

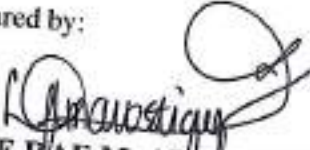


Republic of the Philippines  
Department of Agriculture  
Western Visayas  
Iloilo City


# TECHNICAL SPECIFICATION OF ESTABLISHMENT OF SOLAR-POWERED IRRIGATION SYSTEM

Brgy. Dasal, Sibunag, Guimaras


Prepared by:

  
**DECE RAE M. AROSTIQUE, ABE**  
Engineer I (ABE No. 0011402)

Recommending by:

  
**MARIA TERESA T. SOLIS**  
OIC-RTD for Operations and Extensions


Reviewed by:

  
**YVONNE GRACE H. SUR, ABE**  
Engineer III (License No. 0005970)  
Head, Engineering Plans, Designs and  
Specifications Section

Approved by:

  
**DENNIS R. ARPIA**  
Regional Executive Director

Submitted by:

  
**MOISES D. MANA-AY, ABE, MEE**  
Engineer V (License No. 0006077)  
Chief, RAED

## **I. GENERAL ITEM**

### **SPL1. TEMPORARY FACILITY**

The Contractor shall furnish all materials, labor, equipment, tools and install such temporary works as are necessary for the successful completion of the Contract Work. The Contractor shall negotiate the site for his construction camp, office, and work areas.

These temporary works and construction plan shall include but shall not be limited to the following:

1. Construction camp for housing, feeding and accommodation for all the Contractor's employees. The Contractor shall also, with-in close proximity of his camp, provide an office and sleeping quarter for DA-RAED 6 monitoring employees, complete with facilities and shall have a minimum floor area of 48 sq.m.
2. Facilities such as haul roads, potable water, supply, drainage, lighting, sewage disposal system, sanitation, first aid and fire protection facilities.
3. Workshops, laboratory, warehouses, site offices, stockpile areas, storage areas for materials, equipment, spare parts, fuel and oil.
4. River diversion system including construction of cofferdam.
5. All other temporary facilities not specifically listed but nevertheless required for the proper functioning of the camp set-up and construction activities.

Temporary works shall conform to all government standards and codes and shall meet the sanitary requirements of the Department of Health.

### **SPL2. PROJECT SIGNBOARD, COA BILLBOARD, AND PROJECT MARKER**

The project signboard design layout and dimension shall be on standard billboard measuring 1200 mm x 2400 mm (4ft x 8ft.) using 12 mm (1/2 inch) thick marine plywood or tarpaulin posted on 5 mm (3/16 inch) marine plywood. The billboard shall be installed in front of the project site. Framing support shall be 2" x 2" x 8' good lumber.

COA Billboard layout shall be 2400 mm x 2400 mm (8 ft x 8 ft) tarpaulin posted with 12 mm (1/2 inch) marine plywood and framed with 2" x 2" x 8' good lumber support. Resolution used shall be 70 dpi with Helvetica font name and black color as font design.

The project marker shall conform to the detailed engineering design as per plan. All slopes and dimensions must follow base on the prescribed detailed in plan. All text letters are engraved on a granite plate.

### **SPL3. MOBILIZATION/ DEMOBILIZATION**

The Contractor shall mobilize and move into the Project Site (in accordance with his approved Construction Program and Equipment Moving-in and Utilization Schedule) the required construction equipment needed for the successful completion of the Contract Work immediately after receipt of the approved Construction Program. Notwithstanding the approved Equipment Moving-in and Utilization Schedule, the initial equipment required to be mobilized by the Contractor to the Project Site within twenty (20) calendar days after date of receipt of the approved Construction Program are listed below:

EQUIPMENT	NUMBER	
	OWNED	OR LEASED
1. Bar Cutter		1 unit
2. Welding Machine		1 unit
5. Concrete Mixer 1 bigger		1 unit



