



UNIVERSITY OF THE PHILIPPINES MINDANAO

**GENERAL SPECIFICATIONS FOR CENTER
FOR ADVANCEMENT OF RESEARCH IN
MINDANAO (CARIM) PHASE 3
TECHNICAL WORKS AND MATERIALS**

CONTRACT DOCUMENTS

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**ITEMS FOR SUBMISSION / PRESENTATION BY THE CONTRACTOR FOR THE
ENGINEER'S APPROVAL PRIOR TO ORDER PURCHASE, WORK FOR
MANUFACTURER**

SECTIONS OF WORK

**Prepared by
OFFICE OF THE CHANCELLOR
CAMPUS PLANNING AND DEVELOPMENT OFFICE**

INTRODUCTION

The Drawings and the Specifications are complementary to each other. Drawings are graphic means of showing work to be done. They are particularly suited to showing where materials are located. Thus, drawings exist essentially to show size, location and placement. Not all works, however, can be presented in the drawings. Generalized works are usually in statement form and hence the Contractor is strongly advised to read the specifications carefully.

Specifications, on the other hand, are used to describe the materials, construction techniques, samples, shop drawings, guarantees, and other contract requirements. Together, the drawings and Specifications are used to inform the Contractor. In cases where the specified brand carries with it the manufacturer's specifications, the manufacturer's specification shall hold precedence over this Specifications.

The specifications herein are presented in three section as follows:

1. Summary of Materials and Finishes
2. Items for Submission by the Contractor for the Engineer's Approval prior to Order, Purchase, Work, and Manufacture;
3. Technical Specifications:

SECTION 1.0 – Indicates in a concise form the scope of work and the materials for the project, as well as mentioning in a general way the location or placement of construction elements within the project.

SECTION 2.0 – Is a listing of materials and construction documents for the Engineers appreciation to ensure that the design objectives for the intended class of construction are met, as well as to avoid waste such as when a Contractor installs specific materials or systems which are not acceptable for the project.

SECTION 3.0 – or the TECHNICAL SPECIFICATIONS, consists of the standard procedures for the testing and application of specified materials and systems. As a general guide and in the spirit for which the technical specifications are prepared, works and materials necessary for the project, and which may, or may not be, included of traditional ad established institutes, societies or associations for specific materials and work trades, and as per the procedures proposed by pertinent governmental construction bodies, whenever applicable.

THE LANGUAGE OF THE SPECIFICATIONS

The specifications are of the abbreviated type and include complete sentences.

The selection of sentence structure depends on the underlying principles of specifications:

- a. That the technical specifications are only one part of the Contract Documents;
- b. That the contract is between the Owner and the General Contractor; and
- c. That the General Contractor is the only parties responsible for completing the work in accordance with the Contract Documents. Therefore:
 - a. Only the General Contractor is referred to in the Specifications so as not to violate the intent of the contract and so as not to undermine the proper chain of command.

b. Any reference to Specialty Trade Contractors in the technical specifications is made in relation to the selection or appointment of such contractors under the bidding guidelines. Once the Specialty Trade Contractors are selected and assigned to the General Contractor, the General Contractor assumes all responsibilities for the execution of the whole project in accordance with the Contract Documents. Therefore, in the contract between the Owner and the General Contractor, the Specialty Trade Contractor is not referred to. In all the Contract Documents, the word "Contractor" is meant the General Contractor.

c. The omission of the phrase "The Contractor shall" is intentional because the whole specification is directed to the Contractor. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the drawings.

d. Where "as shown", "as directed", "as detailed", or words of similar import are used, it shall be understood that reference to the drawings accompanying the specifications is made unless otherwise stated.

e. Where "as directed", "as required", "as permitted", "as authorized", "as approved" or words of similar import are used, it shall be understood that the direction, requirement, permission, authorization, approval, or acceptance of the Engineer is intended unless otherwise stated.

f. As used herein, "provided" shall be understood to mean "provided complete in place", that is furnished and installed.

g. Most sentences are in the imperative mood. This style is especially suited for instructions covering installation of products and equipment.

INTENT AND APPLICATION OF THE PROVISIONS OF THIS SECTION

a. The Scope of Work covered within this Specification is the complete shall and interior construction works of the **PROPOSED CONSTRUCTION OF CENTER FOR ADVANCEMENT OF RESEARCH IN MINDANAO (CARIM) PH.3**

b. This Section is prepared in a concise manner, the intention of which is to save time and effort in locating important contents within the Specifications.

c. The execution of this Section shall be coordinated and correlated to each corresponding elaborated section of this same Specifications.

d. In case discrepancies exist between this Section and its corresponding elaborated sections, notify the Architect/Engineer immediately for clarification; his decision shall be final.

e. The Contractor shall bear the responsibility to check all the numbers and units as may be indicated on the Specifications. It is understood that the Contractor shall supply and install the actual required units as approved on the Plans and Specifications.

f. Substitution of materials or equipment's of makes other than those specified in the Contract will be approved by the Engineer for the following reasons only:

h. That the materials or equipment proposed for substitution is equal or superior to the materials or equipment specified in construction efficiency and utility.

i or that the materials or equipment's specified cannot be delivered to the job site in time to complete the work of the other Contractor due to conditions beyond the control of the Contractor.

j in case of a difference in price, the Owner shall receive all benefits of the difference in cost involved in any substitution and the Contract shall be altered by Charge Order to credit the Owner with any savings so obtained.

k. To receive consideration, request for substitution shall be accompanied by documentary proof of quality or difference in price and delivery, if any, in the form of certified quotations and guaranteed date of delivery from suppliers of the proposed substituted materials or equipment.

l. All applicable provision of the divisions of the technical specifications for each trade in the ensuing pages shall apply for all items cited in this Summary.

m. Materials deemed necessary to complete the work but not specifically mentioned in the Specifications, Working Drawings or in the other Contract Documents are inferred, and shall be supplied and installed by the Contractor without extra cost to the Owner. Such materials shall be of highest quality available, and installed and applied in workmanlike manner at prescribed or appropriate locations.

n. Materials specifically mentioned in this Summary shall be installed following efficient and sound engineering and construction practice, and specifically as per Manufacturer's application or installation specifications which shall govern over all works alluded to in this Specification.

o. When specified for the project, equipment, materials, and finishes for on-site improvement and facilities as listed below are part of the scope of the work and shall be supplied, applied and installed by the Contractor without extra cost to the Owner.

p. The Contractor shall conduct thorough inspection of the existing jobsite conditions.

q. The Scope of Work shall include all demolition and additions necessary in order to implement the whole set of approved Plans, Working Drawings, and Specifications.

r. All demolition and removal shall be approved by the Architect or his Authorized representative. Demolished materials shall be removed and disposed of from the site.

s. Demolish existing slabs and walls where required and additional construction of wall footings, slabs and beams in order to implement the Plan concerned.

t. The Contractor shall secure and pay for all pertinent permits for construction works.

u. All items which are so shown on the Plans and not mentioned in the Specifications shall be included. Discrepancies in these items are to be verified with the Engineer in Charge.

v. Miscellaneous: All temporary lighting, power and water supply within the premises shall be shouldered by the General Contractor and sufficient enough to supply the requirements of the other Trade Contractors. The billing of the local water supply and electric company shall be prorated by General Contractor and all Trade Contractors based on the Contract Cost.

ITEM SUBMISSION BY THE CONTRACTOR.

The following Specs is a listing of materials and construction documents for the INTERIOR OF THE PROJECT appreciation to ensure that design objective for the intended class of construction is met. It is designed to avoid waste such as when the Contractor install specific materials or system which are not acceptable for the project.

SAMPLES

1. CONCRETE

- a. Cement.....1 bag
- b. Aggregates.....1 bag
- c. All specified types of arch pre-cast units.....1 piece each
- d. Other (if required by Architect's).....1 unit each

2. MASONRY

- a. All specified sizes and types of unit masonry.....1 piece each
- b. Glass blocks.....1 piece each
- c. Others (if required by Architect's)1 unit each

3. METALS

- a. All specified sizes of structural steel sections.....1000 mm length
- b. All specified sizes of steel reinforcement pre-bulk delivery.....1000 mm length
- c. Steel decking (if needed)300 mm length
- d. All aluminum & stainless-steel section.....150 mm length
- e. Brass nosing section.....150 mm length
- f. Others (if required by Architect's)1 unit each

4. WOOD AND PLASTICS

- a. Yakal and Guijo with preservative.....300 mm length
- b. Hardware and Fasteners.....1 piece each
- c. Others (if required by Architect's).....1 unit each

5. THERMAL AND MOISTURE PROTECTION

- a. All waterproofing & dump proofing product.....300mmx300mm swatch
- b. Water stops.....100 mm length
- c. Joint sealants.....1 piece each
- d. Other (if required by Architect's)1 unit each

6. DOOR & WINDOWS

- a. All corner sections of metal doors, jambs and hardware.....1 unit each
- b. All aluminum door and the window panels complete with operating Mechanisms, locksets and other hardware.....1 panel each
- c. All glass panes & glazing compounds.....1 panel each
- d. Aluminum and steel storm resistant fixed louver.....1 panel each
- e. All finishing hardware: lockset, hinges, door stopper/holder, Closer, chain lock, eye, deadlock, cabinet & drawer pulls, Locks, butt hinges and aluminum door hardware.....1 unit each
- f. Other (if required by Architect's)1 unit each

7. FINISHES

- a. All plaster types.....1 panel mock-up
- b. All engineered wood types.....1 panel each
- c. Fiber cement board.....1 panel each

- d. Gypsum board.....1 panel each
- e. All colors of vitrified tiles.....1 piece each
- f. All color of carpet tiles.....1 piece each
- g. All paints and lacquers for
sample swatches all types and colors.....300mmx300mm
- h. Other (if required by Architect's)1 unit each

8. SPECIALTIES

- a. Identifying device letter size.....1 piece each
- b. All toilet accessories.....1 piece each
- c. Other (if required by Architect's)1 unit each

9. MECHANICAL AND SANITARY

- a. All plumbing pipes, fittings, and accessories.....1 of each type
- b. All fire alarm system components and accessories.....1 of each type
- c. All exhaust fans.....1 unit each
- d. All valves.....1 unit each
- e. Other (if required by Architect's)1 unit each

10. ELECTRICAL

- a. All conduits, fittings, wires, cables, and accessories.....1 of each type
- b. All junction box, pull box and accessories.....1 of each type
- c. All lighting fixtures, switches and convenience outlets.....1 complete set each
- d. All telecommunication and internet connectivity boxes
And accessories.....1 of each type
- e. CCTV and MATV devices.....1 piece each
- f. All fire alarm wiring devices.....1 of each type
- g. Other (if required by Architect's)1 unit each

11. MOCK-UPS

NOTE: All mock-ups are for ARCHITECT'S approval before final installation.

- a. Stainless steel railing assemblies
- b. Aluminum horizontal devices assemblies
- c. All waterproofing materials in place
- d. All types of wall assemblies
- e. All types of partition assemblies
- f. All types of ceiling board assemblies
- g. All types of wall and floor tile and other finish
- h. All paint finishes
- i. Other (if required by Architect's)

12. TECHNICAL CATALOGUES AND BROCHURES

- a. Wall, floor and ceiling finishes and assemblies
- b. Wall, glass partition and toilet partition system
- c. Lighting fixture system
- d. Fire alarm system
- e. Fire extinguisher
- f. Electrical panel distribution
- g. Exhaust & ventilation fans
- h. Other (if required by Architect's)

LABORATORY TEST CERTIFICATES

1. Structural steel strength
2. Reinforcing steel strength
3. Welding test
4. Concrete (bases on batch mix for specified phases of pouring work)
Concrete mix design
Concrete test results
5. Fireproofing test
6. Waterproofing test
7. Leak test for all plumbing and water pipes
8. Other (if required by Architect's)

GUARANTEES / WARRANTIES

Submittals for environmental performance

1. Wood treatment
2. All waterproofing materials
3. Aluminum door and windows
4. Fire alarm systems and fire extinguishers
5. Fire doors
6. Other (if required by Architect's)

GENERAL REQUIREMENTS

- a. **RELATED SECTIONS:** All applicable provisions of the different divisions of the Specifications for each work trade shall apply for all items cited in this Summary.
- b. **INFERRED ITEMS AND WORK:** Materials and workmanship deemed necessary to complete the works but NOT specifically mentioned in the Specifications, Working Drawings, or in the other Contract Documents, shall be supplied and installed by the Contractor without extra cost to the Owner. Such materials shall be of the highest quality available, and installed or applied in a workmanlike manner at prescribed or appropriate locations.
- c. **SPECIFICATION:** Materials specifically mentioned in this Summary shall be installed following efficient and sound engineering and construction practice, and especially as per manufacturer's application for installation specifications which shall govern all works alluded to in these Specifications.

SECTION-1 Earthwork (Excavation)

1.0. General

Any soil which generally yields to the application of pickaxes and shovels, rakes or any such ordinary excavating implement or organic soil, gravel silt, sand turf loam, clay, peat etc., fail under this category.

2.0. Clearing the site

The site on which the structure is to be built shall be cleared, and all obstructions loose stone, materials and rubbish of all kind bush wood and trees shall be remove.

The rate of side clearance is deemed to be included in the rate of earth work for which no extra will be paid.

3.0. Setting out

After clearing the site; the center lines will be given, by the Engineer-in-charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all parts of the work. Contractor shall supply labors materials, etc. required for setting out the reference marks and bench marks and shall maintain them as long as required and directed.

4.0. Excavation

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown in the drawings or as directed. The contractor shall do the necessary shoring and shutting or providing necessary slopes to a safe angle, at his own cost. The payment for such precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be leveled both longitudinally and transversely as directed by removing and watering as required. No earth filling will be allowed for bringing it to level. If by mistake or any excavation is made deeper or wider than, that shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor.

5.0 Disposal of Excavated Materials

No materials excavated from foundation trenches of whatever kind they may be, are to be placed even temporarily nearer than 1.5 m. or distance prescribed by the Engineer from the outer edge of excavation. All materials excavated shall remain the property of Government. Rate for excavation includes sorting out of useful materials and stacking them separately as directed within the specific lead. Materials suitable and useful for backfilling or other use shall be stacked in convenient places but not in such a way as to obstruct free movement of men, animals and vehicles or encroach upon the area required for constructional purpose. The site shall be left clean of all debris on completion.

6.0 Disposal of excavated materials is subject to the following:

Unsuitable materials obtained from clearing site and excavation shall be disposed of within a lead of 50 meters as directed. Useful materials obtained from clearing site and excavation shall be stacked within a lead of 50 M beyond the building areas as directed. Materials suitable for back-filling shall be stacked at convenient places within a lead of 50 M. from the structure for reuse. Useful stones from rock excavation shall be stacked neatly. within a lead of 50 M. and will be allowed to be used by the contractor on payment at rates laid down in the contract or if not so laid down, at scheduled rates of the Division or at a mutually agreed rates if there are no such rates in the schedule of rates.

7.0. Mode of measurements & payment

The measurement of excavation in trenches for foundation shall be made according to the sections of trenches shown on the drawing or as per sections given by the Engineer-in-charge. No payment shall be made for surplus excavation made in excess of above requirements or due to stopping and sloping back as found necessary on account of conditions of soil and requirements of safety.

The rate shall be for a unit of one cubic meter

Approval Note

All works was writing on this section should have approval by Architect or by Engineer-in-charge.

SECTION-1(a)

Earthworks (Fill Materials)

1.0 Materials:

General Fill for structures and under spread footings, pavers, or concrete slabs on grade shall conform to the general requirement for soil materials above and shall be classified as GW, GM, GP, SW, SM by the ASTM 2487 and conform to the following.

- a) Liquid Limit – shall not exceed 25% when tested in accordance with ASTM 423.
- b) Plasticity Index – shall not exceed 12 % when tested in accordance with ASTM 424.

Under Buildings, no more than 25% by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D 1140.

Granular Fill shall conform to the general requirements for soil material above and shall be clean, crushed stone or gravel conforming to ASTM C 33, size 67 and with a sand equivalent of not less than 50% when tested in accordance with ASTM D 2419.

Backfill material behind walls shall consist of free-draining granular fills, sized in particular to provide a filter media around subsoil drainage system.

Drainage Fill: Fill material shall clean, well graded, free draining sand conforming to ASTM C33 for Fine Aggregate.

Borrow: If additional material is required for fill in excess of that obtained by excavation at the site, obtain same from sources acceptable to the Owner's Engineer. All arrangement for obtaining borrow from off-site shall be the responsibility of the Contractor and all cost thereof shall be borne by the Contractor. Acceptable borrow will consist of suitable material for fills as herein before specified. Representative of each type of borrow materials considered suitable shall be delivered to the Testing Laboratory and tested prior to placement. Any borrow material not meeting the standard herein specified, or considered unsuitable by the Owner's Engineer will be rejected at the site.

RIPRAP: Rock Boulders, natural, hard rock, high density, from 400 mm to 800 mm in diameter.

BATTERBOARDS: Second class, pest free lumber assembled and rendered secure for proper delineation of building lines and grades.

2.0. Workmanship

The work shall be carried out in best workman like manner.

3.0. Mode of measurements and payment

The relevant specifications of this item shall be followed for mode of measurements and payment.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-1(b) TERMITE PROOFING

1.0 Materials:

Product and application by Owner-accredited termite and pest control contractor.

A. TERMITE PROOFING: Use Termiticide Concentrate or approved equal. Dilution rating: 1-part Termiticide Concentrate to 50 parts water. There shall be no disturbance of treated soil between application of poison and pouring concrete.

2.0. Workmanship

The work shall be carried out in best workman like manner.

3.0. Mode of measurements and payment

The relevant specifications of this item shall be followed for mode of measurements and payment.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-1(b) Road and Parking- Concrete Curbs, Gutter and Paved Walks

1.0 Materials:

A. CEMENT: Shall be as per ASTM Standard Specifications for Portland cement (ASTM C-150: latest revision) for Type 1 Portland Cement.

B. CONCRETE AGGREGATES;

1. AGGREGATES: shall be well-graded, clean, hard particles or gravel or crushed rock conforming to the STANDARD SPECIFICATION FOR CONCRETE AGGREGATES (ASTM Designation C-33: latest revision).

