

SECTION 14 - MISCELLANEOUS WORKS

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S14.01 HIGH STRENGTH CONCRETE

High strength concrete is a special concrete used at the control equipment alternative structure (see Section 8).

S14.02 REINFORCED CONCRETE BRIDGE

Reinforced concrete Bridge as shown on the Drawings are the responsibility of the Contractor to make shop drawings and type of materials and submit to the Engineer for approval.

- (a) Dead weight of the bridges shall be as follows:
- (b) Live load:
 - AASHTO standard truck HS 20-44,
 - 10-Wheel truck of 36-ton gross weight
 - Mobile Crane of 45-ton Lifting capacity
- (c) Impact of live load
- (d) Wind load, 150 kg/sq.m

S14.03 POLYMORPHIC RESIN LINING (NOT APPLICABLE)

(1) General

- (a) The work covers the requirement for furnishing materials, equipment and services necessary and incidental to provide, install and apply protective lining on concrete surface at the Barrage crest as shown on the Drawing or as directed.
- (b) The approved material shall be subject to additional test if required by the Engineer, the Contractor through his supply shall submit proof or competency of the material to the satisfaction of the Engineer.
- (c) All applications and installations shall be made under the supervision of the manufacturer expert.

(2) Material

Material shall be QTT – Polymorphic Resin by Repcon Co., Ltd. or Derakane 470 by Dow Chemical Co., Ltd. or Ceilcoat 658 by Master Builder Co., Ltd. or equivalent.

(3) Application

(a) Surface Preparation

Surface preparation of concrete shall conform to the manufacturer's recommendations. In general, concrete surface shall be free of deteriorated concrete and contamination such as oil, grease, etc. All application work shall be in accordance with manufacturer's recommendation.

(b) Method Statement

Prime Coat : Silicone Modified Epoxy Based Vinylester Resin

Base Coat 1 : Polymorphic Resin + Fiberglass 300 gm/sq.m

Base Coat 2 : Polymorphic Resin + Fiberglass 300 gm/sq.m

Top Coat 1 : Polymorphic Resin + Pigment Paste

Top Coat 2 : Polymorphic Resin + Wax + U.V.Absorber

Total Thickness : 2.0 mm (approx.)

(c) Typical properties

Type : Polymorphic Resin – Vinylester Base

Tensile Strength (PSI) (ASTM D638)	10,000
Flexural Strength (PSI) (ASTM D790)	17,000
Elongation % (ASTM D638)	5 - 8
Barcol Hardness (ASTM D2583)	40
Heat Distortion Temp (°C) (ASTM D648)	100

S14.04 EXAMINATION THE BEARING CAPACITY OF FOUNDATION

Examination the bearing capacity of foundation by drilling as noted on the Drawings or as directed by the Engineer used for examining the bearing capacity of doundation is the responsibility of the Contractor. The Contractor shall submit Details of drilling to the Engineer not later than thirty (30) days prior to the

commencement of the drilling work. The drilling details shall include, but not be limited to the following:

- (a) The locations of drilling holes.
- (b) The drilling, Dampling and field and laboratory testing methods
- (c) The drilling programs (the number of holes, Samples and testings)
- (d) The method of foundation analysis

The Contractor shall submit the results of drilling and the foundation analysis to the Engineer not later than fifteen (15) days prior to the commencement of the foundation works.

S14.05 PVC PIPE DRAIN

(1) General

The work covers the requirement for furnishing materials, equipment and services necessary and incidental to provide, install and supply PVC pipe drain on at the Power house as shown on the Drawing or as directed.

The following standards are referred to:

- AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4-Inches through 12-Inches, for Water
- TIS 17 Polyvinyl Chloride Pipes for Drinking water Services

(2) Materials

(a) Pipe and Fittings

Polyvinyl chloride pipe, unless otherwise specified, or shown on the drawings, shall conform to the provisions of AWWA V900 for Class 150 Dimension Ratio (DR) 18 or TIS 17, subject to the exceptions and supplemental Requirements contained in this section. Unless otherwise specified, fitting shall be made of cast iron, in general, conform to TIS 918.

