Span 30 M (B) h. Span 33 M i. Span 35 M j. Span 40 M
	<p>2) Prestressing Work - shall consist of furnishing, fabricating, and installing all anchoring devices, tensioning tendons and related items necessary for the particular prestressing systems indicated, specified or approved to be utilized for the work; including but not be necessarily limited to tendons of the types and sizes indicated, anchoring devices, tendon ducts, grout and pressure grouting of ducts, and all tensioning equipment and operations; all in accordance with the prestressing program as approved, or otherwise in accordance with the requirements of the technical specifications.</p>
	<p>3) Concrete Reinforcement Work - shall consist of furnishing reinforcing steel bars of the grade and in the sizes indicated; and shall include fabrication and erection.</p>
	<p>4) Miscellaneous Items - shall consist of furnishing, fabricating and installing of railings, bearings, drain pipes, expansion joints, utility chase covers, shoe foundation mortar, anchoring, deck pads and related details as indicated.</p>

<u>Item No.</u>	<u>Title and Description for Scope and Measurement</u>
4.08	<p>- shall be measured as a lump sum item for providing the respective works complete in place.</p> <p>FABRICATION AND DELIVERY OF THROUGH PLATE GIRDER - shall consist of furnishing all structural members and necessary materials of the grade and sizes indicated; and packing, crating or otherwise proper preparation for delivery; and delivery to the site.</p> <p>- shall be measured as a lump sum item for providing the respective works complete in place</p>
4.09	<p>INSTALLATION OF THROUGH PLATE GIRDER - shall consist of assembly at site, installing, furnishing the necessary equipment and facilities for installation and marking for erection identification or other appropriate method as the case may be for proper completion of the work; and also include field painting.</p> <p>- shall be measured as a lump sum item for providing the respective works complete in place.</p>

Item No. Title and Description for Scope and Measurement

GROUP 5: ROAD CONSTRUCTION WORK

5.01 EMBANKMENT - shall consist of constructing embankment using material obtained from borrow sites; and shall include locating, selecting, obtaining, loading, hauling, placing, watering and compacting the borrow material in place; and shall include subgrade preparation.

- shall be measured by the cubic meters of borrow materials actually placed in the completed work.

5.02 ASPHALT CONCRETE CONSTRUCTION - shall consist of bituminous mixed course, base course, subbase course for the asphalt pavement of the types and depths indicated; and shall include, obtaining, hauling, spreading and compacting the materials in place; and also include field layouts, grade control, prime and tack coats, and subgrade preparation.

Asphalt pavement shall be classified and shall apply to:

- a. Type A
- b. Type B
- c. Type C
- d. Type D

- shall be measured by the square meters of the respective types of asphalt concrete material placed in the completed work.

5.03 GUARD RAILING - shall consist of a complete assembly of roadway guard railing of the type and size indicated; shall include posts, metal beam railings and sections in straight and curved units as indicated; accessories and fastening as indicated or specified; concrete post bases when indicated, and shall include materials, fabrication and installation; excavation, backfilling and compaction; and disposal of surplus excavation material.

- shall be measured by the lineal meters of beams placed in the completed work; based upon dimensions taken to post centerlines, plus the straight-line dimension from the centerline of the terminal end post to the outer end of the flared end section.

Item No.	Title and Description for Scope and Measurement
5.04	<p>SAFETY MARKINGS - shall consist of paint material in the types and colors indicated; and shall include surface preparation, marking layouts, material application, clean up and related work.</p> <p>- shall be measured by the square meters of marking material of the respective types and colors placed in the completed work.</p>
5.05	<p>ROADWAY SIGNS - shall consist of furnishing and installing various roadway signs of the types and sizes indicated; shall include aggregate subbase with sheeting or leveling concrete as indicated; cast-in-place concrete base as shown; and shall also include excavation, backfilling and compaction; and disposal of surplus excavation in place.</p> <p>- shall be measured by the count of the individual number of the respective types of roadway signs placed in the completed work.</p>
5.06	<p>CONCRETE CURBING - shall consist of precast concrete curb and cast-in-place concrete base of the types, sizes and related work indicated on the drawings; depths, extent and locations indicated; and shall include obtaining, hauling, fabrication; and shall also include excavating, backfilling, compacting and disposal of surplus excavation material.</p> <p>- shall be measured by the cubic meter of curbs and bases placed in the completed work.</p>