2. SAND: shall be coarse sand free from injurious materials such as shells or earth or organic materials. Sand from salt water is not allowed.

- C. WATER: Shall be clean and free from injurious amounts of oils, acids, alkali, organic materials or other deleterious substances.
- D. FORMS: shall be either wood or steel.
- E. CONTROLLED STRENGTH OF CONCRETE: Concrete shall develop a minimum of 28-day cylinder strength of 21 Mpa. (3,000 Psi).

2.0. Workmanship

The work shall be carried out in best workman like manner.

3.0. Mode of measurements and payment

The relevant specifications of this item shall be followed for mode of measurements and payment.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-1(c) SITE DRAINAGES

1.0 Materials:

A. DRAINAGE PIPE:

1. Plain concrete drain pipes and fittings: 250 mm (10") and below in diameter: T & G conforming to ASTM C 14 59.
2. Reinforced concrete pipes fittings: 300 mm (12") and bigger: Centrifugally cast or vibrated T & G conforming to ASTM C 76 59 T.

B. JOINING MATERIAL: One part cement to two parts sand.

C. BUILDING STORM DRAIN CONNECTION TO MAIN: Concrete wye branch and clean out, T & G or use junction boxes.

D. AREA DRAIN CATCH BASIN: Load bearing 4.8 Mpa (700 PSI) concrete hollow blocks (CHB) or reinforced concrete with cover as shown on the drawings.

E. CATCH BASINS OF JUNCTION BOXES: Load bearing 4.8 Mpa (700 PSI) concrete hollow blocks (CHB) or reinforced concrete as indicated in the drawings, with solid reinforced concrete cover.

2.0. Workmanship

The work shall be carried out in best workman like manner.

3.0. Mode of measurements and payment

The relevant specifications of this item shall be followed for mode of measurements and payment.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-1(c) LANDSCAPING

1.0 Materials:

A. TREE AND SHRUB MATERIALS

1. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well shaped, fully-branched, healthy, vigorous, and stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

2. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for types of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to the Landscape Architect, with a proportionate increase in size or roots or balls.

B. GROUND COVER MATERIALS: Provide ground covers established and well rooted in removable containers or integral peat pots and with not less than the minimum number and length of runners required by ANSI Z60.1 for the pot size indicated.

C. GRASS MATERIALS: Carabao Grass with a minimum of 2 nodes and any attached roots free of soil.

D. TOPSOIL: ASTM D 5258. pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth.

E. STAKES AND GUYS

1. Upright and Guy Stakes: Solid bamboo poles, sound, pressure preservative-treated, free of holes and other defects, 3 pieces per tree as shown in Plans, 32 mm to 50 mm dia. by length indicated, pointed at one end.

2. Guy and Tie Wire: ASTM A 641 (ASTM A 641M), Class 1, galvanized-iron wire, 2-strand, twisted, 2.7 mm (0.106 inch) in diameter.

3. Rope: Abaca rope tied loosely to horizontal bars.

F. EXISTING TREES: Contractor shall secure the necessary environmental permits required to ball-out, or cut down affected existing trees with 100mm or more in trunk diameter.

Cut down trees shall be the property of the Owner. All costs and logistics of the transportation and transfer of balled-out trees to the new site shall be the responsibility of the contractor.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-2 CONCRETE

1.0. General

1.1. Portland cement shall conform to the requirements of ASTM C-50,

Concrete shall be composed of Portland cement, fine and coarse aggregates, water and admixture as specified, all thoroughly mixed and brought to the proper consistency, uniformity and temperature for final placement. Strength requirements shall be:

- 27.6 MPa (4000 psi) for footings, retaining walls, footing tie beams, cistern and suspended slabs.
- 27.6 MPa (4000 psi) for columns, girders, beams and RC gutters;
- 21 MPa (3000 psi) for slabs-on-grade, partitions, walks, & other non-structural members;
- 10.5 MPa (1500 psi) for lean concrete, or as required by the Engineer

1.2. The water cement ratios shall not be more than specified. The cement content of the mix shall be increased if the quantity of water in mix has to be met eased to overcome the difficulties of placements and compaction so that the water-cement ratio

1.3. Workability of the concrete shall be controlled by maintaining a water -cement-ratio that is found to give a concrete mix which is just sufficient wet to be placed and compacted without difficulty with the means available.

1.4. The maximum size of course aggregate shall be as large as possible within the limits specified but in no case greater than one fourth of the minimum thickness of the member provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and to fill the corners of the form.

1.5. For reinforced concrete work; coarse aggregates having a nominal size of 20 mm. are generally considered satisfactory.

1.6. For heavily reinforced concrete members as in the case of ribs of main beams, the nominal maximum size of coarse aggregate should usually be restricted to 5 mm. less than the minimum clear distance between the main bar or 5 mm. less than the minimum cover to the reinforcement whichever is smaller.

1.7. Where the reinforcement is widely spaced as in solid slabs, limitations of size of the aggregate may not be so important, and the nominal maximum size may sometimes be as great as or greater than the minimum cover.

1.8. Admixture maybe used in concrete only with approval of Engineer-in-charge based upon the evidence that with the passage of time neither the compressive strength of concrete is reduced not are other requisite qualities of concrete and steel impaired by the use of such admixtures.

2.0. Workmanship

The work shall be carried out in best workman like manner.

3.0 Inspection:

Contractor shall give the Engineer-in-charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength, alignment and general fitness but such inspection shall not relieve the contractor of his responsibility for the safely of men machinery materials and for results obtained immediately before concreting all forms shall be thoroughly cleaned.

4.0 Transporting and laying:

The method of transporting and placing concrete shall be as approved. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All form work shall be cleaned and made free from standing water dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the engineer-in-charge has been obtained.

5.0. Curing:

Immediately after compaction, concrete weather including rain, running water, shocks, vibration, traffic, rapid temperature charges, frost and drying out process. It shall be covered with wet sacking has Sian or other similar absorbent material approved, soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonry work over foundation concrete may be started after 48 hours of its laying but curing of concrete shall be continued for a minimum period of 14 days.

6.0 Sampling and testing of concrete:

Samples from fresh concrete shall be taken and cubes shall be made, cured and tested at 7 days, 14 days and 28 days as per requirements in accordance standard. A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested i.e. The sampling should be spread over the entire period of concreting and cover all mixing units.

7.0. Mode of Measurement & Payment

The consolidated cubical contents of concrete work as specified in item shall be measured. No deduction shall be made for (a) Ends of dissimilar materials such as joints, beams, posts, girders, falters, purling trusses, corbels and steps etc.

The rate includes cost of all materials labor, tools and plant required for mixing, placing in position, vibrating and compacting, finishing, as directed, curing and all other incidental expenses for producing center of specified strength. The rate excludes the cost of form work.

The rate shall be for a unit of one cubic meter.

SECTION-3 Reinforcement

Work including bending binding and placing in position etc. complete up to floor two level.

1.0. Materials

- **STEEL BARS:** Use locally manufactured deformed billet-steel bars conforming to Philippine standard, Steel bars Grade of 275.8 Mpa ($F_y = 40,000$ psi) for bars 10mm and 12mm diameter and steel bars Grade of 414 Mpa for bars 16mm diameter and larger. Use standard-sized deformed steel conforming to ASTM A615 / PNS 49 standards, for concrete and masonry reinforcements. Upgrade to next bigger size if specified standard sizes are unavailable.
- **TIE WIRES:** Use Ga.16 Galvanized Iron (G.I.) tie wires at joints or laps of placed reinforcements.

2.0. Workmanship

The work shall consist of furnishing and-placing reinforcement to the shape and dimensions shown as on the drawings or as directed

Steel shall be clean and free from rust and loose mill scale at the lime of fixing in position and subsequent concreting.

Reinforcing steel shall conform accurate to the dimensions given in the bar bending schedules shown on relevant drawings. Bars shall be bent cold to specified shape and dimensions or as directed, using a proper bar bender, operated by hand or power to attain proper radius of bends. Bars shall not be bent or straightened in a manner that will injure the material. Bars bent during transport-or handling shall be straightened before being used on the work. They shall not be heated to facilitate bending unless otherwise specified a "U" type hook at the end of each bar shall invariably be provided to main reinforcement. The radius of the bend shall not be less than twice the diameter of the round bar and the length of the straight part of the bar beyond the end of the curve shall be at least four times the diameter of the round bar. The hooks shall be suitably encased to prevent any splitting of the concrete.

3.0. Mode of Measurements & Payment

For the purpose of calculating consumption, wastage shall not be permitted beyond 5 percent Excess consumption over 5% will be charged at penal rate.

Reinforcement shall be measured in length including overlaps, separately for different diameters as actually used in the work. Length shall include hooks at the ends Wastage and annealed steel wire for binding shall not be measured and the cost of these items shall be deemed to be included in the rate for reinforcement.

The rate for reinforcement includes cost of steel binding wires. It's carting from suppliers to work site, cutting, bending, placing, binding and fixing in position as shown on the drawings and as directed It shall also include all devices for keeping reinforcement in approved position, cost of joining as per approved method and all wastage and spacer bars.

The rate shall be for a unit of one kilogram.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION - 4 Masonry Work

1.0. Materials

- Use 150 mm x 200 mm x 400 mm (6" x 8" x 16") and 100 mm x 200 mm x 400 mm (4" x 8" x 16") Non-Load Bearing machine-made Concrete Hollow Block Units of standard manufacture, machine vibrated with even texture and well-defined edges, steam-cured, conforming to PNS16 Type 1, Class A, with a minimum compressive strength of 2.5 MPa (350 psi) for building exterior and interior walls and septic tank retaining wall around open court and wherever else specified. Note: For interior walls, use 4" CHB from floor to bottom of slab or bottom of beam, with 10mm dia. reinforcing bars at 600 mm O.C. vertically and 800 mm O.C. horizontally. Anchor to floor by embedding vertical bars 75mm deep into the floor slab. Anchor to slab or beam by providing 10mm dia. dowels. Provide stiffener columns and beams as required in the general notes.
- REINFORCING BARS: Masonry reinforcing steel yield strength (f_y) = 228 Mpa (33,000 psi), Grade 33 bars, conforming to ASTM Specifications A615 / PNS 49 of sizes shown in Plans. Use standard sizes; upgrade to next bigger size if specified standard sizes are unavailable.
- TIE WIRES: Gauge 16 Galvanized Iron (G.I.) tie wires.

2.0. Workmanship

The work shall be carried out in best workman like manner.

3.0. Proportion:

PORTLAND CEMENT: Use only one brand of cement throughout. Portland cement shall conform to the Standard Specifications for Portland Cement (ASTM Designation C-150 latest revision) for type 1 Portland Cement.

SAND: ASTM C 35 – 67, clean, washed river sand, strong, free from organic and other deleterious materials. Sand from salt water or lahar is not allowed.

WATER: Fit for drinking, free from injurious amount of oil, acids, alkali, organic materials and other deleterious substances.

CONCRETE MORTAR COMPRESSIVE STRENGTH: (f'_c) = 13.8 Mpa (2000 psi).

ADHESIVE MORTAR: Use adhesive mortar for laying vitrified ceramic tiles, with dispersion compound as an additive to adhesive mortar.

GROUT: Use grout pre-mixed dry wall filler for floor and wall tile joints either glazed or semi-glazed tiles. Masonry concrete grout compressive strength (f_c') = 13.8 Mpa (2000 psi). For tile works.

PLASTER BOND: Apply on all wall areas prior to plastering.

MORTAR TOPPING & PLASTER REINFORCING FIBER: For plaster works thicker than 25mm (1"). The proportion of the cement mortar shall be 1:5 (1 cement: 5 fine sand) by volume.

4.0 Laying:

CHB shall be laid in properly. Half or cut Hollow blocks shall not be used except when necessary to complete to bond; closures in such case shall be cut to required size and used near the ends of walls.

A layer of mortar shall be spread on full width for suitable length of the lower course. Each block shall first be properly bedded and set home by gently tapping with handle of trowel or wooden mallet. Its inside face shall be flushed with mortar before the next block is laid and pressed against it. On completion of course, the vertical joints shall be fully filled from the top with mortar.

The walls shall be taken up truly in plumb. All courses shall be laid truly horizontal and all vertical joint shall be truly vertical. Vertical joints in alternate course shall generally be directly one over the other. The thickness of brick course shall be kept uniform.

5.0 Joints:

Block shall be so laid that all joints are quite flush with mortar. Thickness of joints shall not expose 12 mm. The face joints shall be raked out as directed by raking tools daily during the progress of work, when the mortar is still green so as to provide key for plaster or pointing to done.

The face of block shall be cleaned the very day on which the work is laid and all mortar dropping removed.

6.0 Curing:

Work shall be protected from rain suitably. Masonry work shall be kept moist on all the faces for a period of seven days. The top of masonry work shall be kept well wetted at the close of the day.

7.0 Mode measurements & payment

The measurements of this item shall be taken for the block masonry fully completed in foundation up to plinth. The limiting dimensions not exceeding those shown on the plinths or as directed shall be final. Battered tapered and curved portions shall be measured net.

No deduction shall be made from the quantity of block work, for any extra payment made for embedding in masonry.

The rate shall be for a unit of one square meter.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION – 4(a) Plastering

10 mm. thick cement plaster in single coat on fair side of CHB concrete walls for interior plastering up to floor two level and finished even and smooth.

1.0. Materials

Water, cement mortar of proportion 1:3 shall conform to materials and workmanship as directed.

Note: PLASTER BOND: Apply on all wall areas prior to plastering.

MORTAR TOPPING & PLASTER REINFORCING FIBER: For plaster works thicker than 25mm (1”).

2.0. Workmanship

Scaffolding:

Wooden bullies, bamboos, planks, trestles and other scaffolding shall be sound. These shall be properly examined before erection and use. Stage scaffolding shall be provided for ceiling plaster which shall be independent of the walls.

Preparation of back-ground:

The surface shall be cleaned of all dust, loose mortar droppings, traces of algae, efflorescence and other foreign matter by water or by brushing. Smooth surface shall be toughened by wire brushing if it is not hard and by hacking if it is hard. In case of concrete surface, if a chemical retarded has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the readers if left on the surface. Trimming of projections on brick/concrete surfaces where necessary shall be carried out to get an even surface.

Raking of joints in case of masonry where necessary shall be allowed to dry out for sufficient period before carrying out the plaster work.

The work shall not be soaked but only damped evenly before applying the plaster. If the surface becomes dry, such area shall be moistened again.

For external plaster, the plastering operation shall be started from top floor and carried downwards. For internal plaster, the plastering operations may be-start wherever the building frame and cladding work are ready and the temporary supports of the ceiling resting on the wall of the floor have been removed. Ceiling plaster shall be completed before starting plaster to walls.

Application of plaster:

The plaster about 15x15cms. shall be first applied horizontally and vertically at not more than 2 meters intervals over the entire surface to serve as gauge. The surfaces of these gauges shall be truly in plane of the finished plastered surface. The mortar shall then be applied in uniform surface slightly more than the specified thickness, then brought to a true surface by working a wooden straight edge reaching across the gauges with small upward and sideways movements at a time. Finally, the surface shall be finished off true with a trowel or wooden float according as a smooth or a smooth or a sandy granular texture is required Excessive troweling or overworking the float shall be avoided. All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Hounding or chamfering, corners, arises junctions etc. shall be carried out with proper templates to be size required.

Cement plaster shall be used within half an hour after addition of water. And mortar or plaster which is partially set shall be rejected and removed forthwith from the site.

In suspending the work at the end of the day, the plaster shall be left out clean to the line both horizontally and vertically, when recommencing the plaster, the edges of the old work shall be scraped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and nearer than 15 cm. to any corners or arises. It shall not be closed on the body of features such as plaster bands and cornices not at the corners or arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakage. No portion of the surface shall be left out initially to be packed up later on.

Each coat shall be kept damp continuously till the next coat is applied or for a minimum period of 7 days. Moistening shall commence as soon as plaster is hardened sufficiently. Soaking of walls shall be avoided and only as much water as can be readily absorbed shall be used, excessive evaporation on the sunny or windward side of building in hot air or dry weather shall be prevented by hanging matting or gunny bags on the outside of the plaster and keeping them wet.

3.0. Mode of measurements & payment

The rate shall include the cost of all materials, labor and scaffolding etc. involved in the operations described under workmanship.

All plastering shall be measured in square meters unless otherwise specified. Length breadth or height shall be measured correct to a centimeter.

The thickness of the plaster shall be exclusive of the thickness of the key i.e., grooves or open joints in brick work, stone work etc. or space between laths. Thickness of plaster shall be average thickness with minimum 10 mm. at any point on this surface.

This item includes plastering up to floor two level.

The measurement of wall plastering shall be taken between the walls or partition (dimensions before plastering being taken) for length and from the top of floor or skirting to ceiling for height. Depth of cover of cornices if any shall be deducted.

The rate shall be for a unit of one sq. meter.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION -5 Centering & Form Work

Providing form work of ordinary timber planking so as to give a rough finish including centering strutting and propping etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same for in situ reinforced concrete and plain concrete work in foundation, footings, bases of columns, and mass concrete.

1.0. Materials

- The shuttering to be provided shall be of ordinary timber plank and shall conform to standard. TYPE OF FORMS: Use phenolic boards Use 9mm thick Marine plywood for all exposed and unexposed concrete works, or approved equal, for all cast in place and pre-cast works.
- The dimensions of scantlings and battens shall conform to the design. The strength of the wood shall not be less than that assumed in the design.

2.0. Workmanship

The form work shall conform to the shape lines and dimensions as shown on the plans and be constructed as to remain sufficiently rigid during the placing and compacting of the concrete. Adequate arrangements shall be made by the contractor to safe-guard against any settlement of the form-work during the course of concreting and after concreting. The form work of shuttering, centering, scaffolding, bracing etc. shall be as per design.

3.0 Stripping time:

In normal circumstances and where ordinary cement is used forms may be struck after expire of following periods.

