

SECTION 5 WATER DISTRIBUTION SYSTEMS

S5.01 General

This work shall consist of the construction of water supply pipe, pipe fitting in accordance with these Specifications and the specifications for treatment plant work items including architectural, mechanical and electrical works of treatment plant facilities, all in conformity with the lines, grades and dimensions instructed by the Employer.

The Contractor shall submit a all detailed design of water treatment facilities who is recommended by the manufactures that specified tanks material, production method, installation procedures, operation manual and testing of drinking water.

The Inspector reserves the right to inspect and test of pipe, fitting, valve and especially, water treatment plant in factory before their delivery to the site and at any time prior to and during laying.

The type and characteristics of the water pipes and treatment facilities shown on the Outline Drawings and their estimated total quantities entered in the Bid Schedule are not to be taken as final. To assist the Employer in his review of the outline drawings, the Contractor will undertake a review design of the site to determine the location, pipe or size, invert level and estimated distribute of water flow to the site. On the bases of the results of this review the final types, lines, characteristics and quantities will be decided by the Employer, who will inform the Contractor of them in writing of the approved schedule of work submitted by the Contractor. Responsibility for accurately locating water supply flows will rest with the Contractor and the cost of this survey will be deemed to be included in the various pay items of this section.

S5.02 Submit manufacturer's catalog data and Shop Drawings.

S5.02(1) Detailed Shop drawings shall be submitted in accordance with in subsection S1.01 (2) Shop Drawings for but is not necessarily limited to the following:

- a. Review water distribution plans including valves, valve boxes and fittings
- b. Detailed of drawing for water treatment plant
- c. Intake on river
- d. Water reservoir tank
- e. Elevated water tank
- f. In line static mixer including aluminum sulfate and line systems

- g. Flocculation tank
- h. Lamella clarifier
- i. Sand filter
- j. Pumping station including mechanical and electrical works.
- k. Above item No.c to i shall be installed and fabricated in accordance with the specific instruction of the manufacturer.
- l. Treatment facilities building, administration office, water pump and workshop building, chemical building and guard station in accordance with the Vietnamese Standard.

S5.03 Materials and Equipment

Materials and equipment shall conform to the respective specifications. Material not otherwise specified herein shall be approved commercial products and suitable for the intended purpose.

Polyvinyl chloride (PVC) and Fitting

Material shall conform to commercial product. Approved by the Employer.

S5.04 Gate Valves for Water Lines

Gate valve, 10K, flanged, outside screwed type. 10 kg/sq cm, cast iron body, stainless steel trimmed. Dimensions shall conform to commercial products.

S5.05 Gate Valves on Buried Piping

Valves, except for size, shall conform to Manufacture catalog cut and shall be double disc type with parallel or inclined seat. Valves conforming to inside screw type with operating nut, shall have split-wedge or double disc gate, and shall be designed for a hydraulic working pressure of 10kg/m² Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals and shall be bolted and constructed so as to permit easy removal of part of repair.

S5.06 Valve Boxes

Each gate valve on buried piping shall be provided with an adjustable rubble masonry valve box of a size suitable for the valve on which it is to be used. The head shall be round and the lid shall have the word "WATER" cast on it. The least diameter of the shaft of the box shall be 15cm.

S5.07 Installation of Pipelines

S5.07(1) Location of Water Lines

The work covered by this section shall terminate at a point indicated on drawings. Where the location of the water line is not clearly defined by dimensions on the drawings, the water line shall not be laid closer horizontally than 3 m from any sewer line. Where water lines cross under gravity sewer lines, encase sewer line fully in concrete for a distance of at least 3 m on each side of the crossing unless sewer line is made of pressure pipe with rubber gasketed joints and no joint is located within 90 cm horizontally of the crossing. Lay water lines which cross sewer force mains and inverted siphons not less than 60 cm above sewer lines; joints in sewer line closer horizontally than 90 cm to the crossing shall be encased in concrete. Do not lay water lines in the same trench with gas lines, fuel lines or electric wiring.

S5.07(2) Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe accurately to measurements establish at the site and work into place without springing or forcing. Replace by one of the proper dimensions any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell and spigot pipe with the bell end

pointing in the direction of laying. Grade the pipeline in straight lines, taking care to avoid the formation of any dips or low points. Support pipe at its proper elevation and grade, taking care to secure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports [where indicated and] where necessary for fastening work, into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each day's work, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather are unsuitable.

S5.07(3) Installation of Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operation.

S5.07 (4) Buried Utility Warning and Identification Tape

Provide detectable aluminum foil -plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 75-mm minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be "CAUTION BURIED WATER PIPING BELOW" or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 15cm below the top surface of earth or the top surface of the subgrade under pavements.

