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STAGE – D PROJECT DEVELOPMENT PROGRAM PART 2 – BUILDING WORK PACKAGE

PROJECT SPECIFICATION

Doc. No.: 2533-D2-PS-001
Rev. A
December, 2016

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DIVISION 1
GENERAL REQUIREMENTS

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DIVISION 1 GENERAL REQUIREMENT

01320 Surveying Services

1. General

This work shall cover the limits and extent of the survey works of lines and elevations for site preparation and other works as specified in the Drawings and/or as determined by the Engineer and shall include technical personnel and precise scientific surveying instruments which shall be in accordance to this Specification.

2. Basic Survey Data

A basic survey data based on fixed triangulation polygon points and Bench Marks (BM) shall be provided by the Owner and shall be at the disposal of the Contractor and shall serve as a base for the surveying and setting out which he has to carry out.

Should the Contractor have any objections to this basic survey and the relevant drawings, he shall inform the Engineer in writing within one (1) week after the submittal of the basic survey data.

3. General Survey Requirements

The Contractor shall perform all surveying calculations and setting out necessary to establish the accurate location of the position in accordance with the Drawings and shall be approved by the Engineer. Horizontal and vertical control shall be by closed loop traverses.

Maximum permissible errors of closure shall be:

- Horizontal Traverses
 - Angular error = $10 \sqrt{N}$
 - Relative error < 1/1000
(N= number of stations)
- Vertical Traverses
 - Elevation difference error= $10 \sqrt{D}$ Km (mm)
 - D = total shortest distance

All slope distance shall be reduced to level distances.

4. Bench Marks (BM)

- The Contractor shall protect, preserve and keep accessible the BM of the basic survey and those provided by himself.
- Removal with intent of BM's, including other BM established by other institutions or companies shall be prevented. Tying a rope for working animal is strictly not permitted. Any damage of BM accidental or other non-surveying purposes shall be immediately brought to the attention of the Engineer. The Contractor at all times shall be responsible for timely replacement or repair of the damaged BM's. The costs of rebuilding BM's shall be the Contractor's responsibility without additional compensation.
- BM's shall be made of mild steel or cast iron encased in an appropriate size of concrete block as directed by the Engineer.
- In places where the soil is weak, the steel with an anchor shall be embedded in a concrete block (f'c = 18.5MPa) and sizes shall be as approved by the Engineer.
- Foundation of BM's shall be prepared in conformity with this specification.
- The inscriptions shall be clearly legible and durable.
- Underground BM's shall be protected by concrete pipes and other acceptable structures and shall be kept free from water and earth.
- Horizontal traverse pegs shall be wood pegs, 50mm x 50mm by 300mm long, firmly driven into the ground, protruding 20mm above the ground surface with nails at the center to mark the point.

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5. Survey Personnel and Equipment

The Contractor shall recruit only qualified surveyors, who prior to the engagement in the project area shall be approved by the Engineer, and they are directly responsible and bound to supply the Engineer with any required information on questions relating to the survey. The Contractor shall use a sufficient number of reliable, accurate and certified scientific instruments and shall be approved by the Engineer.

01400 Concrete Test

1. General

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

- Laboratory tools and equipment needed.
- Storage provision.
- Mixing platform near storage area.
- Non-absorptive molds with base.
- Steel tamping-rod bullet pointed at the bottom, the dimensions shall be 16 mm (5/8") diameter by 600mm (2') long.
- Slump cone.
- Air content test.
- Shovel and hand-scoop.
- Boxes for shipping the specimens.

2. Specimens

- Concrete samples shall be taken in accordance with ASTM C172 or as specified below.
- The specimens shall be representative of the batch and shall consist of portions from different points in the batch.
- The specimens shall be taken in three (3) or more regular increments throughout the discharge of the entire batch except at the beginning or end, and placed in a metal container such as a boggie or wheelborrow.
- The specimens for compressive test shall be taken for every 30 or less cubic meters of concrete placing.
- The rate of discharge of the batch shall be regulated by the rate of revolution of the drum and not by the size of the gate opening. Sampling shall be worked out by passing a receptacle repeatedly through the entire discharge stream or diverting the entire stream into the container. Care shall be observed not to restrict the flow in such a manner not to cause segregation of concrete.
- Sample shall be mixed thoroughly with a shovel to ensure uniformity. The slump test and the test specimens shall be made immediately.

01500 Temporary Facilities and Controls

This work shall consist of providing, operating and maintaining all temporary connections to public utilities in locations acceptable to the Owner, Engineer and local authorities having jurisdiction thereof.

This work shall include, but not be limited to the following:

- Temporary light and power,
- Temporary cooling, ventilation and enclosures,
- Temporary water,
- Temporary drainage,
- Temporary fire fighting services,
- Site offices and sheds,
- Temporary fencing,
- Environmental protection and safety plan
- And others as directed by the Engineer.

DIVISION 2
SITE CONSTRUCTION

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DIVISION 2 SITE CONSTRUCTION

02315 Excavation, Backfilling and Compaction

1. Excavations

- Excavation work is final when the bottom of the excavation has reached the required elevation as shown in the Drawings or has been approved by the Engineer.
- All excavated material shall be deposited at designated place as determined by the Engineer so when needed and suitable that excavated material can be used for backfilling or shall be disposed as determined by the Engineer.

2. Backfill Material

- The approved material used in backfilling shall be free of any appreciable amount of gravel or stone particles more than 100mm in greatest dimension and of such gradation as to permit thorough compaction.
- When, in the opinion of the Engineer, such material is not readily available, the use of rock or gravel mixed with earth will be permitted, in which case no particles larger than 150mm in greatest dimension and 50mm in least dimension may be used, and the percentage of fines shall be sufficient to fill any void and ensure a uniform and thoroughly compacted mass of proper density.

3. Compaction

a. Maximum Dry Density and Optimum Moisture Content.

Maximum dry density and optimum moisture content of soils shall be determined by one of the methods described in ASTM D1557 (AASHTO T180) commonly known as the Modified Proctor Test.

b. Moisture Control

At the time of compacting areas where high density is required, fill material and the surface on which it is placed shall be within the specified range of moisture content. The Contractor shall not compact fill until it is within the range required for moisture content. He shall add an accurately determined and carefully measured amount of water to materials or surfaces that are too dry.

He shall pile or spread out to dry, material which is too wet, and if necessary, disk, harrow or pulverize it by hand or mechanical means.

c. Density for Cohesive Soils

For soil having 30% or more, by weight, of particles passing a No. 200 sieve, required relative compaction, as determined by one of the method described in ASTM D1557 (AASHTO T180), and expressed as a percentage of maximum dry density, and moisture content, at the time of compaction shall be as stated in the table as shown.

Fill Areas	Relative Compaction (%)	Moisture Range (%)*
General Fill	90	-3 W_o +3
Main Roads and Heavy Vehicle Parking (Top Meter)	95	-4 W_o +2
Connecting Roads and Light Vehicle Parking (Top Half Meter)	95	-4 W_o +3
Building Pad (Top Half Meter)	90	-4 W_o +2
Trench Backfill (Except where superseded by higher compaction requirement)	90	-3 W_o +3

* W_o = Optimum Moisture Content.

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d. Density for Cohesionless Soils

Soil having less than 30% by weight, of particles passing a No. 200 sieve, required relative compaction as determined by one of the methods described in ASTM D1557 (AASHTO T180), and expressed as a percentage of maximum dry density as follows :

Fill Areas	Relative Compaction (%)
Drainage blanket beneath embankment	No requirement. Compact with light bulldozer (eg. D-6) traffic
Cushion fill beneath floor slabs	95 May be inspected by proofroling, at Engineer's option
Road base	95
Trench backfill	92
Trench or chimney drains	No requirement

02335 Subgrade Preparation

The subgrade shall be made to conform to the prescribed lines, grades and slopes, and compacted to 90% - 95% modified proctor density at the Engineer's satisfaction so that base or bedding material, when placed and compacted will give the same formation of the grades and lines of the subgrade.

02465 Bored Piles

1. Apparatus

- Prepare adequate equipment such as hydraulic jack, dial gauges, test beam and loading platform etc. All test equipment shall be steady to carry the load and so as to ensure the measuring.
- The Contractor shall carefully examine a reaction pile to avoid a damage of it in case a permanent pile is applied as the reaction pile. The examination report shall be submitted to the Engineer for approval.

2. Concrete

Concrete of $f'c = 30\text{MPa}$ (K-350) shall be in accordance with the requirement of Division 3 - Specification 03300.

3. Reinforcing Steel

Reinforcing steel shall be as indicated in the Drawings and as specified in the Division 3 - Specification 03210.

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02500 Utility Services

1. Water Supply Piping

a. Pipes and Fittings

- Water supply piping shall use PE pipe of PE-100 type of class S-8 with working pressure of 10bar, complying with ISO 4427, such as Wavin Black, Pralon, Vinilon or Tyco-Eurapipe product, with diameter according to the requirements as shown in the Drawings.
- All pipes' fittings such as socket, elbow, reducer, knee, nipple, tee and others shall be made from Polyethylene (PE) and shall be from the same manufacturer of the pipes.
- Jointing system for pipes and fittings shall be heat-fusion butt welding, electrofusion socket welding (heating system) or according to the manufacturer's installation instruction.

b. Valves

- All valves for water supply, with working pressure, type and diameter as specified in the Drawings, shall be new, unused product of reputable and experienced manufacturers and all valves as far as possible of the same type shall be of one manufacturer, such as Kitzatawa, Fortune, Toyo, or Okumura.
- All valves shall have indelibly mark/sign of manufacturer's name, working pressure, diameter and direction of flow on the body.
- All valves shall be complete and ready for operation with all components and accessories in accordance with the applicable standards and codes, and shall be capable of long, reliable, trouble free service and shall require minimum maintenance.
- Valves of diameter up to 65mm shall be of bronze body and shall have tapered threads for screwed joint, and valves of diameter larger than 65mm shall be of cast iron body, manual operated type, and shall be furnished with flanges of flat- faced type conforming to ANSI B16.1 Class 150, forged integrally with valves' body.

2. Sewer Pipes and Fittings

a. Sewer System

Sewer system shall use uPVC pipe of solvent cement joint type with a working pressure 10kg/cm² complying with ISO 4422, such as Wavinsafe, Pralon, Vinilon or approved equal.
Length and diameter of pipes shall be as specified in the Drawings.

b. Fittings

- Fittings for PVC pipes such as elbow, reducer, knee, tee and others shall come from the same manufacturer and in accordance with ISO 4422 requirements.
All fittings shall be suitable for solvent cement jointing.
- Adhesive for PVC's pipes and fittings shall be as recommended by the PVC's manufacturer.

3. Rainwater Pipes and Fittings

Rainwater pipes and fittings shall be as specified in Division 7 - Specification 07600.

4. Fire Water Piping

a. Pipes and Fittings

- Pipes for fire water shall be ERW carbon steel pipes of schedule 40 conforming to ASTM A 53 type E, grade B.

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- All pipes and fittings such as elbow, tee, reducer, tee-reducer and others with diameter up to 65mm shall be threaded carbon steel while fittings larger than 65mm shall be furnished with flanges as specified in this Specification.
- Fittings of electric butt-welding shall be fabricated conforming to AWWA C 208.
- Fittings shall be of the same class with the related pipes and shall be new and of acceptable quality.

b. Valves

- All valves with working pressure of 16kg/cm² shall be new, unused product of reputable and experienced manufacturers, and all valves of the same type as far as possible shall be of one manufacturer. All valves for fire fighting shall be UL Listed.
- All valves shall be made of cast iron material complying with ASTM A 126 Class B, disc seat ring, cover gasket and O-ring complying with ASTM D 2000 AA 7008. All valves shall have name's manufacturer, working pressure, diameter and direction of flow on the body.
- All valves shall be complete and ready for operation with all components and accessories in accordance with the applicable standards and codes, and shall be capable of long, reliable, trouble free service and shall require minimum maintenance.
- Valves of diameter up to 65mm shall have tapered threads for screwed joint.
- Valves of diameter larger than 65mm shall be manual operated type, and shall be furnished with flanges conforming to ANSI B 16.1 CL 125, forged integrally with valves' body.
- SCI product manufactured by Siam Cast Iron Works Co. Ltd., Nibco or acceptable equivalent.

c. Flanges

Flanges shall be ANSI B 16.5 class 150 raised face and shall comply with ASTM A-105. Flange of slip-on type shall have diameter as specified by equipment that shall be connected.

d. Packing/Gasket/Sealing Ring

- Unless otherwise specified, packing/gasket/sealing ring for fire water and fuel piping shall be of ANSI 150 class, made of spiral wound rubber of minimum 3mm thickness.
- Sizes of packing/gasket/sealing ring shall be as specified by the required flanges.
- The necessary amount plus 10% additional of packing shall be supplied.

e. Bolt and Nuts for Flange

Bolts and nuts which shall be completed with washers and are made of black steel of ISO 8.8 with metric thread, shall be used for connection of flanges.

Diameter and length shall be as required by the specified flanges.

Minimum 3 threads shall be left over after connection.

The necessary amount plus 10% additional of bolts and nuts shall be supplied.

5. Fire Fighting Equipment

a. Fire Hydrant Box

Fire hydrant box for outdoor shall be completed with the following items:

- Box which is made of steel plate 2mm thick, complete with lockable door with breakable glass for cover, in size as manufacturer's standard. Box shall be oven-painted in red colour (RAL 3001).
- Fire hose of highcount rubber compound such as Pionier 400 by Ziegler, with coupling type according to local standard, of 65mm in diameter and in length of 2 x 30meters.
- Hose nozzle of 65mm diameter with jet straight nozzle type.
- Fire hose valve of diameter 65mm.

Manufactured by SRI, Gunnebo or Ozeki or approved equal.

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b. Fire Hydrant Pillar

Pillar hydrant shall be of two-way type with main valve, size of 65mm x 65mm x 100mm, such as manufactured by SRI, Gunnebo or Ozeki or approved equal.

c. Fire Brigade Connection

Fire brigade connection from SRI, Gunnebo or Ozeki, shall have characteristics as follows:

- Type : Siamese connection of Y model.
- Sizes : 100mm x 65mm x 65mm.
- Material : Cast iron.
- Coupling : Having the same type of coupling according to the local Fire Department regulation.
- Provided : Check valve (anti water hammer of 11/22 type).

6. Pump and Accessories

a. Water Supply

Pump for water supply shall be centrifugal or booster type of capacity, power and working voltage as indicated in the Drawings, from Grundfos or Ebara product or acceptable equivalent.

b. Waste Water

Pump for waste water shall be submersible type, of capacity, power and working voltage as indicated in the Drawings, from Grundfos or Ebara product or acceptable equivalent.

c. Accessories

- Each pump shall be fitted with an air cock and cup, drain plug and a pressure gauge on each side of the pump.
- Pressure gauge shall be 150mm diameter and of dial type. Scale ranges shall be suitable for the pressures and selected so that the normal operating point is in the third quarter of the range.
- For those fitted on the suction side, they shall be of the Bourdon tube type with brass siphon and cock with piping connections to the measuring point.
Gauges shall have black pointers, red overrun indicators, and red mark at normal working pressure. Gauges must be calibrated in kilo pascals (Kpa).
- All exposed shafts, couplings and moving parts of pumps shall be provided with suitable galvanized angle iron wire mesh guards which shall be stoutly constructed, easily removable, and provided with lifting handles. Care shall be taken that these guards do not cause "ring" and/or create vibration noise.
- Pump shall be provided with panel and water level control (WLC) in capacity as specified in the Drawings.
Panel and wiring diagram shall be as indicated in the Electrical Drawings and electrical system shall be according to Division 16 - Specification 16400.

7. Ground Storage Tank

Ground storage tank shall be made of watertight cast-in-place concrete with capacity as indicated in the Drawings. Cast-in-place concrete shall be in accordance with the requirements of Division 3 - Specification 03300.

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02525 Absorption Well

1. Absorption Well

Absorption well shall be constructed of several porous precast concrete units having nominal diameter of 1000mm, height of 2000mm and wall thickness of 90mm, provided with concrete slab complete with manhole cover made of concrete, all are manufactured according to the Drawings.

2. Filter Material

Filter material shall consist of clean gravel or crushed stones or crushed clay roof tile with size of 30mm to 50mm, and palm fiber (*jjuk*) of thickness as shown in the Drawings.

3. Piping

Pipes shall be from uPVC that complies with ISO 4422, with a working pressure of 8kg/cm² as specified in Division 2 - Specification 02500.

All piping shall be suitable for solvent cement jointing similar to Wavinsafe by Wavin, or Pralon, or Maspion or Vinilon or approved equal.

Diameter required shall be as indicated by the Drawings.

4. Cement Mortar

Cement mortar, if needed, shall be in accordance with the requirements of Division 4 - Specification 04060.

5. Backfill Material

Backfill material shall be as specified in Division 2 - Specification 02315.

02721 Subbase

- Material for subbase shall be a natural or artificial mixture of hard durable particles of mineral aggregates selected from an approved borrow pit source. It shall be free from clay lumps, vegetable matter, organic soil and shall not easily break under prevailing climate and cycles of moisture change.
- If the thickness of required subbase exceeds 200mm, it shall be divided into a layer of upper subbase of 150mm thick and a layer of lower subbase to a minimum of 50mm thick.
- Dry density shall be 90-95% as determined by AASHTO Test T180 Method D with CBR value not less than the requirement as shown in the Drawings.
- The grading of material for subbase shall comply to the following requirements:

Sieve Designations		Percentage by Weight passing
Standard (mm)	Alternative (inch)	
50	2 in	100
25	1 in	60 – 100
9.5	3/8 in	30 – 100
4.75	No. 4	15 – 100
2.00	No. 10	10 – 70
0.425	No. 40	5 – 40
0.075	No. 200	2 – 25

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02722 Base Course

- Aggregate base material shall be selected from an approved source. The coarse aggregate retained on the 4.75mm sieve shall consist of hard durable particles or fragments of rock and gravel. Gravel which splits when alternately wetted and dried shall be avoided. The gravel shall be of approximately uniform gradation and must be screened and washed.
 Fine aggregate passing 4.75mm (no. 4) sieve shall consist of natural or crushed aggregate and fine mineral particles.
- All aggregate shall be free from vegetable matter, lumps of clay and other deleterious substances and shall conform to the following requirements as shown on the table as listed below:

SIEVE		% PASSING WEIGHT
STANDARD (MM)	ALTERNATIVE (INCH)	
50	2"	100
5	1"	65
9.25	3/8"	40 – 60
4.75	No. 4	25 – 45
2.00	No. 10	12 – 30
0.425	No. 40	6 – 16
0.075	No. 200	0 – 8

The fraction passing 0.075mm (No. 200) sieve shall not be greater than 2/3 of the fraction passing the 0.425 (No. 40) sieve. After 4 (four) days soaking, when compacted to 95-100% maximum dry density as determined by AASHTO Test T180 Method D, class A aggregate shall have a CBR of not less than 80

**DIVISION 3
CONCRETE**

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DIVISION 3 CONCRETE

03210 Reinforcing Steel

1. Reinforcing Steel

- The characteristics of reinforcement shall conform to the requirements as follows:
 - Reinforcing steel of plain type with diameter of < 10mm shall have minimum yield strength of 2400kg/cm² and shall comply with ASTM A 615.
 - Reinforcing steel of deformed type with diameter of ≥ 10mm shall have minimum yield strength of 4000kg/cm² and shall comply with ASTM A615/A615M.
- The steel shall be qualified from the very beginning and be marked as prescribed by the above mentioned standard, so that it is constantly recognizable and referable to the production plant.

2. Dowel Bars

Unless otherwise specified in the design drawings, for the designed slabs up to 150mm thickness, use 16mm diameter round dowel bars, 600mm long, spaced at 250mm on centers.
For slabs 160mm to 500mm thickness, use 16mm diameter round dowel bars, 800mm long, spaced at 200mm on centers.

3. Accessories

- Metal chairs, spacers and other shall be sized and shaped to adequately support reinforcing.
- Accessories in exposed concrete shall be galvanized steel material. Steel material shall conform to the requirements of Division 5 - Specification 05500.

03300 Cast-in-Place Concrete

1. Concrete

- Concrete are grouped in different classes, according to the following requirements:
 - f'c= 30MPa (K-350) concrete for columns and others as will be shown in the drawings.
 - f'c= 25MPa (K-300) concrete for structural works such as foundation, culvert and others as will be shown in the drawings.
 - f'c= 21MPa (K-250) concrete for general structure such as open drainage, curbs, stiffening member for masonry and others as shown in the Drawings.
 - f'c= 10MPa (K-125) concrete for lean concrete bedding and filling.
- All ready mixed concrete shall comply with the requirements of ASTM C 94.

2. Cement

- Cement of portland cement type I complying with ASTM C150 shall be used for all general concrete works.
- Cement of Portland cement type V complying with ASTM C150 shall be used for all sulphate resistance concrete works as shown in the design drawings.
- Cement shall come from one brand, such as Holcim or approved equal which shall be obtained locally from nearest town.

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3. Water

Water for mixing, curing or other designated applications shall be clean and free from harmful and deleterious substances such as alkali, acids, salt and other inorganic matters.

However, as the case may happen, all water except what as mentioned herein shall be tested and shall meet the requirement of AASHTO T26 and/or approved by the Engineer.