(b) Pipe Rating and Dimensions

The pipe shall conform to the following dimensions and limiting values :

Nominal Size (mm)	Outside Diameter (mm)	Minimum Wall Thickness (mm)
80	89	4.1
100	114	5.2
150	165	7.5
200	216	8.8
250	267	10.9
300	318	12.9
350	370	15.0
400	420	17.0

(c) Tolerances

The tolerances for the outside diameters and wall thickness shall be in accordance with Clauses 4.1, 4.2, 4.3 and 4.4 of TIS 17-2532 respective.

Measurement of dimensions shall be in accordance with TIS 17-2532.

(d) Joints

All pipe and fittings shall be designed for the rubber ring push-on type of joint, unless otherwise specified. Rubber ring gaskets shall provide a watertight seal for the assembled joint for all vertical and horizontal angular deflections of the pipe up to and including the maximum deflection recommended by the manufacturer, and at all pressures up to and including the test pressure of the pipe.

All materials used for jointing shall be compatible with one another and with the polyvinyl chloride pipe. The shall-neither support the growth of bacteria nor affect the portability of the water.

Solvent-cement couplings will not be allowed.

(e) Manufacturer's Mark

Pipe shall be clearly mark on the outside surface at the interval not exceeding 1.5 meters. The mark shall show the following information :

- raw material (PVC)
- nominal size and pressure rating
- name or trade mark of the manufacturer

- year of manufacture
- Owner's mark
- reference standard

(3) Shop Testing

Inspection and testing of pipe and fittings shall be carried out by the manufacturer in accordance with TIS 17-2532.

S14.06 MEASUREMENT AND PAYMENT

(1) High Strength Concrete

Measurement and payment for high strength concrete $f_c' = 350$ ksc. strength concrete will be made at the rate per cubic meter as stated in the Schedule.

(2) Reinforced Concrete Bridge

Measurement and payment for Reinforced Concrete Bridge will be made at the rate per linear meter as stated in the Schedule which shall include the cost of concrete topping.

(3) Polymorphic Resin

Measurement for payment for furnishing and lining the polymorphic resin will be of the area actually applied.

Payment for protective lining on concrete surface will be made at the rate per square meter therefor in the Schedule, such rate constituting full compensation for all materials, labor, equipment, tools and incidentals needed to complete the work.

(4) Drilling

Payment for the drilling will be made at the rate per linear meter there for in the Schedule which shall include the cost off all materials, preparation of the drilling equipment and all other relevant services that mcessary for the Work described in this Clause.

(5) PVC Pipe Drain

Measurement and payment for PVC pipe drain will be made at the rate per linear meter as stated in the Schedule which shall include the cost of supply and install, joint and fitting for this work.

SECTION 15 - ILLUMINATION EQUIPMENT

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S15.01 GENERAL

Illumination equipment shall be furnished and installed by the Contractor in accordance with this Specification and as shown on the Drawings. Within ninety (90) days prior to the executing of the Work, the Contractor shall prepare and submit shop drawings to the Engineer for approval.

(1) Scope of Works

Illumination equipment both indoor and outdoor shall consist of following work.

(a) Indoor Illumination Equipment

Item	Nature of Works
Lighting fixtures	Furnishing and installation various types of lighting fixtures. Lighting fixtures shall be furnished complete with lamps, ballasts, suspending members and accessories, including accessories necessary for installation at specified positions.
Wiring fixtures	Furnishing and installing circuit breaker boards, switches and receptacles. Installation of fixtures shall include furnishing of accessories necessary for installation at specified positions.
Conduit piping	Furnishing and installing conduits pipes beyond secondary terminals of circuit breaker board to be supplied under this work up to all boxes of indoor lighting fixtures and indoor wiring devices including conduit accessories (boxes, couplings, bushings, supports, normal bends, elbows, etc.) necessary for installation.
Wiring	Installing electric wires beyond secondary terminals of circuit breaker board to be supplied under this Wire up to all lighting and wiring fixtures. Connections to lighting and wiring fixtures are included under this work.

