

Methods of Construction

Backfill of earth material shall be placed in horizontal layers not exceeding 200mm (8 inches), loose measurement, and shall be compacted as specified before the next layer is placed. However, thicker layer may be placed if vibratory roller with high compactive effort is used provided that density requirement is attained and as approved by the Engineer. Trial section to this effect must be conducted and approved by the Engineer. Effective spreading equipment shall be used on each lift to obtain uniform thickness as determined in the trial section prior to compaction. As the compaction of each layer progresses, continuous leveling and manipulating will be required to assure uniform density. Water shall be added or removed, if necessary, in order to obtain the required density. Removal of water shall be accomplished through aeration by plowing, blading, discing, or other methods satisfactory to the Engineer.

Compaction

The Contractor shall compact the material placed in all embankment layers and the material scarified to the designated depth until a uniform density of not less than 95 mass percent of the maximum dry density determined by AASHTO T 99.

MEASUREMENT AND PAYMENT

Measurement and payment shall be made at the contract unit price or lot price as specified in the Bid Price Schedule. Payment shall include all cost in furnishing labor, materials, tools equipment and other incidentals necessary for the satisfactory completion of the project.

TS - 07 CONCRETE WORKS

GENERAL

The work to be undertaken under this Section shall include all labor, materials, equipment, plant and other facilities and the satisfactory performance of all work necessary to complete all concrete work shown on the drawings and specified herein.

MATERIALS

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a) Cement

Except as maybe otherwise provided in these specifications, cement shall conform to the "Specification for Portland Cement" (ASTM C 150 - Latest Revision) and shall be Type I

b) Concrete Aggregates

- 1.) Concrete aggregates shall be well graded, clean, hard particles of gravel or crushed rock conforming with the "Standard Specifications for Concrete Aggregates (ASTM C - 33 Latest Revision),
- 2.) The maximum size of the aggregates shall not be larger than one-fifth (1/5) of the narrowest dimension between form and not larger than three fourth (3/4) of the minimum clear spacing between individual reinforcing bars or bundles of bars, and in no case larger 5.1 cm (2 in) in diameter except that larger diameter may be allowed in massive concreting with written permission from the Engineer.

c) Water

Water used in mixing concrete shall be clean and free from injuring amounts of oils, acids, alkali, organic materials or other substances that may be deleterious to concrete or steel

d) Reinforcing Steel

All reinforcing steel bars used shall be new and free from rust, oil, defects, greases or kinks. They shall conform to the latest edition of ASTM "SPECIFICATIONS FOR DEFORMED STEEL BARS FOR CONCRETE REINFORCEMENT" Grade 40 as shown or latest equivalent Philippine Bureau of Standard Specifications. Deformed Steel Bars shall have the following unit weights

SIZE (mm)	Kg/m	SIZE (mm)	Kg/m
6	0.222	20	2.466
8	0.395	25	3.854
10	0.616	28	4.833
12	0.888	32	6.313
16	1.579	36	7.991

e) Admixture:

To increase concrete workability and to control the set of concrete, the engineer can request that an admixture maybe added subject to his approval and it shall be borne by the Contractor.

Water – reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and retarding admixtures, and water reducing



and accelerating admixtures shall conform to "Specification for Chemical Admixtures for Concrete" (ASTM C494).

Other admixtures required for specific construction conditions and conforming to ASTM (C494) "Standard Specification for Chemical Admixtures for Concrete" maybe incorporated in separate concrete design mixes and submitted to the responsible engineer for approval prior to their use.

STORAGE OF MATERIALS

Cement and aggregates shall be stored in such a manner as to prevent deterioration or intrusion by foreign matter. Any material which has deteriorated or which has been damaged shall not be used for concrete. Steel shall be stored under cover or otherwise prevented from rusting.

CONTROLLED STRENGTHS OF CONCRETE

- 1.0.1 Concrete for structural elements shall develop a minimum **28-day compressive cylinder strength of 20.68 MPa (3,000 psi)**, unless otherwise specified in the plans.
- 1.0.2 Concrete for non-structural elements such as cradles, unreinforced encasements, thrust blocks, and partition walls shall develop a minimum **28-day compressive cylinder strength of 17.25 mega Pascal (2,500 psi)**, unless otherwise specified in the plans.

CONCRETE PROPORTION AND CONSISTENCY

- a. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed on the work but without permitting the materials to segregate, or excess free water to collect on the surface. The combined aggregates shall be of such composition of sizes that when separated on the No. 4 standard sieve, the weight passing the sieve (fine aggregate) shall not be less than thirty percent (30%) of the total except that these proportions do not necessarily apply to lightweight aggregates.
- b. The methods of measuring concrete materials shall be such that proportions can be accurately controlled and easily checked at any time during the work. Measurement of materials for ready-mixed concrete shall conform with the "Standard Specifications for Ready mixed Concrete" (ASTM C-94, Latest Revision) where applicable.
- c. Aggregates shall be measured out by weight and to within one percent (1%). Cement shall conform to 40 kg (88 lb.) per bag and this is to be verified from time to time. Water shall be measured by weight or volume to within one and one half (1-1/2 %).

- d. The water shall in no case exceed 21.24 liters, and 25.67 liters (5.62 and 6.79 US gallons) per bag of cement for all concrete with specified strength of f_c respectively. Slumps shall be within the following limits:

Portion of Structure	Slump Millimeters	Inches
Columns and end supported beams, girders	50-100	2-4
Walls and thin Vertical sections	75-125	3-5
Footings, slabs on Grade and cantilevered beams and slabs	50-80	2-3

Slumps shall be according to "Test of Slump for Portland Cement Concrete" (ASTM C-143).