4. Fine Aggregates

- The fine aggregate for concrete shall consist of natural hard sand and shall be approved by the Engineer for concreting works. Fine aggregate shall meet the requirements of the following:

DESCRIPTION	AASHTO TEST METHOD	% BY WEIGHT
Clay Lump	T 112	0.5%
Coal and Ignite	T 113	0.5%
Material Passing No. 200 Sieve	T 11	3 %

- Fine aggregate shall not contain inorganic materials, acids, alkalis and other substances. Fine aggregates shall be uniformly graded and shall meet the following grading requirements:

SIEVE DESIGNATION		% WEIGHT PASSING SIEVE (AASHTO T 27)
3/8"	(9,5mm)	100
No. 4	(4,75mm)	95 – 100
No. 16	(1,18mm)	45 – 80
No. 50	(0,300mm)	10 – 30
No. 100	(0,150mm)	2 – 10

5. Coarse Aggregates

- The coarse aggregates for construction shall consist of granular stones, crushed stone, blast furnace slag or other approved inert material of similar characteristics which is hard, durable and free from undesirable substances.

Coarse aggregates shall not contain deleterious substances in excess of the percentages:

DESCRIPTION	AASHTO TEST METHOD	% BY WEIGHT
Clay Lumps	T 112	0.25%
Materials passing No.200 sieve	T 11	1%
Thin or elongated pieces (length greater than 5 x max. thickness	-	10%

Other deleterious substances shall not exceed the percentage limits set forth-in this Specification and/or approved by the Engineer.

- Coarse aggregate grading requirements shall be as specified in ASTM A33:

MAXIMUM SIZE OF COARSE AGGREGATE (CM)	% BY WEIGHT PASSING SIEVES							
	SIEVE DESIGNATION							
	5.08	2.54	1.905	1.27	0.952	4	8	16
3.81	95-100	-	-	-	10-13	0-5	-	-
1.905	-	100	90-100	-	20-55	0-10	0-5	-
0.952	-	-	-	100	85-100	10-30	0-10	0-5

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- Separate sizes of coarse aggregate shall be combined with other sizes at the proportions by weight or by volume to produce an aggregate that meets the grading requirements specified.

6. Curing Materials

Curing materials shall conform to the following requirements:

DESCRIPTION	TEST METHOD
Burlap cloth made from jute or kenaf	AASHTO M 182
Liquid membrane-forming compounds for curing concrete	AASHTO M 148
White polyethylene sheeting (film) for concrete curing	AASHTO M 171

Other applicable method of curing concrete shall be approved by the Engineer.

7. Admixture

- Air entraining admixtures shall conform to ASTM C 260 for all exposed concrete.
- Water reducing and retarding admixture for controlling the setting time of concrete, if required, shall conform to ASTM C 494 type B and D.
- Admixture for accelerating the setting time of concrete, if required, shall conform to ASTM C 494 type C.
- Admixture for waterproofing substructure concrete, if required or as instructed by the Client Engineer, shall conform to BS 1881: Part 122 for water absorption or ASTM C 494 type A.
- Superplasticiser shall be of the following types:
 - Non-retarding type shall conform to ASTM C494 type F,
 - Slump-retaining type shall conform to ASTM C494 type G,
 - Retarding type shall conform to ASTM C494 type G,

from BASF, Sika, Fosroc or acceptable equivalent.

Type of superplasticiser to be used shall be as recommended by the admixture manufacturer and as approved by the Engineer.

8. Joint Filler and Joint Sealant

- Joint filler shall conform to the requirement of AASHTO M 213 and US Federal Specification HH-F 341a type 1 class B, such as Bitumen Impregnated Board by Sika, Flexcell by Fosroc or acceptable equivalent.
- Joint sealant shall conform to the requirement of BS 4254 and US Federal Specification SS-S-200 D EA.A. Spec. P.D.-605-2.1F, such as Masterflex 700, Thioflex 600 or acceptable equivalent.

9. Water Stop

a. Swellable Type

Unless otherwise specified, water stop shall be blended natural, synthetic rubbers and unique hydro swelling polymer type complying with JIS K 6258, K 6350, JIS K 6253 (A), JIS K 6251, JIS K 6251, such as Masterflex 610 by BASF, SikaSwell S2 or acceptable equivalent.

b. PVC Type

Water stop shall be made of high quality flexible PVC for long durability suitable for high water pressure, and can be placed in the center or outside of concrete wall or floor, such as Waterbars by Sika or acceptable equivalent, in different sizes and types available, depending on their use as shown in the Drawings.

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10. Floor Hardener

- Floor hardener shall be a ready-to-use surface hardener to be used to improve the wear resistance of concrete floors. Floor hardener shall be dry-shake, mineral aggregate and non-metallic type in natural colour, at proportion of 5kg/m², such as Mastertop 100 by BASF, Chapdur by Sika or Nitoflor Hardtop by Fosroc.
- Floor hardener shall be completed with curing compound from the same manufacturer as the hardener

11. Moisture Barrier

Moisture barrier shall be from plastic membrane made of high density polyethylene (HDPE) sheet with minimum thickness of 0.5mm (unless otherwise shown in the Drawings). This plastic membrane shall be approved by the Engineer prior to delivery and installation.

12. Reinforcing Steel

Reinforcing steel shall be as specified in Division 3 - Specification 03210.

13. Utility Pipes and Conduits

- Unless otherwise shown in the Drawings, piping for fire water, plumbing and conduit for power and communication cables that are to be embedded in concrete shall be as specified in Division 13 - Specification 13900 for fire water, Division 15 - Specification 15100 for plumbing, Division 16 - Specification 16400 for power cable and Specification 16700 for communication cables.
- Diameter of pipes shall be as shown in the Drawings.

14. Falsework and Formwork

- Falsework shall be built on foundation of sufficient strength to carry the loads without settlement.
- Falsework which cannot be founded on solid footings must be supported and reinforced by sufficient additional supporting falsework. Prior to placing of falsework, a representative design to carry the loads for a certain job shall be submitted to the Engineer for approval.
- Forms shall comply with the requirements below:
 - All forms shall be provided with adequate clean out openings to permit inspection and easy cleaning after all the reinforcement is in position.
 - Form materials shall be of lumber not less than 20mm thick and plywood not less than 12mm, metal not less than 0,6mm, or other acceptable material.
 - All exposed concrete surfaces shall be cast with a smooth "off-form" finish. No plastering shall be undertaken without the approval of the Engineer.
 - Provide timber or plastic chamfer strips (20mm x 20mm) securely nail fixed on all corners of formwork for exposed concrete members as indicated in the Drawings.
 - Wood material used shall be approved by the Engineer, sufficiently dry and solid enough to receive load, selected straight, sound and free from loose knot holes, splits and other defects, milled to net shapes and sizes.
 - The samples of materials, dressed on at least 2 edges and one side for tight fit, shall be submitted to the Engineer for approval.
 - Form, shoring and bracing design and construction shall be the Contractor's responsibility.
 - Forms shall be mortar tight and structurally rigid to disallow distortion due to the pressure of the vibrator and the concrete and other loads.
 - All corner joints shall be rigid in order to prevent opening during construction progress. The Contractor shall be responsible for the adequacy of forms and supports.
 - Metal ties, struts, bolts and rods shall be arranged so that when the forms are removed, all metal shall not be less than 50mm from the exposed concrete surface.

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- All form surfaces shall be treated with approved form release oil prior to placing of reinforcing steel, and, wood forms shall be wetted with water before concrete placing.
- No treatment compound shall be used which may discolour the finished concrete.

03600 Grout

1. Grout

Grout for grouting of anchor bolts and base plates shall be made of cement material and shall have minimum characteristics as follows:

- Premixed product ready to use,
- Impact and vibration resistant,
- Non-shrinkage and non-metallic type,
- Complying with ASTM C 1107,
- Having minimum compressive strength of 610kg/cm² at 7days of age, according to ASTM C 109 or 650kg/cm² according to BS 1881 part 116,

such as Sika Grout 214-11, Conbextra GPXtra by Fosroc, Masterflow 810 by BASF or approved equal.

2. Water

Water for mixing shall be clean water complying with the requirements of Division 3 - Specification 03300.

3. Moulds/Formworks

Moulds/formworks shall be made of steel plate or plywood from suitable thickness, which shall be formed in sizes and forms as shown in the design drawings.

Moulds/formworks shall be made in same size for places which shall have same size and form.

**DIVISION 4
MASONRY**

Project Specification

DIVISION 4 MASONRY

04060 Cement Mortar

1. Cement Mortar Mixed at Site

a. Cement

Cement shall be Portland cement of type I complying with ASTM C150, as specified in Specification 03300.

Portland cement to be used shall be from one brand, such as Tonasa, Holcim, Gresik or acceptable equivalent.

b. Sand/Fine Aggregates

Sand/fine aggregates shall be clean, hard, solid, rough edges and shall not contain harmful amounts of mud, clay or organic matters.

Fine aggregate shall conform to and be tested according to ASTM C 33.

Test shall start 30 days prior to the start of the work.

c. Admixture

Admixture for increasing waterproofing and bonding shall come from a proven product such as Febond SBR, Barra Emulsion 57D or acceptable equivalent.

2. Premix Mortar and Plaster

a. Premix Mortar for Autoclaved Aerated Concrete (AAC) Blocks

Premix mortar for AAC block shall consist of cement, fine silicate sand, lime stone powder and other materials that are mixed in dry condition to make the mixture ready to be used by adding some water as recommended by the manufacturer, such as MU-380 by PT Cipta Mortar Utama or PM-100 by PT Prima Mortar Indonesia.

b. Premix Plaster for Autoclaved Aerated Concrete (AAC) Blocks

Premix plaster for AAC block shall consist of cement, fine silicate sand, lime stone powder dan other materials that are mixed in dry condition to make the mixture ready to be used by adding some water as recommended by the manufacturer, such as MU-301 by PT Cipta Mortar Utama or PM-200 by PT Prima Mortar Indonesia.

c. Premix Fine Coat Plaster for Smoothing Out

Premix fine coat plaster for smoothing out all masonry surfaces shall consist of cement, lime stone powder, other additional material that are evenly mixed to make the mixture ready to use for soothing out just by adding water, such as MU-200 by PT Cipta Mortar Utama or PM-300 by PT Prima Mortar Indonesia or approved equal.

3. Water

Water for mixing shall be clean and free from harmful and deleterious substances such as alkali, acids, salt and other inorganic matters.

Water of known quality and for human drinking consumption need not be tested. However, as the case may happen, all water except what as mentioned herein shall be tested and shall meet the requirements of AASHTO T26 and/or approved by the Engineer.

Project Specification

04220 Concrete Masonry Unit

1. General

Concrete masonry units shall be autoclaved aerated concrete blocks (AAC) block made of silicate sand, cement, lime, water and aluminium powder, complying with AS/NZS 4455.
Minimum ultimate crushing strength over the gross area shall be 36kg/cm².
Concrete masonry unit shall also be resistant to fire for 2 hours minimum according to AS 1530.

2. Concrete Block

Concrete block such as from Citicon, FastCon, Hebel, Jaya Celcon or approved equal, shall have dimension of 600mm x125mm x400mm.

3. Cement Mortar

Cement mortar shall conform to Division 4 - Specification 04060.

4. Caulking and Sealing

Caulking and sealing for exposed joints at the perimeters of door and window frames, window openings for equipment and others shall be as specified in Division 7 - Specification 07920.

5. Anchor Ties

Anchor ties shall be of galvanized mild steel with dimensions as shown by the Drawings.

6. Reinforcement

Stiffening members and columns shall be made of reinforcing steel of 8mm in diameter.
Reinforcing steel shall be in accordance with the requirements of Division 3 - Specification 03210.

7. Embedded Flashing Materials

- Sheet metal flashing shall be fabricated from the following metal:
 - Stainless steel of 0.4mm thick.
 - Copper of 0.3mm thick for fully concealed flashing, or 0.5mm thick elsewhere.
 - Metal expansion-joint strips from sheet metal, formed to shape as indicated in the Drawings.
- Manufacturer's standard laminated flashing shall be of copper sheet of weight 0.9kg/m².
- Asphalt-coated copper flashing shall be of manufacturer's standard product consisting of sheet copper of weight 0.9kg/m², coated with flexible asphalt.

04400 Stone Masonry

1. Stones

All stones for open drainage shall be river stone, and each stone shall have 3 contact sides, with maximum size of 200mm, unless otherwise determined by the Engineer.
Material shall be sound, durable, tough, and dense and shall not break into pieces, due to excessive spalling or flaking.

2. Cement Mortar

Cement mortar for stone masonry work shall be in accordance with Division 4 - Specification 04060.

Project Specification

3. Weep Holes

- All retaining walls shall be provided with weep holes.
- Unless otherwise shown in the Drawings, weep holes shall be located at the lowest points where free outlets can be obtained and shall be spaced not more than 200cm or 50mm in diameter maximum.
- Weep holes shall be from uPVC pipe having working pressure of 8kg/cm² complying with ISO 4422, such as from Wavin, Pralon, Vinilon. Diameter of uPVC pipe shall be as shown in the design drawings.
- Aggregate suitable for filter shall be placed behind each weep hole.

**DIVISION 5
METALS**

Project Specification

DIVISION 5 METALS

05120 Structural Steel

1. General Requirements

- All material values shall be in accordance with and as stated in this Specification, unless otherwise noted.
- Chemical composition, mechanical properties, dimensions and other qualities of materials are specified in each standard. These material qualities shall be confirmed by a testing prior to shop works whether it is equivalent with the manufacture certificates.

2. Structural Steel

- All steel material shall be new and be free from defects impairing strength, durability or appearance and shall be of the best commercial quality, and shall comply with the specified standard.
- Steel grade 50 for steel profile or primary structural steel shall comply with the requirements of ASTM A572 grade 50 or JIS G3026 SM 490
- Steel grade St. 37 having yield strength of 24kg/mm² and tensile strength of ≥ 37 kg/mm² for secondary structural steel shall comply with ASTM A36/A36M.
- Steel grade SS 400 having yield strength of 24kg/mm² and tensile strength of ≥ 41 kg/mm² for secondary structural steel shall comply with JIS G 3101.
- The steel to be used shall not have any structural defects and not be obtrusively corroded. The shape and dimensions including dimensional tolerance of steel profile and other related items shall be according to the relative SNI, JIS and ASTM, or equivalent.
- Bolts, nuts, washers, anchor bolt and plates shall be as follows:
 - Ordinary bolts, nuts and washers shall meet the requirements of ASTM A307 as specified in Specification 05500.
 - High strength bolt, nuts and washers shall meet the requirements of ASTM A325/A325M and shall be hot dip galvanizing according to ASTM A123.
 - Anchor bolts made of hot dip galvanized steel round bar having minimum yield strength of 2400kg/cm² shall meet the requirements of JIS G 3101 (SS 400) or ASTM A36/A36M with hot dip galvanizing according to ASTM A123, and bolts and nuts conforming to ASTM A307.
 - Nuts, washers and screw threads shall be according to standards of ordinary bolt listed above.
- For standardized items the certificates proving the conformity of the products to the approved standards may be submitted in lieu of tests. However the Project Manager may, when necessary, request the Contractor to carry out mechanical tests of the materials at the Contractor's expense.

3. Welding Materials

- Electrodes to be used for welding shall be standard products conforming to AWS D1.1 of latest edition or equal. The appropriate electrodes shall be selected best fitting the type of steel to be welded, such as E70XX electrodes.
- Welding materials other than those stipulated above shall be selected according to the method of welding to be employed.
- When base metals of two different yield stresses are welded together, filler metal shall be selected based on the base metal that has the higher yield stress.

4. Grout

Grout for filling anchor's holes, base-plate's pad and others as indicated in the Drawings shall be made of cement material, of non-shrinkage and non-metallic type as specified in Division 3 - Specification 03600.

Project Specification

5. Galvanizing

- Hot-dip galvanizing is to be applied for all structural steel, high strength bolts, nuts, washers, base plates and anchor bolts as shown in the Drawings.
- Method of hot-dip galvanizing shall conform to ASTM A 123 and the thickness of zinc coating shall be minimum of 100microns.

05500 Miscellaneous Metals

1. General.

The work shall comprise all work necessary to install metal works in relation to civil and architectural works as indicated in the Drawings.

It shall include but not be limited to the following:

- Anchor bolts,
- Bolts, nuts and washers,
- Bollards or protection posts,
- And others as indicated in the Drawings.

2. Steel Material

In general, all steel materials shall have minimum yield strength of 2400kg/cm², complying with ASTM A 36/A 36M.

3. Steel Pipe

- a. Steel pipe for bollards or protection post and handrails and railing shall be galvanized steel type or black steel type (to be coated with paint), both of medium class complying with BS 1387, of diameter as required and as specified in the Drawings.
- b. Stainless steel pipe of seamless type used for handrails, railings, door and window trellis and others as indicated in the Drawings shall conform to AISI 304 or SUS 304 with minimum thickness and diameter as shown in the Drawings.

4. Grating

Grating of grille type for trenches shall be composed of steel bars and/or steel plates and other steel profiles, in sizes as shown in the Drawings, fabricated on site, or using prefabricated product, all finished with hot dip galvanizing in minimum 75microns thick, such as made by Webforge or approved equal, or locally available.

5. Base Plate, Anchor Bolts, Bolts, Nuts and Washer

- Base plates shall be made of steel material having minimum yield strength of 2400kg/cm², complying with ASTM A 36/A 36M, in size and thickness according to the Drawings.
- Anchor bolts shall be made of steel round bar having minimum yield strength of 2400kg/cm², complying with ASTM A 36/A 36M, and in diameter and length as indicated in the Drawings.
- Bolts and nuts shall conform to ASTM A-307, and shall be zinc plated, except where high strength bolts are shown or specified.
- Ring washers and others than those in contact with high strength bolt head and nuts shall conform to ANSI B 18.22.1.
All washers shall be zinc plated
- Chemical and or expansion anchor bolts shall be from Hilti, Ramset or Fischer.
Diameter and length of expansion anchor bolts shall as indicated in the Drawings and as recommended by the manufacturer.

Project Specification

6. Welding Materials

- Electrodes to be used for welding shall be standard products conforming to AWS D1.1 of latest edition. The appropriate electrodes shall be selected best fitting the type of steel to be welded, such as E70XX electrodes.
- Welding materials other than those stipulated above shall be selected according to the method of welding to be employed.
- When base metals of two different yield stress are welded together, filler metal shall be selected based on the base metal which has the higher yield stress.

7. Painting

Except for miscellaneous metals with galvanized finish, all miscellaneous metals shall be finished with anti corrosion finish that complies with the requirements of Division 9 - Specification 09910.

05810 Expansion Joint Covers

1. Manufacturers.

Manufacturer shall have a minimum ten (10) years experience specializing in the design and manufacture of expansion control systems

2. Aluminium

- Aluminium shall comply with ASTM B 221, alloy 6063 T5 for extrusions, ASTM B 209, alloy 6061-T6 for sheet and plate.
- Protect aluminium surfaces to be placed in contact with cementitious materials with a protective coating.

3. Stainless Steel

Stainless steel shall comply with ASTM A 167, type 304 with 2B finish, unless indicated otherwise, for plates, sheet and strips.

4. Extruded Preformed Seals

Extruded preformed seals shall be single or multicellular elastomeric profiles as classified under ASTM D 2000, designed with or without continuous, longitudinal, internal baffles. Formed to fit compatible frame, in colour indicated or, if not indicated, as selected by Architect from manufacturer's standard colours.

5. Preformed Sealant

Preformed sealant shall be manufacturer's standard elastomeric sealant complying with ASTM C 920. Use T, factory-formed and bonded to metal frames or anchor members, in color indicated or if not indicated, as selected from Manufacturer's standard colors.

- Joints 50mm wide and less shall withstand plus or minus 35 percent movement of the joint width without failure.
- Joints greater than 50mm to 10mm wide shall withstand plus or minus 50 percent movement of the joint width without failure.

6. Seismic Seals

Seismic seals shall be typically for exterior application, two single-layered elastomeric profiles, one interior and exterior, as classified under ASTM D 2000, retained in a set of compatible frames, in colour indicated or if not indicated, as selected from manufacturer's standard colours. At manufacturer's option, omit interior profile for interior application.

Project Specification

7. Fire Barriers

Fire barriers shall be designed for indicated or required dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Tested in maximum joint width condition with a field splice as a component of an expansion joint cover per ANSI/UL 263, NFPA 251, UBC 43-1, or ASTM E 119, including hose stream test of vertical wall assemblies by a nationally recognized testing and inspecting agency acceptable to authorities having jurisdiction.

8. Accessories

Accessories shall be manufacturer's standard anchors, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesive, and other accessories compatible with material in contact, as indicated or required for complete installations.

DIVISION 6
WOOD AND PLASTICS

Project Specification

DIVISION 6 WOOD AND PLASTICS

06200 Finish Carpentry

1. Lumber

- Lumber shall be from good quality, with durability of class I and strength of class I complying with local standard.
- It shall be free from wane, sap, clefts, shakes, radial cracks and bark pockets.
- Long loose and large dead knots, decay and insect attack material is not acceptable.
- Except as specified hereinafter, all lumber for interior work shall be kiln-dried, and at time of delivery the moisture content shall be within 6 - 11 %.
- Great care shall be taken to ensure that it does not materially change during transit, storage, erection and drying out to the natural conditions.
- Type of lumber to be used for such items as wall skirting, shall be selected lumber from Bangkirai, Merbau, Kapur or Meranti which shall have a good appearance and finishing qualities. Lumber which shall receive natural/transparent finishes shall be practical clear, or of high quality and generally clear. Lumber which shall receive paint finishes shall be suitable for receiving high quality paint finishes.