S5.07 (5) Jointing of pipe and valve

Make flanged joints up tight, taking care to avoid undue strain on flanges, fittings, valves, and other equipment and accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When any flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified in this paragraph, replace it by one of proper Dimensions: Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer, as approved.

S5.07 (6) Installation of Valves

Install gate valves in accordance with the requirements of construction manual valve and fitting installation. Make and assemble joints to gate valves as previously specified for making and assembling the same type joints between pipe and fittings.

S5.07 (7) Installation of Hydrants

Install hydrants in accordance with the requirements of hydrant installation. Make and assemble joints as previously specified for making and assembling the same type joints between pipe and fittings.

S5.07(8) Requirements for installation of polyvinyl chloride (PVC) plastic piping.

S5.07(8)i Installation, General

Install pipe and fittings in accordance with the general requirements for installation of pipelines and with the requirements of Manufacture

Recommendation for laying of pipe, joining PVC pipe to fittings and accessories, and setting of s and fittings, except as otherwise specified in the other subparagraphs hereunder.

S5.07(8)ii Jointing

Make push-on joint with the elastomeric gaskets previously specified for this type joint, using either elastomeric gasket bell-end pipe or elastomeric gasket couplings. use push-on joint, having factory made bevel on pipe ends for pipe to pipe joint connections only; for push-on joint connections to metal fittings valves, and other accessories, cut spigot end of pipe off square and re-bevel end to a bevel approximately the same as that on ductile iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe to pipe joint connections in accordance with the requirements of the pipe manufacturer for laying the pipe. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of the pipe manufacturer for joining PVC pipe to fittings and accessories. Make compression joint and mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble these joints in accordance with the requirements of the pipe manufacturer for joints PVC pipe to fittings. Cut off spigot end of pipe for compression joint and mechanical joint connections and do not re-bevel. Assemble joints made with sleeve mechanical couplings in accordance with the recommendations of the coupling manufacturer, as approved, using internal stiffeners as previously specified for compression joints.

S5.08 Earthwork

S5.08 (1) Trench Excavation

Trenches shall be of necessary width for proper laying of pipe, and banks shall be as nearly vertical as practicable. Bottoms of trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length, except for portions of pipe sections where it is necessary to excavate for bell holes and for proper making of pipe joints. Bell holes and depressions for joints shall be dug after trench bottom has been graded and shall be only 13 mm greater in length, depth and width than the bell, as required for properly making the particular type of joint, and to insure that the bell does not bear on the bottom of the hole. When hard materials are encountered, trenches shall be cut to an overdepth of not less than 10 cm including bell holes, and back-filled to at least midpoint of pipe. Trench shall be maximum 30 cm wide. At the option of the Contractor, the trenches may be cut to an overdepth of not less than 10 cm including bell holes, and backfilled to required grade as specified hereinbefore when hard materials are not encountered.

S5.08 (2) Water Distribution Lines

Trenches for water distribution lines shall be at the depths indicated. Interference of water lines with other utilities shall be avoided. Water lines shall be graded so as to avoid air pockets.

S5.08(3) Backfilling Pipe Trench

Backfilling pipe trench shall be coordinated with testing of utilities. Where damage is likely to result from withdrawing sheeting, the sheeting shall be left in place and contract price will be adjusted accordingly. Trenches shall be carefully backfilled with sand and natural soil free of lumps, stones, and organic matters, and deposited in 20cm maximum layers, loose depth. Backfill shall be brought up evenly on both sides of pipe for its full length, and shall be thoroughly and carefully tamped until pipe has a cover of not less than 30 cm for water. Care should be taken not to damage pipe or special coatings on pipe. The remainder of backfill material shall then be deposited in the trench in 30cm maximum layers and compacted by mechanical means. Trenches and excavation pits improperly backfilled, or where settlement occurs, shall be reopened to the depth required to obtain the specified compaction, then refilled and compacted with the surface restored to the required grade and compaction.

S5.08(4) Under Streets

Backfill trenches across streets or other areas to be paved as specified above, except that remainder of trench above the 30- or 60-cm cover over pipe as specified hereinbefore shall be backfilled with material in 15-cm maximum layers, and each layer moistened and compacted to 90 percent of a maximum dry density to be obtained at optimum moisture. Similarly backfill with a cohesionless soil shall be compacted to 95 percent of a maximum density. Backfilling shall be accomplished in such manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value, so that paving of the area can proceed immediately after backfilling is complete.