- e. **Classification and Design Mixture.** The mixtures for all classes of concrete shall be designed by the Contractor and approved by ICWS to obtain the compressive strength at the age of twenty eight (28) days as specified below.

Class	Size of Maximum Dia. of Aggregate	Minimum Compressive Strength	Designated Size of aggregate
Y	1/2" (12.5mm)	3,000 psi	12.5mm to 4.75mm
AA	3/4" (19mm)	3,000 psi	19mm to 4.75mm
A	1-1/2" (37.5mm)	3,000 psi	37.5mm to 4.75mm
B	2" (50mm)	2,400 psi	50mm to 4.75mm
C	3" (75mm)	2,400 psi	75mm to 4.75mm

- f. **Cement Content.** The minimum cement content per cubic meter of concrete for the different classes or gradation of aggregates shall be in accordance with the following:

Class and Gradation of Aggregates	Minimum Cement Content
Y with 1/2"	400 kgs/cu.m
AA with 3/4"	400 kgs/cu.m

A with 1-1/2"	360 kgs/cu.m
B with 2"	600 kgs/cu.m
C with 3"	270 kgs/cu.m
Z with 3"	340 kgs/cu.m

- g. Job mix adjustments on water content shall be allowed only with Engineer's permission and provided that cement is also added to maintain the original water cement ratio of the design mix.

EXCLUSION OF WATER

No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited under water without the explicit permission of the Engineer, and then only in strict accordance with his directions; nor shall the Contractor, without explicit permission allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the approval of the Engineer.

MIXING CONCRETE

No hand mixing shall be allowed, except in case of emergency such as mixer breakdown during pouring operations and shall stop at the first allowed construction joints. All concrete shall be machine mixed for at least 1 minutes after all materials including water are in the mixing drum.

The mixer shall be of approved size and type which will insure a uniform distribution of material throughout the mass, it shall be equipped with a device for accurately measuring and controlling amount of water in each batch.

Placing of material in mixer shall be done in such a way that first batch of concrete materials placed in the mixer shall contain sufficient excess of cement, sand and water to coat the inside of the drum without reducing the cement content of the mix to be discharged.

Retempering, i.e. remixing with the addition of water to concrete that has been partially hardened shall not be permitted.

PREPARATION OF SURFACES FOR CONCRETING

Earth surfaces shall be thoroughly wetted by sprinkling prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, in the opinion of the Engineer, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be leveled with a wooden float to provide a reasonably smooth surface. A surface consisting largely of coarse aggregate shall be avoided. Except where the drawings call for joint surfaces to be painted, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accompanied by sandblasting followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed. After the surfaces have been prepared to the satisfaction of the Engineer, all approximately horizontal construction joints shall be covered with a layer of mortar approximately 25mm (1") thick. The mortar shall have the same proportion of cement and sand as the regular concrete mixture, unless otherwise directed by the Engineer. The water-cement ratio of the mortar in place shall not exceed that of the concrete to be placed upon it, and the consistency of the mortar shall be suitable for placing and working in a manner hereinafter specified. The mortar shall be spread uniformly and shall be worked thoroughly into all irregularities of the surface, and wire brooms shall be used where possible to scrub the mortar into the surface. Concrete shall be placed immediately upon the fresh mortar.

When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means that will secure proper union with subsequent work, provided that construction joints shall be made only where approved by the Engineer.

PLACING OF CONCRETE

Concrete which upon or before placing is found not to conform with the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these specifications, or which is of inferior quality, as determined by the engineer, shall be removed and replaced by and at the expense of the Contractor. No concrete shall be placed except in a presence of duly authorized representative of the Engineer. Concrete shall not be placed when unsuitable heat or wind will prevent proper placement and curing, as determined by the Engineer, prior to placing any concrete, the Contractor shall give the Engineer twenty four (24) hours written notice.

Concrete shall be deposited in its final position without segregation, re-handling, or flowing. Placing shall be done preferably with buggies, buckets, or wheelbarrows. No chutes will be allowed except to transfer concrete from hoppers to buggies, wheelbarrows, or buckets in which case, they shall not exceed six (6) meters (20') in aggregate length.



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Placing of concrete with a free drop or fall more than 1.20m (4') shall not be allowed, except when approved by the Engineer and when approved sheet metal conduits, pipes or "elephant trunks" are employed. When employed, these conveyors shall be kept full of concrete and the ends kept buried in the newly placed concrete as pouring progresses.

Concrete in forms shall be deposited in uniform horizontal layers not deeper than 450mm (18") and care shall be taken to avoid inclined layers or inclined construction joints except where such care required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 1.5 meters (5') of vertical rise per hour.

TAMPING AND VIBRATING

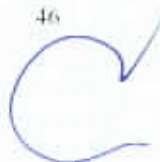
As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement.

Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are used, the concrete shall be worked under the waterstops. Where the concrete shall be worked under the waterstops by hand making sure that all air and rock pockets have been eliminated.

Concrete in wall shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers previously placed have been worked thoroughly as specified. Except in special cases where their use is deemed impracticable by the Engineer, the Contractor shall use internally vibrated, high speed power vibrators not less than 8000 rpm of an approved immersion type in sufficient numbers, with standby units as required, to accomplish the results herein specified within fifteen (15) minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its face.