2. Plywood

- All interior plywood for transparent finish shall be selected for uniformity of colour and graining, free from splits, scratches and blemishes and shall be clean and smoothly sanded on 2 (two) sides.
- Plywood to be pressure-preservative treated shall be fully-waterproofed type. Grade for preservative-treated plywood shall not be less than that specified for the specific use.
- Plywood shall have the same quality veneer and be clean and smoothly sanded on 2 (two) sides, and shall come from a proven manufacturer, and consisting of :
 - Plain plywood.
 - Plywood made of Sungkai or Teak wood.

Plywood that is consisted of chips or small rest material at the middle of its plies should not be used.

- The minimum number of plies required for plywood shall be 3 plies for 4 to 6mm thick, 4 plies for 9 to 15mm thick and 7 plies for 18 to 25mm thick.

DIVISION 7
THERMAL AND MOISTURE PROTECTION

Project Specification

DIVISION 7 THERMAL AND MOISTURE PROTECTION

07100 Waterproofing

1. Waterproofing of Membrane Type

- Waterproofing of membrane type shall be a minimum 1.5mm thick pre-formed self-adhesive membrane composed of high-density polyethylene film and a self-adhesive rubber/bitumen compound.
It shall adhere tightly and permanently to the substrate to form a continuous water barrier without using job applied adhesives, hot materials, mechanical fastening or special equipment.
- Waterproofing shall have the following characteristics:
 - Capable of resisting a hydrostatic head when fully supported.
 - Stable in dimension, high tear strength, puncture and impact resistance.
 - Flexible and chemical resistant,
 - Withstands extreme climates,
 - Shall have uniform thickness,
 - Quick installation,
 - Performance properties complying with ASTM requirements (ASTM D146, D 412 and D 570, ASTM E 96 and E 154),

such as Proofex GPE, Masterpren 1000, Bituthene 3000 or approved equal.

- Primer for all concrete or masonry surface shall be from the same manufacturer of waterproofing membrane.
- Mastic seal that to be placed at all critical points such as terminations, drain, and pipe penetration shall come from the same manufacturer as the waterproofing membrane.

2. Waterproofing of Liquid Type

- Waterproofing shall be in white colour liquid.
- Waterproofing liquid shall have the following characteristics:
 - Non-toxic and VOC compliant water based coating,
 - Protecting concrete from deterioration,
 - Withstands extreme climates,
 - UV resistance,
 - Preventing oil ingress into concrete,
 - Quick installation and reducing maintenance costs,
 - Slip resistance,
 - Preventing water leaks and reinforcement corrosion,
 - Creating a hydrophobic barrier inside the penetrated concrete.
 - Complying with ASTM requirements,
 - SRI (Solar Reflectance Index) ≥ 78 ,

such as Sikalastic 560 by Sika or approved equal.

3. Waterproofing of Cementitious Type

- Waterproofing shall be predosed, ready for use waterproofing slurry based on resin modified cementitious material.
- Waterproofing shall have the following characteristics:
 - Easy to mix,
 - Easy to use,

Project Specification

- Consistency can be chosen for application by brush or by trowel,
- Excellent adhesion to sound substrates,
- Impermeable,
- Good resistance to abrasion and erosion,
- Non corrosive and non flammable,
- Non toxic,
- Slightly flexible,

such as Formdex Uniflex by Hitchin, SikaTop 107 Seal, Brushbond from Fosroc, or Barra Lastic from BASF.

4. Screed

Screed material shall be in accordance with the requirement of cement mortar as specified in Specification 04060.

07210 Building Insulation

1. Roof Insulation

a. Insulation

Roof insulation shall be a fibre free product constructed of pure aluminium foil of at least 99% attached to fire retardant non-dripping close-cell polyethylene bubble sheeting in thermal process without glue or chemical, and having the following characteristics:

- High thermal resistance performance
- Non irritation, non asthmatic, non allergenic, non carcinogenic
- Rodent and insect resistance, formaldehyde free
- Flame retardant, meets international standards (Fire passes ASTM E 84, UL 723),
- Effective in high humidity, acts as vapor barrier and water under sheeting
- Fast installation, reduce transportation and storage cost.
- Reflectivity of foil surfaces 97%,
- Nominal thickness of 4mm,

such as Net FR Polynum Super or approved equal.

b. Self Adhesive Aluminium Tape

Self-adhesive aluminium tape for roof insulation shall have characteristics according to the standard of the manufacturer, and shall come from the same manufacturer with the roof insulation manufacturer.

c. Supporting Plate and Screw

- Supporting plate made of metal of 40mm width by 10m length shall come from the insulation manufacturer
- Screw of WFH 10-16 type shall be supplied by the insulation manufacturer.

Project Specification

2. Acoustical and Sound Insulation

a. Acoustical Insulation

Acoustical insulation for dry wall partition shall be made of rockwool bonded with phenolic resin having minimum characteristics as follows:

- Lightweight,
- Board type,
- Minimum density 60kg/m³,
- Thermal conductivity 0.043W/mk at 100°C,
- Minimum thickness 50mm or according to the Drawings,
- Non-combustible according ASTM E-136,

such as from UniFiber, ABR Rockwool or approved equal.

b. Sound Insulation

Insulation for sound absorbing shall be made of rockwool bonded with phenolic resin having minimum characteristics as follows:

- Lightweight,
- Mattress type,
- Minimum density 100kg/m³,
- Thermal conductivity 0.043W/mk at 20°C,
- Minimum thickness 50mm or according to the Drawings,
- Non-combustible according ASTM E-136,

such as from UniFiber, ABR Rockwool or approved equal.

07410 Metal Roofing and Siding

1. Metal Roofing and Siding

- Metal roofing and siding shall be made from zinc/aluminium alloy coated metal having 5500kg/cm² minimum yield strength and 150gr/m² minimum coating mass (AZ 150) complying with AS 1397, factory prepainted with an oven baked silicone polyester finish (clean colorbond) complying with AS 2728, in corrugated profile of Lysaght Klip-lok by PT NS BlueScope Lysaght Indonesia or acceptable equivalent, in colour to be determined later by the Engineer.
- Corrugated metal sheet shall have 0.45mm base metal thickness.
- All sheeting shall be provided with concealed fixing and specified fasteners as recommended by the manufacturer.

2. Flashing

Flashing shall match adjacent metal cladding and shall be manufactured from the same sheet and colour as for cladding, and shall be manufactured by the same manufacturer, and as specified in Division 7 - Specification 07600.

3. Fasteners

Fasteners shall be of self-drilling screw type complying with AS 3566 as recommended and supplied by the manufacturer which produces the metal roofing and siding to be used.

Fasteners exposed in the finished work shall be coated to match the colour of the material to be fastened.

Galvanizing of fastenings shall comply with ASTM A 153.

Fasteners shall be fitted with EPDM washers.

Project Specification

4. Sealants

Refer to Division 7 - Specification 07920.

07430 Aluminium Composite Panel

1. Panel

- Available manufacturers shall be subject to compliance with requirements, manufactures offering metal wall panel systems that may be incorporated in the work include but are not limited to the following:
 - Maco.
 - Alucopan.
- Thickness shall be 6mm, or as shown in the Drawings.
- The panels shall have composition of polyurethane core sandwich between two layers of 0.5mm thick aluminium alloy.
- Aluminium sheets shall comply with ASTM B 209 for Alclad alloy 3003 or 3004 with temper as required to suit forming operations.
Provide manufacturer's standard finish in colour to be selected.
- 3 layer coating of PVDF Hylar 5000 or Kynar 500.
- Coatings shall be applied either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Coating shall be protected either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching colour for touch-up.

2. Miscellaneous Materials

Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.
Use aluminium, corrosion-resistant steel, or stainless steel fasteners for exterior application and galvanized fasteners for interior applications.

3. Panel Supports and Anchorage

Provide the following secondary framing members:

- "C" or "Z"-shaped sections fabricated from 1.5mm shop-painted, roll-formed steel shall be for wall girts.
- Unequal flange "C"-shaped sections formed to provide adequate backup for wall panels, from 1.5mm shop-painted, roll-formed steel, to be used for eave struts.
- Angles in sizes and thickness as shown in the Drawings fabricated from shop-painted, roll-formed steel to be used for flange and sag bracing.
- Base and sill angles shall be fabricated from 1.9mm cold-formed galvanized steel sections.
- Secondary structural members, except columns and beams, shall be the manufacturer's standard sections fabricated from 1.9mm cold-formed galvanized steel.

4. Sealants

Refer to Division 7 - Specification 07920.

Project Specification

07456 Fiber Cement Board

1. Boards

a. General

Fiber cement board made of calcium silicate shall not contain asbestos and shall be manufactured from high density, autoclaved, cellulose fibre-reinforced cement, silica flour, additive and water, and having properties and characteristics as follows:

- Immune to water damage,
- Will not rot and is unaffected by termites,
- Lightweight,
- Non combustible,
- Moisture content maximum 10%,
- Density 1300kg/m³
- Complying with AS 4801,

such as KalsiBoard Ling, KalsiPlank, KalsiPart manufactured by Eternit Gresik.

Thickness and type of calcium silicate board to be used for ceiling, partition, fascia, plank, exterior wall and others shall be as indicated in the Drawings.

b. Joints

Generally joints shall have joining strips/gap, unless otherwise specified in the Drawings.

2. Frames

Metal frame for installation and supporting calcium silicate board of flush joint system shall be prefabricated products made of aluminium-zinc coated steel sheet such as Zinalume, in shape and size specially made for calcium silicate board installation, from Eternit Gresik.

3. Sealants

Unless otherwise determined by the calcium silicate board manufacturer, sealants for finishes all joints and connections shall be as specified in Division 7 - Specification 07920.

4. Painting

Painting of water based type for calcium silicate board surfaces shall comply with the requirements of Division 9 - Specification 09910.

07600 Flashing and Sheet Metal

1. Flashing

a. Metal Sheet

Longitudinal flashing and capping, transverse flashing and capping, flashing around roof or wall protrusions, flashing around wall openings or others as required, shall be made from zinc/aluminium alloy coated metal having 5500kg/cm² minimum yield strength and 150gr/m² minimum coating mass (AZ 150) complying with AS 1397, factory prepainted with an oven baked silicone polyester finish (colorbond) complying with AS 2728, from PT NS BlueScope Steel Indonesia or approved equal, with minimum 0.40mm base metal thickness, in a matching colour with the adjacent sheet.

Project Specification

b. Flexible Sheet

Flexible sheet for flashing shall be made of refinery bitumen with rubber adhesive resin, coated with aluminium sheet to withstand UV and climate changes and can adhere to every kind of substrates such as concrete, fibreglass, metal, plastic, timber, glass, clay and others, such as Ritoband or Evo-Stik or approved equal.

Thickness, width and length of flexible sheet shall be according to the standard of the manufacturer.

c. Rain Gutter

- Rain gutters shall be pre-fabricated from zinc/aluminium alloy coated metal having 5500kg/cm² minimum yield strength and 150gr/m² minimum coating mass (AZ 150) complying with AS 1397, factory prepainted with an oven baked silicone polyester finish (clean colorbond) complying with AS 2728, with base metal thickness of 0.40mm, in colour matching to the adjacent roofing/siding, from PT NS BlueScope Steel Indonesia, shaped and formed by PT NS BlueScope Lysaght Indonesia, sizes and shapes according to the Drawings.
- Rain gutter shall be provided with hooks for supporting and they shall be supplied by the rain gutter manufacturer.
- Fasteners shall be stainless steel, aluminium, or other type as proposed by the Contractor and approved by the Project Manager.

d. Rain Leader (Downspout)

- Rain leader (downspout) shall be PVC pipe of working pressure 10kg/cm² complying with SNI 06-0084-2002, such as Wavinsafe by Wavin, or Pralon, Vinilon or acceptable equivalent.
- PVC pipe fittings such as elbow, tee, outlets, adaptors and others as shown in the Drawings shall comply with SNI 06-0135-1989 and come from the same manufacturer as the pipes.
- All PVC pipes and fittings shall be suitable for solvent cement jointing.
Adhesive for solvent cement jointing of rain leader (downspout) connection shall be as recommended by the PVC manufacturer and approved by the Engineer.

e. Roof Strainer and Scupper Drain

Roof strainers/drains of dome grate type shall be made of cast-iron material in sizes as indicated in the Drawing or according to the standard of the manufacturer, such as manufactured by Batur Artha Yulis or Sanwell Austindo or acceptable equivalent.

f. Fasteners

Fasteners shall be stainless steel, aluminium or other type as proposed by the Contractor and approved by the Project Manager.

g. Bituminous Paint

Where it is stated in the Drawings or according to the Engineer's directions, bituminous paint shall be acid and alkali resistant type in black colour.

Project Specification

07840 Firestopping

1. Coated Board System

- Firestop of intumescent coating type shall be ready-to-use, water soluble, odourless, silicone free, solvent free, non-sagging, non-shrinking, asbestos free, adhesive sealant used to seal in large opening against the spread of flame, smoke, gases and water in fire-rated walls and floors that have been penetrated for the passage of items such as pipes, cable tray or cables and others as required by the design, having the same fire integrity rating as the wall or floor, complying with the requirements of AS 1530 Part 4, BS 476: Part 20, UL Listed and FM Approved, such as CP 670 by Hilti, consisting of firestop coating, firestop filler and non-flammable mineral wool as backfilling.
- Backfilling for firestop installation shall be of non-flammable mineral wool with minimum density of 150kg/m³ or foam as recommended by the firestop manufacturer.

2. Foam Type

Firestop of intumescent foam type shall be ready-to-use, consisting of two-component foam in an environmentally friendly foil pack for quick, trouble-free dispensing, ideal solution for installing reliable, smoketight firestop seals in small to medium-sized openings (optimum size range: 100mm x 100mm to 300mm x 300mm), and single cable can be retrofitted easily without drilling or cutting, complying with the requirements of AS 1530 Part 4, BS 476: Part 20, UL Listed and FM Approved, such as CP 660 by Hilti

3. Mortar Type

Firestop of intumescent mortar type shall be ready to use (by adding some water, about 3 : 1 by volume) consisting of gypsum based mortar with thermal insulating properties used to seal medium sized penetrations, designed for use in walls and floors, in concrete and porous concrete and masonry, asbestos free low VOC, paintable, complying with the requirements of BS 476: Part 20, UL Listed and FM Approved, such as CP 636 by Hilti or acceptable equivalent.

07920 Joint Sealants

1. General

- Caulking compound shall be designed weatherability appropriate to prevailing local conditions that enables it to retain original design properties after prolonged periods of exposure. Elongation, tensile strength, hardness and adhesion shall not change significantly with ageing or exposure to weather.
- Material selected shall have proven ability to withstand the conditions prevailing at the site and written documentation shall be made available by manufacturer to the Engineer before selection.

2. Sealant

Unless otherwise specified, compound for part of buildings of that are required to be sealed, shall be a flexible one component water based acrylic gap sealant and paintable, having low VOC, such as Acrylic Sealant from GE, PROseal PAS-100 by Propan Raya, V-Tech Sealant, Dunlop Eco Green Seal, PE Polymer -PE900, ALLYSEAL Gap Filler - Acrylic Sealant or approved equal that cures in the presence of atmospheric moisture to produce a durable and flexible building joint seal.

Porous substances shall be primed with primer as recommended by the manufacturer.

**DIVISION 8
DOORS AND WINDOWS**

Project Specification

DIVISION 8 DOORS AND WINDOWS

08110 Steel Doors and Frames

1. Doors and Frames.

Steel door and frame shall be constructed from steel material complying with ASTM A36/36M standard, and shall be in accordance with the manufacturer's standard, such as from Bostinco or acceptable equivalent, and shall consist of the following materials:

- Steel sheet for door panel in specified thickness and size.
- Steel profile for door frame in specified shape and size.
- Mineral insulation for core of door panel.
- Vision panel of wired-glass, where specified.
- Steel louvers where specified.

Steel door and frame shall be constructed and fabricated in accordance with the design and dimension as indicated in the Drawings and shall be pre-painted in the factory in colour as specified.

2. Hardware

All locks and fittings shall be corrosion proof, provided by one manufacturer, and shall be in accordance with Division 8 - Specification 08700.

3. Glass and Glazing.

Glass and glazing, if required, shall refer to Division 8 - Specification 08800.

08115 Fire-Rated Steel Doors and Frames

1. Fire-Rated Steel Door

- Fire-rated steel door shall be constructed of hot dip galvanized or electrolytic zinc coated steel sheet with steel grade complying with ASTM A36/36M, such as manufactured by Bostinco or proven manufacturer approved by the Engineer.
All fire-rated steel doors shall be approved by local Fire Department and shall bare UL stamp.
- Door leaf shall be rebated with overlap of 24mm width around the door leaf. Door leaf shall be reinforced, stiffened and insulated with thermal insulation such as mineral wool or rockwool, according to the standard of the manufacturer.
- Flush frames shall have form/shape and sizes according to the standard of the manufacturer.
- Reinforcing made of steel shall be provided for lockset, hinges and surface hardware.
- The door, frame and hardware shall be designed for 1.5 (one and a half) hour fire rating (for external doors) and 3 (three) hours fire rating (for internal door or between compartments), and shall be approved by the local Fire Department.
- The fire-rated steel door leaf with 55mm overall thickness shall be fabricated from steel sheet of thickness and sizes according to the standard of the manufacturer.

2. Hardware

All locks and fittings shall be of corrosion proof material and shall have fire rating of 1 (one) hour and 2 (two) hours as recommended by the manufacturer, and shall have the provision to be incorporated in a masterkey system.

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The lock and fitting shall be as follows:

- Lockset with key of cylinder type.
- Lever handle and backplate.
- 2 (two) or 3 (three) hinges for every door (depending on the standard of the door manufacturer).
- Door closer of hold-open arm type.
- Panic bar (can be replaced by lever handle on plate).

08120 Aluminium Doors, Windows and Frames

1. Aluminium

- Unless otherwise specified, all aluminium works of pre-fabricated profile to be used for doors, windows (including sliding windows), louvers, grilles and frames shall be of clear anodized extruded aluminium alloy 6063, temper T5 or T6 of minimum 10microns, in finish colour as specified by Colour Scheme to be issued later or as shown in the Drawings, and shall conform to ASTM B 221 M, such as YKK, Indalex or Alakasa.
- Unless otherwise indicated in the Drawings, thickness of all pre-fabricated profiles shall be 1.35mm minimum, with shape and dimension as shown in the Drawings.
Dimension of profiles can change depending on the types of profile approved by the Engineer.
- Exposed surfaces of aluminium shall be free of die marks, scratches, blisters, "leave-off" marks, or other blemishes which are visible.

2. Fasteners and Accessories

- Fasteners shall be stainless steel, AISI type 300 series, selected to prevent galvanic action between fasteners and components fastened. Where exposed in finished surfaces, use oval-head countersunk head screws with shank diameter one size smaller than the diameter of holes in fastened material, and colour to match adjacent surfaces.
- Anchors shall be AISI type 300 stainless steel in size and length as recommended by the aluminium profile manufacturer.

3. Fasteners and Accessories.

- Fasteners shall be stainless steel, AISI type 300 series, selected to prevent galvanic action between fasteners and components fastened. Where exposed in finished surfaces, use oval-head countersunk Philips head screws with shank diameter one size smaller than the diameter of holes in fastened material, and colour to match adjacent surfaces.
- Anchors shall be AISI type 300 stainless steel.

4. Glass and Glazing.

Refer to Section 08800.

5. Caulking and Sealing.

Caulking and sealing materials for covering screws and filling gaps shall be in accordance with the requirements of Section 07920.

6. Finish Hardware.

All locks and fittings shall be as indicated in the Drawings and in accordance with Section 08700.

Project Specification

08210 Wood Doors and Frames

1. General

All doors leaves and other related wood works shall be prefitted, premachined for hardware and prefinished at the factory.

2. Door Frames

Unless otherwise specified, all door frames for external and internal doors shall be from extruded aluminium as specified in Specification 08120 and as indicated in the Drawings.

3. Flush Door Construction

a. Internal Frame

- Internal frames (rails, stiles, lock rail and lock block) for internal and external doors shall be kiln-dried Meranti or Kapur, with durability of class I and strength of class II complying with local standard.
- Internal frames in hollow and solid core construction shall be nominally 100mm wide x 30mm deep giving an overall thickness of door leaf of nominally 42mm.

b. Core Construction

- Core construction for general internal doors shall be hollow core consisting of mesh grid or ladder strips or honeycomb or spiral blanks or according to the standard of the approved manufacturer.
- Core construction for external doors shall be solid core made of particle board or mineral composition or staved lumber or according to the standard of the approved manufacturer.
- Refer to the Drawings for locations of other required solid core doors.

c. Facing

- Facing made of 6mm thick plywood of Kamper or Teak wood.
- Facing made of calcium silicate board shall comply with the requirements of Division 7 - Specification 07456. Thickness of board shall be as shown in the Drawings.

d. Manufacturer

- PT Karya Cipta Unggul Nusantara
- PT Intisurya Citratama
- PT Tulus Tri Tunggal

e. Glass and Glazing

Glass and glazing, if required, shall refer to Division 8 - Specification 08800.

e. Finishes

Unless otherwise specified, wood doors and windows shall have transparent finish.