If for the reasons or causes other than "major calamities", the Contractor fails to mobilize fully the initial equipment required within said period, and all other equipment listed in his approved Equipment Moving-in and Utilization Schedule, at the discretion of the Secretary/Director, he may be given an extension of time to mobilize them fully but in no case shall it exceed thirty (30) calendar days. Failure to fully mobilize the required construction equipment within said period will be a ground for contract rescission. During said extension period liquidated damages equivalent to the ACEL operated daily rental rate for eight (8) hours of the undelivered equipment per day of delay shall be imposed and collectible from any subsequent payment due the Contractor. Delays caused by "major calamities" will not be counted. Delays shall be reckoned starting at 12:00 o'clock noon of the succeeding day after the date scheduled for the mobilization of the programmed equipment. The Project Engineer shall certify to the date of actual mobilization of the programmed equipment to the site.

The DA Western Visayas shall check and verify the number, type and actual condition of the equipment moved into the Project Site. The DA Western Visayas reserves the right to order the removal of such equipment that are not in good working condition from the Project Site at the Contractor's expense and said equipment are not accounted for. Demobilization shall include dismantling and removal from the site of Contractor's Construction Plant. Demobilization shall also include clean-up of the site after completion of the Contract Work as approved by DA Western Visayas and transportation from the site of Contractor's employees.

### **BASIS OF PAYMENT**

Basis of payment shall be as follows unless other conditions are agreed mutually by contracting parties:  
Payment for furnishing all materials equipment and labor for other items shall be made on fixed lump sum price. No payment for demobilization of construction equipment will be made.

## **II. POWER HOUSE**

### **ITEM 803**

### **STRUCTURE EXCAVATION**

**Refer to Item 103, Part C of Volume II (Blue Book)**

#### **103.1 Description**

This Item shall consist of the necessary excavation for foundation of bridges, culverts, underdrains, and **other structures (column footings, grade beam and pedestal)** not otherwise provided for in the Specifications. Except as otherwise provided for pipe culverts, the backfilling of completed structures and the disposal of all excavated surplus materials, shall be in accordance with these Specifications and in reasonably close conformity with the Plans or as established by the Engineer.

It shall also include the furnishing and placing of approved foundation fill material to replace unsuitable material encountered below the foundation elevation of structures.

#### **103.2 Construction Requirements**

##### **103.2.1 Excavation**

(1) General, all structures. The Contractor shall notify the Engineer sufficiently in advance of the beginning of any excavation so that cross-sectional elevations and measurements may be taken on the undisturbed ground. The natural ground adjacent to the structure shall not be disturbed without permission of the Engineer.

Trenches or foundation pits for structures or structure footings shall be excavated to the lines and grades or elevations shown on the Plans or as staked by the Engineer. They shall be of sufficient size to permit the placing of structures or structure footings of the full width and length shown. The elevations of the bottoms of footings, as shown on the Plans, shall be considered as approximate only and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be deemed necessary, to secure a satisfactory foundation.

Boulders, logs, and other objectionable materials encountered in excavation shall be removed. After each excavation is completed, the Contractor shall notify the Engineer to that effect and no footing, bedding material shall be placed until the Engineer has approved the depth of excavation and the character of the foundation material.

(2) Structures other than pipe culverts. All rock or other hard foundation materials shall be cleaned all loose materials, and cut to a firm surface, either level, stepped, or serrated as directed by the Engineer. All seams or crevices shall be cleaned and grouted. All loose and disintegrated rocks and thin strata shall be removed.

##### **103.2.2 Utilization of Excavated Materials**

All excavated materials, so far as suitable, shall be utilized as backfill or embankment. The surplus materials shall be disposed off in such manner as not to obstruct the stream or otherwise impair the efficiency or appearance of the structure. No excavated materials shall be deposited at any time so as to endanger the partly finished structure.

##### **103.2.3 Backfill and Embankment for Structures Other Than Pipe Culverts**

Excavated areas around structures shall be backfilled with free draining granular material approved by the Engineer and placed in horizontal layers not over 150 mm (6 inches) in thickness, to the level of the original ground surface. Each layer shall be moistened or dried as required and thoroughly compacted.