(b) Outdoor Illumination Equipment

Item	Nature of Works
Lighting fixtures	Lighting fixtures shall be furnished complete with lamps, ballasts, poles and accessories, including concrete foundation work and excavation and back-filling therefore, and accessories necessary for installation at specified positions.
Wiring fixtures	Furnishing and installing circuit breaker boards and photoelectric switches. Installation of equipment shall include the furnishing of accessories necessary for installation and specified positions.
Conduit piping	Furnishing and installing conduits pipes beyond secondary terminals of circuit breaker board to be supplied under this work up to all outdoor lighting fixtures and wiring devices including conduit accessories (boxes, couplings, bushings, supports, normal bends, elbows, etc.) necessary for installation.
wiring	Furnishing and installing electric wires beyond secondary terminals of circuit breaker board to be all outdoor wiring fixtures. Connections to lighting and wiring fixtures are to be performed under this work. Unless otherwise stipulated, electric wires shall be NYY cable, and shall be laid in conduit on dam crest as shown on the Drawing and Conduit pipes. Cable accessories, cable laying and earthing of cable shall be executed under this work.

(2) Instruction Book

The Contractor shall within two (2) months prior to start installation furnish ten (10) copies of instruction books the operation and maintenance of principal equipment furnished and installed by him under this clause.

S15.02 MATERIALS

(1) General

All fixtures and materials shall be furnished by the contractor and shall conform to applicable provision of TIS, ASTM or JIS and shall be approved by the Engineer prior to installation.

Lighting fixtures shall be finished products, complete with socket, ballast, power factor improvement condensers, installation hardware and other technically required accessories and parts.

Appliances shall be of the highest performance, shall not deteriorate in their function under prolonged use, shall be of construction easy to dismantle and to inspect, and shall be completely interchangeable as to common parts, including spare parts. Those items which are to be assembled at site shall be accompanied by all bolts, nuts and accessories necessary for assembly.

(2) Lighting Fixtures

Fixtures shall be of sturdy construction, easy to maintain and inspect. In particular, installation and connection leads shall be of sufficient strength. Fixtures shall be free of light leakage, shall admit no dust, insects and other objectionable matter so far as possible, and shall be so constructed as to sufficiently withstand surrounding temperatures. Consideration shall be given so that any heat generated within the appliances shall be diffused completely. No defects of electrical parts, insulating materials shall occur by overheating, and there shall be no deterioration, deformation, dis-coloring, peeling of paint due to overheating, poor material, and workmanship after many years of use.

For wiring within fixtures, different colored vinyl insulated electric wires shall be used, and a wiring diagram for each terminal shall be attached to each appliance.

Prior to installation at the site, dielectric strength of 1 or 2 fixtures of each type shall be tested at 1,500 V for 10 minutes in the presence of the Engineer.

Insulation resistance of the fixtures tested shall be more than 5 meg-ohms.

(a) Power Source

Mercury vapor lamp for normal use: AC single phase 220 V 50 Hz.

(b) Lamp

Mercury vapor lamp 250 W: total flux 19,000 luminal or more. The lamp shall be of the following manufactures, Philips or Sylvania or G.E. or as approved by the Engineer.

(c) Ballast

Mercury vapor lamp: high power factor, constant wattage.

(d) Lamp Post

Posts for outdoor illumination shall be of galvanized steel, and of the shape and type as shown on the Drawings or of similar shape and type approved by the Engineer.

(3) Tumbler Switches and Receptacles

The types and rating of tumbler switches and receptacles shall be in accordance with the descriptions on the Drawings. The standards are set as below.

Item	Description
Monopole tumbler switch:	250 V, 10 A, surface mounted type monopole tumbler switch with plate.
Receptacle:	250 V, 10 A, 2 poles with ground, surface mounted type, Single or duplex receptacle with plate.
Power receptacle:	400 V, 30 A, surface mounted type, 4 poles with ground, 5 wires, with plate.

(a) Tumbler Switches

Tumbler switches shall of the totally enclosed tumbler type and shall be thoroughly tested and inspected according to the Underwriters' Laboratories VDE, IEC or JIS standards for control of incandescent and fluorescent lamps to the full rated capacity. The terminals shall be of the side connecting screw type. The switch housing and operating lever shall be constructed of phenolic compound or high grade plastic. Switches with porcelain bases are not acceptable.