3. Finish Hardware.

All locks and fittings shall be as indicated in the Drawings and in accordance with Division 8 - Specification 08700.

Project Specification

08450 Glass Doors

1. General

All materials specified herein shall be new and of first quality, from a manufacturer with a proven record in this field of production, and of acceptable quality to the Engineer.

2. Type of Glass Doors

Unless otherwise indicated in the Drawings, glass doors shall be of frameless types.

3. Door Panel

Door panel shall be flat, fully tempered glass made of clear glass, in thickness as shown in the Drawings, complying with the requirements of Division 8 - Specification 08800.
Size of each door panel shall be as indicated in the Drawings.

4. Door Fittings

Door fittings shall be manufacturer's standard fittings of profile and arrangement as indicated in the Drawings, and shall comply with the requirements indicated for kind and form of metal and finish and Division 8 - Specification 08700.

5. Hardware

Hardware for glass doors such as pull handle, double acting floor closer/floor hinge, locks, and cylinders shall be as indicated in the Drawings and Division 8 - Specification 08700.

6. Weatherstripping

Weatherstripping shall be manufacturer's standard sweep-type flexible, clear PVC housing with poly pile seal complete with self adhesive tape.

7. Glass Edge Protection

Glass edge protection shall be manufacturer's standard flexible, clear PVC complete with self adhesive tape, in size suitable with the glass thickness to be protected.

8. Anchors and Fastenings

Anchors and fastenings shall be manufacturer's standard concealed type. Exposed fasteners shall not be used.

9. Glass and Glazing

Glass and glazing shall comply with requirements of Division 8 - Specification 08800 and the specified Drawings.

Project Specification

08700 Finish Hardware

1. General

- All materials specified herein shall be new and of first quality, free from any defect, and the manufacturer having a proven record in this field of manufacturer.
- All fittings shall be corrosion-proof in all locations where exposed to a relative humidity of more than 70%.
- Lock system shall be sufficiently broad in coverage and types available to provide master-keying for door locks, cabinet locks, utility panelboard locks, padlocks and keyed switches, unless otherwise shown.
- Establish key system based upon specified requirements and per exact requirements determined by the Engineer at the time after starting the work under this contract.
- Except as hereinafter specified, all hardware supplies shall be in accordance with the types indicated below.

2. Hardware

a. Door Locksets

All locksets for external and internal doors shall be similar or equal to Kend, Dekkson, or Hafele product.

All locksets shall consist of the following:

- Lock of double cylinder type made of brass complete with 3 keys.
- Turnpiece WC cylinder for WC/toilet doors.
- Lockcase made of steel with zinc plated, with the type suitable with the type of door and the width of the door frame.
- Faceplate made of stainless steel or brass or steel with zinc plated, dead-bolt made of brass or hardened steel saw resistant, latch-bolt made of brass and striking plate made of stainless steel or brass, each shall be in accordance with the manufacturer's standard.

b. Handles

Unless otherwise directed by the Engineer, type of push plate, handle whether lever handle on plate or rose, pull handle on plate or rose, knob on plate or rose, and each rose complete with escutcheon, shall be in accordance with the type of door and as shown in the Drawings.

c. Patch Fittings and Accessories for Glass Door

Top and bottom patch fittings, bottom patch lock fitting and accessories for frameless glass doors of double action swing type shall be manufacturer's standard fittings of profile and requirements as indicated in the Drawings and shall be completed with cylinder lock, handle and floor closer as herein specified or as shown in the Drawings.

d. Hinges

- Hinges for aluminium and wood doors shall be full mortise butt type made of steel with polished brass finish, in size of 102 mm x 76mm x 2mm.
- Hinges for steel doors, hinge shall be made of steel with brass pin, in appropriate sizes corresponding with the door weight, or according to the standard of steel door manufacturer.
- Window hinges of full mortise butt type shall be made of steel with polished brass finish in size of 76mm x 64mm x 2mm
- Window hinges of friction stay shall be in appropriate size suitable with the size and weight of each window.

Project Specification

e. **Window Holder**

Window holder for window with full mortise butt shall be of hook type made of nickel plated brass in size and length according to the standard manufacturer.

f. **Window Lock/Fastener**

Window lock/fastener shall be of cam handle type made of brass with polished brass finished. Each window shall have one lock/fastener.

g. **Flush Bolt**

All double doors shall be fitted with flush bolt made of steel with satin chrome finish.

h. **Padlock**

Padlock shall made of solid brass with shackle made of hardened steel, nickel plated

i. **Door Stop**

Door stop to prevent the door from banging to the wall, shall be of floor type made from rubber with steel reinforcement.

j. **Overhead Closers**

All external doors and all doors leading to air conditioned rooms shall be provided with door closer of "hold open arm" type, with size according to the door width and weight.

k. **Floor Closers**

All double action doors shall be provided with floor closer of "hold open" type, with size according to the door width and weight.

l. **Door Seal**

Unless otherwise shown in the Drawings, all the bottom of the doors leaves leading to air conditioned rooms shall be provided with door seal of brush strip seal type made of nylon complete with aluminium holder, such as RP2A by Raven or acceptable equivalent.

3. Finishes

Unless otherwise specified, finishes of all hardware exposed to view shall be US 32 (polished stainless steel).

08800 Glass and Glazing

1. Plain Glass

Plain glass shall be selected clear float glass sheet which is flat and having uniform thickness, free from any defect and from the best quality conforming to AS1288, such as Indoflot type by Asahimas or approved equal.

Thickness and sizes shall be as required and as indicated in the Drawings.

Project Specification

2. Tinted Glass

Tinted glass shall be of clear float glass with a tint which is made by adding metals like cobalt, manganese and others into than glass base material, for heat-absorbing and light-reducing, such as Panasap from Asahimas, with nominal thickness, sizes and colour as indicated in the Drawings.

3. Reflective Glass

Reflective glass shall be of tinted float glass with solar-reflective metallic oxide coating applied pyrolytically during initial manufacture, for heat and light reflecting, such as Stopsol by Asahimas, in nominal thickness of 6mm, of supersilver dark blue colour, and in size as required and as shown in the Drawings.

4. Tempered Glass

Tempered glass shall be as follows:

- Flat heat-strengthened and flat fully tempered coated and uncoated glass used in general building construction complying with ASTM C1048, with nominal thickness as indicated in the Drawings or as directed by the Engineer.
- Such as Magitemp by Magi, or by Asahimas or by Sinar Rasa Kencana.

5. Mirror

Mirror shall be as follows:

- Having high light reflection,
- Excellent resistance to natural atmospheric corrosion,
- No copper and greatly reduced levels of ammonia waste produced in the process,
- Improve resistance to chemical attack in the form of cleaners and adhesives,

such as Miralux by Asahimas.

Size and thickness shall be as shown in the Drawings.

6. Elastomeric Sealant

Elastomeric sealant or other equal synthetic material complying with ASTM C 920 shall be used throughout, unless otherwise specified, for all glazing in metal/aluminium frames.

Type and dimension of neoprene/gasket shall be made suitable for each metal/aluminium frame.

7. Glazing

a. Glazing Tapes

Shall be preformed, butyl-based elastomeric tape with a solid content of 100%, non-staining and non-migrating in contact with nonporous surfaces, with or without spacer rod as recommended by tape and glass manufacturer for application as indicated in the Drawings.

b. Glazing Gaskets

- Neoprene extrusions in size and shape as shown fabricated into frames with moulded corner units and zipper lock strips shall comply with ASTM C542, in black.

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- Moulded or extruded gaskets of material indicated below, shall comply with standards referenced with name of elastomeric indicated below, and of profile and hardness required to maintain watertight seal:
 - Neoprene, ASTM C864.
 - EPDM, ASTM C864.
 - Silicone, ASTM C1115.
 - Thermoplastic polyolefin rubber, ASTM C1115.

- Extruded or moulded closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C509 and of profile and hardness required to maintain watertight seal:
 - Neoprene.
 - EPDM.
 - Silicone.
 - Thermoplastic polyolefin rubber.

**DIVISION 9
FINISHES**

Project Specification

DIVISION 9 FINISHES

1. Gypsum Board

- Gypsum board with tapered/recessed edges shall consist of the following types:
 - Standard type having minimum thickness as indicated in the Drawings, such as by Jayaboard, Knauf, Elephant or acceptable equivalent.
 - Noise absorption type with perforation diameter of 10mm, having minimum thickness as indicated in the Drawings, such as S10 No. 8 type by Jayaboard or acceptable equivalent.
- Gypsum board shall comply with the requirements of AS 2588, BS 1230 or ASTM C 36.

2. Jointing Cement

Jointing cement for flush jointing on gypsum board shall come from the approved gypsum board manufacturer to be used in this project.

3. Metal Frame

Metal frame for installation and supporting gypsum board, such as studs, runners, furring members, channels, backing plates and others shall be prefabricated products made of aluminium-zinc coated steel sheet such as Zinalume or Galvalum, in shape and size specially made for gypsum board installation, such as from Jayaboard or Knauf or Elephant or acceptable equivalent.

4. Fasteners

Fasteners such as screw from the type in accordance with the type of installation, shall be as recommended by the gypsum board manufacturer and shall comply with AS 2589.

5. Miscellaneous Accessories

Other accessories for installing gypsum board, such as mentioned below, shall be as recommended by the gypsum board manufacturer:

- Protection coated steel corner beads and edge trim, type designed to be concealed in finished construction by tape and joint compound,
- Corner beads of manufacturer's standard metal beads,
- Metal edge trim,
- Adhesive and perforated/reinforcing tape,
- Jointing cement/compound for gypsum board according to the standard's of the manufacturer.
- Control joints with 4mm thick polyethylene air seal,
- Acoustical insulation of preformed mineral wool, friction fit type without integral vapour barrier, of thickness as required to meet STC ratings as indicated,
- Acoustical sealant of type recommended for use in conjunction with gypsum board system, paintable, non-shrinking and non-cracking where exposed,
- Prime coat specially made for gypsum board surfaces,
- And others as required, to complete the installation.

09310 Ceramic Tiles

1. General

All tiles shall be new, free from any defect and of first quality, from a manufacturer with a proven record in this field of production.

Tiles shall be of colour and type as specified in Colour Scheme or as directed by the Engineer.

Project Specification

2. Ceramic Tiles

Ceramic tiles shall consist of the following types:

- 600mm x 600mm glazed ceramic tiles of non-slip type to be installed on floor in wet area, and 600mm x 600mm glazed type for wall in wet area.
- 400mm x 400mm glazed ceramic tiles of semi-gloss/matt type to be installed on all floor of areas as indicated in the Drawings.
- 100mm x 400mm glazed ceramic plinth type to be installed in area as indicated.
- Nosing tiles of semi-glazed ceramic tile complete with "ribbed" non-slip surface for stair nosing to concrete stairs.
- Such as from Roman or Asia Tile or acceptable equivalent.

3. Homogenous Ceramic Tiles

Homogenous ceramic tiles of polished or unpolished type shall be from Granito or Niro Granite, in size of 800mm x 800mm, and 900mm x 1800mm skirting, for floors in area as shown

4. Tile Adhesive

Adhesive of thin bed up to 3mm for floor and wall tiles, and submerged area or pools shall consist of synthetic latex based liquid mixed with dry mortar to produce a superior mortar for use on concrete slab or vertical surfaces.

Synthetic latex based liquid shall comply with AS 2358, BS 5358 Part 1, ANSI 118.4, 118.1 and 136.1 such as AM 30 or MU-420 for ceramic tiles on floors and walls in dry areas, AM 30 or MU-460 for ceramic tiles in wet areas, AM 42 or MU-400 for homogenous tiles on floors and walls.

5. Cement Mortar Bedding (thick bed minimum generally 25mm) – Mixed on Site

Cement mortar which shall be mixed with some admixture or as required by manufacturer, shall be in accordance with Division 4 - Specification 04060.

6. Cement Grout

Cement grout shall be factory prepared portland powder mixture grout, factory precoloured in colour as selected, such as AM 50, MU-408, Sika Tile Grout or acceptable equivalent.

09380 Natural Stone Tiles

1. Natural Stone Tile

- Provide matched blocks from a single quarry for each type, variety, colour, and quality of stone required.
- Natural stone tile shall be of standard grade, free from cracks or seams which may impair its structural integrity of function. Inherent variations of characteristics of the source from which stone is obtained will be acceptable.

Natural stone tile shall consist of the following:

- Sandstone,
- Andesite stone (volcanic rock),
- Black lava stone (batu candi),
- Paras Yogya.

each in size and thickness as shown in the Drawings.

Project Specification

2. Cement Mortar

Cement mortar shall be in accordance with the requirements of Division 4 - Specification 04060.

3. Grout

Cement grout shall be factory prepared portland powder mixture grout, factory precoloured in colour as selected, such as AM 50, MU-408, Sika Tile Grout or acceptable equivalent.

4. Water Repellent

Water repellent to avoid fungus and moss on natural stone tiles installed on wall of the building shall be colourless, slip and stain resistant sealer, not affecting colour or physical properties of stone surfaces, such as Sicosol from Propan Raya.

09500 Ceilings

1. Ceiling Panels

a. Calcium Silicate Boards

Calcium silicate boards shall not contain asbestos and shall be manufactured from high density, autoclaved, cellulose fibre-reinforced cement, silica flour, additive and water, and having properties and characteristics as specified in Division 7 - Specification 07456, with minimum thickness of 6mm, unless otherwise shown in the Drawings.

b. Gypsum Boards

Gypsum board with tapered edges shall be of standard type, and noise absorption type with perforation, each having minimum thickness as indicated in the Drawings, and shall comply with the requirements of Specification 09250.

2. Exposed Grid Ceiling System

- Runners to hold acoustical ceiling panels shall be of lay-in type, made of hot dipped galvanized steel with oven-baked paint in the factory, such as Prelude XL from Armstrong or acceptable equivalent.
Runners shall consist of the following:
 - Main Tee of 24mm wide, 38mm deep.
 - Cross Tee of 24mm wide, 27mm deep.
 - Side Angle of 22mm wide, 22mm deep.
- Adjustable rod shall be of 4mm galvanized steel wire as recommended by the runners' manufacturer or of galvanized steel wire annealed either 1 strand or 2 interwoven strands of dimension as shown in the Drawings.
- Hold down clip shall be provided to hold each ceiling tile at its place. Hold down clip shall be made of galvanized steel sheet in size and form as recommended by the runners' manufacturer.

Project Specification

3. Concealed Grid Ceiling System

a. Metal Frame

Metal frame for installation and supporting gypsum board and calcium silicate boards, such as furring member/channels, top cross rails, connectors, backing plates and others shall be prefabricated products made of aluminium-zinc coated steel sheet such as Zinalume or Galvalum, in shape and size specially made for gypsum board and calcium silicate boards installation, such as from Jayaboral or Knauf, Eternit Gresik or acceptable equivalent.

b. Fasteners

Fasteners such as screw from the type in accordance with the type of installation shall be as recommended by the gypsum board and calcium silicate boards' manufacturer.

4. Structural Support Members

Structural support members for holding suspended system, adjustable rods, trafficable system, lighting fixtures, air conditioning accessories and others as specified which are laid adjacent to the ceilings shall be fabricated from steel profile in shape and sizes as indicated by the Drawings.

A Shop Drawing is to be submitted by the Contractor for Engineer's approval. This structural support shall comply with the requirements of Division 5 - Specification 05500.

09515 Metal Panels

1. Clip-In Tile Ceilings.

Perforated type, made from 0,6mm high quality hot-dipped galvanized steel, electrostatic polyester coating, PVDF coating, provided with acoustic felt, sizes 600mm x 600mm and 600mm x 1200mm by Chicago Metallic or acceptable equivalent or acceptable equivalent, in finish colour as specified in Colour Scheme to be issued later.

2. Frames and Accessories

Shall be as recommended and supplied by the ceiling manufacturer

3. Structural Support Members

Structural support members for holding adjustable rods, lighting fixtures, air conditioning accessories and others specified, shall be of steel profile in shape and sizes as indicated by the Drawings. A Shop Drawing is to be submitted by the Contractor. This structural support shall comply with Division 5 - Specification 05500.

4. Painting

Painting for metal panel ceilings support members shall be as specified in Division 9 - Specification 09910.

09545 Metal Linear Ceiling

1. Ceiling

Ceiling shall be made from 0,6mm high quality hot-dipped galvanized steel, electrostatic polyester coating, PVDF coating, sizes according to the Drawings.

Project Specification

2. Frames and Accessories

Shall be as recommended and supplied by the ceiling manufacturer

3. Structural Support Members

Structural support members for holding adjustable rods, lighting fixtures, air conditioning accessories and others specified, shall be of steel profile in shape and sizes as indicated by the Drawings. A Shop Drawing is to be submitted by the Contractor. This structural support shall comply with Division 5 - Specification 05500.

4. Painting

Painting for metal panel ceilings support members shall be as specified in Division 9 - Specification 09910.

09630 Granites

1. Granites

- Granite shall be domestically produced or locally available, such as from Yogyakarta or Makassar.
- Granite shall have characteristics as follows:
 - Absorption by weight 0.90% maximum.
 - Hardness of 240-340kg/cm².
- Unless otherwise specified, granite shall come in 2 types of surface:
 - Polished,
 - Textured (non-slip),

in size and thickness as indicated in the Drawings. Colour of granite shall be as directed by the Engineer or as shown in Colour Scheme to be issued separately.

2. Cement Mortar

Cement mortar for wet system installation of granite that consists of cement, sand, water and some waterproofing admixture, shall be in accordance with the requirements of Division 4 - Specification 04060.

3. Working Mat/Lean Concrete

Working mat that consists of light concrete with thickness according to the Drawings or condition of the substrate, shall comply with the requirements of Division 3 - Specification 03300.

4. Sealer/Stain Preventive Coat

Sealer/stain protective coat shall be colourless, slip and stain resistant sealer, not affecting colour or physical properties of granite surfaces such as Ishinol Clear Coat or approved equal or as recommended by granite manufacturer for application indicated.

5. Joint Sealants

Joint sealants to cover and fill gap shall be as specified in Division 7 - Specification 07920 or as recommended by granite installer.

Project Specification

09910 Paints

1. General

- All painting materials shall conform to the specifications shown in the painting schedule herein and to the requirements hereinafter specified. Paints shall not contain any toxic or harmful substances such as lead, mercury or asbestos, and all paints (primers, undercoats and finish) shall have low VOC (Volatile Organic Compounds).
- All primers and finish paints to be used in this work shall be provided by the same designated manufacturer, and shall not be mixed with paint from other sources or of dissimilar compositions.
- For the purpose of establishing a basis of quality, the paints specified herein are based upon paints as manufactured by Dulux, Jotun, or Propan, but the designation thereof shall not be construed as being proprietary.
- The Contractor shall provide painting schedule for each type of material to be painted as stipulated in this Specification and as shown in the Drawings.
- Painting for areas where materials are exposed to possible contamination and in area with corrosivity category C3 and C4 conforming to the requirements of EN ISO 12944-2 shall be as specified in Division 9 - Specification 09960.

2. Primers

Primer to be used shall be as follows:

- Water-based sealer for interior masonry, calcium silicate board and concrete surfaces such as:
 - Dulux Alkali Resisting Primer.
 - Majestic Primer.
 - Decor Alkali Resisting Primer.
- Wall sealer for interior gypsum board surfaces shall be Décor Wall Sealer from Propan Raya or acceptable equivalent.
- Water-based sealer for exterior masonry, calcium silicate board and concrete surfaces such as:
 - Dulux Alkali Resisting Primer.
 - Jotashield Primer 07.
 - Decor Alkali Resisting Primer.
- Alkyd based primer with zinc phosphate as an anti corrosion preventing pigment for steel and miscellaneous metal surfaces, such as:
 - Dulux Quick-Drying Universal Primer Green.
 - Gardex Primer.

3. Undercoat

Undercoat for metal surfaces shall be similar or equal to undercoat with pigment of titanium dioxide and binder of alkyd, such as:

- Dulux Undercoat.
- Gardex Primer.

Project Specification

4. Finish Paints

Finish paint to be used shall be as follows:

- High durable and washable emulsion (*acrylic copolymer emulsion*), fungus resistant, with a mid sheen finish, for interior masonry, calcium silicate board surfaces, such as:
 - Dulux Pentalite Emulsion.
 - Majestic Ecohealth Royal Matt.
 - Decorlotus Interior Wallpaint.
- Acrylic emulsion paint for interior gypsum board surfaces shall be Decocryl Premium Emulsion Paint from Propan Raya or acceptable equivalent.
- Premium quality, 100% acrylic based emulsion paint, fungus resistant, for exterior masonry surfaces, such as:
 - Dulux Weathershield.
 - New Jotashield Antifade
 - Decorshield Acrylic Weathershield.
- High quality alkyd enamel topcoat finish for steel and miscellaneous metal surfaces, such as:
 - Dulux Synthetic Supergloss.
 - Gardex Premium Gloss/Semi Gloss.