Item No. Title and Description for Scope and Measurement

GROUP 6: ARCHITECTURAL WORK

6.01 AIRPORT TERMINAL STATION - shall consist of furnishing of all materials, equipment and labor for respective types of the work as required to complete the work; and shall include:

- a. Excavating, filling and grading
- b. Substructure and superstructure
- c. External finish
- d. Internal finish
- e. Doors, windows and louvers
- f. Furnishings
- g. Landscaping
- h. Ventilating and air-conditioning
- i. Plumbing
- j. Electrical work

- shall be measured as a lump sum item for providing the respective works complete in place. Payments for the quantities listed herein shall include all materials necessary for the proper completion of the work, whether or not such materials are specifically indicated in the specifications or on the drawings.

6.02 KOTA INTAN STATION - shall consist of furnishing of all materials, equipment and labor for respective types of the work as required to complete the work; and shall include:

- a. Excavating, filling and grading
- b. Substructure and superstructure
- c. External finish
- d. Internal finish
- e. Doors, windows and louvers

Item No. Title and Description for Scope and Measurement

- f. Furnishings
- g. Landscaping
- h. Ventilating and air-conditioning
- i. Plumbing
- j. Electrical work

- shall be measured as a lump sum item for providing the respective works complete in place. Payment for the quantities listed herein shall include all materials necessary for the proper completion of the work, whether or not such materials are specifically indicated in the specifications or on the drawings.

6.03 SIGNAL CABIN - shall consist of furnishing of all materials, equipment and labor for respective types of the work as required to complete the work; and shall include:

- a. Excavating, filling and grading
- b. Substructure and superstructure
- c. External finish
- d. Internal finish
- e. Doors, windows and louvers
- f. Ventilating and air-conditioning
- g. Plumbing
- h. Electrical work

- shall be measured as a lump sum item for providing the respective works complete in place. Payment for the quantities listed herein shall include all materials necessary for the proper completion of the work, whether or not such materials are specifically indicated in the specifications or on the drawings.

6.04

CROSSING WATCHMAN'S BOX - shall consist of furnishing of all materials, equipment and labor for respective types of the work as required to complete the work; and shall include:

- a. Excavating, filling and grading
- b. Substructure and superstructure
- c. External finish
- d. Internal finish
- e. Doors, windows and louvers
- f. Electrical work

- shall be measured as a lump sum item for providing the respective works complete in place. Payment for the quantities listed herein shall include all materials necessary for the proper completion of the work, whether or not such materials are specifically indicated in the specifications or on the drawings.

6.05

DUMP YARD - shall consist of furnishing of all materials, equipment and labor for respective types of the work as required to complete the work; and shall include:

- a. Excavating, filling and grading
- b. Substructure and superstructure
- c. External finish
- d. Furnishings

- shall be measured as a lump sum item for providing the respective works complete in place. Payment for the quantities listed herein shall include all materials necessary for the proper completion of the work, whether or not such materials are specifically indicated in the specifications or on the drawings.

Item No. Title and Description for Scope and Measurement

GROUP 7: TRACK WORK

7.01 TRACK LAYING - shall consist of the temporary track laying using the materials derived from the track removal work or the materials furnished by the Engineer, at the locations and extent as indicated on the drawings; and shall also include hauling, placing, compacting and other related works.

- shall be measured by the lineal meters of track laying work actually placed in the completed temporary track work based upon measurement taken at the longitudinal track centerliness.

7.02 TRACK SHIFTING - shall consist of the temporary track construction using the existing track materials at the locations and extent as indicated on the drawings; and shall also include compacting and other related works.

- shall be measured by the lineal meters of track shifting work actually taken in the completed temporary track work based upon measurement taken at the longitudinal track centerlines.

7.03 REMOVAL OF TRACK - shall consist of the removal work of the existing tracks at the locations and extent as indicated on the drawings; and shall also include hauling, loading and storing the materials derived from the work; and shall also include other related works.