- Sides of walls columns and vertical faces of beams.....24 to 48 hours.
- Beam soffits, (props, left under)7 days.
- Removal of props slabs:
 - Slabs spanning up to 4.5.m.....7 days.
 - Spanning over 4.5 m.....14 days.
- Removal of props t beams and Arches:
 - Spanning up to 6 m14 days.
 - Spanning over 6 m21 days.

Note: The centering and form work shall, be inspected and approved by the Engineer-in-charge before concreting. But this will not relieve the contractor of his responsibility for strength, -adequacy and safety of form work and centering. If there is a failure of form work or centering, contractor shall be responsible for the damages to property.

4.0 Scaffolding:

All scaffolding, hoisting arrangements and ladders etc., required for the facilitating of conceding shall be provided and removed on completion of work by contractor at his own expense. The scaffolding, hoisting, arrangements and ladders etc. shall be strong enough to with stand all live, dead and impact loads expected to act and shall be subject to the approval of the Engineer-in-charge. However, contractor shall be solely responsible for the safety of the scaffolding, hoisting arrangement, ladders, work and workman etc.

The scaffolding, hoisting arrangements and ladder shall allow easy approach to the work spot and afford easy inspection.

The rate is applicable to all condition of working and height up to 4 meters. The rate shall include the cost of materials and labor for various operations involved such as:

- Splayed edges, notching, allowance for overlaps and passing at angles, battens centering, shuttering propping, bolting, wedging easing, striking and removal.
- Filleting to form stop chamfered edges or splayed external angles not exceeding 20 mm: width to beams, columns and the like.
- Temporary openings in the forms for pouring concrete, if required removing rubbish etc.
- Dressing with oil to prevent adhesion of concrete with shuttering and.
- Raking or circular cutting.

5.0 Re-Use:

Before re-use, all form shall be inspected by Engineer-in-charge and their suitability ascertained. The forms shall be scarred, cleaned and joints are gone over, repaired where required. Inside surface shall be retreated to prevent adhesion of concrete.

6.0 Mode of Measurements & Payment

Form work shall be measured as the area in square meters to shuttering in contract with concrete except in the case of inclined member and portion of curved profile and upper side in which case on area of underside shall be measured for payment.

Form work to secondary beams shall be measured up to the sides of main beams but no deduction shall be made from the form work of the main beam at the inter section point. No deduction shall be made from the form work of a column at inter section of beams.

The rate is for the completed item

The rate shall be for a unit of one square meter.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

WOODWORK AND CARPENTRY

SECTION-6 Wood Work

Providing wood work in frames of doors, windows, and other similar work, Wright, framed and fixed in position, hard wood.

1.0. Materials

Wood in frames shall conform to Philippine Standards.

ROUGH CARPENTRY

Note: For K.D. Tanguile, plywood inner sides and for cut ends of Apitong joints, nailers, and framings, supplementary termite and rot treatment to be applied by Owner-approved termite and pest control company, with guarantee. Effect butt joint appearance for all T and cross intersections of exposed frames. When stronger joints are required, introduce half-laps, dowelling or mortise and tenon but still effect a simple butt joint at the exposed surface.

LUMBER: Hard wood: generally, for all plates, corbels, struts and other components of wood-based structures requiring wood which is strong, not resistant and/or capable of holding on firmly to driven nails or other connectors. For cabinet base wood blocks or as specifically called for in the drawings.

HARDWARE AND FASTENERS: use metal nails, screws, bolts, plates, straps, miscellaneous fasteners or anchorage concealed or countersunk whenever called for, with size, shape and type to ensure a rigid connection for laminated items and at cabinet framing joints.

FINISH CARPENTRY (DRY WALL Finishes)

- FINISHING MARINE BOARD: 19mm (3/4"). For free span shelves, and for miscellaneous components of cabinets, overhead cabinets and closet housing; for all doors and exposed and unexposed sides of closets and kitchen cabinets/overhead cabinets.
- FIBER CEMENT BOARD: Use 6mm thick for wall boards. Install as per manufacturer's instructions.
- Metal Studs framing and brace angles shall be of standard thickness sufficient to carry the load of walls.
- HARDWARE AND FASTENERS: Use metal nails, screws, plates, straps, miscellaneous fasteners or anchorage; concealed or countersunk whenever called for, with size, shape and type to ensure a rigid connection for laminated items.
- ASSEMBLY MATERIALS: Approved water-resistant glue, and nails, screws and bolts of appropriate type, shape and size for all types of joints.
- TRADEMARK: Each separate lumber piece or assembly is required to bear an official mark of the millwork's supplier.

2.0. Workmanship

The item covers the requirement of frames for doors, windows, clerestory windows, their supply and fixing.

3.0 Frames:

All members of frames shall be exactly at right angles. The right angle shall be checked from inside surfaces of the-frames of the respective members.

All members of frames shall be straight without any warp of bow and shall have smooth surfaces well planned on the three sides exposed at right angles to each other. The surfaces touching the wall may not be planed unless it is required in order to straighten up the member or to obtain the overall sizes within the tolerances as specified.

Frame shall have dovetail joints. When clerestory windows in included, it shall be provided by having full-length one-piece post for door or windows and clerestory window extending the frame on top at the head to the required extent. Horns shall not be provided in the head of the frame. When no sills are provided, the vertical posts of the frame in the ground floor shall be embedded in the sill masonry for 10 cm. on upper floors, the vertical posts shall be fixed in the floor or masonry by forming notches 10 mm. deep. Slight adjustment of spacing as necessary shall be done to have the hold fasts in the joints of masonry; course. The frame shall be erected in position and held plumb with strong support forms north sides and built-in masonry as it is being built. The transom shall be through tenoned into the mortises of the jamb post to the full width of the jamb post and the thickness of the tenon shall be not less than 15 mm.

4.0. Mode of Measurements and payment

The linear dimensions shall be measured correct up to 1 cm. The quantity shall be worked out correct to places of decimals of board foot.

The rate shall be for a unit of one Board foot.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-6(a) (Doors & Windows)

WINDOWS: Provide and install all windows with complete locksets, hinges and accessories.

1.0 Materials:

ALUMINUM WHITE ANODIZED WINDOWS AND DOORS:

Material: Electrophoresis, Powder coating, Anodized white on 2.0mm thick frame and clear Tempered glass, double glazed.

KILN-DRIED LAUAN SOLID WOOD DOOR PANELS

- WOOD DOORS: All wood from stock, sound and free from imperfections impairing its strength and finish. Kiln-dried (max. moisture content: 12%), with the same shade and color for assemblies or sets of assemblies, warp free, S4S and fine sanded lumber.
- JAMBS AND HEADER: 50mm x 150mm.
- SHOPMADE PANEL DOOR: Single-leaf, 44mm (1-3/4") thick. For all doors as indicate in the plans.

DOOR LOCKS AND LOCKSETS: U.S. made original. Can fit to 25mm to 50mm thickness of door.

Note: Provide 4pcs master key for all cylindrical locksets and deadbolts locking device.

Cylindrical Locksets:

- Entrance Lock, (satin chromium finish), U.S. original, or approved equal. Turn-button locking in inside knob; requires use of key at all times until button is manually restored to unlock position.
- Privacy Lock, (satin chromium finish), U.S. original, or approved equal. Push button locking in inside knob. Can be opened from outside by screwdriver or similar tool or by turning inside knob.
- Deadbolts: Deadbolt Lock, (satin chromium finish), U.S. original, heavy duty, or approved equal. Deadbolt thrown or retracted by key from outside or by inside turn unit. Bolt automatically deadlocks when fully thrown.

ACCESSORIES:

- HINGES: US Standard or approved equal: 88.5mm x 88.5 mm (3-1/2" x 3-1/2") plain bearing, stainless steel, loose pin or fixed pin, button tip, four (4) pieces per door panel where specified.
- Gravity Pivot Hinge: U.S. original, Gravity Pivot Hinge, or approved equal. 2 pieces, plain bearing, for all toilets stall doors.
- DOOR CLOSERS: Door Closers, or approved equal, 40 kg. max. door weight, satin chrome finish. For doors as indicated in the door schedule.
- DOOR STOP / DOOR HOLDER: U.S. original, chrome finish, floor / wall mounting. Attached securely to floor/wall to prevent door knob from hitting the wall.
- DOOR PULLS: 203mm x 408mm (8" x 16") Push Plate, 152mm x 405mm, (6" x 16") Pull Plate, Stainless Steel. For doors requiring the hardware. Kick Plate, SS304 3mm thk, 300mm height from bottom of door x door width. As indicated in the doors schedule.
- DOOR SILENCERS: Rubber, 3 sets per door, installed at jamb side. For all doors.

CABINET ACCESSORIES:

- Pulls: Stainless steel 304 in satin finish: For all cabinet, closets and drawers.
- Self-Closing Hinges: For all cabinet and closet doors.
- Drawer Runners: Use extended design mechanism where necessary. For all drawers.

- Cabinet and Drawer Locks: stainless steel finish. For all cabinet doors and drawers.

PADLOCK: U.S. Made, heavy duty, solid brass, general purpose padlock.

2.0. Workmanship

The work shall be carried out in best workman like manner.

3.0. Mode of measurements and payment

The relevant specifications of this item shall be followed for mode of measurements and payment.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

STRUCTURAL STEEL

SECTION-7 Structural Steel

Steel work riveted, in built up sections, framed work including cutting, hosting fixing in position and applying a priming coat of red lead paint. In beam and joints, channels, angles tees, flats, with connecting plates or Angle cleats as in main & cross beams, Hop and jack falters, pralines connected to common rafters and the like.

1.0. Materials

STRUCTURAL STEEL

The structured steel work shall conform to all materials and workmanship to the requirements of the American Institute of Steel Construction "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings" as amended to date or as may be specifically modified by the drawings or by these Specifications.

PLATES, SHEETS AND CONNECTORS:

Conform to ASTM Designation A36 with specified yield point of 248 MPa (36,000 psi). From mild steel sheets or plates with standard thickness, size, shape and design as indicated in the plans. For miscellaneous stiffener, bearing anchorage and connector plates or straps. Upgrade to next higher / bigger size and thickness if specified sizes & thicknesses are unavailable.

STANDARD SOLID SECTION

Conform to ASTM A36 with specified yield point of 248 MPA (36000 psi). Mild steel angles, flat bars, square bars, channels, U and other sections. For structural steel trusses, purlins, building eaves framing, overhead anchorage of roll-up doors, grillwork's, miscellaneous fabricated mounting brackets, straps, dowels, frames and connectors. Upgrade to next higher/bigger size and thickness if specified sizes and thickness are unavailable.

HIGH STRENGTH BOLTS, NUTS AND WASHERS

Conform bolts to the Specification for High Strength Bolts ASTM A325, Type 1. See structural connection details for location of bearing-type and friction-type bolts.

ANCHOR BOLTS: A36.

WELDING ELECTRODES: Conform welding electrodes to AWS D1.1:2000 Structural Welding Code – Steel, E-60XX for structural welding.

GROUT: Conform non-shrink grout to ASTM C827. Grout shall be non-metallic. Use Non-shrink flowable cementitious grout. Apply using manufacturer's standards strictly.

STRUCTURAL STEEL PRIMER PAINT: Epoxy zinc chromate primer except as otherwise recommended by the manufacturer of the coating for all structural steel surfaces.

FIRE COVER: Cementitious Fireproofing System. Sprayed-On Fireproofing, whenever necessary.

MISCELLANEOUS METALS

- **STANDARD SOLID SECTION:** Conform to ASTM 611 with specified yield point of 228 Mpa (33,000 psi). Mild steel flat bars, square bars, overhead anchorage of roll-up doors, grill work, miscellaneous fabricated mounting brackets, straps, dowels, frames and connectors. Upgrade to next higher / bigger size and thickness if specified sizes & thickness are unavailable.
- **BRACING RODS:** Standard structural grade steel rods with turnbuckles whenever required ex. for roof framing.
- **PAINTING:** Use only approved brand of epoxy zinc chromate paint and linseed oil for all architectural steel components only. For field painting, use only approved brand of enamel paints.
- **STAINLESS STEEL:** Pipes, tubes, square bars, and other sections. Manufactured and installed with guarantee. Provide shop drawings for approval by the Architect before fabrication/installation.
 1. Roof Gutter: 1.2 mm (gauge 18) thick, Stainless Steel Sheets, Type 304 bent to design shape. For all other gutters aside from RC gutters. To be approved by Architect before installation
 2. RC Precast Anchors: 10mm Stainless Steel Plain Bars
 3. Stair, ramp and corridor railings.
 4. Grab bars for toilets (where applicable).

Note: Upgrade to next bigger size if specified standard sizes are unavailable.

GALVANIZED IRON: Yard Hose Bibbs: G.I. Pipes: schedule 40, painted with Epoxy Enamel Paint.

BRASS NOSING: 3 mm thick. x 38 mm wide brass nosing for every change in floor elevation, unless otherwise indicated or any approved equivalent by Architect.

FASTENINGS: Commercial types, except where special types are shown or required. Fastenings for all exterior work shall be non-ferrous, unless otherwise shown. Fastening for stainless steel and aluminum and other interior work, where exposed shall match the fastened metal.

2.0. Workmanship

The steel sections as specified or required, shall be cut, square and to correct lengths, as per drawings and design. The cut ends exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed to make up the required length of member, except as indicated in the drawing or as directed. All straightening and shaping to form shall be done by application of pressure and not by hammering. Any bending or cutting shall be carried out in such a manner as not to impair the strength of the metal. All operations shall be done in cold state unless otherwise directed/permitted.

3.0 Mode of measurements & payment

The steel work shall be measured in general as under:

- All work shall be measured on the basis of finished dimensions as fixed at site and measured net unless specified otherwise.

- The weight of steel sections, steel rods, and steel strips in finished work shall be calculated in standard weight on the same basis on which steel is supplied.
- The weight of steel plates and strips shall be taken from relevant calculation of 7840 kg/cu.m.
- Unless otherwise specified, weight of cleats, brackets, packing pieces, bolts, nuts, washer, distance pieces, separators, diaphragm gusset (taking overall square dimensions) fish plates etc. shall lie added to the weight of respective items.
- In riveted work allowance is to be made for weight of rivet hands. No deductions shall be made for rivet or bolts holes excluding holes for anchor or holding down bolts.
- For forged steel and steel castings, weight shall be calculated on the basis of 7840 kg./cum.
- Unless otherwise specified, no allowance shall be made for the weld metal in case of welded steel structure.
- Dimensions other than cross sections and thickness of plates shall be measured to nearest 0.001m
- Mill tolerance shall be ignored when weight is determined by calculation.

The rate includes cost of all material, labor, erection, hoisting scaffolding, and protective measure, required for proper completion of the item of work. This shall also include conveyance and delivery handling, loading, unloading and storing etc. required for completing the item described above including necessary wastage involved.

The rate shall be for a unit of one kilogram.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-8 (Intentionally put it Blank)

SECTION-9 Paving & Floor Finishing

1.0. Materials

Densifier Retro-plating Floor System, Ceramic tiles, water, cement, Sand shall conform to materials and workmanship as required.

DENSIFIER FLOORING SYSTEM shall have an abrasive resistance at least 400% with Impact Strength more than 20%. The materials shall last at least 10 years and does not support combustion, eliminates smoke or toxic fumes. Surface preparation as per manufacturer specification shall be coordinated prior to concrete slab pouring. All Flooring finish as specified by Architects and Engineers, approved by enduser.

CERAMIC TILES: Use only Class A tiles (one brand from same batch throughout for each type/size):

300mm x 300mm Floor Tiles – For toilet floors. Use non-skid in color patterns approved by end-user and Architect in charge. The tiles use for all toilet floors must be ceramic type, Acid-Resistant and 7.8mm-8.5mm thickness. Floor level sloped to drain. Use 2mm tile spacers for consistency.

300mm x 600mm Wall Tiles – For all toilet walls. In color patterns approved by end-user and Architect in charge. The tiles use for all toilet walls must be ceramic type, Acid-Resistant and 7.8mm-8.5mm thickness. Wall tiles installation 1.8m height from finish floor tiles. Use 2mm tile spacers for consistency.

Finish shall be clean, plumb and true to line. Avoid odd-size tiles.

ADHESIVE, GROUT AND SEALANT: Grout and Sealant color coordinated as required

TILE TRIM: Use metallic or aluminum tile trim to cover all exposed tile joints; color-coordinated as required.

2.0. Workmanship

Tile finish shall be laid over a layer of base concrete in case of ground floor. When the tile floor is laid over R.C. slabs a cushioning layer consisting of 75 mm thick lime concrete shall be provided below the tile floor. The tile flooring shall consist of an under layer of cement concrete and layer of tile which shall be laid monolithically.

Under Layer:

The under layer shall be of cement concrete mix 1:2:4. The maximum size of aggregate used shall not exceed 10 mm. Specification for cement concrete shall be followed as per directed by Engineer in charge.

Tile Topping:

The topping shall have mix of ordinary cement, and marble powder in proportion 3:1 (3 cement: 1 marble powder by weight) and marble aggregate shall be mixed in proportion 4:7 (4 cement marble powder: 7 marble chips by volume). The thickness of concrete and cushioning layer shall not be less than 10cms, and 7.5cms, respectively. The minimum thickness of under layer and topping shall be 40 mm.

3.0. Mode of measurements and payment

Tile flooring shall be measured as laid in sq. meters. Length and breadth shall be measured for visible area of work done.

The rate includes the cost of all materials and labor involved in all operations described above. The rate shall also not include diving strip. The rate shall be for a unit of one sq. meter.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

THERMAL AND MOISTURE PROTECTION

SECTION-10

Roof Covering

Providing 0.64mm thick (Gauge 22) x 1.07m wide rib roofing type pre-painted G.I. sheets roofing fixed with galvanized iron 1J' or 1L' hook bolts and nuts 8 mm. dia. with bitumen and G.I. limpet washers filled with white lead complete excluding the cost of purlins, rafters and trusses (1) 0.6 mm. thick sheet.

1.0. Materials:

METAL SHEET ROOFING: Pre-painted long-span rib-type G.I. roofing sheets, White or any Architect-approved equal in color. For roofing as indicated in the plans.

Base metal type: Cold rolled steel tempered to 275 Mpa (40,000 psi).