5. Colour and Tints

Designated areas shall be subject to colour selection stated in Colour Scheme or as approved by the Engineer after samples showing alternative colours and textures recommended have been furnished. The same thing shall be carried on for colour, tint or texture of prefinish surfaces. Shades of stain shall match the respective colour specimen selected by the Engineer and shall conform to manufacturer's standard colour.

09930 Transparent Coating

1. General

- All coating shall not contain any toxic or harmful substances such as lead, mercury or asbestos, and all paints (primers, undercoats and finish) shall have low VOC (Volatile Organic Compounds).
- All coating materials to be used in this work shall be provided by the same designated manufacturer, and shall not be mixed with paint from other sources or dissimilar compositions.
- For the purpose of establishing a basis of quality, the paints specified herein are based upon paints as from Propan Raya, but the designation thereof shall not be construed as being proprietary.

2. Transparent Coating of Polyurethane Alkyd

a. Base Coat

Sanding Sealer of PUSS-41 by Propan shall be used as base coat.

b. Top Coat

Top coat of two (2) components polyurethane alkyd such as PU-41 by Propan, shall be used as top coat, in semi gloss/satin finish.

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3. Sandpaper

Type of sandpaper shall be suitable with the requirements in point 5.0 of this Specification and shall be approved by the Engineer.

09960 High Performance Coating

1. General

- Coating shall not contain any toxic or harmful substances such as lead, mercury or asbestos, odour, are safe for humans, environmentally friendly, and shall have low to zero VOC (*Volatile Organic Compound*).
- All coating materials for areas where materials are exposed to possible contamination shall conform to the specifications shown in the painting schedule herein and to the requirements hereinafter specified.
- All primers and finish coats to be used in this work shall be provided by the same designated manufacturer, and shall not be mixed with paint from other sources or of dissimilar compositions. For the purpose of establishing a basis of quality, the paints specified herein are based upon paints as manufactured by Jotun for steel coating, but the designation thereof shall not be construed as being proprietary.

2. Corrosion Protection Coating

Unless otherwise determined by Engineer, all coating for steel works in salt and fresh water area shall be of epoxy type, and it shall consist of the following:

- Primer of two-pack, surface-tolerant, high solids epoxy mastic coating, 2 (two) coats - @100microns (dry film thickness), such as Jotamastic 80 by Jotun or acceptable equivalent.
- Finish coat of two-pack polyurethane topcoat type with excellent gloss and colour retention, 1 (one) coat - 50 microns (dry film thickness), such as Hardtop XP by Jotun or acceptable equivalent.

3. Colour and Tints

Designated areas shall be subject to colour selection stated in Colour Scheme or as approved by the Engineer after samples showing alternative colours and textures recommended have been furnished. The same thing shall be carried on for colour, tint or texture of pre-finish surfaces.

Shades of stain shall match the respective colour specimen selected by the Engineer and shall conform to manufacturer's standard colour.

**DIVISION 10
SPECIALTIES**

Project Specification

DIVISION 10 SPECIALTIES

10150 Toilet Cubicles

1. Partition Panel Made of Fibre Cement

a. General

- Partition for toilet and shower cubicles shall be double faced, autoclaved high density cellulose fibre cement/compressed sheet from James Hardie Building Systems or approved equal.
- Each face is to have a smooth surface, free of blemishes.
- All exposed edges are to be neatly machine cut, then ground smooth and arrised.
- Partitions shall be supplied in a factory-finished, high quality polyurethane of selected colour as determined in Colour Scheme to be issued later or as directed by the Engineer.

b. Construction

- Wall connections shall be painted/anodized aluminium channels that are purpose-made to allow attachment of dividers and end panels to walls and frontals with proprietary fixings.
- Head rail shall be painted/anodized aluminium extrusions that are fixed to tops of frontals to provide lateral restraint.
Aluminium infill channels to door openings shall be cut neatly in one piece and fixed between frontal panels.
- Doors shall be 1800mm x 600mm x 18mm solid core, highly moisture resistant medium density fibreboard and shall be formaldehyde free. Doors shall be finished on all surfaces and edges with a durable polyurethane coating.
- Hardware of manufacturer's standard shall consist of two 'hold open' spring hinges, one slotted indicator, one turn bolt and staple and a coat hook and bumper. Hardware shall be chrome plated, or polished brass as specified.

2. Partition Panel Made of Tempered Glass

a. General

- This system opens up a whole new world of possibilities in cubicle partitions and wall panelling made of glass.
- Glass is also a most desirable material, hygienically, as it is easy to clean. Glass elements can be used almost without limits and colours baked into the glass become very scratch resistant.
- The large glass panels are connected by aluminium support posts and profiles.
- Such as supplied by PT Matrikstama Andalan Mitra, Kenari Djaja or acceptable equivalent.

b. System

System of cubicle shall be clean curved appearance of extruded anodised or powder coated aluminium elliptical front profiles and headrail as follows:

- 10mm tempered safety glass with screen printed or acid etched effect.
- The cubicles are suitable for wet or dry use.
- The extruded aluminium 100mm x 28mm elliptical headrail, mechanically joined to elliptical aluminium pilaster profiles with screwport connections to form a structural framework including end caps.
- Door frame with "Safe Edge" anti-finger trap detail.
- Partition panels supported on adjustable legs mechanically connected to pilaster components.
- Full length channels are used to attach partition and pilaster panels to walls.
- Partition panels secured into pilaster frame with high modular, anti-fungal silicone adhesive.
- 3 piece pilaster with alternate width option to enlarge door opening. 260mm or 235mm wide.

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c. Panel and Door

- 10mm toughened float or textured cast glass, ceramic paint finish, for WC, changing cubicles and or shower cubicles.
- Tempered/toughened and laminated float glass with ceramic paint to one internal face. This produces equal colour shade to both outer surfaces.
- Doors shall be 1800mm x 600mm.

d. Hardware and Fittings

Hardware of manufacturer's standard shall consist of two 'hold open' spring hinges, one slotted indicator, one turn bolt and staple and a coat hook and bumper. Hardware shall be chrome plated, or polished brass as specified.

10270 Raised Floor System

1. General

Material structure and construction features of the raised floor system shall improve acoustic values and shall be of first quality.

2. Panel

Panel shall be made of formed sheets of corrosion resistant steel plate filled with a special formulation of light weight concrete.

The panel shall be covered with selected material to meet mechanical and electrical demands, such as High Pressure Laminate (HPL).

Panels shall comply with the following requirements:

- Panel size 600 x 600 ± 0.2mm,
- Actual loading (concentrated load) 300kgf,
- Weight per panel (standard type) approx. 7kg,

such as ConCore 1000 by Tate, by Panasonic, or acceptable equivalent.

3. Pedestal

The pedestal shall be made of steel, and shall be adjustable in height, with finished height according to the Drawings.

4. Various Accessories

Electrical outlets, stairs, ramps, panel lifting devices, air and fire barriers, skirting, bulkheads, ventilation panels and other necessary accessories required shall be in accordance with the manufacturer's installation instruction.

10350 Flagpole

1. Flagpoles

All materials for flagpoles shall come from a proven product and/or manufacturer and shall have characteristics as follows:

- Poles made of stainless steel pipe SUS 304 having minimum thickness of 2mm complying with JIS G3459, with diameter and height according to the Drawings.

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- Provided with wheel at the top and hook at the lower part of the pole for attaching rope as shown in the Drawings.
- Highest part of pole shall be fitted with flush seam finial ball of size as indicated or, if not indicated, to match pole butt diameter.

2. Flagpole Mounting

- Provide base plate system for the type of flagpole installation as required, unless otherwise shown in the Drawings.
- For anchor bolt mounting, furnish cast metal shoe base of same material as flagpole.
- Base plate and anchor bolt shall be of material complying with the requirements of Division 5 - Specification 05500.

10400 Signs

1. Room Number, Name Plate, Toilet Sign and Floor Guidance

- Aluminium Alloy Products

Aluminium extrusions shall be according to ASTM B 221 M.
Provide aluminium extrusions at least 2mm thick.

- Aluminium Finishes

Exposed aluminium surfaces shall be factory finished with the following coatings:

- Anodic coating where exposed aluminium surfaces shall be cleaned and given an anodized finish.
- Organic coating where exposed aluminium surfaces shall be finished with anodic coating followed by a baked enamel finish. The finish colour shall be approved by the Engineer.

- Base for Aluminium Works

Base for aluminium sign works shall be made from timber complying with the requirements of Division 6 - Specification 06200 with type of finishes to be chosen to suit the application and as directed by the Engineer.

- Stainless Steel

Stainless steel sheet for sign works shall comply with AISI 304 with type of finishes to be chosen to suit the application and as directed by the Engineer.
All stainless steel material shall have plastic-coated to prevent scratching during production-process, installation and transportation.

- Anchors and Fasteners

Exposed anchors and fasteners materials shall be compatible with metal to which applied, with matching colour and finish. Provide materials compatible with sign materials. Protect against galvanic action or chemical interaction of adhesives.

2. Building Directories

Frame and trim shall be of extruded aluminium complying with ASTM B 221 M and finished with organic coating.

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3. Exterior Panel Signs

- Unless otherwise specified, panel signs and framing system shall consist of steel material complying with the requirements of Division 5 - Specification 05500, with type of shape and thickness to be chosen to suit the application and as directed by the Engineer. Framing shall use concealed fasteners.
- Unless otherwise specified panel framing system and panel signs made of steel material shall be paint finished to prevent corrosion. Panel sign shall be finished with enamelled paint that to be applied at the panel factory.

10500 Metal Lockers

1. General

Metal lockers shall be of double-tier type, made from galvanized cold-rolled mild steel, free from buckle, scale and surface imperfections, fabricated according the manufacturer's standard, such as from Bostinco or acceptable equivalent.

2. Fasteners

Fasteners shall be cadmium, zinc or nickel-plated, exposed bolt heads, slotless type, self-locking nuts or lock washers for nuts on moving parts.

3. Locker and Accessories

- Each locker shall be furnished with the following items, unless otherwise determined by the Engineer:
 - Coat hanger bar.
 - One double-prong hook and not fewer than 2 single-prong wall hooks.

All the above items shall be of cadmium-plated or zinc-plated steel.

- Provide each locker with manufacturer's standard etched, embossed, or stamped, nonferrous metal number plates with numerals not less than 50mm high. Number lockers in sequence as directed by the Engineer. Attach plates to each locker door, near top, centered, with at least 2 fasteners of same finish as number plate.
- Continuous metal base shall be according to the manufacturer's standard and shall be factory-finish metal base to match lockers, except otherwise specified.
- Trim and filler panels shall be in accordance with the manufacturer's standard and shall be factory-finished to match locker units.
- Unless otherwise specified, each locker shall be provided with projecting handle and latch of:
 - Positive automatic, prelocking, pry-resistant latch and pull with rubber silencer,
 - Chromium-plated, heavy duty, vandalproof lift-up handle, containing strike and eye for padlock,
 - Latching action not less than 2-point latching.
- All doors shall be provided with 2 tight pin hinges welded to frame and bolted to door.

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10600 Partition

1. General

All materials used for partition work shall come from proven manufacturers as specified herein and as approved by the Engineer.

2. Panel

Panel for partition made from calcium silicate board shall be of standard type with tapered edges in thickness as indicated in the Drawings.

Calcium silicate board shall be as specified in Division 7 - Specification 07456.

3. Frame

Metal frame for installation and supporting calcium silicate, such as studs, channels, backing plates and others shall be prefabricated products made of aluminium-zinc coated steel sheet such as Zinalume or Galvalum, in shape and size specially made for calcium silicate board installation, as specified in Division 7 - Specification 07456.

4. Sound Insulation

Sound insulation for filling partition core shall be as specified in Division 7 - Specification 07210 and as shown in the Drawings.

5. Paint

Paint for finishing of calcium silicate board surfaces shall be according to the requirements of Division 9 - Specification 09910.

10810 Washroom Accessories

1. Accessories

Unless otherwise specified, accessories shall be as follows or approved equal:

- Liquid soap dispenser of wall hung type : TS125R type by Toto
- Paper/tissue holder : TS116R type by Toto.
- Hand dryer of electric type : TYC322M type by Toto
- Urinal partition : A100 type by Toto.

All the above accessories shall be of colour as specified later.

2. Grab Bar Tubing

Grab bar tubing for handicap toilet shall be made from type 304 stainless steel in satin finish, such as from Tubular Specialties MFG., Inc. or approved equal. Flanges to complete the installation of grab bar shall also be made from type 304 stainless steel material.

Tubing outside diameter shall be 25mm, and length of grab bar shall be as indicated in the Drawings.

3. Mirror

Mirror shall be as specified in Division 8 - Specification 08800, in thickness and sizes as indicated in the Drawings.

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4. Plumbing Fixtures

Plumbing fixtures such as water closets, lavatory basin, urinal and others shall be as specified in Division 15 - Specification 15410.

**DIVISION 11
EQUIPMENT**

Project Specification

DIVISION 11 EQUIPMENT

11170 Solid Waste Handling Equipment

1. Recycling Station

- Recycling station shall be a covered waste bin, made of material which is light, clean, strong, and durable, practicable and free from corrode, such as high-density polyethylene (HDPE).
- Recycling station shall have two (2) compartments or consist of two (2) single bins, each marked 'organic waste' and 'inorganic waste'. Bins capacity shall accommodate waste collection from all recycling bins, as determined later. From Kribow or acceptable equivalent.

2. Recycling Bins

- Recycling bin shall be a covered waste bin, made of impact-resistant, ultra-violet stabilized plastic. Bins shall be in office-sized capacity, in shape to be determined later.
- Recycling bins shall be provided in a set of two (2) bins, each marked 'organic waste' and 'inorganic waste'. From Krisbow, Claris or acceptable equivalent.

11390 Sewage Treatment Plant

1. Sewage Treatment Plant

Sewage treatment plant for capacity as indicated in the Drawings shall meet the minimum requirements as follows:

- Cylinder tank (body and cover) made of fiberglass reinforced plastic (FRP) in size according to standard of the manufacturer and as shown in the Drawings,
- Biomedia made from *nylon multifilaments* and *monofilaments*, PE, PP,
- Pipe hole for exhaust/vent,
- Manhole cover made of fiberglass reinforced plastic (FRP),
- Pipes for inflow and outflow,
- Air blower,

such as BCR and or BCX Series type by PT Alam Hijau Semesta or approved equal.

2. Pipes and Fittings

Unless otherwise specified, pipes and fittings made of uPVC with solvent cement joint type shall comply with the requirements as specified in Division 2 - Specification 02500.

3. Base

Base for the unit shall be made of cast-in-place concrete in dimension and grade as indicated in the Drawings. Cast-in-place concrete shall be as specified in Division 3 - Specification 03300.

4. Wire Rope

Wire rope to tie down the sewage treatment unit at its base shall be made of hot dip galvanized steel wire in size as recommended by the unit manufacturer.

Grade of steel wire shall comply with the requirements of Division 5 - Specification 05500.

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5. Anchors

Anchors shall comply with the requirement of Division 5 - Specification 05500 and in diameter and length as recommended by the sewage treatment unit manufacturer.

6. Electrical Power and Control

Electrical power and control needed in this work shall be in accordance with the requirements of Division 16 - Specification 16400.

DIVISION 12
FURNISHINGS

Project Specification

DIVISION 12 FURNISHINGS

12500 Furniture

No.	DESCRIPTION	DIMENSION	UNITS	PICTURE	INFORMATION
I.	1 st FLOOR				
A.	CHILDREN LIBRARY				
	A.1 Book storage 2 stack				
	-Basematerial: Particleboard, Paper, Ash veneer, Clear acrylic lacquer -Back : Fibreboard, Foil	Width: 240 cm Depth: 28 cm Height: 106 cm Max. load/shelf	40		EX. IKEA ,informa or equal
	A.2 Round Table				
	-Made of plastic which makes it easy to carry and move for children. - Also perfect for outdoor use since it is made to withstand rain, sun, snow and dirt.	Diameter: 85 cm Height: 48 cm	6		EX. IKEA ,informa or equal
	A.3 library Big Table				
	asematerial: Solid poplar, Acrylic paint Table top: Fibreboard, Acrylic paint	Length: 59 cm Width: 50 cm Height: 50 cm	1		EX. IKEA ,informa or equal
	A.4 Children Chair				
	- Polypropylene plastic - Made of plastic which makes it easy to carry and move for children. - Also perfect for outdoor use since it is made to withstand rain, sun, snow and dirt.		38		EX. IKEA ,informa or equal
	A.5 Table & chair set Belmont				
	-Made of metal and has plastic polypropylene finish - Also perfect for outdoor use since it is made to withstand rain, sun, snow and dirt. - 10 year guarantee		4		EX. IKEA ,informa or equal
	A.6 Three sheet sofa				
	Three-seat sofa frame: - Frame: Solid wood, Solid hardwood, Plywood, Particleboard, Fibreboard, Steel - Seat cushion: Polyester wadding, - Non-woven polypropylene, Highly resilient polyurethane foam (cold foam) 40 kg/cu.m. Back cushion: Non-woven polypropylene, Polyester fibres, Polyurethane foam 20 kg/cu.m. Leg: Solid birch, Clear acrylic lacquer - Cover three-seat sofa: Total composition: 100% polyester Lining: Non-woven polypropylene - 10 year guarantee	Width: 205 cm Depth: 93 cm Seat depth: 56 cm Seat height: 45 cm Height: 80 cm	2		EX. IKEA ,informa or equal
	A.7 Work Chair				
	Finishing : Fabric Material : Fabric , Nylon	length : 56 cm width : 32 cm height : 55 cm	3		EX. IKEA ,informa or equal

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B	A.8 Front Desk	Material : particle board MFC Finishing : Melamine	length : 240 cm width : 65 cm height : 105 cm	2		EX. IKEA ,informa or equal	
	A.9 Side Table	material : solid wood and 8mm tempered glass Finishing : PVC	length : 83.5 cm width : 42.5 cm height : 45 cm	1		EX. IKEA ,informa or equal	
	A.10 Credenza Cabinet	Material : Particle board MFC Finishing : Melamine Surface 10 year guarantee	length : 160 cm width : 40 cm height : 80 cm	2		EX. IKEA ,informa or equal	
	TEENAGE LIBRARY						
	B.1 Book Storage 3 stack	-Basematerial: Particleboard, Paper, Ash veneer, Clear acrylic lacquer -Back : Fibreboard, Foil	width : 160 cm depth : 28 cm height : 202 cm	84		EX. IKEA ,informa or equal	
	B.2 Staff Table	Material : Particle board and metal Finishing : Melamine Surface 10 year guarantee	length : 160 cm width : 65 cm height : 75 cm	10		EX. IKEA ,informa or equal	
	B.3 Work Chair	Finishing : Fabric Material : Fabric , Nylon	length : 56 cm width : 32 cm height : 55 cm	12		EX. IKEA ,informa or equal	
	B.4 Round Meeting Table	Material : Particle board and metal Finishing : Melamine Surface 10 year guarantee	dia : 90 cm high	6		EX. IKEA ,informa or equal	
	B.5 Chair	Material : Fabric and metal Finishing : Fabric 10 year guarantee	based on Manufacture	24		EX. IKEA ,informa or equal	

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<p>B.6 Sofa L 6 seat - Frame: Solid wood, Solid hardwood, Plywood, Particleboard, Fibreboard, Steel - Seat cushion: Polyester wadding, Non-woven polypropylene, Highly resilient polyurethane foam (cold foam) 40 kg/cu.m. Back cushion: Non-woven polypropylene, Polyester fibres, Polyurethane foam 20 kg/cu.m. Leg: Solid birch, Clear acrylic lacquer - Cover three-seat sofa: Total composition: 100% polyester Lining: Non-woven polypropylene - 10 year guarantee</p>	<p>based on Manufacture</p>	<p>1</p>		<p>EX. IKEA ,informa or equal</p>
<p>B.7 Sofa Three-seat sofa frame: - Frame: Solid wood, Solid hardwood, Plywood, Particleboard, Fibreboard, Steel - Seat cushion: Polyester wadding, Non-woven polypropylene, Highly resilient polyurethane foam (cold foam) 40 kg/cu.m. Back cushion: Non-woven polypropylene, Polyester fibres, Polyurethane foam 20 kg/cu.m. Leg: Solid birch, Clear acrylic lacquer - Cover three-seat sofa: Total composition: 100% polyester Lining: Non-woven polypropylene - 10 year guarantee</p>	<p>based on Manufacture</p>	<p>2</p>		<p>EX. IKEA ,informa or equal</p>
<p>B.8 Front Desk Material : particle board MFC Finishing : Melamine</p>	<p>length : 240 cm width : 65 cm height : 105 cm</p>	<p>1</p>		<p>EX. IKEA ,informa or equal</p>
<p>B.9 Coffee Table Material : MDF Finishing : High gloss Surface</p>	<p>based on Manufacture</p>	<p>1</p>		<p>EX. IKEA ,informa or equal</p>
<p>B.10 Credenza Material : Particle board MFC Finishing : Melamine Surface 10 year guarantee</p>	<p>length : 160 cm width : 40 cm height : 80 cm</p>	<p>1</p>		<p>EX. IKEA ,informa or equal</p>
C AUDITORIUM				
<p>C.1 Banguet chair Material : Metal , foam Finishing : Fabric</p>	<p>length : 138 cm width : 86 cm height : 48 cm</p>	<p>324</p>		<p>EX. IKEA ,informa or equal</p>