S5.08(5) Compaction

The subgrade of soils in cut shall have a density of at least 95 percent of a maximum dry density to a depth of 30 cm below the subgrade surface. If the density of the existing material is less than 95 percent, it shall be compacted to a depth of 30 cm. to the minimum of 95 percent density. The upper 30 cm of trenches shall be compacted to at least 95 percent of a maximum dry density.

S5.09 Field Tests and Inspections

S5.09 (1) Field Tests and Inspections, General

Sampling and testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Sampling and testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that materials meet the specified requirements- The Contractor shall be responsible for the performance of all test and inspections as specified herein to requirements. All labor, equipment, and test apparatus shall be furnished by the Contractor. The Government will furnish water, electricity and fuel for the tests. All defects disclosed by the tests shall be rectified by the Contractor. All tests and inspections at the site shall be made under the direction of and be subject to the approval of the Engineer. The Contractor shall produce evidence, when required, that any item of work has been constructed properly in accordance with the drawings and specification.

S5.09 (2) Testing Procedure

Test water mains and water service lines in accordance with the applicable standard specified in Construction Specification.

S5.09 (3) Testing Requirements

For pressure tests, use a hydrostatic pressure 3.5 kg/sq cm greater than the maximum working pressure of the system, but not less than 14 kg/sq cm. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure, of the system- Leakage test may be performed at the same time and at the same test pressure as the pressure test.

S5.10 Measurement and Payment

PVC water main pipe will be measured by linear meter, pipe fitting are to be measured by lump sum, valve and hydrant are to be the actual number, intake on river and deep well, treatment facilities tank and filter are to be measured by lump sum, treatment plant building, administration office, water pump and workshop buiding, chemical building and guard station will be measured by in total of square meter are desinated in the Bid schedule.

Such payment shall be considered to be full compensation for the cost of all labor, tools, materials, and other items incidental to the satisfactory completion of the work

S5.11 Employer's Requirement of Treatment Facilities.

S5.11(1) General

This section of the details specified of the Employer's requirement for the work of details design of treatment facilities to be provided of this contract.

Outline drawing provided with the bid documents are show the site of the Work, Where structural or foundation details or dimensions are shown or may be inferred from such drawing the Employer does not warrant that these comply with the necessary design codes or standards. Where the Contractor adopts any of the layouts, designs or details shown in. such drawing he shall thereby take full responsibility for them.

S5.11(2) Design Requirements

The listed below design requirements shall be applied to the Contractor who shall design of the water supply systems.

General design requirements

- (i) The hydraulic gradient through the water treatment plant: the design shall ensure that the water flows through the process by gravity and/or pumping throughout the range of flows specified.
- (ii) The plants should operate efficiently over the full range of the flows and surface loading rates
- (iii) The layout of all plants and pipes shall give easy access for operation, inspection, in-situ maintenance (including access onto and-into tanks and other structures) and for removal of equipment. The minimum clear distance around equipment for operational access and inspection and for maintenance and repair shall be 900 mm. The minimum size for access manholes shall be 600 mm.
- (iv) Routing of services, potable water pipes, drainage pipes, chemical pipes, electricity supply cables and signal cables shall be easy for maintenance.
- (v) Adequate ventilation shall be provided within buildings to avoid condensation.
- (vi) All equipment shall be suitable for the environment in which it is to operate.
- (vii) All materials which come into contact with potable water, or water to be used for potable supply shall be approved for the purpose and shall have no detrimental effect on water quality.
- (viii) The design of tanks holding treated water (eg. Ground water storage tanks, elevated tanks) shall be so as to hold the water in a

secure pollution free environment which shall not impair or affect the quality of the water in any way.

- (ix) Civil works and steel structures shall be designed in accordance with Vietnamese Standards or Codes. All design loads and load combinations shall be required by the specified codes, occupancy, environmental effects, equipment and process. Design of footings for structures and foundation preparation shall be based on the data contained

S5.11(3) Lamella Clarifier

The classifier shall continuously and efficiently remove suspended solids from the influent with the minimum water loss.

The lamella classifier shall be a proven design, constructed in mild steel painted epoxy and colour paints.

Lamella plates shall be constructed from materials resistant to deterioration from UV light. The supporting structure and fastening and fixings shall be resistant to the corrosive effects of water dosed with aluminium sulphate. The installation shall be sufficiently robust to withstand the rigours of mechanical cleaning and able to support the weight of two operators standing on the plates with the aid of duck-boards to clean them.

The plates shall be inclined at an angle of between 45 to 60 degrees to the horizontal and separated by 30-80 mm with a length of not less than one meter.

Classifier shall have generous perimeter walkways to enable the works staff to inspect the settlement process.