CARE AND REPAIR OF CONCRETE

The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, over stress, or any other cause until final acceptance by the Owner. Particular care shall be taken to the drying of concrete and to avoid roughening or otherwise damaging the surface. Any



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concrete found to be damaged or which may have been originally defective at any time prior to the final acceptance of the complete work, or which departs from the established line or grade, or which for any other reason does not conform with the specifications shall be satisfactorily repaired or removed and replaced with acceptable concrete at the Contractor's expense.

FINISH OF CONCRETE SURFACE

All finished or formed surfaces shall conform accurately with the shape, alignment, grades and sections as indicated on the plans or as prescribed by the Engineer. Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface.

Except as otherwise provided herein, unformed top surfaces of concrete shall be brought to uniform surfaces and worked with suitable tools to a reasonably smooth woodfloat finish. Excessive floating of surfaces while the concrete is plastic will not be permitted. All surfaces shall be placed monolithically with the base slab. Dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floor slabs and exposed tops of walls and curbs shall be given a steel trowel finish. At the Contractor's option, the above mentioned floor slabs may be finished with a power float after screeding. Subsequent to the aforementioned finish, all sloping surfaces of floor slabs shall be lightly boomed to provide a skid resistant surface.

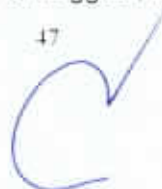
TREATMENT OF SURFACE DEFECTS

As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Engineer, and then only in strict accordance with his directions. Concrete containing voids, holes, honeycombing, similar depression defects shall be completely removed and replaced, provided that where required or approved by the Engineer, defects shall be repaired with gunite or with cement mortar placed by an approved compressed air mortar gun. In no case will extensive patching of honeycombed concrete be permitted. All repairs and replacements herein specified shall be promptly executed by the Contractor at his own expense.

DEPOSITING CONCRETE

Depositing:

Depositing shall be done without segregation, remanding or flowing of concrete. It shall be done with the use of buggies, buckets or wheelbarrows. Use of chutes will not be allowed except to transfer concrete from hoppers to buggies, wheelbarrows or buckets in which case



shall not exceed 20 feet in aggregate length placing of concrete with a free drop of fall of more than 5 feet are not allowed. Conveyors when used shall be kept full of concrete and ends shall be kept buried in the newly placed concrete as pouring progresses.

Vibrations:

No placing of concrete will be allowed without vibrators. Segregation due to over vibration shall be avoided.

Construction Joints:

If possible concreting shall be done continuous until section is complete. When stoppage of concrete operations occur, construction joints shall be placed either horizontally or vertically as indicated by the Engineer and provided with shear keys or dowels to develop bond. Construction joints shall be per plan or shall be approved or as directed by the Engineer.

MEASUREMENT AND PAYMENTS

"Class A" concrete shall be measured by the cubic meter (cu.m.) of concrete completed in place and accepted.

Measurement will be of the actual number of cubic meter within the neat lines of the structure as shown in the plans or revised by authority of the Engineer. The volume of concrete measured as determined above shall be paid for at the contract unit price per cubic meter (cu.m.) which price and payment shall be full compensation mixing, placing, finishing and curing the concrete and all labor, equipment, tools and incidentals necessary to complete the item and accepted.

Payments for the reinforcement placed shall be included in the contract unit price per cubic meter (cu.m.) of concrete which price and payment shall be the full compensation of all labor, equipment, tools and incidentals necessary to complete the item and accepted.

Concrete forms placed shall be included in the contract unit price per cubic meter (cu.m.) of concrete which price and payment shall be the full compensation of all labor, equipment, tools and incidentals necessary to complete the item and accepted.

TS - 08 CONCRETE MASONRY**General**

Concrete masonry construction shall include the furnishing of all labor, material, and equipment, and performing all operations necessary to execute all concrete masonry construction, as specified.

Contractor shall make all preparations and do all work necessary to receive and adjoin other work.

Contractor shall give the work his personal supervision and shall keep a competent foreman on the job at all times when he is not there himself.

Contractor shall specify the position of all dowels required for masonry on other construction, including foundations. Contractor shall arrange for the necessary storage space for construction materials at the jobsite. Contractor shall call for all inspections required in the course of this work by Owner.

Materials

Concrete Hollow Blocks

All property wall shall be 150mm thick x 200mm x 400mm non-bearing concrete hollow blocks, otherwise, use 100mm thick x 200mm x 400mm non-bearing concrete hollow blocks.

Mortar / Grout

Mortar/grout shall be a mixture of 1 part cement and 3 parts fine sand.

Reinforcing Steel

Reinforcing steel shall be 10mm diameter, Grade 40, spaced at 600mm on-center along horizontal and vertical of the walls. Reinforcement shall be secure with a Ga. 16 tie wire.

Masonry Construction

Blocks shall be cut accurately to fit all plumbing ducts, openings, electrical work, and all voids shall be full. Where walls are to receive plaster, the joints should be struck flush. Where certain joints are to be concealed under paint, these joints shall be filled flush and then sanded to produce a dense surface without sheen.

Vertical head joints shall be buttered well for a thickness equal to the face shell of the block and these joints shall be shoved tightly so that the mortar bonds well to both blocks. Joints shall be solidly filled from the face of the block to the depth of the face shell.