Project Specification

NEWSPAPER AND MAGAZINE COLLECTION					
D	D.1 Book Storage stack 2	Width: 240 cm Depth: 28 cm Height: 106 cm Max. load/shelf: 30	64		EX. IKEA ,informa or equal
	Basematerial: Particleboard, Paper, Ash veneer, Stain, Clear acrylic lacquer Back: Fibreboard, Foil				
	D.2 Round Table	dia : 90 cm	5		EX. IKEA ,informa or equal
D.3 Chair	material : metal , fabric Finishing : Fabric	based on Manufacture	20		EX. IKEA ,informa or equal
E	Lounge & Internet Area				
	E.1 Work Station	based on Manufacture	3		EX. IKEA ,informa or equal
	- For 4 person -Material : Glass Melamine Face Chipboard - Finishing : Laminate, melamine				
	E.2 Work Chair	length : 56 cm width : 32 cm height : 55 cm	12		EX. IKEA ,informa or equal
E.3 Sofa L (7 Seat)	based on Manufacture	3		EX. IKEA ,informa or equal	
	- Frame: Solid wood, Solid hardwood, Plywood, Particleboard, Fibreboard, Steel - Seat cushion: Polyester wadding, - Non-woven polypropylene, Highly resilient polyurethane foam (cold foam) 40 kg/cu.m. Back cushion: Non-woven polypropylene, Polyester fibres, Polyurethane foam 20 kg/cu.m. Leg: Solid birch, Clear acrylic lacquer - Cover three-seat sofa: Total composition: 100% polyester Lining: Non-woven polypropylene - 10 year guarantee				

Project Specification

<p>E.4 Sofa U (6 Seat)</p> <ul style="list-style-type: none"> - Frame: Solid wood, Solid hardwood, Plywood, Particleboard, Fibreboard, Steel - Seat cushion: Polyester wadding, - Non-woven polypropylene, Highly resilient polyurethane foam (cold foam) 40 kg/cu.m. Back cushion: Non-woven polypropylene, Polyester fibres, Polyurethane foam 20 kg/cu.m. Leg: Solid birch, Clear acrylic lacquer - Cover three-seat sofa: Total composition: 100% polyester Lining: Non-woven polypropylene - 10 year guarantee 	<p>based on Manufacture</p>	<p>3</p>		<p>EX. IKEA ,informa or equal</p>
<p>E.5 Long Sofa (5 Seat)</p> <ul style="list-style-type: none"> - Frame: Solid wood, Solid hardwood, Plywood, Particleboard, Fibreboard, Steel - Seat cushion: Polyester wadding, - Non-woven polypropylene, Highly resilient polyurethane foam (cold foam) 40 kg/cu.m. Back cushion: Non-woven polypropylene, Polyester fibres, Polyurethane foam 20 kg/cu.m. Leg: Solid birch, Clear acrylic lacquer - Cover three-seat sofa: Total composition: 100% polyester Lining: Non-woven polypropylene - 10 year guarantee 	<p>based on Manufacture</p>	<p>1</p>		<p>EX. IKEA ,informa or equal</p>
<p>E.6 Coffee Table</p> <p>Material : MDF Finishing : High gloss Surface</p>	<p>based on Manufacture</p>	<p>6</p>		<p>EX. IKEA ,informa or equal</p>
D LOBBY				
<p>D.1 Round Table dia. 60cm</p> <p>materil : ABS Wood Finishing : ABS</p>	<p>dia. 60 cm</p>	<p>6</p>		<p>EX. IKEA ,informa or equal</p>
<p>D.2 Chair</p> <p>materil : ABS Wood Finishing : ABS</p>	<p>based on Manufacture</p>	<p>16</p>		<p>EX. IKEA ,informa or equal</p>

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		LOUNGE AND WAITING AREA				
E	A.5 Chair					EX. IKEA ,informa or equal
	E.1 Long Sofa	Material : metal, fabric - Frame: Solid wood, Solid hardwood, Plywood, Particleboard, Fibreboard, Steel - Seat cushion: Polyester wadding, - Non-woven polypropylene, Highly resilient	based on Manufacture manufacture	32 3		
E	A.6 Round Meeting Table	Material : Particle board and metal Finishing : Melamine Surface Leg: Solid birch, Clear acrylic lacquer 10 year guarantee - Cover three-seat sofa: Total composition: 100% polyester	dia : 90 cm	4		EX. IKEA ,informa or equal EX. IKEA ,informa or equal
	E.2 Coffee Table	Material : MDF Finishing : High gloss Surface	Length : 120 Width : 70 Height : 35	6		
		Lining: Non-woven polypropylene - 10 year guarantee				
2nd FLOOR						
ADULT LIBRARY						
2 A	A.1 Book Storage 4 stack	Bookcase: Basematerial: Particleboard, Paper, Ash veneer, S Back: Fibreboard, Foil Height extension unit: Particleboard, Ash veneer, Paper, Ash veneer, Stain, Clear acrylic lacquer	Width: 120 cm Depth: 28 cm Height: 237 cm	56		EX. IKEA ,informa or equal
	A.2 Staff Table	Material : Particle board and metal Finishing : Melamine Surface 10 year guarantee	length : 160 cm width : 65 cm height : 75 cm	74		
	A.3 Work Chair	Finishing : Fabric Material : Fabric , Nylon	length : 56 cm width : 32 cm height : 55 cm	74		EX. IKEA ,informa or equal
	A.4 Rectangular Meeting Table	Material : MDF , Metal Finishing : Melamine Surface	Length : 200 Width : 200 Height : 75	4		

DIVISION 13
SPECIAL CONSTRUCTION

Project Specification

DIVISION 13 SPECIAL CONSTRUCTION

13100 Lightning Protection and Grounding System

1. System

- The lightning protection system shall be of the enhancing type designed to minimise corona emissions and optimise streamer inception when optimum predetermined conditions are met.
- The complete system shall include components, such as air terminal, mechanical support, down conductor and earthing system to the following Specification.
- The design of the components shall be traceable to long-term practical field studies, laboratory testing, fundamental scientific principles, and statistical levels of the lightning event as documented in international standard.
- The lightning protection shall be designed by a company engaged in the manufacture and development of lightning system components, of types, sizes and ratings as shown, who can show evidence or support that their products have been in satisfactory service for not less than 10years.

2. Air Terminal

The air terminal shall have characteristics as follows:

- Weight according to the standard of the manufacturer,
- Made of highly dielectric material that as soon as lightning strikes its tip, it enters into a sealed whole down to earth,
- Radioactive free and require no special licensing,
- Free from radio element, battery, capacitor, diode or electric resistance,
- Capable to receive lightning strike up to 150kA,
- Provide larger radial effect that depends on the height of the installation and lightning intensity,

such as LPI Guardian Terminal from Lightning Protection International Pty Ltd (LPI), EF from Switzerland, Erico or AT3W or acceptable equivalent, with level of protection according to the requirements as shown in the Drawings.

3. Air Terminal Support

- The support structure shall consist of a minimum of 200cm of insulating reinforced fibreglass cylindrical mast. The conductor shall pass through the centre of the mast.
- The support structure shall be securely bolted to other mast materials with guy wires used where necessary to enable the air terminal and mast system to withstand maximum locally recorded wind velocities. The support arrangement shall have sufficient rigidity to ensure that the maximum deflection of the termination under such extreme wind conditions shall not exceed 100mm.

4. Down Conductor

- Down conductors shall consist of two (2) conductors which are insulated from one another and from the structure, consisting of high voltage shielded cable of 70mm².
- The arrangement of the conductors shall be such that one is coaxially placed around the other.
- Each conductor shall have a minimum cross sectional area of electrical grade copper of size as shown in the Drawings.

5. Grounding and Bonding

- The grounding rod of minimum diameter 20mm with length as shown in the Drawing shall be made of galvanized steel pipe medium class of BS-1387 standard and shall be furnished with copper or corrosion resistant 2.5mm thick copper-clad steel grounding electrode.

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- The grounding system shall have a hand hole (test point) for measuring purposes as indicated in the Drawings.
 - Perimeter grounding around the building shall be constructed as indicated in the Drawings.
 - Hand hole shall be constructed of masonry with a concrete plate cover in sizes as indicated by the Drawings.
- At the bottom of the hole shall be placed a sand layer of minimum thickness 150mm or as specified in the Drawings.

13700 Security and Surveillance System

1. Access Control System

a. General

Access control credential readers and cards shall be as manufactured by HID Corporation, Jantek or acceptable equivalent.

b. Proximity Card Readers with Keypad – Wall, Single-Gang Box (ProxPro w/Keypad)

- Provide surface mounting style 125 KHz proximity card readers suitable for wall, post, or window mullion mounting behind glass using an optional mounting bracket, and for mounting configurations as shown in the Drawings.
- The reader shall be capable of reading access control data in standard Wiegand formats up to 84 bits in length from any Proximity card or equivalent, outputting the data in one of the following configurations:
 - The card reader shall output credential data in compliance with the SIA AC-01 Wiegand standard, compatible with all standard access control systems.
 - The card reader shall output credential data using a Clock and Data interface, and be compatible with systems requiring a magnetic stripe reader.
- The card reader shall be available in an optional serial output configuration, which shall output credential data in a Serial protocol interface, transmitting that data in Hex format, compatible with a host device using an RS-232 or RS422 serial port
- The reader shall include an integrated, weather-resistant, 12-position silicone rubber keypad which adds an additional level of security by allowing the use of a personal identification number.
- The keypad shall interface with the host controller either by sending keypad data on the reader's data output lines, or by direct connection to the host controller keypad interface using either a 2 of 7 or 3 x 4 matrix.
- The reader shall be capable of outputting a periodic reader supervision message at a configurable time interval (via the Wiegand or Clock and Data interface) enabling the host system to signal an alarm condition based on the absence of this message.
- The Proximity card reader shall provide the ability to change operational features in the field through the use of a factory-programmed command card, or an 8-position DIP Switch. Operational programming options shall include:
 - Reader beeps and flashes green on a card read, LED normally red, single line control of LED.
 - Reader flashes green on a card read, LED normally red, single line control of LED.
 - Reader beeps on a card read, LED normally red, single line control of LED.
 - Beeper and LED are controlled by host only, LED normally red, single line control of LED.
 - Reader beeps and flashes green on a card read, LED normally off, red and green LED's controlled individually.

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- Reader flashes green on a card read, LED normally off, red and green LED's controlled individually.
 - Reader beeps on a card read, LED normally off, red and green LED's controlled individually.
 - Beeper and LED are controlled by host only, LED normally off, red and green LED controlled individually
 - Change from Wiegand to Mag Stripe output format (excludes Serial output model).
 - Change from Mag Stripe to Wiegand output format (excludes Serial output model).
 - Reset to Factory Defaults
- Proximity card readers shall provide the following programmable audio/visual indication:
- A piezoelectric sounder shall provide an audible tone upon successful power up/self test, good card read, or whenever the beeper control line is asserted by the host.
 - A bi-color, red/green LED shall light upon successful power up/self test, good card read, or whenever the LED control line(s) are asserted by the host.
 - The reader shall have individual control lines for the sounder, and for red and green LED indication. When the LED control lines are asserted simultaneously, an amber LED indication will occur.
- The reader shall have a configurable hold input, which when asserted shall either buffer a single card read or disable the reader, until the line is released. This input may be used for special applications or with loop detectors.
- The reader shall contain an integral tamper switch to provide tamper protection when connected to an external alarm system.
- The reader shall require that a card, once read, must be removed from the RF field for one second before it will be read again, to prevent multiple reads from a single card presentation and anti-passback errors.
- The reader shall contain a 2 position field-configurable jumper, used to optimize read range for mounting near metal objects.
- Typical proximity card read range shall be:
- 8" (20 cm) using HID Proxcard II card.
 - 7" (17.5 cm) using HID ISOProx or DuoProx cards
 - 3" (7.5 cm) using HID ProxKey II key fob
 - 4" (10 cm) using HID Microprox Tag
 - 7 (17.5 cm) using HID iCLASS Prox
 - 3" (7.5 cm) using HID Prox/Wiegand Card
- Proximity card readers shall meet the following physical specifications:
- Dimensions: 5 x 5 x 1" (12.7 x 12.7 x 2.54 cm)
 - Weight: 12.oz (336 g)
 - Material: UL94 Polycarbonate
 - Three-part design with separate reader body, cover, and bezel
 - Color: Beige or Gray as approved by the project architect.
- Proximity card readers shall meet the following electrical specifications:
- Operating voltage: 10 – 28.5 VDC, reverse voltage protected. Linear power supply recommended.
 - Current requirements: (average/peak) 100/120mA @ 12 VDC

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- Proximity card readers shall meet the following certifications:
 - . UL 294
 - . EU and CB Scheme Electrical Safety
 - . CE Mark (Europe)
 - . C-Tick (Australia)
- Proximity card readers shall meet the following environmental specifications:
 - . Operating temperature: -22 to 150 degrees F (-30 to 65 degrees C)
 - . Operating humidity: 0% to 95% relative humidity non-condensing
 - . Weatherized design suitable to withstand harsh environments The reader shall be of polycarbonate material, and sealed with an O-Ring gasket and waterproof cable fitting to a NEMA rating of 3S (IP54).
- Proximity card reader cabling requirements shall be:
 - . Cable distance: (Wiegand/Keypad): 500 feet (150m); RS-232 or Clock & Data: 50 feet (15m); RS-422: 4000 feet (1219 m).
 - . Cable type: 5-conductor #22 AWG w/overall shield. Additional conductors will be required for 2-line LED control, beeper, hold, card present functions, or direct connection to host keypad inputs.
 - . Standard reader termination: miniature screw terminal block
- Warranty of Proximity card readers shall be lifetime against defects in materials and workmanship.

2. Door Security System

a. Exit Push Button

- Exit push button shall a button to exit. It shall hold the button when pressed repeatedly.
- Exit push button shall has a plate made of stainless steel

b. Magnetic Door Contact

Magnetic door contact shall meet the following requirements:

- Completely concealed for attractive installation
- Press fit design is quick and easy, no extra steps
- Packaged complete with wire crimps in easy to handle re-closeable clear plastic box.
- Convenient 5-foot (1.5m) zip cord leads are standard and save time and money.
- Standard gap $\frac{1}{2}$ " (13mm) end to end $\frac{3}{4}$ " (19 mm) parallel.

c. Electronic Dropbolt

Electronic dropbolt shall meet the following requirements:

- Suitable for framed or frameless glass styles.
- Slimline styling suits most narrow profile joinery
- Concealed mortise mounting
- Continuously rated solenoids
- Power reduction module-minimizes power consumption and maximizes durability.
- Door position switch.
- Bolt position switch.
- Power supply : 12 VDC or 24 VDC

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- Power to lock or power to open
- Automatic deadbolt action
- Reverse polarity protected
- Fully protected against transients
- Stainless steel bolt and linkage
- Satin finish stainless steel to CE and strike plates.

d. Electromagnetic Lock

Electromagnetic lock shall meet the following requirements:

- Suitable for internal doors. Aluminum and Stainless Steel Door.
- Standard Magnetic Lock up to 500 Kg Holding Force
- Monitored single magnet
- Power Supply : 12 V or 24 V DC (Nominal 480 mA @ 12 V DC)
- Medium duty

e. Electric Door Strike

Electric door strike shall meet the following requirements:

- Suitable for internal doors. Wood door type
- Standard surface or flush fitting
- Fail Secure provides a degree of physical security when the lock has the power removed. This could be either in its normal operation or in a total power failure.
- Power Supply 12 V DC (340 mA)
- Maximum operational gap (door to frame) 3 mm.
- Jaw strength up to 900 Kg.

3. IP Camera

a. General

All IP cameras, equipment and accessories shall be from the best quality and in the best condition, and shall comply with the related standard, with requirements and characteristics as shown in the Drawings and as specified herein, such as from Panasonic, Bosch or Pelco.

b. Outdoor Day/Night Cameras

Outdoor IP fixed cameras with IR built-in lens shall meet the following requirements:

- Maximum 2 Megapixel resolution
- 16:9 Full HD (1080p) resolution support
- Built-in fixed lens 3.6mm
- H.264 & MJPEG dual codec
- Bi-directional audio
- Built-in SD memory slot
- Intelligent Video Analytics
- IP66, IK 10, Bi-directional audio support.

Project Specification

c. Indoor Cameras

Indoor IP dome, fixed and motorized zoom camera with IR built-in lens shall meet the following minimum requirements:

- Maximum 3 Megapixel resolution
- Multiple Streaming
- Built-in variable focal lens 2.8mm - 12mm
- H.264 & MJPEG dual codec
- Tampering Alarm, Motion Detection
- Privacy Masking, Smart codec (ROI encoding)
- Day & Night (Software)
- Tampering,
- PoE.

d. Network Video Recorder

Network video recorder shall meet the following minimum requirements:

- Input voltage 100 ~ 240V AC $\pm 10\%$, 50Hz,
- Full HD resolution support
- H.264, MPEG-4, MJPEG multiple codec
- 64Mbps recording bit rate
- Local monitor output : HDMI & VGA
- Built-in 1TB HDD
- DVD writer support

e. LCD Monitor

- Screen size : 32"
- Type : LCD TFT, flat
- LCD panel type : 1280 x 1024pixels
- Pixel pitch : 0.280 x 0.280mm
- Resolution : 1280 x 1024 at 50Hz
- Display colour : 16M
- Colour enclosure : black or silver

f. Port KVM Switch

Keyboard and mouse and switch for DVR:

- KVM switch : keyboard, mouse and monitor switch
- Port : 8 port for 8 keyboards and mouse inputs
- Switching system : manual.

4. Cable

- Cable shall be RG 59 with power cable for CCTV 18 AWG BC 95% as shown in the Drawings, such as from Belden or approved equal.
- Cable for outdoor installation shall be fiber optic cables shall be of singlemode 4 core of size as shown in the Drawings, such as from Belden, Pirelli or approved equal.

5. Conduit and Terminal Box

Conduit and terminal box for cables shall be as specified in Division 16 - Specification 16400.
Conduit and terminal box sizes shall be as shown in the Drawings.

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13850 Fire Alarm System

1. General

- Enclosure panel furnished herein shall have a capacity to accommodate control panel modules, input-output modules, power supply modules and other necessary equipment to provide a fire alarm system of the building, with zones as specified by the Drawings.
- The fire alarm control panel shall consist of modular components as much as practical.

2. Fire Alarm Control Panel

Fire alarm control panel for fire alarm system shall be of semi addressable detection type complete with display, battery, battery back-up, capacity of zones as indicated in the Drawings, and of wall mounted type, such as by Siemens, Simplex, Firelite or acceptable equivalent.

3. Annunciator

Annunciator shall have features as follows:

- Select remote control and/or LED annunciation as required,
- Multi-application red LED annunciator,
- Input voltage 18-32VDC,
- LED current 10mA 24VDC,
- Operating temperature range 0°C to 49°C,
- Humidity range up to 95% RH, non-condensing, at 35°C.

4. Heat Detectors

- Heat detector of combination of the rate-of-rise and fixed temperature heat detector type shall be designed to sense the rapid or abnormal rise in temperature of air and upper limit of temperature rise. UL Listed and FM Approved.
- Heat detector of rate-of-rise type and shall have the following characteristics:
 - Universal base for interchangeability.
 - Indication lamp to activate the detector.
 - Sensing chamber is electrically insulated.
 - Self-resetting and requires no replacement of internal elements.
 - UL Listed and FM Approved
- Fixed temperature type with the following characteristics:
 - Reacts quickly when the ambient temperature reaches the nominal operating level.
 - Waterproof type and alkaline-resistant type for special locations.
 - Two different types of heat sensitivity.
 - Requires no replacement.
 - Alarm indicating LED,
 - Voltage range 15 to 32VDC,
 - Standby current 80µA nominal,
 - Humidity range 10% to 95%,
 - UL Listed and FM Approved

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5. Smoke Detectors

Smoke detectors shall be of photoelectric type and shall have the following characteristics:

- UL Listed and FM Approved.
- Indicator lamp/light will lit when the detector is activated.
- Outer cover and detection chambers are removable for easy maintenance and cleaning.
- No affection by wind or variation of atmospheric pressure.

6. Manual Fire Alarm Boxes

Manual fire alarm boxes shall be dual-action station type and shall meet the following requirements:

- UL Listed and FM Approved.
- Addressable.
- Durable design
- Shock-and-vibration resistant
- Pull-down lever is down, until manually reset (reset with Allen Key, No break rods necessary)
- Custom microcomputer-chip technology
- Dynamic supervision to the fire-alarm control panel (FACP).
- Two-wire operation.
- Surface or semi-flush installation.

7. Alarm Bells

Alarm bells shall be ironclad, corrosion proof for 24V DC/4A operation, and 150mm round gong pattern suitable for 20mm conduit entry. Red gongs shall be provided. 200/230mm diameter weatherproof type alarm bells shall be mounted on external walls.
Sound level shall be 85dB at 300cm.