- shall be measured by the lineal meters of track removal work actually removed in the completed work based upon measurements taken at the longitudinal trackway centerlines.

Item No. Title and Description for Scope and Measurement

GROUP 8: ELECTRICAL WORK

8.01 IMPROVEMENT OF OVERHEAD LINE - shall consist of furnishing and installing concrete poles including foundations, beams, guys, overhead catenaries, pull offs, automatic tensioning devices, underground feeders; and also including shifting of overhead catenaries, pull offs, and reformation of the existing feeder branches, and removal of the existing steel masts, beams, overhead catenaries, pull offs, automatic tensioning devices and underground feeders; and also including excavation, trenching, bedding, backfilling, compaction and disposal of surplus excavation and related tests and measurements to complete the reformation work of the overhead contact system in Jakarta Kota Station.

- shall be measured as a lump sum item for providing the respective products and materials in the reformation work of overhead contact system in Jakarta Kota Station.

8.02 CHANGE-OVER OF EXISTING SIGNALLING EQUIPMENT - shall consist of the following work items and related testing, construction and removal of concrete bases for signal equipment including excavation, trenching, bedding, backfill, compaction and disposal of surplus excavation:

- a. Relocation and removal of samaphore signals
- b. Furnishing, installing and relocating of wire carriers
- c. Cutting, relocating and connecting of existing control wires

- shall be considered as a lump sum item for providing the respective works complete in place.

END OF SCOPE AND MEASUREMENT

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

GENERAL SUMMARY

	<u>AMOUNT, RP.</u>
1. SURVEYING	_____
2. GEOLOGICAL SURVEY	_____
3. EARTHWORKS	_____
4. BRIDGE WORK	_____
5. ROAD CONSTRUCTION WORK	_____
6. ARCHITECTURAL WORK	_____
7. TRACK WORK	_____
8. ELECTRICAL WORK	_____
TOTAL	_____

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

1. SURVEYING

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$	TOTAL RP.
1.01	004,019 021,022	RIGHT-OF-WAY STAKE	1,280	No.					
		TOTAL OF SURVEYING							

BILL OF QUANTITIES

2. GEOLOGICAL SURVEY

BIDDER: _____

DATE: _____

SIGNATURE: _____

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$	TOTAL RP.
2.01	008	BORING INVESTIGATION	240	L.M.					
		TOTAL OF GEOLOGICAL SURVEY							

BILL OF QUANTITIES

3. EARTHWORKS

BIDDER: _____

DATE: _____

SIGNATURE: _____

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT	
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$
3.01	007	SAND MAT	55,170	C.M.				
3.02	007	EMBANKMENT	131,210	C.M.				
3.03	017	AGGREGATE SUBBALLAST	15,300	C.M.				
3.04	006	SODDING SLOPE PROTECTION	68,190	S.M.				
3.05	003	EXCAVATION OF EARTH SIDE DITCH	16,530	C.M.				
3.06	004	EXCAVATION -						
a.		CLASS A	6,200	C.M.				
b.		CLASS B	6,640	C.M.				
c.		CLASS C	7,350	C.M.				
d.		CLASS E	420	C.M.				
3.07	012	AGGREGATE SUBBASE (ASB-3)	1,910	C.M.				
3.08	-	SELECT STRUCTURE BACKFILL	420	C.M.				
3.09	005, 016 022	REINFORCED CONCRETE PIPE, 300MM DIAMETER	1,100	L.M.				
3.10	006	CONCRETE SLOPE PROTECTION	260	S.M.				
3.11	022	LEVELING CONCRETE	520	C.M.				
3.12	022	CONCRETE FOR -						
a.		SEMI-GRAVITY TYPE RETAINING WALL	1,590	C.M.				
b.		WATER CHANNEL	210	C.M.				