Grouting

Reinforcing steel shall be in place and inspected before grouting starts. Vertical cells to be filled with mortar shall have vertical alignment to maintain a continuous unobstructed cell area. Cells containing reinforcement shall be solidly filled with grout.

SECTION VI- SPECIFICATIONS

Plastering**Mixture**

Mortar mixture for brown coat shall be freshly prepared and uniformly mixed in the proportion by volume of one part Portland Cement, three (3) parts sand.

- a) Finish coat shall be pure Portland Cement properly graded. Hydraulic Cement and mixed with water to approved consistency and plasticity.

Surface Preparation

- a) After removals of formworks reinforced concrete surfaces shall be roughened to improve adhesion of cement plaster.
- b) Surfaces to receive cement plaster shall be cleaned of all projections, dust, loose particles, grease and bond breakers. Before any application of brown coat is commenced all surfaces that are to be plastered shall be wetted thoroughly with clean water to produce a uniformly moist condition.

Application

- a) Brown coat mortar mix shall be applied with sufficient pressure starting from the lower portion of the surface to fill the grooved and to prevent air pockets in the reinforced concrete/masonry work and avoid mortar mix drooping. The brown coat shall be lightly broomed/ or scratch before surface had properly set and allowed to cure.
- b) Finish coat shall not be applied until after the brown coat has seasoned for seven days and corrective measures had been done by the Contractor on surfaces that are defective. Just before the application of the finish coat, the brown coat surface shall be evenly moistened with potable water. Finish coat shall be floated first to a true and even surface, then troweled in a manner that will force the mixture to penetrate into the brown coat. Surfaces applied with finish coat shall then be smooth with paper in a circular motion to remove trowel marks, checks and blemishes. All cement plaster finish shall be 10 mm thick minimum on vertical concrete and/or masonry walls.

Workmanship

Cement plaster finish shall be true to details and plumb. Finish surface shall have no visible junction marks where one (1) Day's work adjoins the other. Where directed by the NPC or as shown on the Plans vertical and horizontal groove joints shall be 25 mm wide and 10 mm deep.

MEASUREMENT AND PAYMENT

Measurement and payment shall be made at the contract unit price or lot price as specified in the Bid Price Schedule. Payment shall include all cost in

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furnishing labor, materials, tools equipments and other incidentals necessary for the satisfactory completion of the project

TS – 09 ROOF FRAMING (WELDING AND STEEL WORKS)

General

The work to be executed under this section shall include the furnishing of all, labor, tools, equipment and other facilities necessary for the satisfactory performance of all work necessary to complete all demolition and disposal works.

Work Included

- a) The work included under this section shall include the furnishing, fabrication, erection and/or installation of all steel roof framing, steel girts and other work indicated in the Plans and Specifications.

Materials

- a) All G. I pipes shall be schedule 40 unless otherwise noted in the Plans.
- b) Rectangular tube and C-Purlins shall have a 1.00mm thickness
- c) Angle bars and flat bars shall be have a thickness of 3/16"
- d) All arc-welding electrodes shall conform to the requirements of the American Welding Society "SPECIFICATIONS FOR IRON AND STEEL ARC- WELDING ELECTRODES" latest edition

Connections

- a) Shop connections shall be welded unless otherwise indicated in the Plans. All connections shall develop full strength of members.

Workmanship and Fabrication

- a) Workmanship and fabrication shall be in accordance with AISC "Specification for Fabrication and Erection of Structural steel for Buildings" and with the following outline.
- b) Bearing surfaces shall be planed to true beds. Abutting surfaces shall be closely fitted
- c) All columns and bearing stiffeners shall be milled to give full bearing over the cross section. It shall not be necessary to plane bottom surfaces of plate on grout beds.
- d) Assembled parts shall be brought into close contact, and drift pin shall be used only for bringing members into position, not to enlarge or distort holes.

Welding

- a) Welding in shop and field shall be done by qualified welders. Equipment shall be of the type, which produce proper current so that operator may produce satisfactory welds. The welding machine shall be of 300 amperes, 200 -240 volts capacity.

SECTION VI- SPECIFICATIONS

- b) Unless otherwise shown on the Plans, the following low hydrogen electrodes shall be used and shall be suitable for positions and other conditions of intended use in accordance with the instruction with each container.

<u>Welding</u>	<u>Electrode</u>	<u>Submerged Arc Process</u>
A-7 to A-7	E - 60 Series	Grade SAW-2
A-7 to A-36	E - 70 Series	Grade SAW-2
A-36 to A-36	E - 70 Series	Grade SAW-2

- c) The technique of welding employed, the appearance and quality of welds made, and the methods of correcting defective work shall conform to the American Welding society code for arc welding. Surfaces to be welded shall be free from loose scale, rust, grease, paint and other foreign material except that mill scale, which withstands vigorous wire brushing, may remain.
- d) Finish members shall be true to line and free from twists, bends and open joints.

Measurement and Payment

Measurement and payment shall be made at the contract unit price or lot price of the various applicable items specified in the Bid Price Schedule. Payment shall include all cost in furnishing labor, materials, equipments and other incidentals necessary for the satisfactory completion of the project.

TS – 10 ROOFING WORKS AND SIDING SHEETS

General

The contractor shall furnish all labor, materials and operations including tools, other implements and accessories for the complete installation of roofing sheets wherever indicated in the drawings.

Installation shall be performed by skilled workmen in accordance with the construction and shop drawings and the manufacturer's standard.

Shop drawings and manufacturer's catalogue showing product standards and technical data will be provided by the Contractor to the NPC representative for approval.