Thickness: 0.64 mm (Gauge 22)

Effective Coverage: 1030 mm

Anti-rust Coating: 55% Alum, 43.4% zinc & 1.6% silicon

Coating Standards: AZ 125 (125 gm/m²); ASTM A-792

Top Coat: 20 Microns Regular Polyester

Back Coat: 8 Microns Epoxy Primer

METAL ROOFING INSULATION: Thermal Barrier INSULATION. For all metal roofing, installed directly under C-purlins.

Ridge rolls, flashings, capping's, trims, moldings and awnings: 0.60 mm thick base metal thickness, (215 g/m² zinc coating) pre-painted zinc coated from plain sheets, pre-formed with matching shape and fitting provisions for Metal Sheet Roofing.

Roof Gutters and Metal End Fascia at eaves and gable: 1.2 mm (Gauge 18) thick, Stainless Steel Sheets, Type SS304 bent to design shape as shown in Plans.

Fasteners and Fixation: Use corrosion-resistant nails, anti-UV treated washer-caps, corrosion-resistant hook bolt connectors in areas as recommended by manufacturer and approved by Architect. Paint all exposed fixation and fastening devices with the same color as roof.

Concealed Clips: Concealed clips shall be designed to meet the wind uplift requirements. Clips will provide for thermal expansion and contraction and will not abrade the panel against the clips, substrate or fasteners. Clips shall be stainless steel or galvanized steel for steel applications.

Strainer: Use Brass Dome Strainers for gutters.

2.0. Workmanship

Spacing of purlins: One purlin shall be provided at the ridge and one at the eaves. The spacing as specified in the plan. The purlins shall coincide with the center line of the end lap. The ridge purlins shall be placed in such a way that the ridges can be fixed properly. The portion overhanging the wall support shall not be more than one fourth of the 'spacing of purlins.

The top surfaces of the purlins shall be painted before the sheets are fixed over them. Embedded portions of purlins shall be finished with two coats of coal-tar.

3.0. Mode of measurements and payment

The measurements of the roof sheet shall be taken for finished work in superficial area in general plane (not girthed on the roof). The laps between Sheets both at their ends and along the side edges shall not be measured. The overlaps of sheets over the valley piece and they're under lap under the ridge, hip and flashing piece shall be included in the measurements.

No deductions in measurements shall be made for openings for chimney stacks, sky light etc., of area up to 0.40 sq. mt. nor extra be paid for labor in cutting and for wastage etc. in forming such openings.

The rate of roof shall include the cost of all materials and labor involved in all operations described above. The rate also includes the cost of provision, erection and removal of the scaffolding, benching, ladders, templates and tools required for the proper execution and erection of the work. The rate includes the cost of purlins, rafters and trusses.

The rate shall be for a unit of one sq. meter.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-10(a)

Roofing Insulation

GENERAL

1.1 SCOPE OF WORK

A. Furnish all materials, labor, equipment, plant, tools, required to complete works as indicated in Plans.

B. See drawings and details for sizes and location of work required.

1.2 SUBMITTALS

A. Samples: Submit to the Architect samples of materials to be used and secure approval prior to installation.

B. Information Submittals: Submit the following to the Architect and secure approval prior to installation:

1. Product data describing materials and showing "R" values.

2. Manufacturer's complete printed instructions for the installation of the material and

1.3 PRODUCT HANDLING AND PROTECTION

A. Supply and deliver insulation material in its finished form.

B. Store at a place properly protected from rain and sunlight. Extended outdoor exposure is not recommended.

- C. The insulation material shall not be in contact with wet concrete.
- D. All works shall be performed only by qualified contractor.

1.4 PRE-INSTALLATION

Review conditions of installation, installation procedures and coordination with other Sections.

1.0 Materials

METAL ROOFING INSULATION: Thermal Barrier INSULATION, installed directly under C-purlins/trusses.

1. REFLECTIVE INSULATION, double-sided aluminum sandwiched glass-fiber insulation 50mm thick or approved equal
2. G.I. Strap Liner
3. G.I. Tie Wire
4. G.I. Screw

2.0 Workmanship

2.1 GENERAL

- A. Verify that substrate is clean, dry, and free of honeycombs, fins, or projections that will impede adhesive bond or damage insulation sheet.
- B. Examine conditions which affect work of this Section.

2.2 INSTALLATION

- A. Install insulation in dry state.
- B. Where cutting of material is necessary, use sharp knife and straight edge.
- C. Fit tight around all roof protrusions. Fill the gaps with off cuts to avoid heat leakages.
- D. Side and end laps shall be 50 mm (2") to 100 mm (4") and adhered by rugby contact adhesive.
- E. Install insulation before roofing is fixed.
- F. Any accidental punctures and damages shall be repaired and sealed with aluminum tapes.

SECTION-10(b) Waterproofing and Damp proofing

1.0 Materials

WATERPROOFING AND DAMPPROOFING

Apply with surface preparation, methods application and density as per manufacturer's specifications. To be installed only by authorized Applicator with guarantee.

FLUID APPLIED WATERPROOFING. Synthetic rubber, cold-vulcanized, liquid applied waterproofing membrane. Applied 1mm thick following manufacturer's specifications; for positive application on concrete gutter and plant boxes, with 38mm conc. topping, to be installed only by authorized Applicator or by the Architect's approved applicator.

EPOXY SYSTEM WATERPROOFING: Fabric-reinforced, Hi-Built, food-grade, epoxy-based lining for slabs and walls of cistern.

DAMP-PROOFING: Vapor barrier, one layer at six mils (0.006) thick. For slabs on fill at the building interior. Provide 300 mm overlapping.

WATERSTOP: PVC, for all concrete joints wall and floor construction below grade.

2.0. Workmanship

The work shall be carried out in best workman like manner.

2.1 GENERAL

A. Waterproofing:

1. Deliver waterproofing materials to the site in original sealed containers or packages bearing the manufacturer's name and brand designation, specification number, type and class.
2. Store and protect waterproofing materials from damage, weather, moisture and extreme temperature with extraordinary care.
3. Clean, free from holes and imperfections, smooth and dry all surfaces to receive waterproofing materials. The Contractor shall perform the necessary surface preparation according to the manufacturer's specifications. Immediately before application of waterproofing, clean surfaces and secure approval. No application of waterproofing is permitted in wet weather.
4. All work under this section shall be performed only by a qualified Contractor trained and approved by the manufacturer. Apply all waterproofing strictly in accordance with manufacturer's specifications.

B. Damp proofing of slabs on fill:

1. Prior to placing the concrete, the hard core should be compacted to smooth, even surface, eliminating all sharp projections or irregularities which may puncture the moisture barrier.
2. Cover the entire area with a layer of damp proofing film, extending past the perimeter of the slab and turning up against walls for the depth of the concrete.
3. Overlapping of sides and ends: 150 mm (6") minimum.

2.2 TESTING

Flood test all applicable waterproofed areas prior to acceptance of job. Plug all drains, build temporary dams at openings so that water will be 250 mm (1") deep at the high point of the waterproofed area. Maintain the water for at least 24 hours. Remedy at once any evidence of leaking.

2.3 GUARANTEE

The Contractor shall guarantee all waterproofing work to be free from defects in materials and in workmanship and free of leaks for a period of five (5) years from the date of final acceptance. Any defect shall be repaired at the Contractor's expense.

2.4 CURING

Where curing of waterproofing is required, cure strictly in accordance to the Manufacturer's specifications. Allow foot traffic only after complete curing.

2.5 TOPPING

Where topping over waterproofing is required, the Contractor shall provide the topping to the thickness indicated in the drawings.

3.0. Mode of measurements and payment

The relevant specifications of this item shall be followed for mode of measurements and payment.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-10(b) Miscellaneous Metals (Intentionally put it Blank)

SECTION-11 Ceiling Works

Providing and fixing cement board ceiling with long lied and grooved jointing and metal screws.

1.0. Materials

Metal Furring, stud and brace angles shall be of standard thickness sufficient to carry the load of ceiling with manufacturer specified supports.

FIBER CEMENT BOARD: Use 4.5mm thick for ceiling boards Install as per manufacturer's instructions.

FIBER CEMENT SOFFIT AND VENTS: PVC Wood-grain, 300mm wide x indicated length. Install and paint per manufacturer's instructions. Fixings shall be rust-proof screws or nails. For all roof eaves or any approved soffit material by Engineer in charge

HARDWARE AND FASTENERS: Use metal nails, screws, plates, straps, miscellaneous fasteners or anchorage; concealed or countersunk whenever called for, with size, shape and type to ensure a rigid connection for laminated items.

ASSEMBLY MATERIALS: Approved water-resistant glue, and nails, screws and bolts of appropriate type, shape and size for all types of joints.

TRADEMARK: Each separate lumber piece or assembly is required to bear an official mark of the millwork's supplier.

2.0. Workmanship

General

The board shall be clean prior to installation, cut square and straight. Each board shall have grooved for jointing. On exposed faces, it shall be planed for full face.

The frame for supporting the ceiling is metal and the size and the other details of frame work shall be as directed, Suspenders of M.S. angles or other sections may be used for suspending the frame. The bottom surface of the frame shall be checked and corrected to true surface and slope.

Fixing: Board of a specified thickness shall be used. The board shall be of uniform width except in the first and last lines of planks adjacent to the two walls where remaining additional odd width shall be adjusted equally on both sides. The minimum, length of board in finished work shall be such that it will span at least two spacing of the supporting frame work except where shorten lengths are unavoidable. The board shall be planed true on the exposed sides.

3.0. Mode of measurement & payment

The supporting frame, cover fillets, and suspenders shall not be included in rate of ceiling.

No deductions in measurements shall be made for opening not exceeding 0.46 sq. m. and no extra payment shall be made for forming such openings.

Each type of work in ceiling shall be measured separately.

The rate shall be for a unit of one sq. meter.

Approval Note

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- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-12 (Intentionally Left Blank)

SECTION-13 Paintings & Polishing

Use one brand all throughout. All exposed finish hardware, lighting fixtures and accessories, plumbing fixtures and accessories, glass surfaces and the like shall be adequately

protected against stains from paint and other painting materials prior to painting works. All other

surfaces which would be endangered by stains or paint marks should be taped and covered with craft paper or equal. Painting two coats (excluding priming coat) on new surface and other metal surfaces, brushing, interior to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials

The enamel pain shall conform to all materials and workmanship as directed.

EXTERIOR:

- a. ACRYTEX PLAIN FINISH; for all concrete/masonry surfaces, fascia and all exterior FCB fascia after waterproofing:

Surface Preparation: Masonry Neutralizer #44; Putty surface imperfections with Acrytex Cast # 1711; or approved equal

1st Coat: Acrytex Primer or solvent-based primer or approved equal

2nd and 3rd Coats: Acrytex Topcoat Semi-gloss Finish or approved equal.

- b. SEMI-GLOSS LATEX, or approved equal; concrete railing of ramps, stepped platform at front and all other minor surfaces unless otherwise specified.

Surface Preparation: Masonry Neutralizer #44 or approved equal;

1st Coat: Concrete Sealer #705 White or Latex #701 White or approved equal. Putty minor cracks and surface imperfections with Patching Compound or approved equal.

2nd and 3rd Coats: Semi-gloss Latex#715 or approved equal. Tint to get the required color with pre-mix Latex Colors.

INTERIOR:

- a. ACRYTEX PLAIN FINISH or approved equal; for all interior concrete, masonry and FCB wall and column surfaces.

Surface Preparation: Masonry Neutralizer #44 or approved equal; Putty surface imperfections with Acrytex Cast # 1711 or approved equal.

1st Coat: Acrytex Primer or approved equal

2nd and 3rd Coats: Acrytex Topcoat Semi-gloss Finish or approved equal.

- b. SEMI-GLOSS LATEX #715 or approved equal. For walls above toilet tiles; for beams, girders and all ceilings; for storage room and all other miscellaneous concrete areas unless otherwise specified.

Surface Preparation: Masonry Neutralizer #44 or approved equal

1st Coat: Concrete Sealer #705 White or Latex #701 White or approved equal. Putty minor cracks and surface imperfections with Patching Compound or approved equal.

2nd and 3rd Coats: Semi-gloss Latex#715 or approved equal. Tint to get the required color with Latex Colors.

AUTOMOTIVE FINISH:

AUTOMOTIVE LACQUER #1300, or approved equal; for all Door panels and door Frames, and Steel Railing components, plate Supports. These shall be shop-applied.

Surface Preparation: Lacquer Spot Putty # 306 or approved equal

1st Coat: Lacquer Primer-Surface # 305 or approved equal
2nd Coat: Lacquer Spot Putty # 306 or approved equal as required
3rd Coat: Lacquer Primer-Surface # 305 or approved equal on puttied areas.
Top Coat: Automotive Lacquer # 1300 or approved equal in required Coats

CLEAR DEAD FLAT LACQUER #1253, or approved equal; for all exposed interior wood surfaces and wood doors and jambs and where applicable:

Surface Preparation: Wood Paste Filler #60 or Lacquer Wood Tite #61 or approved equal

1st Coat: Lacquer Sanding Sealer #1254 or equal Oil Wood Stain Series #2700 or equal
2nd & 3rd Coats: Clear Dead Flat Lacquer #1253 or equal Solvent/Cleaner: Lacquer Thinner or equal

FLATWALL ENAMEL #800 or approved equal; for minor unexposed wood surfaces, where applicable.

1st Coat: #300 White Interior Primer & Sealer of Flat wall Enamel #800 or equal #311 White Glazing Putty or equal
2nd & 3rd Coats: Flat wall Enamel #800 or equal Thinner: Paint thinner or equal

METAL SURFACES:

EPOXY ENAMEL, or approved equal; for ferrous surfaces such as all structural steel surfaces, steel grille, steel louvers, steel and roof framing and other exposed steel surfaces unless otherwise specified.

Surface Preparation: Masonry Neutralizer #44 or equal

1st Coat: Epoxy Red Lead Primer #2270 or Zinc Chromate Primer #2260 or equal
2nd and 3rd Coats: Epoxy Enamel or equal. Tint to get the required color.
Thinner: Epoxy Reducer or equal.

2.0. Workmanship

General: The materials required for work of painting work shall be obtained directly from approved manufactures or approved dealer and brought to the site in maker's drums; kegs. etc. with seal unbroken.

All materials not in actual use shall be kept properly protected, lids of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of turpentine to prevent formation of skin. The materials which have become state or flat due to improper and long storage shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also, the paint shall be continuously stirred in smaller container. No left-over paint shall be put back into stock tins. When not in use the containers shall be kept properly closed.

If for any reasons, things are necessary, the brand of thinner recommended by the manufacturer shall be used.

The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed part of the work shall be carried out in wet, damp or otherwise

unfavorable weather and all the surfaces shall be thoroughly dry before painting work is started.

3.0. Mode of measurements and payment

The relevant specifications of this item shall be followed for mode of measurements and payment.

The rate shall be for a unit of one sq. meter.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-13(a) Specialties

1.0. Materials

Identifying Devices:

STAINLESS STEEL SIGNAGE: Type 304, built-up, 3 mm (1/8") thick front plate and 1.0 mm (gauge 20) thick side plates, 25 mm average stroke. Size of anchorage dowels shall be as required for the fixation of masonry surface. For main building identification lettering at facade, to be approved by Architect.

FIRE EXIT SIGNS: White acrylic letters and green acrylic background. With LED lighting where required. For all fire exit doors.

Toilet Accessories:

STAINLESS STEEL GRAB RAIL: 38 mm (1-1/2") diameter, at toilets for the disabled and ambulant as indicated in the plans. L-type for water-closet, with folding support bar and 450mm vertical bars for PWD water closet and ambulant Urinal.

2.0. Workmanship

The work shall be carried out in best workman like manner.

3.0. Mode of measurements and payment

The relevant specifications of this item shall be followed for mode of measurements and payment.

Approval Note

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General Technical

Specifications for ELECTRICAL WORKS

SECTION-14 **GENERAL REQUIREMENTS**

All section under the Division shall be subject to the requirements of Architect's General Conditions (UAP Doc. 301), the Contractor's License Law (RA 4566), New Electrical Engineering Law (RA 7920) and the National Building Code which require that only duly - licensed electrical contractors by the Philippine Contractors Accreditation Board (PCAB) be allowed to undertake electrical works for service entrance mains of 200 amperes and above.

14.1 GENERAL DESCRIPTION

The work to be done under this Divisions of the Specifications consist of the fabrication, complete in all details, of the Electrical Work, at the subject premises and all work and materials incidental to the proper completion of the installation, except this portion of the work which are expressly stated to be done by others. All shall be in accordance with governing Codes and Regulations and with the Specifications, except where same shall conflict with such Codes, etc. in which case latter shall then govern. The requirements in regard to materials and workmanship specify the required standards for the furnishing of all labor, materials and equipment necessary for the complete installation of the work specified herein and indicated on the drawings. These specifications are intended to provide a broad outline of the required installation, but are not intended to include all details of design and construction.

14.2 WORK INCLUDED

Under this Division of the Specifications, provide all materials and equipment and perform all the work necessary for the complete execution of all the Electrical Works as shown on the Electrical Drawings and on the general Construction Drawings, as herein specified, or both except as otherwise excluded, and which without excluding the generality of the foregoing, shall include but not be limited to the following principal items of work:

- A complete service entrance system 230 V, 60 HZ or three phase (3-phase), 4 wire including all conduits, wires, supports meter socket, concrete post, main over current devices, support of current transformer cabinet eye bolt, etc. and the application of anti-rust paint to exposed service entrance conduit.
- Construction and installation of service entrance lateral including all conduits, wires, necessary manholes, excavation and the likes as shown in the plans.
- All excavation work, backfilling, de-watering removal of surplus earth, forming and pouring of concrete envelopes around underground conduits as indicated on drawings or as required to complete the installation.
- Power distribution equipment, including normal and emergency lighting distribution panel boards

- A system of lighting and power wiring including all feeders, branch circuits and connections to all lighting and power outlets, exhaust fan, fan coil units, ACCU, pump motor, submersible pump, etc.
- Connection to all power equipment, including wires and conduits necessary for remote controls, motor interlocks, float switches, aqua stat. and pressure switch controls and electric-pneumatic switches and relays, except as hereinafter specified.
- Installation of all separately mounted motor starters and ECB supplied under Division 15 (Mechanical Works) Division 15A (Plumbing Works).
- For standby Generating Set and Manual Transfer Switch.
- All general lighting fixtures and lamps.
- Construction and installation of lightning and ground well system.
- Conduits including service entrance and wiring of the interior telephone system.
- Painting and retouching of all exposed conduit panel art enclosures, etc.
- Complete grounding and bonding system of equipment.
- Complete testing of all electrical system.
- Grouting of openings in floors and walls after all conduits, or ducts are in place and sealing of all such openings if not used.
- Anything that has been omitted in any item of work or materials usually furnished which are necessary for the completion of the Electrical Work as outlined herein before. Then such items must be and are hereby included in this Division of the Work.