8. Cable

- Fire alarm system shall use cable of STP 18 AWG or NYA type complying with SPLN 42 - 1: 1991 for indoor, and NYY type complying with SPLN 42 – 2: 1991 for outdoor use, each in size as shown in the Drawings, from Voksel, Supreme, Kabelindo, Kabelmetal or Extrana.
- Cable of fire resistant type shall have the following characteristics:
 - Conductor made of plain annealed, circular stranded copper,
 - Fire barrier made of mica tape,
 - Insulation made of polyethylene (PE),
 - Sheath made of LSF compound,
 - Earth conductor of bare stranded copper wire, if required,
 - Low smoke emission,
 - Rated voltage of 300/500V,
 - Maximum conductor operation temperature 70°C,
 - Fire resistant for at least 3 hours at 950°C according to IEC 60331, BS 6387 (category C, W, Z),
 - Flame retardant according to IEC 332 Parts 1 & 3,

such as Wilson Cable, Universal Cable or acceptable equivalent in size as indicated in the Drawings.

9. Pipes/Conduits

Pipes/conduits shall be high impact PVC type such as Ega/MK or Clipsal and shall comply with BS 6099, with minimum diameter suitable with the size of cables, and shall be in accordance with the requirements of Division 16 - Specification 16400.

Project Specification

13900 Fire Fighting System

1. General

All materials and equipment furnished shall be brand new and of acceptable quality.

2. Pipes and Fittings

- Pipes for fire water shall be ERW carbon steel pipes of schedule 40 conforming to ASTM A 53 type E grade B.
- All pipes and fittings such as elbow, tee, reducer, tee-reducer and others with diameter up to 65mm shall be threaded carbon steel while fittings larger than 65mm shall be furnished with flanges as specified in this Specification.
- Fittings of electric butt-welding shall be fabricated conforming to AWWA C 208.
- Fittings shall be of the same class with the related pipes and shall be new and of acceptable quality.

3. Piping Appurtenances

a. Flanges

Flanges shall be ANSI B 16.5 class 150 raised face and shall comply with ASTM A-105. Flange of slip-on type shall have diameter as specified by equipment that shall be connected.

b. Packing/Gasket/Sealing Ring

- Unless otherwise specified, packing/gasket/sealing ring for fire water and fuel piping shall be of ANSI 150 class, made of spiral wound rubber of minimum 3mm thickness.
- Sizes of packing/gasket/sealing ring shall be as specified by the required flanges.
The necessary amount plus 10% additional of packing shall be supplied.

c. Bolt and Nuts for Flange

Bolts and nuts which shall be completed with washers and are made of black steel of ISO 8.8. with metric thread, shall be used for connection of flanges.

Diameter and length shall be as required by the specified flanges.

Minimum 3 threads shall be left over after connection.

The necessary amount plus 10% additional of bolts and nuts shall be supplied.

d. Valves

- All valves with working pressure, type and diameter as indicated in the Drawings shall be new, unused product of reputable and experienced manufacturers, and all valves of the same type as far as possible shall be of one manufacturer.
All valves for fire fighting shall be UL Listed and FM approved.
- All valves shall be made of cast iron material complying with ASTM A 126 Class B, disc seat ring, cover gasket and O-ring complying with ASTM D 2000 AA 7008. All valves shall have name's manufacturer, working pressure, diameter and direction of flow on the body.
- All valves shall be complete and ready for operation with all components and accessories in accordance with the applicable standards and codes, and shall be capable of long, reliable, trouble free service and shall require minimum maintenance.
- Valves of diameter up to 65mm shall have tapered threads for screwed joint.
- Valves of diameter larger than 65mm shall be manual operated type, and shall be furnished with flanges conforming to ANSI B 16.1 CL 125, forged integrally with valves' body.
- SCI product manufactured by Siam Cast Iron Works Co. Ltd. Or acceptable equivalent.

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e. Alarm Control Valve/Alarm Check Valve

Alarm control valve shall have same dimension as riser pipe, and shall be of horizontal or vertical type. It shall conform to the requirements of NFPA 20, and shall be of UL and FM approved.

This unit shall be completed with the following:

- Alarm gong and Y-strainer.
- Alarm stop cock.
- Drain valve.
- Drip valve.
- Pressure switch.
- Pressure gauge.
- Main stop valve complete with key and chain.
- Flow switch.
- Other accessories needed for operation.

4. Sprinkler Head

Sprinkler head shall be of standard type and shall have the following characteristics:

- Minimum diameter of 15mm sprinkler head hole (orifice).
- Made of anti corrosion material.
- Minimum spray radius of 4meter at 1kg/cm² water pressure, at 3meter height from floor.
- Pendent type complete with base plate for ceiling mounted, quick response with K factor 5.6, 68°C as shown in the Drawings.
- UL Listed and FM Approved.

Manufactured by Viking or acceptable equivalent.

5. Fire Pumps

a. Electric Fire Pump

- Electric fire pump shall be as specified in the Drawings complete with electric motor driven, fittings, valves and accessories, and shall conform to the requirements of NFPA 20, and shall be of UL and FM approved such Patterson, Aurora, Armstrong.
- Electric fire pump shall be provided with the following accessories:
 - Sluice valve, checked valve, anti-shock type checked valve, foot valve (with lever and chain).
 - Pressure gauge.
 - Strainer.
 - Automatic air and vacuum release valve.
 - Flow meter.
 - Main relief valve with close cone.
 - Discharge tee with relief valve elbow.
 - Flexible pipe.
 - Companion flange.
 - Coupling.
 - And other required accessories.

b. Diesel Fire Pump

- Diesel fire pump shall be of type and capacity as shown in the Drawings.
Diesel fire pump shall comply with NFPA 20 requirements, and shall be of UL and FM approved, such Patterson, Aurora, Armstrong.

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- Diesel fire pump shall be provided with the following accessories:
 - Sluice valve.
 - Check valve.
 - Anti-shock type check valve.
 - Pressure gauge.
 - Companion flange.
 - Coupling (with cover).
 - Common bed.
 - Foundation bolts and tools.
 - Discharge short pipe.
 - Compound gauge.
 - And other required accessories.
- Diesel engine for driving fire water pump shall operate at rated speed not exceeding 1,500rpm and shall develop sufficient horsepower to drive the pump with reserved power as required in NFPA 20.
- The automatic fire pump controllers shall conform to the requirements of NFPA 20 and shall be specifically for fire pump service. The controls shall be enclosed in a base-mounted enclosure. Battery charging shall be automatic and shall conform to NFPA 20.
- All internal and field wiring shall be clearly labeled with sleeve-type markers and so identified in the Drawings.

c. Jockey Pump

- Jockey pump complete with all necessary accessories shall be of type and capacity as shown in the Drawings, conforming to the requirements of NFPA 20, and shall be of UL and FM approved, such as Patterson, Aurora, Armstrong.
- Pump controller shall be of the design specifically for use with the electric motor driven jockey pump and shall be incorporated with necessary equipment and circuitry to perform the required function including a run period timer. All internal and field wiring shall be clearly labeled with sleeve-type markers and so identified in the Drawings.
- Electric motors for jockey pump shall be horizontal shaft induction motors for operation at 220/380V, 50 Hz service, and shall have revolution and power consumption according to the standard of the manufacturer.

6. Clean Agent Fire Extinguishing System

a. Clean Agent System

Clean agent system shall consist of the following equipment:

- UL Listed and FM Approved,
- Agent cylinder with bracket/strap,
- Outlet adaptor valve,
- Discharge nozzle 360° type,
- Electric control head,
- Lever operated control head,
- Cylinder supervisory pressure switch
- Discharge pressure switch.
- Manifold non-return valve,

such as Inergen by Fire Eater, Kidde, Tyco or acceptable equivalent.

Project Specification

b. Releasing Control Panel

Releasing control panel shall consist of the following:

- Single loop control panel,
- Batteries,
- Input/Output module,
- Sounder control module,
- Optical smoke detector complete with base,
- Ionization smoke detector,
- Extinguishing manual release station with abort and hold switch,
- Combined sounder and beacon,
- Alarm horn,
- Evacuate area sign,
- Gas discharge sign.

c. Pipe and Fittings

- Pipes for clean agent shall be seamless carbon steel pipes of schedule 40 conforming to ASTM A 106 (ASTM A53 type S) grade B.
- Fittings shall be 300psi class.

d. Others

Other necessary accessories shall be according to the standard of the manufacturer.

7. Fire Fighting Equipment

a. Fire Hydrant Box

Fire hydrant box for indoor shall be completed with the following items:

- Box which is made of steel plate 2mm thick, size 100cm x 80cm x 11cm. Box shall be oven-painted in red colour (RAL 3001).
- Fire hose complete with coupling of machino type of 40mm in diameter and in length as specified in the Drawings.
- Hose nozzle of 40mm diameter with jet straight nozzle type.
- 1 piece hydrant valve 40mm - 90°.
- 1 piece hose rack 40mm.
- Made by SRI, Gunnebo or Ozeki or approved equal.

b. Fire Extinguisher

- Fire extinguisher of ABC (dry chemical) type, portable and wheeled type, each with powder weight as indicated by the Drawings, shall be of a proven product such as Amerex, Ansul, Yamato, Gunnebo or approved equal.
This ABC type shall be for office rooms or office areas.
- Fire extinguisher of CO₂ type for rooms as indicated in the Drawings shall be from Amerex, Ansul, Yamato, Gunnebo or approved equal.
This CO₂ type shall be for area that having many electricity elements such as control room, panel room and the like.
- All fire extinguishers shall comply with the requirements of NFPA 10 and shall be UL Listed and FM Approved.

Project Specification

8. Electrical Power and Control

Electrical power and control needed in this work shall be in accordance with the requirements of Division 16 - Specification 16400.

DIVISION 14
CONVEYING SYSTEMS

Project Specification

DIVISION 14 CONVEYING SYSTEM

14210 Elevators

1. General

All elevators shall be designed and manufactured according to ANSI/ASME A17.1 of latest edition. Standard type indicated by reference to manufacturer's names and designations are for type indication only, and are not intended to limit selection of other manufacturer's products with similar type and capacity.

2. Elevator

a. General

- Elevator of room-less type with gearless machine, shall have the following characteristics:

- Passenger elevator with capacity and speed as shown in the Drawings,
- Service elevator with capacity and speed as shown in the Drawings,

such as Mitsubishi, Toshiba, Hyundai, LG or acceptable equivalent.

- The elevator shall have quick and quiet power operation of doors, good visual floor indication both in the cars and at landings, easily operated car and landing call button and position indicators with faceplate of stainless steel sheet in hairline finish, and comfortable lighting.
- Unless otherwise specified, the elevator also shall be provided with the outer elevator door frames made of stainless steel sheets with hairline finish covering the entire door frame's soffit, provision of indicator panel on top of door frames and the necessary operating buttons and panels.

b. Car/Cabin for Passenger

- Unless otherwise specified, car interior shall be finished with the following materials:

- Granite of 18mm thick for floor. Type and pattern shall be as shown in the Drawings.
- Clear mirror of 6mm thick with beveled edge for walls.
- Stainless steel with hairline finish for ceiling.

- Car ceiling shall be provided with ventilation fan, lighting, intercom/ interphone and sound system as shown in the Drawings.
- Door sill of the car and floors shall be covered with stainless steel plate.
- Door panels shall be stainless steel with hairline finish.

c. Car/Cabin for Service

Unless otherwise specified, car interior for service elevator shall be according to the standard of the manufacturer.

- Standard equipment according to the manufacturer's standard as follows:

- Automatic door-open time adjustment
- Door warning alarm
- Automatic car light and fan shut off
- Car call canceling
- Safe landing

Project Specification

- . Next Landing
- . Door Load Detector
- . Repetitive Door
- . Overload Holding Stop
- . Variable Voltage Variable Frequency Control (VVVF)
- . Necessary Accessories at Landing

d. Optional Equipment

Unless otherwise indicated in the Drawings, the elevator which also acts as fire elevator or emergency shall be furnished, in minimum, with following optional equipment according to the manufacturer's standard:

- Fireman's emergency operation
- Fire emergency return
- Emergency landing device
- Emergency power source
- Safety door edge
- Fire-rated door
- Supervisory panel
- Automatic rescue device
- Emergency power
- Fire resistance cable

e. Hoistway

Hoistway shall be in minimum provided with the following standard equipment:

- Hoisting machine.
- Brake.
- Sheaves.
- Hoist ropes (shall pass the test carried out by authority laboratory approved by the Engineer).
- Guides rails.
- Counter weight.
- Guide shoes.
- Buffers.

3. Electrical Works

Materials for electrical works such as power and control cable, conduit and others shall be in accordance with the requirements of Division 16 - Specification 16400.

**DIVISION 15
MECHANICAL**

Project Specification

DIVISION 15 MECHANICAL

15100 Plumbing System

1. General

All materials, equipment and accessories furnished shall be brand new and of acceptable quality.

2. Water Supply System

a. Pipes and Fittings

- Pipes for water supply and process water shall be polypropylene random (PP-R) pipe PN 10 complying with DIN 8077 and DIN 8078 standard, such as from George Fischer, ATP Toro, Wavin Tigris or acceptable equivalent.
Diameter of pipes and fittings shall be as specified.
- Fittings shall be of polypropylene random (PP-R) material PN 25 class and of the same manufacturer as the pipes. Fittings shall be suitable for maximum working pressure of 12kg/cm².
- Jointing system for pipes and fittings shall be compression fitting, butt-fusion welding, electrofusion (heating system) or according to the manufacturer's installation instruction.

b. Valves

- All valves with working pressure, type and diameter as specified in the Drawings, shall be new, unused product of reputable and experienced manufacturers and all valves as far as possible of the same type shall be of one manufacturer, such as Kitz, Fortune, Okumura or equal.
- All valves shall have indelibly mark/sign of manufacturer's name, working pressure, diameter and direction of flow on the body.
All valves shall be complete and ready for operation with all components and accessories in accordance with the applicable standards and codes, and shall be capable of long, reliable, trouble free service and shall require minimum maintenance.
- Valves of diameter up to 65mm shall be of bronze body and shall have tapered threads for screwed joint, and valves of diameter larger than 65mm shall be of cast iron body, manual operated type, and shall be furnished with flanges of flat-faced type conforming to ANSI B16.1 Class 125, forged integrally with valves' body.

3. Sewer and Vent Piping

a. Pipes

Pipes for sewer and vent shall be from uPVC conforming to ISO 4422 with a working pressure of 10kg/cm².
All piping shall be suitable for solvent cement jointing, from Pralon, Vinilon, Wavin or acceptable equivalent.

b. Fittings

- Fittings for uPVC pipes such as elbow, reducer, knee, tee and others shall come from the same manufacturer and in accordance with ISO 4422 requirements.
All fittings shall be suitable for solvent cement jointing.
- Adhesive for uPVC's pipes and fittings shall be as recommended by the uPVC's manufacturer.

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4. Floor Strainer

Floor strainer or floor drain cover shall be chrome plated brass strainer with grid cover of diameter as indicated in the Drawings, and shall be recessed 10mm into the floor and equipped with air trap, such as from Toto or acceptable equivalent.

5. Clean Out

Clean out cover shall be chrome plated brass of diameter 4inch or as indicated in the Drawings, such as HN58 from San-Ei or acceptable equivalent.

6. Plumbing Fixtures

Plumbing fixtures such as closets, lavatory, sinks, faucets and others required shall be in accordance with the Drawings and/or Division 15 - Specification 15410.

15410 Plumbing Fixtures

1. Water Closets

- Water closet of western type made of vitreous china shall be shall be close-coupled model with dual flush system, such as CW661JT1-SW661JP by Toto, in white colour.
Entire unit shall be supplied with all necessary fittings and fixtures.
Each WC pan shall have a closed front seat and cover.
Fittings shall be chrome plated brass by Toto.
- Water closet of western type made of vitreous china for disabled persons shall be close-coupled model with siphonic flush, such as C704 L/SW 784 JP by Toto, in white colour.
Entire unit shall be supplied with all necessary fittings and fixtures.
Each WC pan shall have a closed front seat and cover.
Fittings shall be chrome plated brass by Toto or approved equal.
- Water closet of squatting type made of vitreous china shall be CE6 type by Toto, in colour as specified later.

2. Urinals

Urinals shall be of the single unit wall mounted type with flush valve and flow rate maximum 3,7L/flush, tap and other necessary accessories to complete the installation, such as U57M type by Toto or American Standard or approved equal, in white colour.
Fittings shall be chrome-plated brass/metal.

3. Lavatory

- Lavatory basin of counter type shall be made of vitreous china, such as LW523J type (one tap hole) manufactured by Toto or acceptable equivalent, in white colour.
They shall be supplied with a chromium plated waste fitting with P-Trap, stop valve, supporting fittings, all supplied by Toto or acceptable equivalent.
- Lavatory basin of wall hung type shall be made of vitreous china, such as LW247CJ type (one tap hole) manufactured by Toto or approved equal, in white colour.
They shall be supplied with a chromium plated waste fitting with P-Trap, stop valve, supporting fittings, all supplied by Toto or acceptable equivalent.
- Lavatory basin for disable of wall hung type, shall be made of vitreous china, such as LW103JT1 type (one tap hole) manufactured by Toto or acceptable equivalent, in white colour.
They shall be supplied with a chromium plated waste fitting with P-Trap, stop valve, supporting fittings, all supplied by Toto or acceptable equivalent.

Project Specification

4. Pantry Sink

Pantry sink unit shall be of the flushline tub with a bowl in sizes as required and as shown in the Drawings.

The sink units shall be fabricated from 1mm thick stainless steel grade 304 and shall be supplied complete with sealing gasket, mounting brackets, drain fitting flange and plug.

Sink units shall be suitable for mounting in bench top hole, with mounting bracket securing the sink to the bench top and compressing the mounting gasket.

Each sink shall be provided with chromium plated waste fitting complete with P-Trap, and stop valve, such as from Ariston, Teka, Franke or equal approved product.

5. Water Faucets and Shower Spray

a. Faucets

- Faucet for lavatory basin of counter type shall be of extended single lever type of TX116LESBR type by Toto
- Faucet for lavatory basin of wall hung type shall be of deck and of self closing type of TX126LE type by Toto.
- Faucet for lavatory basin for disable shall be T205QN type by Toto
- Faucet of wall type for ablution and janitor shall be T 23 B 13 type by Toto
- Faucet of wall type for garden use shall be T 23 B 13 type by Toto.
- Kitchen or pantry faucet shall be of deck type with swivel spout, such as TX609K type by Toto.

b. Shower Spray

Shower spray for closet type as shown in the Drawings shall be of the type that is completed with stop valve, such as TX403SMCRB by Toto.

6. Mirror and Toilet Accessories

Mirror shall be as specified in Specification 08800, in thickness and sizes as required.

Toilet accessories such as grab bar shall be as specified in Division 10 - Specification 10810.

15700 Ventilating and Air Conditioning System

1. Variable Refrigerant Volume (VRV) or Variable Refrigerant Flow (VRF)

- The systems shall comprise of one or a number of outdoor units connected via interconnecting refrigeration pipe work to multiple indoor units. The systems shall be complete with all the necessary electronic controls and control wiring to maintain the design room conditions.
- The capacity shall be not less than as specified in the Drawings.
From Daikin, ALKO, LG, Fujitsu, with refrigerant of R410A.

2. Split System Air Conditioning

- Split system air conditioning units shall be of equipment which are factory assembled (provided with factory certificate) and shall consist of casing, coil condensation drain, fan and motor, cleanable filter, unit control, expansion valve, compressors, air cooled condenser, condenser fan and motor, pressure and capacity control.
- The capacity and number of the unit shall be not less than as specified in the Drawings.
Split system AC single inverter of wall type shall be from Daikin, Fujitsu or LG, with refrigerant of R410A.

Project Specification

3. Exhaust Fan

Exhaust fan of inline centrifugal type with capacity, size and power as shown in the Drawings and having characteristics according to the standard of the manufacturer, shall be from Fantech, Kruger, Nicotra, Ranesco.

4. Ducts for Exhaust Fan, Supply and Fresh Air

a. Ducts

Ducts for exhaust fan, supply and fresh air shall be made entirely from galvanized steel sheet type (BjLS) with minimum zinc coating of 200gr/m² (Z275) complying with SNI 07-2053-2006, such as Sarana or Lokfom.

b. Insulation

Insulation for duct shall be from glasswool having minimum characteristic as follows:

- Blanket type,
- Thickness of 25mm,
- Density of 32kg/m³,
- Thermal conductivity 0.034W/mK at 20°C,
- Non-corrosive,
- Faced with factory applied reinforced aluminium foil vapour barrier,

such as Ductwrap 32 by ACI Insulation or AB Wool or acceptable equivalent.

5. Piping

a. Drain Pipe

Drain pipe shall be made of uPVC with working pressure 8kg/cm², complying with ISO 4422. All piping shall be suitable for solvent cement jointing similar to Wavinsafe by Wavin, or Pralon, or Vinilon. Pipes shall have insulation made of fibreglass covered with aluminium foil.

b. Refrigerant Pipe

The refrigerant piping, including fittings and other accessories needed for air conditioning equipment shall be made of copper pipe of phosphoric acid deoxidized type, with dimensions as specified by the manufacturer, complying with ASTM B 280, such as from Crane or Kembla.

c. Pipe Insulation

- Pipe insulation for condensation and refrigerant pipe shall have the following characteristics:
 - Made of flexible, black, closed cell, elastomeric nitrile rubber, locally available such as Armaflex or Aeroflex,
 - Minimum thickness of 9mm for condensation pipe, 19mm for refrigerant discharge pipe, and 32mm for suction pipe,
 - Minimum density of 62kg/m³,
 - Minimum thermal conductivity of 0.035W/m K at 10°C,
 - Fire resistant class 1 according to BS 476 Part 7.
- Adhesive tape shall have thickness of 3mm and width of 30mm, such as Armaflex Tape for Armaflex product or Aeroflex or acceptable equivalent.