Sludge discharges and drainage from the classifier shall be arranged to discharge by gravity. The sludge drainage system shall operate at adequate velocities to be self cleaning and deposition of sludge shall be avoided

S5.11(4) Sand filter

The filter shall be conventional down-flow rapid gravity filter with single size sand media. The filter shall be a proven design, constructed mild steel painted epoxy and colour paints. The filter shall be open-topped, circular in plan.

Manual filter drains shall be provided to enable filter to be completely drained for maintenance purposes,

The preferred filter control method is constant level filtration based on level control linked to a modulating butterfly valve on outlet. As an

alternative flow control using rising level without outlet control may be accepted.

Filter media shall be sand and of a material and grading readily available in Viet Nam. Media shall be size 0.5 - 1.0 mm or 0.6 to 1.2 mm with a Uniformity Co-efficient less than 1.7. Minimum sand depth: 600 mm, Minimum gravel support media depth: 100 mm.

Filter backwashing shall be designed for efficient cleaning of the media without excessive washwater consumption and shall be water washing. The backwash water flow will be 10 - 15 l/s/m² Backwash frequency shall be 24 hours minimum.

The control and operation of the backwashing system shall be carried out manually, Control desk for filter shall be located adjacent to the filter.

The dirty washwater outlet arrangement from filter shall be designed to ensure free flow from the filter. The dirty washwater shall be discharged by gravity to the common sludge and drainage system.

Filter shall have generous perimeter walkways to enable the works staff to inspect the operation and backwashing process.

S5.11 (5) Ground water storage tank

A single separated tank shall be provided downstream of the filter incorporating chlorine contact time and treated water storage.

The tank shall be totally enclosed and constructed in reinforced concrete, mild steel painted epoxy or composite.

The floor shall be graded and a sump provided to ensure the tank can be fully drained. A valved drain pipe shall be provided to connect the sump to the plant drainage system.

The tank shall be provided with tight cover or roof.

Ventilation shall be provided and fitted with insect proof screens. The tank shall have an overflow system. If overflow pipes discharge to the open, they shall be designed to exclude animals and insects.

Stainless steel access ladder shall be provided within the tank.

S5.11 (6) Elevated tank

The elevated tank will be constructed in mild steel painted epoxy and colour paints or in composite, The tank footings will be reinforced concrete or steel structure.

The tank shall be provided with tight cover or roof to prevent the entry of rain water or other outside pollution.

The tank shall be provided with overflow pipe with bell-mouth at the high water level.

The tank shall be designed with ventilation equipment and manholes. A water level meter shall be provided. The water level signals will be transmitted to the plant control panel.

S5.11 (7) Distribution piping network

PVC pipes may be used for distribution piping network

Distributing mains and distributing branches should be installed under both sidewalks of the road. The depth of the distributing pipelines should be approximately 0.6 meter. Where distributing pipes are installed crossing or adjacent to the other buried lines or structures, a separating space of more than 0.3 m. should be assured.

Distributing pipes shall not be connected directly with pipes of other systems which could possibly cause pollution of water.

Fire hydrants shall be arranged in accordance with Vietnamese rules. Fire hydrants shall be located near road or street crossings, and also at intervals of 100 to 200 meters along the street. Single nozzle fire hydrant should be located on distributing pipe with diameter of 100 mm or large.

Sluice valves of distributing pipes should be arranged so that failure of water supply is limited to a small service area by operation of minimum number of valves.

Air valves and blow-offs shall be provided where they are required.

S5.12 Design input flow of water treatment plants

S5.12 (1) Flowrates

All treatment plants shall be capable of producing treated water to the specified quality standard, throughout the specified range of raw water qualities, at the following design input flowrates:

- Binh Minh WTP : 9 m³/h

The raw water quality to be treated is as follows:

PH	: 6.8 - 7.2
Suspended solids	: 40 - 150 mg/l
Total alkalinity	: 60 - 70 mg/l CaCO ₃

Total hardness : < 120 mg/1 CaCO₃
Organic matters : < 5 mg/l O₂

At present time, the report on quality of well water at Hung Phu and Chau Thanh sites is not available. However the results of analysis of existing well water drilled in the surrounding areas

(including UNICEF drilled wells) show that the water quality of wells drilled to a depth of 100-150M is not bad. It usually requires iron removal, pH adjustment and disinfection.