14.3 CODES, INSPECTION, PERMITS AND FEES

1. The work under this contract is to be installed according to the latest requirements of the following:

Philippine National Building Code
Philippine Electrical Code
Regulation of Municipal/City Ordinance
Local Communication Company
Local Electric Power Company

Nothing contained in these specifications or shown on the drawings shall be construed as to conflict with National and Local Ordinances or Laws governing the installation of electrical work, and all such laws and ordinances are hereby made part of these specifications. The Contractor is required to meet the requirements thereof.

2. Codes and standards of following organizations other than mentioned above are referenced in this Division.

3. The Contractor shall obtain, at his own expense, prior of any electrical Work in buildings and other locations outside of street areas, all necessary permits from the Department of Public Work for the work covered by the specification, and shall deliver the certificate of final inspection to the Engineer upon completion of work. City work is exempt from electrical permit fees.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-15

15.1 ADJUSTMENT OR RELOCATION OF EXISTING FACILITIES

If required to permit the execution of the work, the adjustment or relocation, As approved by the Engineer, of existing electrical conduit and contained wires, existing pipes or existing ducts, where such conduit and pipes are 1-1/4 inches or less in nominal diameter and the ducts are one square foot or less in cross sectional of larger sized existing facilities, however, unless specifically indicated for such adjustment or relocation on the plans in the special provisions, if necessary, as determined by the Engineer, shall be done as directed, as extra work in accordance with the requirements of section 112.

15.2 FLOOR, WALL AND CEILING OPENINGS

The contractor shall secure the Engineers approval of the locations for holes and openings in floor, wall and ceilings, necessary for the installation of electrical equipment, conduit, and appurtenances, and shall keep to a practicable minimum the size of such holes and openings. All requirements of section 500.04 shall apply to the work under this section, except that the use of any type of impact drill will not be permitted in basement walls or in sidewalks directly above basement.

15.3 UNINSPECTED WORK NOT TO BE CLOSED IN.

The contractor shall not cover up or enclose any of his work until it has been tested by him in the presence of the Engineer if testing is been required, and until it has been inspected and approved by the Engineer. Should any of the work be enclosed or covered up before testing and inspection, the contractor shall, at his own expense, restore such covering and enclosure.

Approval Note

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SECTION-16

CABLE LAYING IN TRENCHES.

1.0. Materials

All cables shall be have approved with ISI marked.

WIRES AND CABLES: No conductor shall be less than 3.5 mm² in size unless otherwise specified.

CONDUITS: As indicated in the Electrical (E) Plans

1. Non-Metallic Conduit (PVC): smooth wall non-metallic conduit conforming to Philippine National Standards No. 14 for PVC Pipes. Conduit shall be in standard length of 3.05 meters including coupling

OUTLET BOXES AND FITTINGS:

1. Convenience Outlets: Cream color, 220V, with amperage as required. For general building interior use.
2. Boxes: Metal utility boxes Ga. 16, sizes and shapes as required

SWITCHES, PANELBOARDS AND CIRCUIT BREAKERS:

1. Switches: With amperage as required. Suited to location and intended purpose. Approved type by architect.
2. Circuit Breakers: GA 16 bolt-on type, pre-painted, surface mounted, with latch lock.
3. Magnetic Starter: With casing, surface mounted with latch lock.

LIGHTING FIXTURES AND ACCESSORIES: Samples of lighting fixtures, complete with lamps and accessories, shall be submitted for approval by the Architect and University prior to fabrication and purchase.

LEDDOWNLIGHTS:

Consider using 100mm diameter x L230mm downlights. Surface-mounted or recessed, as indicated. Housing made of aluminum alloy material, electrostatic coating, and compact design. Warm white or neutral white color temperature. Use equivalent fixtures for 18.5W and 23W.

EXIT LIGHTS/SIGNS – complete with 8W Lamp and Ni-Cad Battery for 2 hrs. Duration.

LAMPS AND ACCESSORIES: LED Down Lights: 18.5-23W

Note: Luminaires of other brands as approved by the Engineers in Charge. Lamps and electronic ballasts, as approved by Engineer in Charge, are acceptable. Submit sample for approval prior to purchase.

(B). STORAGE AND HANDLING OF CABLE:

The cable drums shall be stored on, hard and well drained surface, to avoid sinking of drums in the ground causing damage to the cable drums. For long term storage of all types of cable, paved surface is preferred and protection from rain and sun is to be provided. The drums shall always be stored on their flanges, and not on their flat sides. Both ends of the cable should be properly sealed to prevent ingress/absorption of moisture.

Ventilation should be there between cable drums. Damaged battens of drums etc. should be replaced at the earliest. Handling: when the cable drums have to be moved over short distance, they should be rolled in the direction of the arrow marked on the drum. For transportation of cable drums over long distance suitable mechanical transport should be used. If manual transportation is compulsion, the drum should be mounted on the cable drum wheels, strong enough to carry the weight of the drum, and pulled by means of ropes.

For loading and un-loading from vehicles, suitable capacity crane or a lifting tackle should be used. Small size cable drums as can also be rolled down carefully on a suitable ramp for unloading, provided no damage is likely to be caused to the cable or the drums.

2.0 ROUTE OF CABLE:

Before cable laying, the route of the cable shall be decided by the engineering-in-charge considering the following. The shortest practicable route shall be preferred, the cable route shall generally follow fixed developments. Such as roads, foot paths etc. with proper offsets so that future maintenance, identification etc. are rendered easy. Cross country run merely to short the route length shall not be adopted. Cable route shall be planned away from drains and near the property, especially in the case of LV/MV cables. Cable route should be avoided from corrosive soils, ground surrounding sewage effluent etc.

3.0 LAYING OF CABLE: GENERAL

Cables with kinks, straightened kinks or any other apparent defects like defective amount ring etc. shall not be laid. Cable shall not be bent sharp to a small radius, while handling or laying. The minimum safe bending radius for PVC/XLPE (MV) cables shall be 12 times the overall diameter of the cable. If cable is cut, the ends of cable shall be sealed with suitable sealing compound/ tape/ heat shrinkable caps immediately. The cables shall be tested for continuity and insulation resistance. The cables shall be laid direct in ground, pipe, closed or open ducts, and cables trays or on surface of wall etc. as specified.

4.0 UNCOILING OF CABLE BEFORE LAYING

The cable drum shall be properly mounted on jacks, or on a cable wheel of suitable capacity. The spindle should be horizontal in the bearings to prevent creeping of drum to one side while rotating. PVC/XLPE cables less than 120 sq.mm size may be removed by "flaking" i.e., by making one long loop in the reverse direction. The cable

shall be pulled over on rollers in the trench steadily and uniformly without jerks and strain. The entire cable length shall as far as possible be laid off in one stretch. For short runs and sizes up to 50 sq.mm of MV cables, any other suitable method of direct handling and lying can be adapted without strain or excess bending of the cables.

5.0 LAYING DIRECT IN GROUND

For laying a single cable the minimum width of the trench shall be 35 cm and the depth shall not be less than 75cm. The bottom of the trench shall be level and smooth. Where more than one cable is to be laid in the same trench in horizontal formation, the width of the trench shall be increased such that the inter-axial spacing between the cables shall be at least 20 cm. Adequate precautions should be taken not to damage any existing cable(s), pipes or any other such installations in the route during excavation. Wherever bricks, tiles or protective covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer-in-charge.

6.0 SAND CUSHIONING

The trench shall then be provided with a layer of clean dry sand cushion of not less than 8 cm in depth, before laying the cables therein. Cables laid in trenches in a single their formation shall have a covering of dry sand of not less than 17 cm above the base cushion of sand before the protective cover is laid. In the case of vertical multi-tier formation, after the first cable has been laid, a sand cushion of 30 cm shall be provided over the base cushion before the second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 30 cm as started above. Cables in the top most tiers shall have final sand covering not less than 17 cm before the protective cover is laid.

7.0 LOOPS

At the time of original installation, approximately 3m of surplus cable shall be left on each terminal end of the cable and on each side of the underground joints. The surplus cable shall be left in the form of a loop. Where there are long runs of cables such loose cable may be left at suitable intervals as specified by the Engineer-in-Charge. Where it may not be practically possible to provide separation between cables when forming loops of a number of cables, measurement shall be made only to the extent of actual volume of excavation, sand filling etc. and paid for accordingly.

8.0 PROTECTIVE COVERING

Unless otherwise specified, the cables shall be protected by brick of specified size or 20cmx10cmx10cm or locally available size, placed on top of the sand. The bricks shall be placed breadth-wise for the full length of the cable. Where more than one cable is to be laid in the same trench, one raw of bricks shall use for each cable. Where bricks are not easily available, or are comparatively costly, there is no objection to use locally available material such as stone tiles or slates or stone/ cement concrete slabs. Where such an alternative is acceptable, the same shall be clearly specified in the tender specifications.

14.0 TESTING AFTER LAYING:

After laying and jointing, the cable shall be subjected to a 15 minutes pressure test with 2 KV AC or 3 KV DC pressure. DC pressure testing may normally be preferred to SC pressure testing.

15.0 ROUTE MARKERS:

Route markers shall be provided along the runs of cables at locations approved by the Engineer in- Charge and generally at intervals not exceeding 100m. Markers shall also be provided to identify change in the direction of the cable route and at locations of underground joints. Route markers shall be made out of 100mm x 5mm GI plate welded/ bolted on 35mm x 35mm x 6mm angle iron, 60cm long. Such plate markers shall be mounted parallel to and at about 0.5 m away from the edge of the trench. C.C route marker made of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20mm in size) shall be laid flat and centered over the cable. The concrete markers, unless otherwise instructed by the Engineer-in-Charge, shall project over the surrounding surface so as to make the cable route easily identifiable. The works PWD-MV/HV CABLE as the case may, shall be inscribed on the marker.

16.0 Measurement:

Cable laid direct in ground, duct and surface / cable tray shall be measured in running meter straight along trench (excluding ramble length) in running meter correct to 1cm. Cable laid pipes / closed duct shall be measured in running meter correct to 1 cm taking actual length of the pipe / duct for each run of the cable (excluding ramble length), irrespective of the length of cable drawn through it. Cable length used in connections shall be measured as item of cable layed in open duct. Jointing and route marker shall be counted in number.

17.0 Rates

Cost of all material, labor and machinery used in execution of work of shall be in the cost of item.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-16(a) Electrical Works (LT CABLES AND CABLE TERMINATION)

16(a) General:

The medium voltage cables shall be supplied, laid, connected, tested and commissioned in accordance with the drawings, specifications, relevant Indian Standards specifications, manufacturer's instructions.

The cables shall be delivered at site in the original drums with manufacturer's name, size and type clearly written on the drums. All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of handling during transportation, loading, unloading etc.

The cable shall be supplied in single length i.e. without any intermediate joint or cut unless specifically approved by the client. The cable ends shall be suitably sealed against entry of moisture, dust, water etc. with cable compound as per standard practice.

1.0 Materials:

All cables shall be of approved make and ISI marked only. The brick shall be modular well burnt clay brick of compressive strength not less than 25kg /sq.cm. Only fine sand shall be used.

Bending of Cable: Cable shall not be bend sharp to a small radius either while handling or in laying. The minimum safe banding radius for PILCA/XLPE, 33 KV cable shall be 20 times the overall diameter of the cable.

Conductor: Uncoated, annealed copper / aluminum, of high conductivity, up to 4 mm² size the conductor shall be solid and above 4 mm² the conductors shall be concentrically stranded as per IEC: 228.

Insulation: Cross link polyethylene (XLPE) extruded insulation rated at 70oc.

CORE IDENTIFICATION:

Two cores	:	Red and Black
Three cores	:	Red, Yellow and Blue
Four cores	:	Red, Yellow, Blue and Black
Single core	:	Green, Yellow for earthing. Black shall always be used for neutral.

Assembly: Two, three or four insulated conductors shall be laid up, filled with non-hygroscopic material and covered with an additional layer of thermoplastic material.

Armour: Galvanized steel flat strip / round strips applied helically in single layers complete with covering the assembly of cores. For cable size up to 10 sq.mm: Armour of 1.4 mm dia G.I. round wire for cable size above 10 sq.mm: Armour of 4 mm wide 0.8 mm thick GI strip

Sheath: ST -2 PVC along with polypropylene fillers to be provided. Inner sheath shall be extruded type and shall be compatible with the insulation provided for the cables. Outer sheath shall be of an extruded type layer of suitable PVC material compatible with the specified ambient temperature of 50oc and operating temperature of cables. The sheath shall be resistant to water, ultra violet radiation, fungus, termite and rodent attacks. The colour of outer sheath shall be black. Sequential length marking along with size and other standard parameters shall be required at every 1.0 meter on the outer sheath.

Testing: Finished cable tests at manufacturer’s works: The finished cables shall be tested at manufacturer’s works for all the routine tests for all the length and size of cables to be delivered at site and the certificate for the same shall be furnished to client. If required the cables shall be tested in presence of the client’s representative.

Voltage test: Each core of cable shall be tested at room temperature at 3 KV A.C. R.M.S. for duration of 5 minutes.

Conductor resistance test: The D.C. resistance of each conductor shall be measured at room temperature and the results shall be corrected to 20oc to check the compliance with the

value. Cable tests before and after laying cables at site: Insulation resistance test between phases, phase to neutral and phase to earth. Continuity test of all the phases, neutral and earth continuity conductor. Earth resistance test of all the phases and neutral. All the tests shall be carried out in accordance with the relevant IS code of practice and Indian Electricity Rules. The vendor shall provide necessary instruments, equipment's and labor for conducting the above tests and shall bear all the expenses in connection with such tests. All tests shall be carried out in the presence of client and the results shall be prescribed in forms and submitted. All specification for HV cable laying shall be same as that of MV cable laying. Testing of 11KV HT cable Insulation resistance shall be tested with 2500/5000meger, Pressure testing shall be done for 15minutes with 20KV Ac pressure between conductors and with 11.5KV AC pressure between conductor and earth. If facility for pressure testing is not available then testing for one minute with 2500/5000V megger shall be sufficient.

Cable Marking:

The outer sheath shall be legibly embossed at every meter with following legend:

ELECTRIC CABLE: 1100 V, SIZE: __ C X__ MM² with Manufacturers name, year of manufacturing and ISI symbol.

Sealing drumming and packaging:

After tests at manufacturer's works, both ends of the cables shall be sealed to prevent the ingress of moisture during transportation and storage. Cable shall be supplied in length of 500 meters or as required in non-returnable drums of sufficiently sturdy construction. Cables of more than 250 meters shall also be supplied in non-returnable drums. The spindle hole shall be minimum 110 mm in diameter. Each drum shall bear on the outside flange, legibly and indelibly in the English literature, a distinguishing number, the manufacturer's name and particulars of the cable i.e. voltage grade, length, conductor size, cable type, insulation type, and gross weight shall also be clearly visible. The direction for rolling shall be indicated by an arrow. The drum flange shall also be marked with manufacturer's name and year of manufacturing etc.

Cable Termination:

Cable terminations shall be made with aluminum crimped type solder less lugs for all aluminum cables and stud type terminals. For copper cables copper crimped solder less lugs shall be used. Crimping shall be done with the help of hydraulically operated crimping tool. For joints where by cable is with aluminum conductor and bus bars are aluminum, bimetallic lugs shall be used with compound. CUPAL type of washers shall be used. Crimping tool shall be used for crimping any size of cable.

Cable Glands:

Cable glands shall be of brass single compression type. Generally single compression type cable glands shall be used for indoor protected locations and double compression type shall be used for outdoor locations.

Ferrules:

Ferrules shall be of self-sticking type and shall be employed to designate the various cores of the control cable by the terminal numbers to which the cores are connected, for ease in identification and maintenance.

Cable Joints:

Kit type joint shall be done and filled with insulating compound. The joint should be for 1.1 KV grade insulation.

2.0 Workmanship

Cables shall be laid in the routes marked in the drawings. Where the route is not marked, the Contractor shall mark it out on the drawings and also on the site and obtain the approval of the UNIVERSITY AND/OR ITS Engineer in Charge before laying the cable. Procurement of cables shall be on the basis of actual site measurements and the quantities shown in the schedule of work shall be regarded as a guide only. Cables shall be laid on walls, cable trays, inside shafts or trenches. Saddling or support for the cable shall not be more than 500 mm apart.

Plastic identification tags shall be provided at every 30 m. Cables shall be bent to a radius not less than 12 (twelve) times the overall diameter of the cable or in accordance with the manufacturer's recommendations whichever is higher. In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc. unless marked on drawing by architect / consultant. Cables shall be laid on an excavated, graded trench, over a sand or soft earth cushion to provide protection against abrasion.

Cables shall be protected with brick or cement tiles on all the three sides as shown on drawings. Width of excavated trenches shall be as per drawings. Back fill over buried cables shall be with a minimum earth cover of 750 mm to 1000 mm. The cables shall be provided with cables markers at every 10 meters and at all loop points. All cables shall be full runs from panel to panel without any joints or splices.

Cables shall be identified at end termination indicating the feeder number and the Panel/Distribution board from where it is being laid. Cable termination for conductors up to 4 sq.mm. May be insertion type and all higher sizes shall have compression type lugs. Cable termination shall have necessary brass glands. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape.