(b) Receptacles

Receptacles shall be of 2-pole, 2-wire, ground and round prong and straight blade type. The receptacle body shall be brown phenolic or high grade plastic and shall have screw terminals for side and back wiring. Copper or copper alloy shall be used for all current carry and for wire binding screws. All other metal parts shall be on-ferrous finished to prevent corrosion.

(c) Power Receptacles

Power receptacles shall be as specified in the above table. Plugs of same rating as receptacle shall be furnished for each receptacle.

(d) Device Plates

The plates shall be stainless steel alloy.

(4) Lighting Panel Board

Lighting panel board shall be of steel construction, of the types (electric system, wiring circuit breaker) and construction (outdoor, self standing type) as shown on the Drawings and shall conform to the following:

- (a) Casing shall be fabricated of steel frames and steel plates not less than 1.6 mm thick.

- (b) Metal surfaces shall be cleaned of all rust and then coated with anti-corrosive lead base paint. Finish color scheme shall be as directed by the Engineer.
- (c) Front of cases shall be so constructed as to be easily removable for inspection, and repair of equipment mounted inside, and shall be equipped with a door to facilitate operation of the distribution circuit breaker. Surface of the board shall be painted in a color directed by the Engineer.
- (d) Panels shall be made of steel plate of 3.2 mm thick, and provide with the required distribution circuit breakers, magnetic contactors and shall be connected with copper strips of adequate size.

(5) Circuit Breaker Boards

Circuit breaker boards shall be of steel construction, of the types (electric system, wiring circuit breaker) and construction (surface mounted type) shall conform to the following. Casing shall be fabricated of steel frames and steel plates not less than 1.6 mm thick. Metal surfaces shall be cleaned of all rust and then coated with anti-corrosive lead base paint. Finish color scheme shall be as directed by the Engineer.

Front of cases shall be so constructed as to be easily removable for inspection, and repair of equipment mounted inside and shall be equipped with a door to facilitate operation of the distribution circuit breaker. Surface of the board shall be painted in a color directed by the Engineer.

Power panels shall be made of steel plate of 2 mm thick and provided with the required distribution circuit breakers and shall be connected with copper strips of adequate size.

The circuit breakers shall be of the thermal type with quick-make and quick-break toggle mechanism for both manual and automatic operation. The design shall be such that the moving contacts shall be now welding and full contact assured up to the time of opening whether opened automatically or manually. The bimetallic element shall be such as to insure constant calibration, long life and shall be capable of withstanding short circuits or over load conditions without injury. In case of abnormal overload or short circuit on a branch circuit, the breaker shall open automatically. Automatic tripping shall be indicated by the handle assuming a position distinctive from the manual "ON" and "OFF" positions. The "ON" and "OFF" positions shall be indicated plainly by mean of the operating handle positions and marking.

Prior to installation at the site, tests as stated below shall be executed in the presence of the Engineer.

- (a) Outside appearance, dimension, and structure
- (b) Dielectric strength: 1,500 V for 10 minutes
- (c) Insulation resistance: 1 meg-ohm or more

(6) Photo-electric Switch

Photo-electric switch shall be installed to control electric current by daylight. Switch shall have contract of sufficient rating to handle large currents without failure and to break and connect lamp circuits at specified daylight intensities.

Power source AC 220 V, 50 Hz

Load current 10 A

Operation intensity

Switch – on 5 to 25 lux

Switch – off 25 to 125 lux

(7) Conduit Pipes

Unless otherwise specified, all conduits shall be PVC in accordance with TIS 216-2524.

Conduit accessories shall be galvanized and shall conform to the respective publications and other requirements of Underwriter's Laboratories standards, NEMA, USAS or other equivalent standards.

Suitable conduit pipe accessories shall be selected. Outlet boxes for lighting fixtures, receptacles, local switches, etc., shall be made of metal. Wooden base, wooden box or the like shall not be substituted for metal products. Where 2 or more tumbler switches, receptacles or others are to be installed at the same place, a common box shall be provided together with proper common cover and plate. At the places where heavy lighting fixtures are installed, stud bolts adequate to support the fixtures shall be provided in structures supporting such boxes.

(8) Electric Conductors

Electric wires and cables shall be of 750 V thermoplastic insulated conductors NYY type fabricated according to Table 2, 4, 6, 11 of TIS 11-2531.