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

3. EARTHWORKS

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT	
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$
3.13	022	REINFORCED CONCRETE FOR -						
a.		RETAINING WALL	920	C.M.				
b.		SIDE DITCH	4,330	C.M.				
c.		CATCH BASIN	40	C.M.				
d.		BOX CULVERT	1,770	C.M.				
e.		UNDERGROUND PASSAGE	160	C.M.				
3.14	012,022	CONCRETE PAVEMENT	2,630	S.M.				
3.15	-	DEMOLITION OF EXISTING REINFORCED CONCRETE STRUCTURE	130	C.M.				
3.16	-	PROTECTIVE FENCE	21,890	L.M.				
3.17	019	CONCRETE REINFORCEMENT	370	M.T.				
TOTAL OF EARTHWORKS								

BILL OF QUANTITIES

4. BRIDGE AND VIADUCT

BIDDER: _____

DATE: _____

SIGNATURE: _____

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT	
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$
4.01	004	EXCAVATION -						
a.		CLASS A	29,340	C.M.				
b.		CLASS B	5,950	C.M.				
c.		CLASS C	5,740	C.M.				
d.		CLASS F	5,520	C.M.				
4.02	012	AGGREGATE SUBBASE (ASB-3)	3,940	C.M.				
4.03	008	PRESTRESSED CONCRETE PILES -						
a.		350 MM DIAMETER, A	54,530	L.M.				
b.		350 MM DIAMETER, B	73,510	L.M.				
c.		500 MM DIAMETER, A	12,950	L.M.				
d.		500 MM DIAMETER, B	26,660	L.M.				
4.04	022	LEVELING CONCRETE	1,970	C.M.				
4.05	018, 022 106	REINFORCED CONCRETE FOR -						
a.		ABUTMENT FOUNDATION	720	C.M.				
b.		ABUTMENT WALL	710	C.M.				
c.		PIER FOUNDATION	6,930	C.M.				
d.		PIER WALL AND COLUMN	4,480	C.M.				
e.		GIRDER	2,800	C.M.				
f.		VIADUCT FOUNDATION	10,670	C.M.				

BILL OF QUANTITIES

4. BRIDGE AND VIADUCT

BIDDER: _____

DATE: _____

SIGNATURE: _____

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT	
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$
g.		VIADUCT SLAB, BEAM AND COLUMN	19,330	C.M.				
4.06	019	CONCRETE REINFORCEMENT	6,100	M.T.				
4.07	018, 019 023, 106	PRESTRESSED CONCRETE GIRDER -						
a.		SPAN 20 M	7	L.S.				
b.		SPAN 25 M (A)	6	L.S.				
c.		SPAN 25 M (B)	5	L.S.				
d.		SPAN 26 M	1	L.S.				
e.		SPAN 28 M	1	L.S.				
f.		SPAN 30 M (A)	11	L.S.				
g.		SPAN 30 M (B)	3	L.S.				
h.		SPAN 33 M	1	L.S.				
i.		SPAN 35 M	4	L.S.				
j.		SPAN 40 M	3	L.S.				
4.08	106	FABRICATION AND DELIVERY OF THROUGH PALTE GIRDER	1	L.S.				
4.09	-	INSTALLATION OF THROUGH PLATE GIRDER	1	L.S.				
TOTAL OF BRIDGE AND VIADUCT								

BILL OF QUANTITIES

6. ARCHITECTURAL WORK

BIDDER: _____
 DATE: _____
 SIGNATURE: _____

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT	
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$
6.01		AIRPORT TERMINAL STATION -						
a.	003,007	EXCAVATING, FILLING AND GRADING	1	L.S.				
b.	008,019 022,104	SUBSTRUCTURE AND SUPER-STRUCTURE	1	L.S.				
c.	021,101 102,103 105,106 110,111 125,126	EXTERNAL FINISH	1	L.S.				
d.	021,106 108,109 110,118 119,120 121,122 123,124 127,128 130	INTERNAL FINISH	1	L.S.				
e.	112,113 114,115 116,117	DOORS, WINDOWS AND LOUVERS	1	L.S.				
f.	133	FURNISHINGS	1	L.S.				
g.	101	LANDSCAPING	1	L.S.				
h.	131,134 135,138 139,140 143,144 147,148	VENTILATING AND AIR CONDITIONING	1	L.S.				