Cable armouring shall be earthed at both ends. In case of cables entering the buildings. It would be done duly only through pipes. The pipes shall be laid in slant position, so that no rainwater may enter the building. After the cables are tested the pipes shall be sealed with M. seal & then tarpaulin, shall be wrapped around the cable for making the entry watertight.

Testing: MV cables shall be tested upon installation with a 500 V Meggar and the following readings established:

- Continuity on all phases.
- Insulation Resistance.
- Between conductors.
- All conductors and ground.
- All test readings shall be recorded and shall form part of the completion documentation.

Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages. Insulation cutting shall be done properly taking care that no area of the conductor remains exposed. Crimping shall be done with the help of hydraulic tool. Proper insulation tape shall be applied at the cable and lug joint.

Format for cable testing certificate:

- Drum no. from which cable is taken:
- Cable from__ to__
- Length of run of this cable meter

Insulation resistance test

Between core 1 to earth		mega-ohm
Between core 2 to earth		mega-ohm
Between core 3 to earth		mega-ohm
Between core 1 to core 2		mega-ohm
Between core 2 to core 3		mega-ohm
Between core 1 to core 3		mega-ohm

3.0 Mode of Measurement

The cables shall be measured as specified by the bid.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

**SECTION-16(b)
Electrical Works (DISTRIBUTION BOARDS)**

16(b). General:

Distribution boards shall be fabricated from 14-gauge M.S. sheet or shall be readymade as specified in the make of material list. It shall be of double door type with hinged (lockable if required) door suitable for recessed mounting in wall. Distribution boards shall be powder coated with 7-tank process application.

The distribution boards shall be provided with phase barriers, wiring channels to accommodate wires and individual per phase neutral links. There shall be separate or individual earth link as per requirement. Proper arrangement shall be made for mounting of MCB's and other accessories.

Distribution boards shall meet with the requirements of IS 2675 and marking arrangement of bus bars shall be in accordance with I.S. standards. Bus bars shall be suitable for the incoming switch rating and sized for a temperature rise of 35° C. over the ambient. Each board shall have two separate earthing terminals.

Circuit diagram indicating the load distribution shall be pasted on the inside of the DB as instructed. One earthing terminal for single phase and two terminals for 3 phase DB's shall be provided with an earth strip connecting the studs and the outgoing ECU earth bar. The top and the bottom faces of the D.B. shall be provided for conduit entry of minimum 1" dia.

The faces if asked shall be kept detachable. All outgoing feeders shall terminate on a terminal strip which in turn is interconnected to the MCB/Fuse base by means of insulated single conductor copper wires as follows.

Up to 15 A.	2.5 sq.mm.	40 A	10 sq.mm.
25 A	4.0 sq.mm.	63 A	16 sq.mm.
32A	6.0 sq.mm.		

Each DB shall have indicating lamps preferably neon type denoting power availability in the board after the switch indicating lamps shall be complete with fuses.

1.0 Materials:

Miniature Circuit Breakers (MCB):

MCB's shall have quick make and break non-welding self-wiping silver alloy contacts for 10 KA short circuit both on the manual and automatic operation. Each pole of the breaker shall be provided with inverse time thermal over load and instantaneous over current tripping elements, with trip-free mechanism.

In case of multi-pole breakers, the tripping must be on all the poles and operating handle shall be common. Breakers must conform to BS 3871 with facility for locking in OFF position.

Pressure clamp terminals for stranded/solid conductor insertion are acceptable up to 4 sq.mm. Aluminum or 2.5 sq.mm. Copper and for higher ratings, the terminals shall be suitably shrouded. Wherever MCB isolators are specified they are without the tripping elements.

RCCB / ELCB

The RCCB should suffices all the requirements of IS as per code IS - 12640 - 1988. The RCA should be current operated and not on line voltage.

The RCCB should ensure mainly the following functions:

- a. Measurement of the fault current value.
- b. Comparison of the fault current with a reference value.
- c. The RCCB should have a toroid transformer which has the main conductors of primary (P - N) which check the sum of the current close to zero.
- d. All metal parts should be inherently resistant to corrosion and treated to make them corrosion resistant.
- e. It should be truly current operated.
- f. It should operate on core balance toroid transformer.
- g. Its accuracy should be $\pm 5\%$.
- h. It should operate even in case of neutral failure.
- i. It should trip at a present leakage current within 100 mA
- j. Its enclosure should be as per IP 30.
- k. Its mechanical operation life should be more than 20,000 operations.
- l. It should provide full protection as envisaged by IE rules.

2.0 Workmanship

The D.B. shall be properly grouted in the wall in concealed manner taking care that the powder coating is not scratched and dents are not formed on the D.B. The MCBs and ELCBs. In the distribution boards shall be fixed as per the circuit details provided. All the wires terminating in the MCBs and the ELCBs shall be lugged for proper contact and ferrules depicting the circuit nos shall be provided. D.B.s mounted in concealed manner shall have a groove around it so as to save the finish of the plaster and colour during future opening of the door. The distribution boards shall have circuit chart tagged on the door for future maintenance. Danger notice plates shall be fitted to the distribution boards with screws and not stuck so as to assure its presence for a longer duration.

3.0 Mode of Measurement

The distribution boards shall be measured in no's and the MCBs and ELCBs shall be measured in numbers separately.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-16(c) Electrical Works (INTERNAL WIRING)

16(c). Generals:

1.0 Materials:

RIGID PVC AND FLEXIBLE PVC FRLS LHSFT CONDUITS:

All conduits shall be rigid PVC alloy low in halogens pipe having minimum wall thickness of medium gauge 1.6 to 2.0 approved by F.I.A. & I.S.I. and shall conform to IS 9537 part 3 and complying with fire safety standards classification V-0. The temperature stability shall be from -20oc - +80oc and also shall be uV stabilized.

Up to 38 mm diameter in slab - minimum 1.8 mm wall thickness. Up to 38 mm diameter in floor - minimum 2.0 mm Wall thickness. Above 40 mm. diameter - minimum 2.2 mm. wall thickness. Flexible conduits shall be formed from a continuous length of spirally wound interlocked steel strip with a fused zinc coating on both sides. The conduit shall be terminated in brass adapters.

ACCESSORIES:

PVC conduit fittings such as bends, elbows, reducers, chase nipples, split couplings, plugs etc. shall be specifically designed and manufactured for their particular application. All conduit fittings shall conform to IS: 2667-1964 and IS: 3857-1966. All fitting associated with galvanized conduit shall also be galvanized.

WIRES:

All wires shall be single core multi-strand/ flexible copper or single strand Copper (if specified in BOQ), PVC insulated FRLS grade as per IS: 694 and shall be 660 V\1100 V.

All wires shall be colour coded as follows:

Phase	Color of wire
R	Red
Y	Yellow
B	Blue
N	Black
Earth	Green (insulated)
Control (If any)	Grey
All off wires	same as Phase wire

SWITCHES & SOCKETS:

Switches shall be modular type with silver-coated contacts. Sockets shall be 5 pins with switch and plate type cover. Combination of multiple switch units and sockets should be used to minimize the switch boxes. For heavy duty, metal clad sockets with M.C.B / Isolator mounted in a galvanized steel box shall be provided.

SWITCH PLATE AND BOX:

Plates of the same make, as that of switches shall be used with the modular range. Also M.S. boxes shall be taken as switch boxes.

2.0 Workmanship

Conduits run on surfaces shall be supported on metal 12 mm. thick G.I. pressure saddles which in turn are properly screwed to the wall or ceiling. Saddles shall be at intervals of not more than 500 mm. Fixing screws shall be with round or cheese head and of rust-proof materials.

Exposed conduits shall be neatly run parallel or at right angles to the walls of the building. Unseemly conduit bends and offsets shall be avoided by using fabricated mild steel junction/pull through boxes for better appearances. No cross-over of conduits shall be allowed unless it is necessary and entire conduit installation shall be clean and neat in appearance.

Conduits embedded into the walls shall be fixed by means of staples at not more than 500 mm. intervals. Chases in the walls shall be neatly made and refilled after laying the conduit and brought to the finish of the wall but the building Contractor will do final finish.

Conduits buried in concrete structure shall be put in position and securely fastened to the reinforcement and got approved by the CLIENT AND/OR ITS Engineer in Charge, before the concrete is poured. Proper care shall be taken to ensure that the conduits are neither dislocated nor choked at the time of pouring the concrete suitable fish wires shall be drawn in all conduits before they are embedded.

Where conduit passes through expansion joints in the building, adequate expansion fittings shall be used to take care of any relative movement. Inspection boxes shall be provided for periodical inspection to facilitate withdrawal and removal of wires. Such inspection boxes shall be flush with the wall or ceiling in the case of concealed

conduits. Inspection boxes shall be spaced at not more than 12 meters apart or two 90° solid bends or equal.

All junction and switch boxes shall be covered by 6 mm clear plate. These junction boxes shall form part of point wiring or conduit wiring as the case may be including the cost of removing the cover for painting and re-fixing. No separate charges shall be allowed except where specially mentioned. Conduits shall be free from sharp edges and burrs and the threading free from grease or oil.

The entire system of conduits must be completely installed and rendered electrically continuous before the conductors are pulled in. Conduits should terminate in junction boxes of not less than 32 mm. deep. An insulated earth wire of copper rated capacity shall be run in each conduit.

Lighting & Power Wiring:

All final branch circuits for lighting and appliances shall be single conductor/ stranded/ flexible wires run inside conduits. The conduit shall be properly connected or jointed into sockets, bends, and junction boxes.

Branch circuit conductor sizes shall be as shown in the schedule of quantities and or drawings.

All circuits shall preferably be kept in a separate conduit up to the Distribution Board. No other wiring shall be bunched in the same conduit except those belonging to the same phase. Each lighting branch circuit shall not have more than ten outlets or 800 watts whichever is lower. Each conduit shall not hold more than three branch circuits.

Flexible cords for connection to appliances, fans and pendants shall be 650/1100 V grade (three or four cores i.e. with insulated neutral wire of same size) with tinned stranded copper wires, insulated,

Twisted and sheathed with strengthening cord. Color of sheath shall be subject to the UNIVERSITY AND/OR ITS ARCHITECT'S approval.

Looping system of wiring shall be used. Wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors. No such joints shall be made unless the length of the sub-circuit, sub-main or main is more than the length of the standard coil.

Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in 3 mm. thick painted or galvanized steel boxes with cover plates as specified. Cadmium plated brass screws shall be used.

Power wiring shall be distinctly separate from lighting wiring. Conduits not less than 25 mm. and wires not less than 2.5 sq.mm. Copper shall be used.

Every conductor shall be provided with identification ferrules at both ends matching the drawings.

Testing: the entire installation shall be tested for:

Insulation resistance.

Earth continuity.

Polarity of single pole switches.3

General: All the wiring switch board, outlet points shall be done in a concealed manner in wall & slab in PVC conduit of minimum 25 mm dia. (medium gauge) & with 650v / 1100v grade PVC insulated flexible copper conductor wire. The switches should be modular with molded cover plates, blank plates for outlet boxes. The accessories, connectors, sockets, should be fixed with brass chrome / cadmium plated machine screw. For fan points the rates should be with hum –free type 300 W regulators as required to complete the point wiring. The wiring shall be as per IS: 732 and IS: 4648. The wiring shall be done in a looping manner so as to avoid junction boxes at any place. All the looping shall be done only in the switchboard and outlet points. The size of the wire shall be as per the specification. Color code shall be strictly followed.

The size of wires shall as follow:

25-32 Amp. metal clad points:

Phase / Neutral 6.0 mm²

Earth 4.0 m m²

20 Amp. Out let points:

Phase / Neutral 4.0 mm²

Earth 2.5 mm²

Two nos. of 15 Amps. Socket out let connected in parallel from

DB to first outlet

Phase / Neutral 4.0 mm²

Earth 2.5 mm²

from first outlet to second outlet.

Phase / Neutral 2.5 mm²

Earth 2.5 mm²

Light, fans, exhaust fan, 5 Amp. On board plug point, two way light points, bell point etc from switch to outlet.

Phase / Neutral 1.5 mm²

Earth 1.5 mm²

From D.B. to switch board - lighting / 5 A socket etc - i.e. circuit mains part of point wiring

Phase / Neutral 2.5 mm²

Earth 2.5 mm²

15/20 Amps. Socket outlet for AC (Single Phase/Three Phase) / Geyser

Phase / Neutral 4.0 m m²

Earth 2.5 m m²

5/20 Amps. Socket outlet for appliances or looped from sockets with 4 sq. mm ckt.

Phase / Neutral 2.5 m m²

Earth 2.5 m m²

Separate pipes shall be laid for off wires and circuit mains.

Circuit mains of same phase shall be drawn in one pipe with prior permission/discussion with the consultant.

Separate phase, neutral and earthing wire of sizes recommended by consultant shall be drawn for each and every circuit main.

Mains for lighting and on-board plug points shall be of one-size higher wires than those used in off.

3.0 Mode of Measurement

The items shall be measured on unit basis or on meter basis as per BOQ.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-16(d) Electrical Works (LIGHT FIXTURES)

16(d). Generals:

1.0 Materials

Light fixtures as mentioned in the BOQ with the catalogue no's and makes shall be installed. The fixtures shall be complete with ballast and shall be prewired by the manufacturer. Fans of the Proposed makes and size shown in the drawing shall be used and install in the hook type M.S. box used by the UNIVERSITY.

2.0 Workmanship

The fixture shall be installed on wall / ceiling as directed and as per manufacturer's instruction, with necessary accessories for surface, concealed, suspended from ceiling, bracket mounting etc. The job also includes connection of fixture with respective outlet point with heat resistant wires through heat resistance sleeve and PVC connector. The exhaust fan shall be installed complete with M.S. angle iron mounting frame/ ring, G.I. louvers, wire mesh and plug at the end of the cord including wiring & earthing etc. Proper earthing shall be provided to the fixtures.

3.0 Mode of Measurement

The unit rate shall be considered for fitting one fixture. The rate shall include following

All fixing accessories, mounting bracket, ballast condensers and control gear wherever applicable. Supplying and fixing Ball and socket joints wherever required.

Earthing of fittings.

Electrical connections to fittings/fans from the junction box/ceiling rose.

Installation and interconnection of Electronic regulators for ceiling fans.

Supplying and fixing 300 mm. GI down rod for ceiling fans.

SECTION-16(e)
Electrical Works (EARTHING)

1.0 Materials

PLATE ELECTRODE EARTH STATION:

The earth station shall be as shown on the drawing and shall be used for equipment earth grid and/or street light pole earthing and shall be as per IS 3043. The earth electrode shall plate of copper / GI as per BOQ of size in BOQ with copper or GI strip of required size as per BOQ coming out to ground level.

The earth resistance shall be maintained with a suitable soil treatment as shown on the drawing. The resistance of each earth station should not exceed 5 ohms. The earth lead shall be fixed to the pipe with a nut and safety set screws. The clamp shall be permanently accessible.

The earthing grid and the earthing conductor shall be hot dip galvanized iron strips of the size as shown in the drawing. G.I. pipe with funnel of approved quality shall be used for watering the earth electrode \ station. The block masonry chamber with Cast Iron hinged cover shall be provided for housing the above referred funnel and pipe.

The hardware and other consumable for earthing installation shall be brass or hot dip galvanized iron material as shown on the drawing.

EARTH LEADS AND CONNECTIONS:

Earth lead shall be galvanized steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. Galvanized steel buried in the ground shall be protected with bitumen and Hessian wrap or polythene faced Hessian and bitumen coating.

At road crossing necessary Hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is at least 8 mm away from the wall surface. The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

2.0 Workmanship

Following activities shall be carried out for the earthing station

- Excavation in hard murrum.
- Laying Watering pipe.
- Brick masonry with hinged covers.
- Charcoal and Salt fill.
- Earth station should be 1 meter. away from building.
- Keep minimum 2 meters. distance between two earth pits.
- The pit should be minimum 10ft deep.
- The earth resistance should not exceed 1- 5 ohm. (As per IS)
- All earth pits of same category shall be interlinked with strip.

Following points shall be followed strictly.

The plate electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 2.5 M below finished ground level.

The plate electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall \ column.

The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.

20 mm. dia. G.I. pipe for watering, shall run from top edge of the pipe electrode to the mid-level of block masonry chamber.

Top of the pipe shall be provided with G.I. funnel and screen for watering the earth \ ground through the pipe.

The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing.

The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame, which shall be embedded in the block masonry.

Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS: 3043, Code of Practice for Earthing Installation.

The earth conductors (Hot dip G.I. strips) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Mild Steel Zinc Passivated screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.

The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.

Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.

The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

Additional equipment earthing shall be done with Cu strip / Bare Cu Wire as per size indicated in drawing.

Lightening arrestors shall be installed at topmost point of the building. The quantity for the same shall be designed & specification in BOQ to cover total building area. Finial type arrestor shall be used with Cu pipe & Cu base plate. The arrestor / base plate shall be connected to separate earth pit with Cu Strip.

Following tests shall be carried out:

The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS: 3043.

The following earth resistance values shall be measured with an approved earth megger and recorded.

Each earthing station Earthing system as a whole Earth continuity conductor

Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 5 Ohm in each case.

Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.

3.0 Mode of Measurement

Earthing stations shall be measured as specified in the bid.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

END OF SECTION

General Technical Specifications for Low Voltage System CCTV MONITORING & RECORDING SYSTEMS

SECTION-17 (Auxiliary Works)

17.0 Generals:

The Closed-Circuit Television System (CCTV system) shall provide an on-line display of video images on monitor. Cameras with suitable lenses shall be used to view specific areas of interest. The primary objective of implementing a CCTV system is to ensure effective surveillance of an area and also create a record for post event analysis.

17.1. EQUIPMENT

The CCTV System shall comprise of Fixed Lens, C-CS Mount high resolution color Cameras, Hi-Speed Dome Camera's, Standalone Digital Video recorder, Monitor and other associated accessories.

17.2 BULLET CAMERA:

The Dome camera unit shall be 1/3" High quality Color CCD type and shall provide a minimum of 720 HDTV lines resolution. It shall be possible to use any size of Fixed Lenses of 2.8/3.6/6 mm & Vari Focal Autoiris Lens size of 2.8-10 mm. The camera shall operate on 12 volts D.C.