Materials

Material for roofing shall be weather and chemical resistant. It shall be corrugated aluminum-zinc-silicon alloy coated metal sheet. Base metal shall be determined as specified in the drawing that shall range from 0.4 to 0.60mm thick. Branded sheets such as flat barge caps, flashings, ridge rolls, capping and mouldings that serve as its accessory components shall have the same composition with the roofing and sidings of which minimum thickness base metal shall be 0.5mm. Gutters likewise shall have the same material composition with base metal thickness of 0.50mm unless otherwise specified in the drawing commonly as stainless.

Workmanship

Roofing and siding sheets shall be securely fastened on purlins and channels by hook or stove bolts or self-drilling screws or as required. Fasteners shall have a maximum distance of 0.30m O.C. along purlins.

Special care shall be given to the joints, lapping, bolting and setting of closers.

Measurement and Payment

Measurement and payment for Roofing Works and Siding Sheets will be based on the projected area inspected and accepted by the NPC Representative. No measurement & payment will be made on hidden areas covered by side & end overlaps, the cost for these being included in the projected area.

Payment will be made at the corresponding unit price per square meter including ridge roll, flashing, capping for pertinent items in the Bill of Quantities

TS-11 ELECTRICAL WORKS**Work Included**

The work included under this section shall include the furnishing, fabrication, erection and/or installation of electrical system and other steel work indicated in the Plans and Specifications.

Standard of Materials

All materials to be used in the work shall be new, of high quality, free from all defects and of proven acceptability from the purpose of intended. Unless otherwise specified, materials shall conform to the latest applicable standard issued by the following authorities:

- a) American National Standards Institute (ANSI)
- b) Institute of Electrical and Electronic Engineers (IEEE)
- c) Underwriter's Laboratory (UL)
- d) National Electrical Manufacturers Association (NEMA)
- e) National Electrical Code (NEC)

f) Philippine Electrical Code (PEC)

Other recognized national standards maybe accepted if, in the opinion of NPC representatives, such will guarantee a quality not inferior to that guaranteed by the above standards.

In case of conflicting requirements between authorities cited above and those specified, such disagreement shall be resolved by representative of which his decision shall be final.

Lighting System

The lighting system covered by this specification includes associated conduits and cables, lighting fixtures, fittings, etc.

The device/materials furnished shall be in accordance with, but not limited to, the latest issues of the Applicable Codes and Standards, including all addenda, in effect at time of purchase order unless otherwise stated in this Specification.

All materials and parts which are not specifically mentioned herein but are necessary for the proper installation and safe operation of the lighting system shall be identified by the Contractor and shall be furnished at no additional cost to NPC.

Lighting Fixtures and Accessories

Street Lighting Fixtures

All lighting fixtures when installed shall be free of leaks, warps, dents and other irregularities.

All lighting fixtures, samples and catalogues shall be submitted for NPC's review and approval prior to the order. No lighting fixtures shall be installed without the approval of NPC.

Lighting fixtures shall be wired with approved wire, 75°C insulation. Each fixture shall be wired to a single point with an adequate slack for proper connection. All lighting fixture shall be protected from damage during installation. Any broken lighting fixtures, receptacle, stem and the like shall be replaced with new parts, at no cost to NPC.

Cables / Wires

Cable shall be stranded annealed copper conductor suitable for continuous temperature of 90°C when used in wet or dry location and 90°C when exposed to oil or coolant. The minimum size of conductor to be used shall be 5.5mm².

The cables shall be designed for trouble free service for the highest system voltage. All cables and their accessories to be supplied shall have insulation levels able to withstand any voltage surges which are normally expected to occur in the power system in which are normally expected to occur in the power system in which the cable is to be employed, due to switching operations, sudden load variation, faults, etc.

The cables and accessories shall be constructed to fulfill the requirements when operating with full load or any load factor and is suitable for use in ducts, trays and or direct burial in ground.

Cables Installation

Cable pulled through conduit shall be supported in an approved manner so as to avoid damaged to the insulation. Grease or oily substances shall not be used to facilitate the passage of the conductor in conduits.

The pull shall be applied to cables only by means of approved grips and the end portion of the cable which has been marked or deformed by the grip shall be cut-off by the Contractor.

All cable runs shall be continuous and all termination shall be at the terminal boards, equipment, etc. No splices are allowed in conduit or cable tray.

Prior to installation of cables, conduits shall be thoroughly cleaned to prevent damage to cables during installation. After cables have been installed, cables shall be tested for continuity and insulation resistance and shall be tagged with respective cable number.

Conduits

All conduits, boxes and fittings required for the power and control conductors including necessary hardware and accessories such as screws, bolts, concrete inserts, clamps, locknuts, couplings shall be furnished by the Contractor. The required quantities shall be furnished in accordance with the installation requirements.

During installation, due precaution shall be taken to protect the conduit and threads from mechanical injury. The ends of the conduit shall be sealed in an approved manner. Conduit runs shall be sealed by the use of caps and discs or plugs. The seals shall be maintained, except during inspection and tests, until the conductor is pulled in. Conduit shall be checked to be free from obstructions by pulling a wooden mandrel of appropriate size through the conduit.

Conduits installed outdoors running underground shall be buried to a minimum of 0.457 m.

Measurement and Payment

Measurement and payment shall be made at the contract unit price or lot price of the various applicable items specified in the Bid Price Schedule. Payment shall include all cost in furnishing labor, materials, equipment and other incidentals necessary for the satisfactory completion of the project.