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6. Air Grilles

Air outlet and grilles shall be mass produced items of steel or aluminium fabrication, with powder coated finish in ivory or white. Type, model, dimension or sizes shall be as required, from Modul or Tamura or acceptable equivalent.

7. Dampers

a. General

- All volume dampers shall be adjustable and can be adjusted and locked manually from outside.
- Damper shall be of opposed type and shall be made from galvanized steel sheet with oven-baked paint finish, with a protractor which indicates the setting of the damper.
- Volume dampers shall be installed in each supply duct that heads to outlet.

b. Motorized Volume Damper

Motorized volume damper with characteristics according to the standard of the manufacturer shall be from Modul or Tamura or acceptable equivalent.

c. Fire Damper

Fire damper shall be of the type provided with fusible link

DIVISION 16
ELECTRICAL

Project Specification

DIVISION 16 ELECTRICAL

16225 Diesel Generator Set

1. General

Diesel unit that consisting of engine and alternator, shall be of first quality, new, free from any defect and from a manufacturer with a proven record in this field of production, and shall be supplied in a CBU (completely built up) unit, such as from Cummins or Perkins.

2. Diesel Engine

- Diesel engine of silent type with capacity of prime power as shown in the Drawings, shall in minimum, have the following characteristics:
 - Speed : 1500rpm.
 - Working voltage : 3phase, 415/220V, 50Hz.
 - Cooling system : Radiator cooling (mechanically driven).
 - Power factor : 0,8.
 - Insulation class : H.

- Diesel engine shall be completed with standard accessories as follows:
 - Daily and weekly fuel tank with capacity as indicated in the Drawings.
 - Radiator.
 - Air filter.
 - Electric starter.
 - Flange muffler.
 - Battery and its accessories.
 - Panel consisting of the following:
 - Water temperature meter.
 - Oil pressure meter.
 - Contact key.

 - Wall mounted switch board consisting of:
 - 1 voltmeter.
 - 1 frequency meter.
 - 1 selector switch volt.
 - 1 auto breaker/MCCB.
 - 3 ampere meters.

 - Operation and maintenance manual in book form.
 - Unless otherwise indicated in the Drawings, diesel engine shall also be completed with suitable additional accessories as follows :
 - Synchronized control panel.
 - Over-speed protection.
 - Heated air outlet duct flange.

3. Alternator

- The rating shall be as detailed in the data sheet and shall have a continuous lagging power factor of 0.8.
- Alternator shall be capable of supplying its rated kVA output at voltages ranging between ± 5 percent of the rated voltage, at the rated speed and power factor.

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- Alternator shall be capable of withstanding (without damage) a 3-phase short circuit at its terminals when operating at rated kVA, and power factor at 5 percent overvoltage. The alternator shall also be capable of withstanding (without damage) an unbalanced load for 30 seconds or less under the conditions described in the appropriate standards.
- Alternator shall withstand overspeed of 20 percent of rated speed for 2 minutes, without mechanical damage or permanent distortion.
- The terminal box shall be adequately sized for the cables detailed in the data sheet. It will be located on the free end or side of the machine.
- Provision shall be made for the prevention of shaft circulation current.
- The insulation materials used in the generator and exciter shall be Class F insulation, B temperature rise and 40°C of design ambient temperature.

4. Cable and Accessories

Cable and accessories such as termination and others shall be as specified in Division 16 - Specification 16400.

16270 Transformer

1. General

- Transformer shall be of first quality and from a manufacturer with a proven record in this field of production, such as Unindo/Schneider or Trafindo.
- Transformer shall be designed for tropical climate with maximum temperature of 40°C, and shall be fabricated and tested in accordance with IEC standard.
- Transformer shall be capable to transmit nominal capacity at 105% of nominal tension with work factor 80% without exceeding the specified maximum temperature increasing.
- Transformer shall be for indoor use and of oil immersed type, with ONAN cooling system.
- Transformers shall have the nominal capacities and working voltage as shown in the Drawings.

2. Transformer

- The transformer shall be furnished with name plate containing the following data:
 - Serial number and date of manufacturer.
 - Capacity, phase and frequency.
 - Primary and secondary voltage.
 - Current.
 - Impedance.
 - Vector group.
 - Cooling type.
 - Oil quantity.
 - Coil winding diagram.
 - Transformer weight.
- Each transformer shall be provided with standard equipment as follows:
 - Oil indicator glass.
 - Thermometer.
 - Oil filling hole.
 - Oil draining valve.
 - High voltage and low voltage bushing.
 - Tap changer.
 - Skids.

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- Each transformer shall be provided with additional appurtenance as follows :
 - MV plug-in bushing withdrawable type
 - Protection box for secondary bushing.
 - Integrated safety detector, and protective and monitoring device.

16345 Medium Voltage Cubicle

1. Cubicle

- The medium voltage cubicle shall be of first quality and from a manufacturer with a proven record in this field of production, such as Schneider, Siemens or approved equal.
- The medium voltage switchgear shall be of sulphur hexafluoride (SF6) type which can be placed in service location and in closed electrical service location in accordance with VDE and IEC standard.
- The switchgear shall be designed for tropical climate with maximum temperature of 40°C and shall be fabricated and tested in accordance with IEC standard.
- Incoming and outgoing cubicles shall have minimum features according to the standard of the manufacturer and the requirements of the Drawings.
- By Schneider, Siemes or ABB

2. Cable

Cable feeder of multi conductor for direct burial application at 20kV shall be XLPE insulated with copper conductor, in size and type of cable as indicated in the Drawings, from Kabelindo, Supreme, Extrana or Kabelmetal.

16400 Low Voltage Distribution

1. Panels

- Panels shall be in accordance with the requirements of local power supply and suitable for 40°C ambient temperatures.
- Unless otherwise specified, all panels shall be of wall mounted type and shall be built up from enclosed units made from galvanized steel sheet in 2mm minimum thickness, furnished with front access doors, and shall have index protection of IP 54 for indoor type and IP 65 for outdoor type, by Schneider, EPACS, PT Sinar Metrindo Perkasa, Prastiwahyu or acceptable equivalent.
- All panels shall be built up on substantial framing with all necessary stiffeners and supports. Panels dimension shall include 30% free space of spare.
- All doors shall be provided with gasket of neoprene or other equal and approved material. Hinged doors shall have keyed-alike flush type cylinder locks.
- Unless otherwise shown, main panel with IP54 shall be completed with separation of Form 2 Type Test (international certificate) that has to be shown in the Shop Drawings.
- All panels shall have oven-baked coating with colour as specified.
- All panels shall be fitted with an escutcheon plate to prevent contact with live parts. Escutcheon plates shall be earthed.
- Removable gland plates of non-ferrous material shall be provided at the top and at the bottom of the panels with knock-outs or blanked-off openings for incoming and outgoing circuit cables.
- All components for all panels shall be of Schneider, Siemes or ABB.
- Unless otherwise specified, all panels shall be provided with relay for phase failure protection of capacity as required and as directed by the Engineer.
- Circuit breakers shall be of the mini circuit breaker and moulded case circuit breaker type unless otherwise noted in the Drawings. MCCB shall comply with IEC 157-1 of fixed type. Rated short circuit current shall be as shown in the Drawings.

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- Type and capacity of components shall be as specified and indicated in the Drawings and shall be suitable with the type of equipment to be installed.
- Fault rating of bus system and busbars shall be as indicated in the Drawings.
- Every panel shall be equipped with power indicator lamps for every phase, which to be installed on the outer side of panel door and easily sighted.
- Panel shall be fitted with proprietary busbar chassis, neutral and earth busbars.

2. Capacitor Bank

Capacitor bank complete with reactor (including safety protection), with capacity and characteristics as shown in the Drawings shall come from Shizuki or approved equal.

3. Digital KWH Meter

Digital metering shall be an integrated system for the management of postpaid electricity. It shall apply a one-way system for the use of electricity consumption with integrated billing system for prepaid or postpaid system.

It shall have features as follows:

- Prepaid or postpaid system,
- LCD display that can display remaining KWH, voltage, current and power,
- Relay breaker if the deposit used up,
- Full-digital metering with very reliable micro controller,
- Authentication and cryptographic data,

such as manufactured by PT Hariff Daya Tunggal Engineering.

4. Cables

- Cable feeder or multiconductor cable for direct burial application at 600V/1kV or below shall be from NYFGbY type complying with SNI 04-2700-1992, such as from Voksel, Kabelindo, Supreme, Extrana or Kabelmetal.
- All single conductor cable for power, lighting and control circuits installed in conduit for operation at 600V/1kV or below shall be NYY type complying with SNI 04-2701-1999 or NYM type which complying with SNI 04-2699-1999, such as from Voksel, Kabelindo, Supreme, Extrana or Kabelmetal.
- Cable colour code shall be as follow:
 - Neutral : Blue.
 - Ground : Yellow with green stripe.
 - Phase : Red.
- Cable splicing and termination shall be from a good product such as 3M or Raychem, and shall be from the type suitable with the cable type to be spliced or terminated.
- Termination of cables 6mm² to 16mm² shall use cable lugs and suitably sized ratched type crimping tool.

5. Raceways

a. Conduit

- Conduit for cables leading to sockets, switches, lights and equipment shall be high impact PVC type such as Ega/MK or Clipsal and shall comply with BS 6099, with minimum diameter suitable with the size of cables.

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- Conduits for cables installed underground across the road or under floor up to 150cm outside the building perimeter shall be galvanized steel pipe of medium class and shall comply with BS 1387 standard or PVC pipes of 6kg/cm² working pressure complying with SNI 06-0084-2002, such as Pralon or Maspion.
Diameter shall be as indicated in the Drawings.
- Flexible/corrugated conduit shall be of high impact PVC such as Ega or Clipsal and shall comply with BS 6099.
Flexible conduit shall be suitable for tropical climate, and shall be hard to break, dustproof and waterproof.

b. Junction Boxes

Junction boxes shall be of welded sheet steel, galvanized finish, with removable cover attached by round head screws.
Size of junction boxes shall be as required.

c. Cable Trays and Ladder

- Cable trays and ladder shall be made of hot dip galvanized slotted steel sheet in shape, type and size as indicated in the Drawings.
- All accessories needed to complete the installation such as clamps, ties and others, shall also be made from hot dip galvanized steel.
- Cable trays and ladder for outdoor installation shall be provided with cover specially made for this application.
- Cable trays and ladder shall come from an approved product, such as Trias, Tri Abadi, Lion, or Nobi or equal.
- Cable tray lids shall be raised to allow air circulation between cable and lid due to ambient temperature.

6. Sockets and Switches

- Socket outlets (single or twin) of 1phase with side earthing contacts, shall be of flush mounted type (complete with box) and shall comply with CEE 7 standard, such as from Boss, Schneider or Legrand.
Minimum capacity of each socket shall be 250V 16A.
Sockets that shall be placed at ± 30 - 50cm from floor or as shown in the Drawings shall be provided with cover and shall be of waterproof type.
- Socket outlet of surface-mounted type of 1phase with three pins contact conforming to BS-1363 Pt. 2: 1995 shall have index protection of IP 66, such as Mennekes, or Plexo 66 by Legrand, with minimum capacity of 250V 20A.
- Switches shall be of flush mounted type (complete with recessed wall box) with minimum capacity of 10A/250V and shall comply with BS-3676 Pt. 1: 1989/BS EN 60669-1: 1996/IEC 60669, such as Boss, Schneider or Legrand
Switches shall be placed 150cm above floor, unless otherwise indicated in the Drawings.
- All sockets and switches with surface installation shall be sealed around the back of outlet to the surface
- Unless otherwise specified, all sockets and switches shall be of white colour.

7. Supports

All necessary supports for equipment installed under this Specification shall be provided.
Supports consisting of steel frames, plates, brackets, racks and others with shapes and size as shown in the Drawings shall comply with the requirements of Division 5 - Specification 05500.
All supports shall be fastened with bolts, screws or by welding, to rigid supports.

Project Specification

16500 Lighting

1. Fluorescent Lamps

- Fluorescent lamps shall be of tubular type such as TL5 (cool daylight/840) by Philips, with capacity as required, complete with electronic ballast and starter, all made by Philips, shall be used for luminaire made of white stove enameled of 0.5mm sheet steel, of recessed, surface mounted and batten type as shown in the Drawings.
- Several luminaires shall be provided with back-up Ni-Cad battery of duration as specified for emergency lighting.

2. Compact Fluorescent Lamps

Compact fluorescent lamp of Essential type (cool daylight/840) with base E27 and capacity as specified shall be used for garden luminaire as shown in the Drawings.

3. Halogen Lamp

Halogen lamp of reflector of PAR38 HalogenA of spot type by Philips with capacity as required shall be for weatherproof spotlight luminaire as shown in the Drawings, from Philips or acceptable equivalent.

4. High Discharge Lamps

a. Metal Halide Type

- High discharge lamp of metal halide of HPI-T type with capacity as required, complete with ballast and ignitor, shall be for spot and flood lighting luminaire, from Philips or acceptable equivalent..
- The flood lighting luminaire shall be completed with taper pole made of hot dip galvanized steel material, in diameter and height as required.

b. SON-T Plus Type

- High discharge lamps of SON-T Plus type of capacity as specified, complete with ballast, ignitor and capacitor for power factor of 0.85 minimum, shall be for street lighting luminaire, such as RL Arto B by Artolite or SPP 368 type by Philips.
- The street lighting luminaire shall be completed with taper pole made of hot dip galvanized steel material, in diameter and height as required, from Bakrie or PPI.

5. Exit Lamps

Exit lamps with Nicad battery of 2 hours duration shall have fluorescent lamps of 1 x 8W, from PNE, Sancom, Legrand or acceptable equivalent.

6. Switches

Switches for lighting shall be as specified in Division 16 - Specification 16400.

7. Supports

All necessary supports for equipment installed under this Specification shall be provided. Supports consisting of steel frames, plates, brackets and others with size as shown in the Drawings shall comply with the requirement of Division 5 - Specification 05500.

Project Specification

16700 Communication System

1. General

All materials which shall be installed for the telecommunication system shall be new, free from any defect, of first quality from a proven manufacturer and shall be suitable for a tropical climate.

2. Telecommunication System

a. PABX

The PABX unit which has extension capacity as specified in the Drawings shall be the extendable unit (provide for extensions in the future).

Features that needed are at least:

- Alternate routing
- Call back
- All call
- Call forwarding (busy line, no answer, override)
- Call hold
- Call pick-up (group)
- Call transfer
- Call waiting
- Day/night service
- Direct in termination/special dial tone (which hand set will be able to receive direct in to be decided by Engineer in coordination with Owner).
- Direct outward dialing
- Music on hold
- Outward dial block
- Every hand set record (bill monitoring).

From Siemens, Alcatel or acceptable equivalent.

b. Handset

Handset units shall be multifunction desk top with push button dial type, such as Siemens, Alcatel or acceptable equivalent.

Each unit shall be provided with cable spare of 10meters.

c. Telephone Outlet

Telephone outlet shall be a flush mounted face plate of RJ45 type complete with telephone symbol, such as from Panasonic, Boss, Schneider or Legrand or acceptable equivalent.

d. Indoor Cable

- Cable from telephone box up to handset shall be of PVC insulated and sheathed aluminium screened indoor cable, such as R-V (Pe) V type, and shall be in accordance with SNI 04-2077-1990 standard, from Kabelindo, Supreme, Extrana or acceptable equivalent, in sizes as shown in the Drawings.
- Underground cable shall be of PE insulated and sheathed jelly filled aluminium screened, armoured cables such as T-EJ (Pem) E type, and shall be in accordance with SNI 04-2069-1990 standard, from Kabelindo, Supreme, Extrana or acceptable equivalent, in sizes as shown in the Drawings.

Project Specification

e. Telephone Box

Telephone box/connection and distribution box of type and size as indicated on the Drawings, shall be from Siemens, Alcatel or acceptable equivalent.

f. Main Distribution Frame

Main distribution frame shall be of outdoor type with capacity as indicated in the Drawings, and shall have minimum characteristic as follows:

- Housing made of reinforced polyester,
- Provided with doors which could be dismantled for cable termination,
- Provided with ventilation at top and bottom for air circulation and to prevent moisture,
- Index protection of IP 43,

such as Rumah Kabel Geyer or acceptable equivalent.

g. Terminal Box

Terminal box of type and capacity as indicated in the Drawings shall have minimum characteristics as follows:

- Can be installed at pole or on the wall,
- Easy to install,
- Light and strong,
- Box made of recyclable resin,
- Metal part made of stainless steel material,
- Could be opened up to 90°,
- UV resistant with index protection of IP 53/54,
- Could be locked,
- Approved by Telkom,

such as Universal DP Sanbox by PT Timur Agung Kencana or acceptable equivalent.

3. Computer System

a. Server

Server shall be HP Proliant ML 310 G3 type, processor Intel Pentium 42.4Ghz, RAM 512MB, HDD 36GB Integrated NIC 10/100/1000, and rack, such as 289917-372 type.

b. Switch/Hub

Unless otherwise shown in the Drawings, switch shall be 16 and 24 10/100 ports type with 2 10/100/1000Base-T ports, Enhanced image complying with IEEE 802.3i 10Base-T, IEEE 802.3u 100Base-T, and each shall be completed with outlet of RJ-45 type, such as from D-Link, Link Sys, Asus or acceptable equivalent.

c. Data Outlet

Data outlet shall be a flush mounted face plate of RJ45 type complete with data symbol, such as from Panasonic, Boss, Schneider or Legrand or acceptable equivalent.

Project Specification

d. Cable

- Distribution cables for data/computer system shall be 4 pairs UTP Category 6 (100m maximum) cable, such as from Systimax, Leoni, Clipsal Datacomms, Belden or AT&T, with minimum characteristics according to the standard of the manufacturer, and shall be provided with guarantee of material and installation for minimum 20 years.
- Cable from patch panel to switch/hub with length up to 100m shall use 4 pairs UTP Category 6, while length over 100m shall use fiber optic cables of multimode (OM3) type, 4 cores, of size as shown in the Drawings, such as from Netviel Prysmian, Systimax, Belden or acceptable equivalent.

4. Battery System

Battery system shall consist of the following:

- Battery which has the characteristics as follows:
 - Voltage : 48V DC
 - Type : Ni Cd
 - Endurance : 8hours (around 600AH)
 - Battery rack : corrosion proof coated metal
- Automatic battery charger which shall be able to charge the battery from empty to full load in 6hours. This device shall be equipped with over current protection.
- Rectifier which shall be able to convert 220V AC to 48V DC with capacity of minimum 100A.
- Surge protection unit which shall have the characteristics as follows:
 - Peak pulse current : 60KA
 - Maximum line rated voltage : 275VAC
 - Maximum DC Voltage : 369V
 - Inductor : air core, non-saturable
 - Arrestor :
 - * Strike Voltage : 90V
 - * Arc Voltage : less than 20V
 - * Peak Current : 20KA
- Stabilizer which shall have the characteristics as follows:
 - Capacity : 5000W
 - Voltage : 220V
 - Frequency : 50Hz
 - Voltage variation : $\pm 15\%$.

5. Conduit

Conduit for communication cables shall be as specified in Division 16 - Specification 16400.
Conduit sizes shall be as shown in the Drawings.

6. Over-voltage Arresters

Unless otherwise specified, over-voltage arrester for communication system shall be provided as specified and indicated in the Drawings.

Project Specification

16820 Sound System

1. General

All equipment for sound system shall have capacity as shown in the Drawings and characteristics according to the standard of the manufacturer.

2. Central Public Address and Background Music System

Central public address and background music system shall consist of the following equipment:

- CD/MP3/DVD player,
- Emergency microphone,
- Remote microphone 20 channels,
- Sound repeater,
- Mixer frame with modules,
- Equalizer,
- 10 channels speaker selector,
- Power amplifier,
- Ceiling speaker,
- Attenuator,
- Cabinet rack,

from Phillips, Sennhaiser, Mackie, ATEIS, TOA, BOSCH or acceptable equivalent.

3. Multifunction Room

Multifunction room shall be equipped with the following equipment:

- CD/MP3/DVD player,
- Dynamic microphone,
- Inlet microphone,
- Floor stand microphone,
- Handheld wireless microphone with receiver,
- Wireless antenna,
- 16 channels mixing console,
- Digital processor,
- Multi channel power amplifier,
- Speakers,
- Cabinet rack,

all from Phillips, Sennhaiser, Mackie, ATEIS, TOA, BOSCH or acceptable equivalent.

4. Car Call

Car call shall consist of the following equipment:

- Paging microphone,
- Mixer amplifier,
- Column speaker,

from Bosch, TOA or acceptable equivalent.

Project Specification

5. Cables

Power cable shall be of PVC insulated and sheathed flexible cable of 500V nominal voltage, from Jembo, Voksel or Yamanaka.

6. Electrical Materials

Other electrical materials such as junction box, socket outlets and others shall comply with the requirements of Division 16 - Specification 16400.

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