17.3 KEY FEATURES:

- 1/3" CCD (NTSC: 410,000 / PAL: 470,000)
- 0.1 Lux Minimum illumination
- High performance 1080 TV Lines Resolution
- 48dB
- Dip Switch control
- Flickerless
- BLC (Back Light Compensation)
- AGC (Auto Gain Control)
- Various lens option available (2.8mm, 3.6mm, 6.0mm, 2.8~12mm)
- SMART IR technology, up to 20/40/80m IR distance (night vision)
- IP66 Weatherproof

Specification:

Minimum Illumination 0.1 Lux@F1.2, 30IRE, AGC On

Video Output 1Vp-p, 75Ω,

Resolution 1080 TVL	S/N Ratio 48 dB or more (AGC off)
Sync System Internal	White Balance Auto
AE AI/AES	AGC On/Off
BLC On/Off	Flicker less on/Off
Power Input DC Jack Type	Video Output BNC Connector
Voltage DC 12V (±2V)	Power Consumption Max. 1.0W
Lens Fixed Lens (2.5mm, 3.6mm, 6mm),	Vari-focal Auto Iris Lens (2.8mm~10mm) F1.3
Dimensions (D X H) 124.6(D) X 106.1 (H) mm	Weight 278g(Fixed Lens), 300g(Vari-focal Lens)

Case Color Ivory	Material Polycarbonate
H. Adjustable Angle 0°C~360°C	V. Adjustable Angle 0°C~60°C
Operation Temp -10°C ~ 55°C	Storage Temp -20°C ~ 70°C
Operation Humidity <90% (Non-condensing)	
Case Color Ivory	Material Polycarbonate

17.4 STANDALONE DIGITAL VIDEO RECORDER

16CH Audio & Video Hybrid real time Digital Video Recorder, it includes features such as Mpeg4 & H.264 compression format, superior real time performance with 480 IPS (NTSC) / 400 IPS (PAL), longer recording time via independent disk array, advance motion trigger recording, and Other relevant features & functions.

Specification:

Operating System	Linux
User Interface	GUI Mouse supported and Menu color changeable
Video Input Video Output	16channelscompositevideosignal (NTSC/PAL) 2 channels PAL/NTSC, BNC(1.0Vp-p,75)
Composite video signal / 1 channel VGA	
Audio Input Audio Output 1 channel: 2000mv 1KG (RCA) 16DVR)	16 channels 200~1000mv10K (RCA) Alarm Input 16 alarm inputs (applied to 4, 8,
AlarmOutput6channels(applyHD-4,8,16DVR)	Alarm Relay 30VDC 1A, 125VAC 0.5A (linkage output)
Video Display Video Standard PAL(1080TVL,30fps),NTSC(1080/TVL 30fps)	1,4,9,16 splits System Resource Multi-Channel Record/Video
	Replay/Network Operation
Recording Resolution Motion Detection	CIF Realtime / 4 CIF Detecting zone: Whole screen divided into
192(16x12) sections; Multi-levels of sensitivity	
Image Movement	Detect Zone Set Each picture can set 396 detect zones; Detect sensitivity set:3choice each zone
Image Compression Audio Compression	MPEG4/H.264 fixed code flow, MPEG4codeflow ADPCM / PCM
Image Compression Ratio	325*288 CIF, 176*144 QCIF
Video Record Speed	Real-time Mode: PAL/NTSC
1frame/10sec~25frames/sec and NTSC	
Image Quality Hard Disk Interface	1frame/10sec~30frames/sec 6 selections SATA, support max 8HDDs
Hard Disks Space Video: 40-460MB/h	Audio: ADPCM 14.4MB/h; PCM: 28.8MB/h ,
Backup	CD-RW/USB storage devices / Download through
Internet	
Network Interface	RJ45 10M/100M self-adjusting Ethernet port
PTZ Control Interface	RS485, RS232

Power Supply	230±25%V 50±2%Hz / 115V 60Hz
Power Consumption (3W) <w/o H DD>	40W
Temperature	-10°C~ +55°C
Humidity	10%~90%
Barometric pressure	86kpa~106kpa
Size	2U , 441(W)x 430(D)x 89(H)mm
Weight	7.5Kg (w/o HDD)

17.5 MONITOR

The monitor shall be suitable with the standards of the selected cameras. It shall be solid state and modular in design. It shall provide a bright, clear and well-defined picture display on the screen. All controls for brightness, contrast etc. shall be provided on the front panel for readily adjusting the levels of the video signal. The rear panel shall be provided with input and output BNC connectors for coupling the video output to other Monitors. The video monitors installed shall be at least 17" size or more and shall comply with the specification.

17.6 SAFETY CODE

Suitable scaffolds shall be provided for workmen for all work that cannot safely be done from the ground, or from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra labor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and handhold shall be provided on the Ladder and the ladder shall be given an inclination not steeper than 1/4 to 1 (1/4 horizontal and 1 vertical).

To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the contractor shall be open to inspection by the Engineering-charge or his representatives and the Inspecting Officers.

If the height at which the contractor is working is more than 12 feet then the staff should wear safety helmet and tie himself with softy belt, client/ architect have all right to ask the contractor to stop wire if the safety condition are not fulfilled.

17.7 TESTING, PERMITS

Testing:

Testing shall be carried out for the completed installations, in the presence of and to the satisfaction of the Engineer-in-charge by the contractor. All test results shall be recorded and submitted to the University.

Instruments:

All necessary test instruments for the tests shall be arranged by the contractor if so, required by the Engineer-in-charge.

Permits:

The Contractor shall obtain all necessary permits prior to work commencement for the excavation of cable trenches etc. in the areas where it is suspected that existing services are present the contractor shall carry out excavation work by hand. He shall also obtain the necessary permits from the respective authorities prior to working on major items of the switchgear. All application permits shall be made in writing with a copy to the consultant.

As-Built Drawings/ Shop drawings:

Contractor shall make all necessary shop drawings indicating conduit / cable tray routes / quantities / sizes; cable schedule, circuiting details etc. complete before starting the works and get approval of consultant / Engineer in Charge.

At the completion of the works and before issue of the certificate of virtual completion, the contractor shall submit to the consultant 4 sets (HARD AND SOFT FORMAT) of layout drawings drawn at approved scale indicating the complete wiring system as installed. These drawings must provide the following minimum information:

Manufacturer's Instructions:

Where manufacturers have furnished specific instructions, relating to the materials used in this job for covering, paints which are not specifically mentioned in this documents, manufacturer's instructions shall be followed.

Guarantee:

At the close of the work and before issue of the final certificate of virtual completion. The contractor shall furnish written guarantee indemnifying the Architect/Consultant against defective materials and workmanship for a period as mentioned in the schedule of fiscal aspects. The contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to client.

Completion Certificate:

On completion of the Electrical Installation a certificate shall be furnished by the Contractor counter signed by the licensed supervisor, under whose direct supervision the installation was carried out. The certificate shall be in the prescribed form as required by the local authority.

The contractor shall be responsible for getting the Electrical installation inspected and approved by the local authorities connected.

Operating and Maintenance Manuals:

The Contractor shall furnish two sets of operating manuals which shall include services maintenance instructions and circuit diagram for each item of equipment.

END OF SECTION

General Technical Specifications for PLUMBING SYSTEM

SECTION-18 Water Supply, Plumbing and Sanitary Fittings

GENERAL PROVISION:

Reference on specifications, workmanship, installation requirements are based on the attached Annex C UP Master Development Plan (MDP) Restroom Design Standards and the UP MDP Accessibility Guidelines of 2018, for guidance and compliance.

1.0. Materials

Galvanized mild steel tubes and PPR of specified diameter nominal bore shall conform to materials and workmanship as directed.

The galvanized/ PPR fittings, clamps, etc. required for specified dia. bore pipes shall be of best quality and makes as approved by the Engineer-in-charge.

PLUMBING SYSTEMS

a) PIPES AND FITTINGS:

- COLD WATER LINES: Main risers and branches; Polypropylene Pipe.
- SEWER AND WASTE PIPES:

b) Main Lines and Stacks: POLYVINYL CHLORIDE PIPES AND FITTINGS Equivalent to ASTM D 1785. Rigid (uPVC) pipe and drainage pattern fittings or approved equal conforming to ASTM D2564.

c) Branches Only: POLYVINYL CHLORIDE PIPES AND FITTINGS Equivalent to ASTM D 1785. Rigid (uPVC) pipe and drainage pattern fittings or approved equal conforming to ASTM D2564.

d) Vent Pipes: POLYVINYL CHLORIDE PIPES AND FITTINGS Equivalent to Series 1000, Class 35.

STORM DRAINAGE SYSTEMS:

a) Downspouts: POLYVINYL CHLORIDE PIPES AND FITTINGS Equivalent to Series 1000, Class 35.

b) Storm Drainage: CONCRETE PIPES: Sizes as required, conforming to Class IV.1, reinforced for 300 mm Φ and larger.

AIR-CON DRAIN: POLYVINYL CHLORIDE PIPES AND FITTINGS, Equivalent to Series 1000, Class 35, with Elastomeric Closed Cell Insulation.

VALVES:

Valves: ASTM B-61 & 62, ASTM A-197, U.S. made. For gate valves and check valves, cast brass, sizes as required in the drawings.

TRAPS AND CLEANOUTS:

Cleanout plugs for PVC pipes shall be cast brass ferrule with countersunk tap screw cover.

Underground traps except P traps on floor drains shall be provided with removable cleanouts. Cleanout and cleanout access cover for cast iron pipes as indicated below:

<i>APPLICATION</i>	<i>TYPE</i>	<i>PRODUCT NO.</i>
<i>Concealed Drainage Lines</i>	<i>Horizontal Cleanouts with Access Covers</i>	<i>Z 1440 5</i>
<i>Exposed Drainage Lines</i>	<i>Horizontal and Vertical Cleanouts</i>	<i>Z 1440</i>
<i>Finished Floor Area</i>	<i>Floor Level Access Cleanouts tile floor</i>	<i>Z 1425 6/ Z 1400 10</i>
<i>Finished Walls</i>	<i>with Round Plate Access Covers</i>	<i>Z 1440 1</i>

DRAINS: ASA, METMA, as indicated or approved equal.

Roof Gutter - M-319-16, ASA or equal
 Floor - M-210, ASA or equal
 Cleanout - M-240, ASA or equal

FAUCETS: See Plumbing Fixtures.

HOSE BIBBS:

Hose Bibbs: Stainless steel satin finish faucet for slop sink area and shall be size 20 mm hose thread connection, and for other faucet with bronze body as indicated in the plans shall be brass, made of male inlet threads, hexagon shoulder and three-quarter inch hose connections.

PIPE SLEEVES:

- Wrought iron or steel pipe schedule 40 for sleeves in walls and partitions.
- Steel pipe schedule 40 for sleeves in concrete beams or concrete fireproofing.
- Galvanized steel pipe schedule 40 for sleeves through floors.
- Steel pipe sleeves in footings shall be not less than four inches larger in diameter than the pipe to be installed.

CATCH BASINS/JUNCTION BOXES: 140 kg/cm² RC with C.I. grating cover M-452 E. In-site and pre-cast reinforced slabs, with concrete hollow block walls, details as shown in the drawings. For drain terminals discharge, and generally at all intersecting points of pipes.

JOINTING: Flanged Joint Gasket – GARLOCK or equal Screwed Joints – U.S. Federal Specifications GG-P-251 PVC Pipes and Fittings – PVC cement or as per Manufacturer’s recommendations. Dissimilar Pipes – Adopter fittings shall be used. Concrete Drain Pipe – Cement mortar

2.0. Workmanship

Cutting, Laying & Jointing

When the tubes are to be cut or rethreaded, the ends shall be carefully filed out so that no obstruction to bore in offered. The ends of the tubes shall then be threaded conforming to the requirements with pipe dies and taps carefully in such a manner that it will not result in slackness of joints when the two pieces are screwed together.

All pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable. The pipes shall be fixed to walls with standard pattern clamps of required size and shape, one end of which shall be properly plugged or cemented into walls with cement mortar 1:3 (1 cement: 3 coarse sand) and the other tightened round the pipes to hold it securely. These clamps shall be spaced at regular intervals in straight lengths at 2 MC/C interval in horizontal run and 2.5 m. interval in vertical run. For pipe of 15 mm. dia. up to 25 mm. diameter the holes in the walls and floors shall be made by drilling with chisel or jumper and not by dismantling the brick work or concrete. However, for bigger diameter pipes the holes shall be carefully made cement: 3 coarse sand), and properly finished to match the adjacent surface.

Testing of joints:

After laying and jointing, the pipes and fillings shall be inspected under working conditions of pressure and flow. Any joints found liken shall be redone, and ail leaking pipes removed and replaced without extra cost.

The pipes and fittings after they are laid shall be tested to hydraulic pressure of 6 Kg. /Sq cm. The pipe shall be slowly and carefully charged with water allowing all air to escape and avoiding all shocks and water hammer. The draw off takes and stop cock shall then be closed and specified hydraulic pressure shall be applied gradually the pressure gauge must be accurate. The pipes and fittings shall be tested in sections as the work laying proceeds, keeping, the joints exposed for inspection during the testing.

3.0. Mode of measurements and payment

The description of this item shall, unless otherwise stated be held to include where necessary. conveyance, and delivery, handling, unloading, storing fabrication, hoisting, all labor for finishing to required shape and size, setting, fitting in position straight, cutting and waste return of packing.

The rate shall be for a unit of one running meter.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION-19 Plumbing Fixtures

GENERAL PROVISION:

Reference on specifications, workmanship, installation requirements are based on the attached Annex C UP Master Development Plan (MDP) Restroom Design Standards and the UP MDP Accessibility Guidelines of 2018, for guidance and compliance.

1.0. Materials

Cement mortar shall conform to Philippine standard.

PLUMBING FIXTURES

Note: Verify roughing in dimensions and installation procedures from manufacturer before proceeding with final set of pipe inlets and mounting hardware.

PLUMBING FIXTURES: All plumbing fixtures and accessories with approval from the end-user, with the Architect and/or Engineer in Charge.

WATER CLOSET: Elongated front type, white color only, Floor or wall-mounted, one-piece tank type, Dual flush, low consumption 4.5 liters per flush or less, ceramic glazed finish, with toilet seat and cover, provide spray/bidet hose in stainless steel satin finish. For all toilets.

WALL-HUNG LAVATORY: For PWD toilet. Wall-hung Semi-pedestal Lavatory, white color only. Use self-closing delayed action sensor type tap/faucet, stainless steel satin finish, with angle valve, steel braided flexible hose, strainer, P-trap, and all other fittings to complete.

COUNTER LAVATORY/BASIN: For Male, Female toilets. Ceramic, Bowl-type, Semi-countertop installation, white color only. Use wall-mounted gooseneck Single Lever Ceramic Disc Faucet in stainless steel satin finish, strainer, P-trap, and all other fittings to complete.

FLOOR DRAINS: Stainless Steel SS304 at least or Brass with tamper-proof fixing screws for removable cover and removable basket and insect trap, 100mm x 100mm (4" x 4"). For all floor drains and slop sinks.

ACCESSORIES: door hook, jumbo tissue roll dispenser, sanitary bin, child protective seat, soap dispenser, mirror, hand dryer. As indicated on plan. For all toilets.

2.0. Workmanship

The pan shall be sunk into the floor and embedded in a cushion of average 15 cm. cement concrete 1:5:10 (1 cement: 10 graded stone aggregate or brick aggregate 40 mm. nominal size) or and its bed concrete, the floor should be left 115 mm.-below the top level of the pan so as to allow for flooring and its bed concrete. The floor should be suitably stopped so that the. waste water is drained into the pan. Shall be provided with 100 mm. 'P' or 'S' trap as specified in the item No. 23.113 with approximately 50 mm seal-The joints between the pan and the trap shall be made leak-proof with cement mortar 1:1 (1 cement: 1 fine sand).

3.0. Mode of measurements and payment

The rate shall include the cost of all materials and labor involved in the operations described under workmanship. The rate shall be for a unit of one number.

Approval Note

All materials and works writing on this section should be approved by the end-user Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

END OF SECTION

General Technical Specifications for MECHANICAL

SECTION-20 GENERAL REQUIREMENTS

1.0. RULES AND REGULATIONS.

Mechanical work, equipment and materials, including the installation thereof, shall be in full accordance with the requirements of (BFP) Bureau of Fire protection. The safety orders issued by the division of industrial safety, department of industrial relation of the Bureau of Fire Protection, the fire protection and plumbing and gas appliance codes, and any other prevailing codes and regulation pertinent to adequate protective measure and prevention of hazardous conditions.

2.0 PERMIT.

The contractor shall obtain, at his own expense, prior to start of any mechanical work in buildings and in other location outside of street areas, all necessary permit from the department of public work for the work covered by specification, except as such permits may have been previously obtained by the city.

3.0 ADJUSTMENT OR RELOCATION OF EXISTING FACILITIES.

If required to permit the prosecution of the work, adjustment or relocation, as approved by the Engineer, of existing electrical conduit and contained wires, existing pipes or existing ducts, where such conduit and pipes are 1-1/4 inches or less in nominal diameter and the ducts are one square foot or less in cross-sectional area, shall be considered incidental work. The adjustment or relocation of larger sized existing facilities, however, unless specifically indicated for such adjustment or relocation on the plans or in the special provision, if necessary, as determined by the Engineer, shall be done as directed.

4.0 FLOOR, WALL AND CEILINGS OPENINGS.

The contractor shall secure the Engineers approve of the location for holes and openings in floor, walls and ceilings, necessary for the installation of mechanical equipment, ducts, piping and appurtenances, and shall keep to a practicable minimum the size of such holes and openings. He shall conduct his operations in such manner as to prevent cracking or otherwise damaged floors, walls, and ceilings. He shall close all holes and openings, and repair, in an approved manner, all damage resulting from his operations, leaving no impairment of structural, functional, or architectural quality and shall match the configuration, texture and color of the adjacent existing surfaces, with one coat of primer and two coats of finish paint to match the surrounding area. Painting and preparation therefor shall be in accordance. Holes and openings in or through existing concrete or masonry floors, walls and ceilings shall be made by drilling with proper size carbolic-tipped twist drills, diamond drill bits, or diamond core drills. The use of impact drills of any type will be permitted only with the approval of the Engineer.