TS – 12 CEILING WORKS

General

The work to be executed under this section shall include the furnishing of all labor, tools and ladders, scaffolding and other facilities necessary for the satisfactory performance of all work necessary to complete the works specified in this specifications.

Material

Materials to be used shall be the following but not limited to:

1. Double Furring
2. Wall Angle
3. ¼" thick Fiber Cement Board
4. Blind Rivets

Workmanship

All work shall be done by skilled workers in a workmanlike manner.

Wall angles shall be firmly secured at the walls of the building through nails. All double furring shall be installed firmly and aligned. Nylon or string connected wall to wall shall be used so that correct level of furring will be attained. Fiber cement board shall be installed and secured on the furring through rivets or screws.

MEASUREMENT AND PAYMENT

Measurement and payment shall be made at the contract unit price or lot price as specified in the Bid Price Schedule. Payment shall include all cost in furnishing labor, materials, tools equipment and other incidentals necessary for the satisfactory completion of the project.

TS – 13 DOORS AND WINDOWS**General**

The work to be done under this section include the furnishing of materials, tools and equipment and performing labor required to complete flush type hollow core doors, panel doors, glass and roll-up type doors or as indicated in the drawings. This work also covers the fabrication of aluminum framed sliding window and fixed louver type window.

Doors shall be thoroughly seasoned, kiln-dried wood and pressure preservative treated. Doors and windows shall be products of reputable, known manufacturers in the locality approved by NPC.

All doors and windows shall be the type and size indicated in the drawings and as specified herein.

Workmanship

The contractor shall take special care in the manufacturing and assembly process of joint work. All joint works shall be done in accordance with accepted practices and shall be accurate and clean so as the joined elements fit perfectly together.

SECTION VI- SPECIFICATIONS

Analok aluminum frame shall fit the wall openings and shall be sturdy and fixed neatly at all corners.

Materials**Doors**

Flush Type – Hollow Core Plywood shall be of first class quality marine plywood and the color shall be approved by the NPC representative.

Panel Type – Panel shall be of first class quality wood and the color shall be approved by the NPC

Glass Door shall be frameless with analok aluminum header and jamb.

Windows

Awning/Sliding/Fixed Louver Type Window – Glass window shall have a frame of 2" x 4" analok aluminum frame. All glass panels shall be 6mm thick and color bronze.

Installation

- a. Each door and window shall be accurately cut, trimmed and fitted to its frame and hardware.
- b. Allowance shall be given for painter's finish and possible swelling of shrinkage.
- c. Clearance shall not exceed 3.2mm (1/8") at lock and hanging stiles and at top, and 6.3mm (1/4") at bottom.
- d. All corners shall be rounded to 0.07mm (1/26") radius. Lock and rail edges shall be slightly beveled.
- e. The screws for hardware shall not be driven, but merely started by driving and then screwed home.
- f. All doors and windows shall operate freely and with all hardware properly adjusted and functioning.
- g. Doors shall be installed complete with finishing hardware, e.g. doorknob with key, hinges, doorstep, etc.
- h. Windows shall be sturdy and can withstand the force and pressure of the frequent opening and closing.

Measurement and Payment

Measurement and payment shall be made at the contract unit price or lot price of the various applicable items specified in the Bid Price Schedule. Payment shall include all cost in furnishing labor, materials, equipment and other incidentals necessary for the satisfactory completion of the project.

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TS – 14 TILE WORKS**General**

The work to be done under this section shall consist of furnishing of all labor, materials and other facilities to complete all tile works shown on the drawings and specified herein.

Materials

Floor tiles for rooms and hallways shall be 60cm x 60cm granite tiles. For bathrooms walls and floors shall be ceramic tiles, 30cm x 30cm or 30cm x 60cm. Kitchen sink counter tiles shall be granite tiles, 60cm x 60cm black with silver metal tile trim.

Execution

All surfaces to receive tiles, shall be structurally sound, plumb level and true, free from dust, grease, calcimine water and other foreign matter.

All existing and old tiles shall be thoroughly removed before the new tiles will be installed.

Wall and floor surfaces with minor variations (1/8" or less) shall be true and smooth with a skim coat of adhesive applied with flat trowel. Allow to dry before spreading more adhesive for setting the tile.

Tile preparation

Tiles – may be set dry or pre-soaked depending on grouting methods to be used. Wall tile may be prepared by soaking in clear water for not less than 15 minutes. If pre-soaked method is used, drain excess water on tile before setting.

Grouting – After floor on tile have been in place for not less than four hours, all joints shall be grouted and cleaned. Tile which becomes dry after setting shall be soaked at the joints with wet sponge, or sprayed with water before grouting to prevent cracking of the grouting compound, grout used with floor tile must be kept moist properly cured.

Caulking – At completion of tile work, clean out joints between tile and other built-in fixtures and apply this bead of caulking compound tooled slightly below tile surface.

Clearing – Upon completion, clean all tile surfaces with warm water and a good washing compound and stiff brushes as recommended by tile manufacturer.

Protection – Before traffic is permitted over finished floor, cover floors with building paper. Lay board walkways on floor that are to be continuously used as passageway by workmen. Tile floor areas to be trucked over have suitably constructed continuous plank runaways of required width installed over building paper. Remove cracked, broken or damage tile and replace with new one.