S5.12 (2) Treated water quality requirements

The treated water shall comply with the Vietnamese Standards for drinking water issued by Ministry of Medicine on 13/4/1992. Details of these standards are shown on Outline Drawing

S5.13 Water treatment plant

The raw water source will be Tra On river. The following water treatment process may be adopted:

- Water intake and raw water pumps
- Raw water transmission pipelines
- Chemical coagulation and flocculation
- Sedimentation (or filtration with floating media)
- pH adjustment
- Gravity sand filtration
- Disinfection

S5.14 Water treatment facilities

i) Water intake and raw water pumps

Raw water intake pipes:	2
Diameter of pipe:	50 mm
Number of raw water pumps:	2 (1 stand-by)
Flowrate/Head:	9 m ³ /h, 45 m
Power supply:	50 Hz, 3 phases, 380V, 3 Kw

ii) Raw water transmission pipelines

Velocity minimum:	0.3 m/s
Diameter maximum:	DN80
Length	~ 500m

iii) In-line static mixer

Diameter:	DN80
Mixing time:	1 - 3 mm.

iv) Coagulation and flocculation tank

Number of tanks:	1
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Retention time: 20 mm
Volume of tank: 3.0 m³

v) Lamella classifier / Filter with floating media

Number of classifiers: 1
Design flowrate: 9.0 m³/h
Surface loading rate: 4.0 m/h
Surface area: 2.25 m²
Length x Width: 2.25 x 1.0 m
Height: 3.5 m

In case of using filter with floating media:

Number of filters: 1
Design flowrate: 9.0 m³/h
Surface loading rate: 4.5 m/h
Surface area: 2.0 m²
Diameter of filter: 1.6 m
Height: 3.2 m

vi) Gravity sand filter

Number of filters: 1
Design flowrate: 9.0 m³/h
Surface loading rate: 5.0 m/h
Surface area: 1.8m²
Diameter of filter: 1.5 m
Height: 3.0 m

vii) Treated water pumps (TWP)

Number of TWPs: 2 (1 stand-by)
Flowrate/Head: 9 m³/h, 25 m
Power supply: 50Hz, 3phases, 380V, 2.2Kw

viii) Alum dosing system

Number of dissolving tanks: 2
Volume of each tank: 100 liters
Number of dosing pumps: 2 (1 stand-by)
Capacity of dosing pump: 0 - 8 l/h

ix) Lime dosing system

Number of slaking tanks: 1
Volume of slaking tank: 100 liters
Number of slurry tanks: 1
Volume of slurry tank: 100 liters
Number of dosing pumps: 2 (1 stand-by)
Capacity of dosing pump: 0 - 3 l/h

x) Chlorine gas dosing system

Number of chlorinators: 2 (1 stand-by)

Capacity of each chlorinator:	0 - 1 kg/h
Chlorine gas drums:	2 drums x 60 kg/drum
Motive water pump:	1 unit, capacity 300 l/h, head 45m

xi) Instrumentation and control system

Flowmeters:	2
Pressure gauges:	8
Level meters:	2

xii) Electrical system

- 1 power and control cabinet for river water pumps
- 1 power and control cabinet for treated water pumps
- 1 power and control cabinet for chemical building (mixers, dosing pumps, etc.)
- 1 control desk for filter
- Lighting and service electrical system
- Stand-by power generator 10 Kva

xiii) Interconnecting pipework

- 1 set of uPVC / steel interconnecting pipework including pipe fittings and valves.

SECTION 6 PUBLIC TOILET

S6.1 General

This work shall consist of the construction of public toilet in accordance with these specifications and the drawings for septic tank and piping including all in conformity with the lines, grades and dimensions instructed by the Employer.

The Constructor shall submit a all detailed design of reinforced concrete structure of septic tank, toilet devices and building in accordance with the Technical Standard of Vietnam TCVN 4448-87, 5674-92,4819-88 and others relative standard, and shop drawing in accordance with in Subsection S1.01(2).

S6.02 Material

- i) Reinforced concrete structures shall be applied to Section 4.04. concrete strength specified class II. Compressive strength at 28 days of 210 kg/m².
- ii) Steel reinforcement for concrete structures shall be applied Section 4.08 (2)
- iii) Mortar for plasting shall be applied Section 4.18 (2)

S6.03 Earth work

S6.03(1) Excavation and backfilling in accordance with the Construction Specification.

S6.04 Construction

S6.04(1) Concrete and reinforcement bars including forms.

Reinforcement concrete structure of concrete proportioning, mixing, placing and form or falsework, and reinforcement bending, placing shall be applied Section S4.06 to S4.13.

S6.05 Measurement and Payment

Payment for reinforcement structures of septic tank was made as stipulated in the Bid.

Such payment shall be considered to be full compensation for the cost of all labor, tools, materials, and other items incidental to the satisfactory completion of the work.

SECTION 7 STREET LIGHTING SYSTEM

S7.01 Description

The work shall consist of furnishing and installing, modifying or removing one or more electrical systems, all as shown on the Outline Drawings and in the Outline Specifications.