Insulations shall be satisfactory for installation in wet or dry locations on AC and DC circuits and shall be suitable for use on a copper conductor with maximum operating temperature of not less than 70°C wet or dry.

The size of conductors of wires and cables shall be as indicated on the Drawings and shall be not less than 2.5 mm² for lighting and power.

S15.03 PERFORMANCE OF WORK

(1) Installation of Fixtures

Wiring connection shall be made in outlet boxes. In case of installing on wooden structures, the attached box or flange for pendant shall be screwed on directly to such structure. In case of installing on reinforced concrete structure, the outlet box shall be screwed on concrete for exposed piping, or shall be placed in concrete for embedded piping. In case of installing a built-in type fixture on ceiling, steel or timber furring shall be provided parallel with the longitudinal direction of the fixture, and the fringe of the reflecting shade or body shall be either supported by, or screwed on to, such steel or timber furring support. Concrete foundations shall be provided as shown on the Drawings for post type outdoor lighting and the poles shall be firmly installed on such foundations by bolts or other fasteners, or embedded in concrete foundation.

(2) Conduit Work

Conduit pipes and accessories of lighting fixtures, other than those which are laid in control building shall, unless other wise specified, be exposed. Exposed conduits shall be laid out in such an orderly manner as to match with the condition of surface for support.

Except for rising of pipes, other wall surface piping shall be generally supported along or suspended from the ceiling surface. Pull-boxes shall be generally suspended from the ceiling or attached to walls. All radii of conduit bends shall be 9 times or more than the inside diameter of conduit. The tube shall not have more than 4 rectangular bends or similar curves between any 2 fixtures or between any 2 boxes.

Conduits shall be sufficiently protected so that no water, dust, or other objectionable matter shall enter the pipes. During the period from the laying of tubes up to installing conductors, adequate measures shall be taken to prevent entry of moisture, dust or other materials into conduits, and the inside of the tube shall be cleaned by adequate means immediately prior to installing conductors.

(3) Wiring Work

In installing conductors, substance harmful to conductor, such as oil, grease shall not be used. Splicing of conductors within the conduit tube shall be strictly prohibited. No soldering shall be applied to the conductor joints.

Insulation resistance against round of each circuit shall be more than 1 meg-ohm.

S15.04 AIR-CONDITIONING SYSTEM

The Contractor shall supply and install air conditioner rotary split type in the buildings of capacity as shown on the Drawing.

S15.05 MEASUREMENT AND PAYMENT

Payment shall be made at the lump sum price bid therefore in the Schedule and shall include all costs for materials, fabrication, transportation, installation, tests and all other incidentals works.

The lighting system shall be maintained and protected by the Contractor in a satisfactory condition unit final acceptance by the Owner. Defective materials, including spare items and equipment damaged in the course of installation or tests, shall be replaced or repaired by and at the expense of the Contractor in a manner meeting the approval of the Engineer.

(1) Indoor illuminating Equipment at Power House

The Works shall consist of all illuminating equipment work including the furnishing and installation of indoor lighting fixtures, indoor wiring fixtures, indoor conduit piping, indoor wiring panel board or control box and painting.

The equipment to be furnished and installed by the Contractor under this item shall be as shown on the Drawing.

Payment for indoor illuminating equipment shall be made at the time of completion of installation the lump sum bid therefore in the Schedule.

(2) Outdoor illuminating Equipment and main low power cable

The Works shall consist of and include all the illuminating equipment Works including the furnishing and installation of outdoor lighting fixtures, outdoor wiring fixtures, control box, outdoor conduit pipes, outdoor wiring and painting and main low power line, 3 phases 4 wires, NYY, THW for all buildings, offices and others.

The equipment to be furnished and installed by the Contractor under this item shall be as shown on the Drawing.

Payment of outdoor illuminating equipment and main low power cable shall be made at the time of completion of installation and at the lump sum bid therefore in the Schedule.

- (3) Payment for air-conditioner will be made to rate bid therefore in the schedule.**
- (4) Payment for ventilator will be made to rate bid therefore in the schedule**
- (5) Payment for miscellaneous equipment will be made to rate bid therefore in the schedule**