Measurement and Payment

Measurement and payment shall be made at the contract unit price or lot price of the various applicable items specified in the Bid Price Schedule. Payment shall include all cost in furnishing labor, materials, equipments and other incidentals necessary for the satisfactory completion of the project.

TS –15 PAINTING, VARNISHING AND OTHER RELATED WORKS**General**

This Item shall consist of furnishing all paint materials, varnish and other related products, labor, tools, equipment and plant required in undertaking the proper application of painting, varnishing and related works indicated on the Plans and in accordance with this Specification.

Material Requirements

1. Top Coat, Liquid Tile or approved equivalent
2. Primer, Liquid Tile or approved equivalent
3. Tile Cast
4. Liquid Tile Reducer
5. Brush and Roller

Paint Materials

All types of paint material, varnish and other related product shall be subject to random inspection by NPC Inspector or GSFM (Use the following approved and tested brand name: Boysen, Davies, Dutch Boy, Fuller O Brien, or any approved equal).

Tinting Colors

Tinting colors shall be first grade quality, pigment ground in alkyd resin that disperses and mixes easily with paint to produce the color desired. Use the same brand of paint and tinting color to effect good paint body.

Concrete Neutralizer

Concrete neutralizer shall be first grade quality concentrate diluted with clean water and applied as surface conditioner of new interior and exterior walls thus improving paint adhesion and durability.

Silicon Water Repellant

Silicon water repellant shall be transparent water shield especially formulated to repel rain and moisture on exterior masonry surfaces.

Patching Compound

Patching compound shall be fine powder type material like calcimine that can be mixed into putty consistency, with oil base primers and paints or pre-

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mix glazing putty, tile cast to fill minor surface dents and imperfections whichever is applicable.

Varnish

Varnish shall be a homogeneous solution of resin, drying oil, drier and solvent. It shall be extremely durable clear coating, highly resistant to wear and tear without cracking, peeling, whitening, spotting, etc. with minimum loss of gloss for a maximum period of time.

Lacquer

Lacquer shall be any type of organic coating that dries rapidly and solely by evaporation of the solvent. Typical solvent are acetates, alcohols and ketones. Although lacquers were generally based on nitrocellulose, manufacturers currently use vinyl resins, plasticizers and reacted drying oils to improve adhesion and elasticity.

Sanding Sealer

Sanding sealer shall be quick drying lacquer, formulated to provide quick dry, good holdout of succeeding coats, and containing sanding agents such as zinc stearate to allow dry sanding of sealer.

Schedule

Exterior

- Plain cement plastered finish to be painted - 3 coats Acrylic base masonry paint or Solvent-type paint
- Concrete exposed aggregate and/or tool finish - 1 coat water repellent
- Ferrous metal - 1 coat primer and 2 coats enamel paint
- Galvanized metal - 1 coat zinc chromate primer and 2 coats Epoxy paint
- Wood painted finish - 1 coat zinc chromate primer and 2 coats Epoxy paint
- Wood varnished finish - 3 coats oil based paint or 3 coats varnish water repellent

Interior

- Plain cement plastered finish to be painted - 3 coats Acrylic base masonry paint or Solvent-type paint

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SECTION VI- SPECIFICATIONS

Painted

Concrete exposed aggregate and/or tool finish	-	clean surface
Ferrous metal	-	1 coat primer and 2 coats enamel paint
Woodwork sea-mist	-	3 coats of 3 parts thinner 1 part lacquer
Woodwork varnish	-	1st coat, of one part sanding sealer to one part solvent 2nd coat of 2/3 sanding sealer to 1/3 solvent
Woodwork painted	-	3 coats of oil base paint finish
Ceiling boards textured finish	-	1 coat oil based paint allow to dry then patch surfaces unevenness and apply textured paint coat

Construction Requirements

The Contractor prior to commencement of the painting, varnishing and related work shall examine the surfaces to be applied in order not to jeopardize the quality and appearances of the painting varnishing and related works.

Surface Preparation

All surfaces shall be in proper condition to receive the finish. Woodworks shall be hand-sanded smooth and dusted clean. All knotholes pitch pockets or sappy portions shall be sealed with natural wood filler. Nail holes, cracks or defects shall be carefully puttied after the first coat, matching the color of paint.

Interior woodworks shall be sandpapered between coats. Cracks, holes of imperfections in plaster shall be filled with patching compound and smoothed off to match adjoining surfaces

Concrete and masonry surfaces shall be coated with concrete neutralizer and allowed to dry before any painting primer coat is applied. When surface is dried apply first coating. Hairline cracks and unevenness shall be patched and sealed with approved putty or patching compound

After all defects are corrected apply the finish coats as specified on the Plans (color scheme approved).

Metal shall be clean, dry and free from mill scale and rust. Remove all grease and oil from surfaces. Wash unprimed galvanized metal with etching solution and allow it to dry. Where required to prime coat surface with Red Lead Primer same shall be approved by the NPC Engineer.

In addition the Contractor shall undertake the following:

1. Voids, cracks, nick etc. will be repaired with proper patching material and finished flush with surrounding surfaces.
2. Marred or damaged shop coats on metal shall be spot primed with appropriate metal primer.
3. Painting and varnishing works shall not be commenced when it is too hot or cold.
4. Allow appropriate ventilation during application and drying period.
5. All hardware will be fitted and removed or protected prior to painting and varnishing works.

Application

Paints when applied by brush shall become non-fluid, thick enough to lay down as adequate film of wet paint. Brush marks shall flow out after application of paint.