All materials furnished and used shall be new, except materials specified to be reused.

All incidental parts which are not shown on the Outline Drawings or in the Outline Specifications, and which are necessary to complete or modify the existing systems, shall be furnished and installed as though such parts were shown on the Drawings or specified herein. All systems shall be in satisfactory operation at the time of completion of the Work.

S7.02 Regulations and Codes.

S7.02(1) General

All work shall be performed in accordance with the following regulations and codes.

Electric installation criteria:

11 TCN-18-84; 11 TCN-20-84;
11 TCN-19-84; 11 TCN-21-84;

Vietnamese Standard

TCVN	1835	1994	TCVN	5377	1991
TCVN	2103	1994	TCVN	5661	1992
TCVN	2104	1994	TCVN	5828	1994
TCVN	3144	1994	TCVN	5829	1994
TCVN	5064	1994	TCVN	5935	1995
TCVN	5344	1994	TCVN	5936	1995

The Contractor shall verify that the equipment and parts used will be entirely suitable for the work to be performed and that they will be manufactured to proper clearances.

The Contractor shall be responsible for the inspection of all equipment and parts before their incorporation in the works.

S7.03 Materials

S7.03(1) Electroliers.

Electroliers shall be applied to the materials and equipment list as shown on the Drawings or in the Specifications.

S7.03(2) Conduit.

Conduit and conduit fittings shall be PVC pipe, PVC conduit conform to standards for the ends of the conduit shall be free of burrs and rough edges.

The maximum bend of a conduit shall be 90° and the minimum radius of a bend shall be not less than six times the inside diameter of the conduit.

Ends of conduit shall be properly coupled. Running threads, threadless connectors or threadless couplings will not be permitted.

S7.03(3) Wire.

Copper wire and sizes shall conform to the applicable Vietnamese Standard, in section 7.02.

Conductors for series street lighting systems shall be solid copper wire insulated with 2.5mm thickness Polyethylene insulation, and designated for operation at 5,000 volts.

A certificate of compliance with these specifications shall be submitted to the Employer by the manufacturer with all 5,000 volt series lighting conductors.

Where isolating transformers or ballasts are used, the secondary conductors from transformer to luminaire shall be insulated solid copper wire. Multiple-circuit conductors shall be of a size indicated on the Drawings. Insulation for such conductors shall be rated and approved for 600 volt operation, and shall be standard grade polyvinyl chloride, conforming to the applicable provisions of Vietnamese Standard.

S7.03(4) Electrical concrete Pole

Pre-cast centrifugal electrical concrete pole shall be supplied in compliance with the followings latest edition of Vietnamese Standard (TCVN).

- TCVN 5864-1994: Structure and Dimension of Power Pole Reinforced Concrete Centrifugal.

- TCVN 5847-1994: Specifications and Testing Method of Concrete pole.
- TCVN 5574-1991: Structure of Reinforced Concrete – Design Standard
- TCVN 2737-1995: Load and Impact – Design Standard.
- TCVN 4506-1987: Water for Concrete and mortar – Specification.
- TCVN 2682-1992: Cement Portland.
- TCVN 1770-1986: Sand in Construction – Specification.
- TCVN 1771-1987: Crushed stone, Gravel stone in the construction.
- TCVN 1651-1985: Hot rolled deform bar.
- TCVN 1650-1985: Hot rolled rebar.
- TCVN 1651-1985: TCVN 1765-85, TCVN 4453-1995. TCVN 3223-89.. and other standard concerned.

S7.04 Equipment List and Drawings.

S7.04 (1) General

Unless otherwise authorized in writing by the Employer, the Contractor shall, within 10 days following execution of the Contract, submit to the Employer for approval, a list of equipment and materials which it proposes to install. The list shall be complete as to name of manufacturer, size, and identifying number of each item. In addition, the Contractor shall submit detailed drawings and wiring diagrams for all electrical equipment to be used. The Agency will not be liable for any material purchased, labor performed, or delay to the Work prior to review of documents required above.

If ordered by the Employer, the Contractor shall submit for review sample articles of the material proposed for use. After review, said sample article will be returned to the Contractor.

Upon completion of the Work, the Contractor shall submit one complete set of or corrected Drawings showing in detail all construction changes.

S7.04(2) The following data shall be furnished by the Contractor to the Employer and shall be included in the design documents.

- a) Catalogues of electrical component; transformer, lanterns, ballast, etc.
- b) Plans and circuit diagrams, ground road connection diagram.
- c) Photometric data;

- i) Utilisation Curve
 - ii) Isocandela Diagram
 - iii) Horizontal Iso Foot Candle Diagram
 - iv) Polar Light Distribution Curve
- d) Details of columns, brackets, base plates.