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

6. ARCHITECTURAL WORK

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		TOTAL RP.
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$	
i.	136,137	PLUMBING	1	L.S.					
	141,142 146								
j.	145	ELECTRICAL	1	L.S.					
TOTAL OF AIRPORT TERMINAL STATION									
KOTA INTAN STATION -									
6.02	a.	EXCAVATING, FILLING AND GRADING	1	L.S.					
					003,007				
b.	008,011 014,017 019,022 104	SUBSTRUCTURE AND SUPER-STRUCTURE	1	L.S.					
c.	021,101 102,103 105,106 110,111 125,126	EXTERNAL FINISH	1	L.S.					

SCHEDULE OF QUANTITIES

6. ARCHITECTURAL WORK

BIDDER: _____

DATE: _____

SIGNATURE: _____

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$	TOTAL RP.
d.	021,106 108,109 110,118 119,120 121,122 123,124 127,128 130	INTERNAL FINISH	1	L.S.					
e.	112,113 114,115 116,117	DOORS, WINDOWS AND LOUVERS	1	L.S.					
f.	133	FURNISHINGS	1	L.S.					
g.	101	LANDSCAPING	1	L.S.					
h.	131,134 135,138 139,140 143,144 147,148	VENTILATING AND AIR CONDITIONING	1	L.S.					
i.	136,137 141,142 146	PLUMBING	1	L.S.					
j.	145	ELECTRICAL	1	L.S.					
		TOTAL OF KOTA INTAN STATION							

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

6. ARCHITECTURAL WORK

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		TOTAL RP.
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$	
6.03		SIGNAL CABIN -							
a.	003,007	EXCAVATING, FILLING AND GRADING	1	L.S.					
b.	008,019 022,105 106	SUBSTRUCTURE AND SUPER-STRUCTURE	1	L.S.					
c.	021,102 103,108 110,111 126	EXTERNAL FINISH	1	L.S.					
d.	021,118 119,120 121,123 124	INTERNAL FINISH	1	L.S.					
e.	112,113 114,115 116,117	DOORS, WINDOWS AND LOUVERS	1	L.S.					
f.	134	VENTILATING AND AIR CONDITIONING	1	L.S.					
g.	136,137 141,142	PLUMBING	1	L.S.					
h.	145	ELECTRICAL	1	L.S.					
		TOTAL OF SIGNAL CABIN							

BILL OF QUANTITIES

6. ARCHITECTURAL WORK

BIDDER:

DATE:

SIGNATURE:

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT	
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$
6.04		CROSSING WATCHMAN'S BOX -						
a.	003,007	EXCAVATING, FILLING AND GRADING	15	LOT				
b.	019,022	SUBSTRUCTURE AND SUPER-STRUCTURE	15	LOT				
c.	102,103 110,111	EXTERNAL FINISH	15	LOT				
d.	020,118 120,123	INTERNAL FINISH	15	LOT				
e.	112,113 114	DOORS, WINDOWS AND LOUVERS	15	LOT				
f.	145	ELECTRICAL	15	LOT				
		TOTAL OF CROSSING WATCHMAN'S BOX						
6.05		DUMP YARD -						
a.	003,007	EXCAVATING, FILLING AND GRADING	1	L.S.				
b.	019,022	SUBSTRUCTURE AND SUPER-STRUCTURE	1	L.S.				
c.	102,103	EXTERNAL FINISH	1	L.S.				

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

6. ARCHITECTURAL WORK

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$	TOTAL RP.
d.	132	FURNISHINGS	1	L.S.					
		TOTAL OF DUMP YARD							
		TOTAL OF ARCHITECTURAL WORK							

BILL OF QUANTITIES

7. TRACK WORK

BIDDER: _____

DATE: _____

SIGNATURE: _____

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$	TOTAL RP.
7.01	027	TRACK LAYING	1,250	L.M.					
7.02	027	TRACK SHIFTING	1,620	L.M.					
7.03	026	REMOVAL OF TRACK	1,260	L.M.					
		TOTAL OF TRACK WORK							

BILL OF QUANTITIES

8. ELECTRICAL WORK

BIDDER: _____

DATE: _____

SIGNATURE: _____

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US\$	L.C. RP.	F.C. US\$	TOTAL RP.
8.01	305	IMPROVEMENT OF OVERHEAD LINE	1	L.S.					
8.02	025	CHANGE OVER OF EXISTING SIGNALING EQUIPMENT	1	L.S.					
TOTAL OF ELECTRICAL WORK									