5.0 UNINSPECTED WORK NOT TO BE CLOSED IN.

The contractor shall not cover up nor enclose any of work until it has been tested by him in the presence of the engineer and until it has been inspected and approved by the engineer. Should any of the work be enclosed or covered up before such inspection and test, the contractor shall, at his own expense, uncover the work, and after it has been inspected, tested and approved, restore such covering and enclosure. Backfilling shall not commence until after structures, or furnished and installed, as applicable, and inspected, and, if required tested.

6.0 DAMAGES BY LEAKS OR BREAKS.

Damage to any part of the premises or its improvement caused by leaks or breaks in the equipment, piping or appurtenances installed by the contractor, or caused by leaks or breaks in existing equipment, piping or appurtenances resulting from his operation, shall be considered defects in the work or damage to existing improvements, as the case may be, as the contractor for a period of one year following the date of acceptance of the work in the case of surface improvements.

SECTION 21 STEEL WORK

1.0 STEEL AND MATERIAL.

Steel, and the fabrication and all bolts and nuts shall conform to ASTM" standard specification for low-carbon steel externally and internally threaded standard fasteners, designation A 307, grade "B" and shall be standard machine bolts with cold pressed hexagonal nuts, except as otherwise specified.

All bolts and nuts specified to be galvanized shall have a free running fit.

Anchor and assembly bolts shall be of ample size and strength for the purpose intended.

No existing bolts, nuts, washers, etc., shall be reused in contract work, unless specifically indicated for such reuse on the plans or in the special provisions.

2.0 WORKMANSHIP.

2.1 GENERAL

All welding shall be performed in accordance with the applicable requirements of the latest (Standard Code for Arc and Gas Welding in Building Construction.) Serial designation D 1.0, of the American welding society, or the latest specification for fusion welding of the American Institute of steel contraction.

Only those welders who are experienced and have passed qualification test under the TESDA (Standard Qualification procedures) shall be employed and the contractor may be required to show the certified employment and test records for each welder.

All welding shall be done in the shop before galvanizing, if the latter is required, except as specifically otherwise permitted by the engineer.

Surface to be welded shall be cleaned by wire brushing, chipping or hammering away any loose mill scale, rust, paint or other foreign matter present on the metal. The

cleaning shall extend at least two inches on each side of the weld, except as otherwise specified. Welds shall be cleaned each time the electrode is changed.

In assembly and during welding, the component part shall be held by sufficient clamps or other adequate means to keep the part in the proper position and in close contact.

Welds shall show uniform section, smoothness of metal, feather edges without undercuts or overlays and freedom from cracks, porosity or clinkers. Visual inspection of edges and ends of fillets and butt joint or welds shall indicate good fusion with and penetration into the base metal. All burrs and lumps of metal shall be removed, leaving a neat and workmanlike appearance.

All weld slag and spatter shall be completely removed before galvanizing or painting.

Any welds or portions of weld found defective, in opinion of the Engineer, shall be removed and replaced.

2.2 WELDING OF STEEL PIPE AND FITTINGS.

All welded joints for steel pipe, attachment and fittings, unless otherwise shown on the plans of specified in the special provisions, shall be fusion-welded in accordance with the AWS code for industrial piping, using suitable welding rods as recommended by American welding society.

All joints shall open, single "V" type with all pipe and fitting ends scarfed on an approved angle to within 1/16-inch of the fitting.

The abutting ends shall be separated and properly spaced before tacking.

All finished welds shall be of sound metal and shall present a neat and workmanlike finish.

All welded pipes and fittings shall be subjected to a hydrostatic test pressure not less than that specified in the special provision, followed by a soap-and-water test for leaks.

All defects in the welding shall be corrected.

All welds that leak or sweat are defective and shall be cut away.

The pipe and/or fittings shall then be resurfaced and new welds made and retested.

2.3 GALVANIZING

Galvanizing shall be done where shown on the plans or when specified.

3.0 Mode of measurements and payment

Rigid steel conduit, galvanizing, of each size, payment therefor shall be included in the price or prices bid.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION 22 PIPING, TUBING, FITTINGS, VALVES AND OTHER APPURTENANCES- MATERIALS AND INSTALLATION.

1.0 GENERAL

All piping, tubing, fittings, valves and other piping system appurtenances shall be free of defects, and of the make, brand and quality specified, or approved equal.

All such piping, tubing and appurtenances shall be installed by the contractor where and as shown on the plans, or were directed by the Engineer.

The kind and size of pipe, tubing and appurtenances to be used for the particular application shall be as shown on the plans and/or as specified in the special provisions.

Workmanship shall be of the highest quality, and installation shall be in accordance with the practices recognized as best by the plumbing trade.

When sizes and strengths of pipes are omitted from the plans and not set forth in special provisions, the sizes and strengths shall be adequate for the functions to be performed, as determined by the applicable codes and regulations and as approved by the engineer, unless heavier materials or more stringent requirements are indicated, in which case the indicated sizes will govern.

All piping shall be erected to accurate lines and grades, and where possible, pipes shall lay horizontally or vertically, and parallel or perpendicular to each other and to building walls, to make a workmanlike installation.

All lines, fittings, valves and appurtenances in buildings or elsewhere shall be located so that they can be easily removed or repaired without disturbing other parts of the lines; shall be adequately stayed, braced and anchored, and shall be installed in a neat and workmanlike manner.

All vertical lines in buildings shall be supported by brackets or standard clamps and shall not depend upon resting or hanging from other pipelines or equipment.

Maximum clearance beneath piping in buildings shall be maintained.

2.0 STEEL PIPING AND FITTINGS.

2.1 GENERAL

where weight or strength of pipe is referred to in the special provision or on the plan by "schedule number" such "schedule number" refers to standard B-36-10 as adopted by American National Standards. Standard weight pipe is referred to as schedule 40" and extra strong pipe is referred to as "schedule 80".

Steel pipe and fittings used for domestic hot and cold piping, waste and vent piping, shall be galvanized.

FITTINGS AND FLANGES.

Screwed fittings for steel pipe, unless otherwise specified, shall be threaded, squire band, malleable or cast iron and cut with full threads.

Fittings for steel pipe used for waste lines, unless otherwise specified, shall be of the long sweep pattern, cast iron drainage fitting.

2.0 MATERIALS

a. The piping, tubing, and fittings specified inclusive, are of those materials, classes and types used most frequently in Bureau of Engineering Mechanical Construction, replacement and reconstruction, and maintenance and repair jobs.

- Not precluded is the use of piping, tubing, and fitting as otherwise may be specified in the special provision, including, but not limited to, the following;
- Alloy steel pipe fittings.
- High silicon iron alloy pipe and fittings, bell and spigot type, extra heavy weight, of “duriron,” “corrosiron,” or equal.
- Red brass pipe and fittings.
- Asbestos-cement pressure pipe and fittings.
- Polyvinyl chloride (PVC) and other plastic pipe and fittings.
- Vitrified clay pipe and fittings.

4.0 Mode of measurements and payment

If the proposal contains a Bid item for rigid steel conduit, galvanized, each size thereof for which there is a bid item, satisfactorily furnished and installed, complete in place, as specified, will be paid for at price bid per linear foot.

Approval Note

All materials and works writing on this section should be approved by the Architect or Engineer-in-charge.

- Materials: provide sample for approval by the end-user, the Architect and/or Engineer-in-charge
- Working: provide mock-up for approval by the end-user, the Architect and/or Engineer-in-charge

SECTION 23 MECHANICAL EQUIPMENTS, MATERIALS AND WORKS

1.0 Equipment Selection

1. All equipment supplied shall be in accordance with this Specification and the relevant drawings and to the approval by the University.
2. Physical sizes of all plant and equipment are to be suitable for the space allocated for the accommodation of such plant and equipment, taking into account the requirement of access for maintenance purposes

3. Where the General Contractor proposes to use an item of equipment other than that specified or detailed in the drawing which requires any redesign of the system, drawings showing the layout of the equipment and such redesign as required therefore shall be prepared by the General Contractor at his own expenses. Where such approved deviation necessitates a different quantity and arrangement of materials and equipment's from that originally specified or indicated in the drawings.
4. Equipment catalogue and manufacturer's specifications must be submitted for examination and details shall be submitted for the approval of the Employer's Representative before any equipment is to be ordered. This shall include all information necessary for the Employer's Representative to ascertain the equipment comply with this Specification and drawings.
5. Before ordering equipment, the General Contractor shall provide the Employers Representative with full details of the weights and characteristics of the equipment for purposes of determining floor loading, power consumption etc.

2.0 Pipe / Duct and Equipment Installation

1. Locate distribution systems, equipment and materials for maximum usable space, optimum service clearances and to accommodate current requirements and identified future expansion.
2. Installation above typical floor modular ceilings to allow installation and future relocation of lights and air troffers without interfering with or requiring relocation of mechanical, electrical or other services, or removal of ceiling grid.
3. All copper tubes that will be used for refrigerant piping will be "Soft Drawn".
4. Include all pipe and duct offsets required to eliminate interference with the work of other.
5. Install equipment and materials to present a neat appearance. Run piping, ducts and conduit parallel to or perpendicular to building planes. Conceal piping, ducts and conduit in finished areas. Install so as to require a minimum amount of furring.
6. Install pipe, duct and conduit straight, parallel and close to walls and slab or deck underside, with specified pitch.
7. Use standard fittings for all direction changes. Do not use drilled tees and other field fabricated fittings.
8. Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.
9. Where pipe sizes differ from connection sizes of equipment, provide reducing fittings between inline components such as valves, strainers and fittings, and equipment. Reducing bushings are not permitted.

10. Cap open ends of piping during installation.
11. Lay copper tubing so that it is not in contact with dissimilar metal and will not kink or collapse.
12. Use non-corrosive lubricant or Teflon tape equal to Dow Corning and apply on male thread.
13. Provide brass adaptors or dielectric couplings wherever dissimilar metals are joined.
14. No pipe to be laid in water or when, in opinion of Consultant conditions are unsuitable.
15. Ensure that pipe installation does not transmit vibration to the walls and floors through which they pass.
16. Make provisions for neat insulation finish around equipment and materials. Do not mount equipment within insulation depth

3.0 CONNECTION TO EQUIPMENTS

1. Provide unions or flanges at all connections to equipment. Ensure that piping adjacent to equipment is readily removable for servicing and/or removal of equipment without shutting down entire system.
2. Install unions in piping up to and including 50 mm pipe size. Install flanges in piping 65 mm pipe size and larger.

4.0 HANGERS AND SUPPORTS

1. Suspend piping, ductwork and equipment with all necessary hangers and supports required for a safe and neat installation. Ensure that pipes are free to expand and contract and are graded properly. Adjust each hanger to take its full share of the weight.
2. Suspend hanger rods directly from the structure. Do not suspend pipes, ducts or equipment from other pipes, ducts, equipment, metal work or ceilings
3. Provide auxiliary structural steel angles, channels and beams where ductwork, piping and equipment must be suspended between joists or beams.
4. Use galvanized rods, steel support angles, channels and beams where exposed to direct contact with water or to possible high humidity conditions where condensation can occur.
5. Space hangers to ensure that structural steel members are not over stressed. In no case shall pipe hangers be further apart than indicated in the tables. When requested, submit detailed drawings showing locations and magnitude of ductwork, piping and equipment loads on the structure.

6. Do not use hooks, chains or straps to support equipment and materials.
7. For precast concrete work, if inserts cannot be cast into members, pass hanger rods between the members and weld to steel plates resting on the upper surface of the precast material. To prevent raising of the hanger rod, apply a lock nut and 50 mm minimum dia. flat washer tight against the under surface of the precast material.
8. Provide round steel threaded rods meeting ASTM A-36.
9. The following table establishes minimum standards of rod sizes and hanger spacing for steel and copper piping.

MAXIMUM HORIZONTAL SPACING OF SUPPORTS			
Pipe Size (mm)	Rod Size (mm)	Steel (m)	Copper (m)
12	10	1.5	1.5
20	10	1.8	1.8
25	10	1.8	1.8
32	10	2.4	2.1
40	10	2.7	2.4
50	10	2.7	2.7
65	12	3.0	3.0
75	12	3.0	3.0
90	12	3.0	3.3
100	16	3.0	3.7
125	16	3.7	3.7
150	20	3.7	3.7
200	22	3.7	
250	22	3.7	
300	22	3.7	
350	25	3.7	
400	25	3.7	
450	29	3.7	
500	32	3.7	
600	32	3.7	

5.0 MECHANICAL WORKS

1. All equipment, pipes and ductworks shall be installed in approximate location as shown on the drawings.
2. All equipment specifications and duct sizes must be coordinated with the drawing.
3. All equipment shall set on level reinforced concrete foundation at least 150mm. higher than the floor line, if applicable.
4. All equipment shall be mounted on or supported with vibration isolation units or assemblies as specified and or shown on the drawings.
5. Installation of all works shall be done in a neat and workmanlike manner, improperly

set work or finish as determined by the architect shall be removed and replaced at extra cost.

6. All materials to be used shall be brand new and clean.
7. Deviations and revisions from plans shall be referred to the architect for review and approval
8. All necessary government permit shall be secured and paid for by the contractor.
9. All dimension is in millimeter unless otherwise specified.
10. All mechanical works shall be in accordance with the latest Mechanical Engineers code ASVE and ASHRAE standard.
11. Mechanical contractor shall observe always safety and orderliness.
12. Mechanical contractor shall verify site prior to actual installation.

SECTION 24 FIRE PROTECTION SYSTEM

1.0 PIPING

1. All piping shall be a minimum schedule 40 steel pipe. All exposed pipe shall be painted (unless prohibited by code).
2. Piping shall be concealed in areas with drop ceilings. Sprinklers shall generally be centered in ceiling tiles.
3. Piping shall be installed in a craftsman like manner and shall not interfere in the complete function of other systems such as cable trays, access panels, or pedestrian passageways. Installation of all piping shall be in coordination with duct, light fixture, and any other work that may obstruct sprinklers. The contractor shall coordinate with all trades having materials in above ceiling spaces prior to commencement of any work.

2.0 VALVES

1. Unless specified otherwise, all valves shall be suitable for the anticipated pressures or a minimum of 175 psi working pressure, whichever is greater.
2. All valves on connections to water supply to sprinklers shall be UL listed.
 - All indicating valves on the supply side of the backflow preventer;
 - The indicating valve immediately adjacent to the backflow preventer on the system side.
 - All indicating valves on the suction side of a fire pump.
 - Where indicated on the contract drawings.

3. Where OS&Y indicating valves are installed, the following shall apply:
 - Valves 2-1/2 inches and larger shall be iron body, except seats, discs, and stems which shall be brass. Valves 2 inches and smaller shall be brass body and brass stem seat.
4. A check valve shall be installed between each floor (isolation) control valve and the floor drain valve to permit draining of only the floor (area) affected. Check valves shall comply with the following:
 - Check valves 2-1/2 inches and larger shall be iron body swing check with cast brass hinge, rod, and brass faced discs.
 - Check valves 2 inches and smaller shall be UL listed brass body and all brass fitted.
5. Ball valves shall be constructed of forged brass with Teflon seats and shall be provided with a vinyl-covered handle.
6. All valves controlling water supply for sprinklers shall be readily accessible for use by emergency and maintenance personnel.
7. All accessible valves controlling water supply for sprinklers shall be supervised by the fire alarm system. All valves controlling water supply for sprinklers shall be red in color.
8. A valve shall be installed at the base of each riser.

3.0 PIPING & ACCESSORIES

1. All hanger components other than all thread shall be UL listed or FM approved. No sprinkler piping is to be supported from any mechanical or electrical devices and/or equipment (ducts, lights, etc.). Hanger assemblies installed outside, or otherwise exposed to weather, shall be externally galvanized.
2. Sleeves shall be installed prior to construction of walls or pouring of concrete. Install sleeves flush with all surfaces.
3. Pressure gauges shall be UL listed or FM approved for fire service.

4.0 FIRE DEPARTMENT CONNECTIONS

1. Each fire department connection shall be the flush type. Freestanding type fire department connections shall only be installed when approved by Project Management. Each fire department connection shall be two (2) 2-1/2 inches, equipped with UL listed screw caps with pin lugs and chains. The fire department connection shall be labeled "AUTOMATIC SPRINKLER" with raised letters at least one inch in size and cast on plate. The fire department connections shall be not less than two feet and not more than 3 feet 6 inches in elevation, measured from the ground level to the centerline of the inlets.
2. A bypass with a normally closed valve shall be installed around the check valve in the fire department connection piping, to permit flow testing of the backflow prevention

assembly.

5.0 DRAIN AND TEST PIPING

1. A bypass with a normally closed valve shall be installed around the check valve in the fire department connection piping, to permit flow testing of the backflow prevention assembly.
2. All risers, including the alarm check valve, shall be equipped with drains with sizes as specified in NFPA 13. The alarm check valve drain ("main drain") shall be piped to the sanitary sewer system.
3. All drains and test piping shall be piped to the sanitary sewer system.

6.0 FIELD AND ACCEPTANCE

1. Upon completion of the pump and sprinkler piping installation, a field acceptance test shall be conducted to 110% of the design capacity. All acceptance testing shall be conducted by installing contractor in the presence of a representative of Owner and the Project Management. Team documentation of all factory and field tests shall be submitted at the conclusion of the field acceptance test. The Owner and the Project Management will not approve any equipment prior to receipt and review of these test results.

7.0 QUALIFICATIONS

1. System design and installation shall be supervised by a licensed mechanical engineer sprinkler system with not less than one (2) years' experience with sprinkler systems. Shop drawings shall be prepared and engineered. Accurate As-Built drawings shall be required in the form of three hard copies and two copies on CD in the specified format. The signature of the RME or engineer constitutes an affidavit that the statements, representations, and information presented in the submittal constitute a complete operational system conforming with applicable state laws and recognized good engineering practices. All field installation work shall be continuously supervised by a mechanical engineer sprinkler system technician

END OF SECTION