S7.05 Warranties, Guarantees, and Instruction Sheets.

Manufacturers' warranties and guarantees furnished for materials used in the Work and instruction sheets and parts lists supplied with materials shall be delivered to the Employer prior to acceptance of the Work. The duration of the warranty or guarantee shall be the standard of the industry with a minimum of 1 year from the date of acceptance of the Work.

S7.06 Maintenance of Existing Systems.

Existing electrical systems, or temporary replacements thereof, shall be maintained in effective operation by the Contractor during the progress of the Work. The Contractor shall notify the Employer at least 2 working days prior to performing work on existing systems.

Temporary wiring as described herein shall not apply to circuits exceeding 220 volts to ground.

Temporary wiring may be either overhead or underground conductors. All temporary overhead conductors shall be slackspanned with 7m minimum overhead clearance across thoroughfares and 4m minimum clearance across thoroughfares and 4m minimum clearance above sidewalk areas. No temporary conductor may run on top of the ground or across any sidewalk area unless adequately protected in an electrical raceway. Conductors less than 3m above ground level must be protected in an electrical raceway. Overhead conductors shall be multi-conductor cable or single conductors. Securely tied or taped at intervals not to exceed 1.5m. No spare conductors are required. All splices within 3m above ground level shall be enclosed in metal junction boxes. Splice made at ground level shall be enclosed in pull boxes.

S7.07 Construction General.

S7.07 (1) Excavation and Backfill.

The excavations required for the installation of conduit, foundations and other equipment shall be performed in such a manner as to cause the least possible damage to the streets, sidewalks, and other improvements. The trenches shall not be excavated wider than necessary for the proper installation of the electrical equipment or foundation. Excavating shall not be performed until just prior to installation of equipment. The

material from the excavation shall be placed in a location to cause the least obstruction to surface drainage and vehicular and pedestrian traffic.

Where excavations are required in parkways and lawns, existing sod shall be removed and preserved by the Contractor. After backfilling, the sod shall be replaced, and the entire area restored to original grade and condition.

After backfilling, excavations shall be kept well filled and maintained in a smooth and well-drained condition until permanent repairs are completed.

At the end of each day, and at all other times when construction operations are suspended, all equipment, material and debris shall be removed from that portion of the right-of-way open for vehicular and pedestrian traffic. Barricades shall be erected at all excavations not backfilled or finished to final grade.

All excavations, including those resulting from removal of existing equipment as specified on the Outline Drawings, shall be backfilled and the surface restored to match existing improvement.

The work in the street or highway shall be performed in such a manner that not more than one lane of traffic is restricted in either direction at any time, unless approved by the Employer.

S7.07 (2) Foundations.

All work conform to line elevation and grade as shown on the Drawings or as established by the Inspector.

The longitudinal grade for the foundation cap shall be the same as the grade for the top of the existing curb. If there is no curb, the longitudinal grade will be established by the Inspector .

Existing curb and sidewalk- the grade shall be a straight line from the top of the back face of curb to the top of the near edge of sidewalk, and shall joint all around in full-width sidewalk or sidewalk constructed adjacent to the curb.

The foundation shall be constructed in a single placement of concrete of the class II specified in Subsection S4.05. The bottom of the Foundation shall rest securely on firm, undisturbed ground.

Where forms are required because of soil conditions or grade, they shall be true to line grade, firmly braced and secured in place, and shall not be removed until the concrete has set.

S7.07 (3) Pull Boxes.

Pull boxes shall be installed at the locations shown on the Drawings. If not shown, they shall be approximately equally spaced but not over 70m apart. It shall be the option of the Contractor, as its expense and subject to the approval of the Employer to install additional pull boxes that it may desire to facilitate the work.

The bottom of the pull box shall rest firmly on a thick bed of crushed rock extending beyond the outside edges of the pull box.

The grade for the top of pull boxes shall be established as provided for in Subsection S7.07. Where practical, pull boxes shown in the vicinity of curbs shall be placed adjacent to the back of curb. Pull boxes where practical shall be installed with the long side parallel to the curb.

Where ballasts or transformers are installed in a pull box, a pull extension shall be used.

Pull box shall not be installed in any part of a driveway or other traveled way unless otherwise specified.

S7.07 (4) Wiring.

Wiring shall be done in conformance with Subsection S7.02 and the requirements of this subsection.

Connectors and terminals for use with aluminum utility power service conductors shall be aluminum and shall be greased with an approved inhibitor.

Where low-voltage conductors are run in standards containing high-voltage conductors, either the low-voltage or the high-voltage conductors shall be encased in flexible or rigid metallic conduit, to a point where the two types of conductors are no longer in the same raceway.