Paints made for application by roller must be similar to brushing paint. It must be nonstick when thinned to spraying viscosity so that it will break up easily into droplets.

Paint is atomized by high pressure pumping rather than broken up by the large volume of air mixed with it. These procedures change the required properties of the paint.

Mixing and Thinning

At the time of application paint shall show no sign of deterioration. Paint shall be thoroughly stirred, strained and kept at a uniform consistency during application. Paints of different manufacture shall not be mixed together. When thinning is necessary, this may be done immediately prior to application in accordance with the manufacturer's directions, but not in excess of 1 pint of suitable thinner per gallon of the paint.

Storage

All material to be used under this Item shall be stored in a single place to be designated by the Engineer and such place shall be kept neat and clean at all time. Necessary precaution to avoid fire must be observed by removing oily rags, waste, etc. at the end of daily work.

Cleaning

All cloths and cotton waste which constitute fire hazards shall be placed in metal containers or destroyed at the end of daily works. Upon completion of the work, all staging, scaffolding and paint containers shall be removed. Paint drips, oil, or stains on adjacent surfaces shall be removed and the entire job left clean and acceptable to the Engineer.

Workmanship in General

- a) All paints shall be evenly applied. Coats shall be of proper consistency and well brushed out so as to show a minimum of brush marks.
- b) All coats shall be thoroughly dry before the succeeding coat is applied.
- c) Where surfaces are not fully covered or cannot be satisfactorily finished in the number of coats specified such preparatory coats and subsequent coats as may be required shall be applied to attain the desired evenness of surface without extra cost to the owner.
- d) Where surface is not in proper condition to receive the coat the Engineer shall be notified immediately. Work on the questioned portion(s) shall not start until clearance be proceed is ordered by the NPC Engineer.
- e) Hardware, lighting fixture and other similar items shall be removed or 'protected during the painting varnishing and related work operations and re-installed after completion of the work.

MEASUREMENT AND PAYMENT

Painting and/or varnishing shall be measured in square meter (sq.m.) of painting completed in place and accepted. Measurement will be of the actual number of square meter within the neatlines of the structure as shown in the plans or revised by authority of the NPC Engineer. The area of painting measured as determined above shall be paid for at the contract unit price per square meter (sq.m.) which price and payment shall be full compensation of all labor, equipment, tools and incidentals necessary to complete the item and accepted.

TS-15 PLUMBING FIXTURES AND FITTINGS**General**

The work covered by this section consists in furnishing all labor, equipment and tools, materials in performing all operations in connection with the installation of all plumbing fixtures, fittings and accessories, complete, in strict accord with this section of the Specifications or indicated on the drawings, are included in this work.

Make

The model numbers herein given are intended to illustrate the quality and design of fixtures that will be required. American standard fixtures specified herein and any substitution made to any item of fixtures specified must first be approved by the NPC Representative.

Trade Marks and Certificate of Origin

All plumbing fixtures and fittings must bear the trademarks of the manufacturer. The Contractor shall furnish the NPC representative with the Original and two (2) copies of the Certificate of Origin of all plumbing fixtures and fittings that will be used in the project.



All plumbing fixtures and fittings installed without the above trademarks included in the Certificate of Origin shall be removed and replaced with properly marked fittings without extra cost to the NPC.

Maintenance Manual shall be submitted including complete instructions for replacing valve washers and strainers and give manufacturers recommendations as to cleaning finish fixture surfaces

Submit samples of valves, faucets, trims and others for approval of the NPC Representative.

Fixtures

- a) Water Closet – HCG or approved equivalent. Must include fittings and accessories
- b) Urinal - HCG or approved equivalent. Must include fittings and accessories
- c) Lavatory - HCG or approved equivalent. Must include fittings and accessories
- d) Bibbs – Nickel plated Copper or Brass Alloy
- e) Shower Sets – Nickel plated Copper, telephone type
- f) Kitchen Sink – Stainless and Double bowl with stainless steel goose neck type faucet
- g) Floor Drain – Stainless or Brass Alloy
- h) Hand Bidets - Nickel plated Copper or Brass Alloy

Installation

Plumbing fixtures shall be installed free and open in a manner to afford access cleaning. All brackets, cleat, plates and anchors required to support the fixtures shall be furnished in a rigidly manner. Water closets shall be sat on Boll-Wax.

Installed plumbing fixtures shall be kept clean and in working order for adequate protection so as not be used by anybody until issuance of Certificate of Completion

All fixtures shall be provided with individual control stop so that each fixture may be separately controlled without affecting any other fixture.

All flush valves shall be equipped with vacuum breaking devices.

Toilet Accessories

Soap Holders – Contractor to submit sample and to be approved by GSFM

Measurement and Payment

Measurement and payment for Plumbing Fixtures and Fittings will be based on what is required in the Bill of Quantities

TS- 16 CLEARING AND DEMOBILIZATION

Before moving out, the contractor shall restore the orderly state of worksite by clearing all temporary structures. Remove all excess/waste materials and store in designated areas.

Before the Contractor will demobilize its construction equipment/ tools, materials and crew, he shall secure approval from NPC security office for the release of the contractor's equipment and to surrender the workers Identification (I.D) cards. A joint inspection with the NPC inspector and Contractor will be conducted to make sure that all his accomplishment / work that needs remedial attention or correction shall be done prior to the issuance of the Certificate of Completion. The Certificate of Completion will serve as basis for the processing of payments.

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