Conductors shall be pulled by hand. Winches or other power-actuated pulling equipment shall not be used. Only approved lubricants may be used in placing conductors in conduit.

Splices shall be made only in pull boxes and standard bases. Conductors shall be jointed by the use of a connector approved by the Employer. The splice shall be capable of satisfactory operation under continuous submersion in water.

Conductor insulation shall be well penciled, trimmed to conical shape, and roughened before applying splice insulation. Splice insulation shall consist of layers of vinyl chloride electrical insulating tape, conforming to Standard plied to a thickness equal to and well lapped over the original insulation.

A total of 60cm of slack shall be left at each standard, and within each pull box sufficient slack shall be left to extend 50cm above the top of pull box grade.

Small permanent identification bands shall be marked as specified. The bands shall be securely attached to conductors in pull boxes and near the termination of each conductor. Where circuit and phase are clearly indicated by conductor insulation, bands need not be used. Permanent identification bands shall be embossed, 6 mil, oil-resistant polyvinyl chloride tape with pressure-sensitive backing. Tape shall be of a type such that symbols contrast with the background color.

S7.07 (5) Bonding and Grounding

Metallic cable sheaths, metallic conduit, nonmetallic conduit grounding wire, ballast and transformer cases, service equipment, sign switches, anchor bolts and metal standards that form a continuous system shall be copper wire or copper strap of the same cross-sectional area as No. 8 for all systems, except where noted herein.

Grounding of metallic conduit, service equipment and neutral conductor at service points shall be accomplished as required by the applicable Code and the Serving utility, except that grounding conductors shall be No. 6 copper wire.

For bonding purposes in all nonmetallic type conduit, a bare No.8 copper wire shall be run continuously in all circuits.

Bonding of standards shall be accomplished by means of a No. 8 bonding wire attached from a grounding bushing to a foundation bolt or a 5mm, or larger, brass or bronze bolt installed in the lower portion of the standard.

Bonding of metallic conduit in nonmetallic pull boxes shall be by means of copper strap or galvanized grounding bushing and bonding jumpers.

The metallic conduit or building conductor system shall be securely grounded, at intervals not to exceed 170m, to one of the following:

- 1) A galvanized pipe driven to a depth of 2.5m and having its upper end not more than 75mm above the conduit; or
- 2) A minimum 15mm by 2.5m copper coated (minimum thickness of rod coating 0.01) steel rod driven to a depth of 2.5m; or,
- 3) A metal water service pipe on the street side of meter, with the approval of the owner. The water meter shall be thoroughly scraped and cleaned prior to connection.

On wood poles, all equipment mounted less than 2.5m above ground surface shall be grounded.

S7.08 Service.

The Contractor shall furnish and install all material and equipment necessary to complete the electrical connection between the terminating point of the serving utility and the electrical system, as shown on the Drawings. Prior to the expiration of the first 10 percent of the working days, the Contractor shall install the necessary facilities to receive utility connection. The Employer shall arrange with the serving utility to complete service connections.

S7.09 Street Lighting Construction

S7.09(1) General.

Street lighting construction shall conform to the requirements of Subsection S7.07 and this Subsection S7.09.

S7.09(2) Pull Box Cover

Concrete pull box covers shall be inscribed "STREET LIGHTING " "HIGH VOLTAGE"

S7.09(3) Wiring.

For series circuit lighting conductor splices, sufficient synthetic oil-resistant rubber tapa, conforming to the requirements of standard, shall be applied over the conductor to fill all voids before placing the vinyl chloride tape specified herein and then be well covered with a coating of approved insulating paint or similar material.

For multiple circuits, an approved fused disconnect splice connector shall be installed in each ungrounded conductor between the line and the ballast. The connector shall be installed in the base of the luminaire standard or in an adjacent pull box and be readily accessible.

S7.09(4) Service

For series street lighting systems served from overhead circuits, a switch of 5,000 volt rating shall be connected to control each circuit. The switch shall be enclosed in a Type 3R, 45cm x 60cm x 15cm for minimal box. The terminal box shall be fitted with a cover permanently inscribed "DANGER - HIGH VOLTAGE." The cover shall be attached to the box to form a raintight plate and shall require tools for removal. The terminal box shall be installed not less than 3m above the ground.

S7.10 Measurement and Payment

Street lighting and fixers, and concrete pole and wiring will be measured by linear meter, transformers are to be measured by each are desinated in the Bid Schedule.

Such payment shall be considered to be full compensation for the cost of all labor, tools, materials, and other items incidental to the satisfactory completion of the work.

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