### 103.3 Method of Measurement

#### 103.3.1 Structure Excavation

The volume of excavation to be paid for will be the number of cubic meters measured in original position of material acceptably excavated in conformity with the Plans or as directed by the Engineer, but in no case, except as noted, will any of the following volumes be included in the measurement for payment:

- (1) The volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed ground.
- (2) The volume of excavation for footings ordered at a depth more than 1.5 m (60 inches) below the lowest elevation for such footings shown on the original Contract Plans, unless the Bill of Quantities contains a pay item for excavation ordered below the elevations shown on the Plans for individual footings.

### 103.4 Basis of Payment

The accepted quantities, measured as prescribed in Section 103.3, shall be paid for at the contract unit price for each of the particular pay items listed below that is included in the Bill of Quantities. The payment shall constitute full compensation for the removal and disposal of excavated materials including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Pay Item Number	Description	Unit of Measurement
103	Structure Excavation	Cubic meters

## ITEM 1707

### GRAVEL BEDDING

Refer to ITEM 200, Part C, Volume II (Blue Book)

#### 200.1 Description

This item shall consist of furnishing, placing and compacting an aggregate subbase course on a prepared subgrade in accordance with this Specification and the lines, grades and cross-sections shown on the Plans, or as directed by the Engineer.

#### 200.2 Material Requirements

Aggregate for subbase shall consist of hard, durable particles or fragments of crushed or natural gravel and filler of natural or crushed sand. The composite material shall be free from vegetable matter and lumps or balls of clay, and shall be of such nature that it can be compacted readily to form a firm, stable subbase.

The subbase material shall conform to Table 200.1, Grading Requirements

Table 200.1 – Grading Requirements

Sieve Designation		Mass Percent Passing
Standard, mm	Alternate US Standard	
50	2"	100
25	1"	55 - 85
9.5	3/8"	40 - 75
0.075	No. 200	0 - 12

The fraction passing the 0.075 mm (No. 200) sieve shall not be greater than 0.66 (two thirds) of the fraction passing the 0.425 mm (No. 40) sieve.



The fraction passing the 0.425 mm (No. 40) sieve shall have a liquid limit not greater than 35 and plasticity index not greater than 12 as determined by AASHTO T 89 and T 90, respectively.  
 The coarse portion, retained on a 2.00 mm (No. 10) sieve, shall have a mass percent of wear not exceeding 50 by the Los Angeles Abrasion Tests as determined by AASHTO T 96.  
 The material shall have a soaked CBR value of not less than 25% as determined by AASHTO T 193. The CBR value shall be obtained at the maximum dry density and determined by AASHTO T 180, Method D.

### 200.3 Construction Requirements

#### 200.3.1 Placing

The aggregate subbase material shall be placed at a uniform mixture on a prepared subgrade in a quantity which will provide the required compacted thickness. When more than one layer is required, each layer shall be shaped and compacted before the succeeding layer is placed.  
 The placing of material shall begin at the point designated by the Engineer. The layer or windrow shall be of such size that when spread and compacted the finished layer be in reasonably close conformity to the nominal thickness shown on the Plans.

#### 200.3.2 Spreading and Compacting

When uniformly mixed, the mixture shall be spread to the plan thickness, for compaction.  
 Where the required thickness is 150 mm or less, the material may be spread and compacted in one layer. All subsequent layers shall be spread and compacted in a similar manner.  
 The moisture content of subbase material shall, if necessary, be adjusted prior to compaction by watering, as required in order to obtain the required compaction.  
 Immediately following final spreading and smoothing, each layer shall be compacted to the full width by means of approved compaction equipment. Any irregularities or depressions that develop shall be corrected by loosening the material at these places and adding or removing material until surface is smooth and uniform.  
 If the layer of subbase material, or part thereof, does not conform to the required finish, the Contractor shall, at his own expense, make the necessary corrections.  
 Compaction of each layer shall continue until a field density of at least 100 percent of the maximum dry density determined in accordance with AASHTO T 180, Method D has been achieved. In-place density determination shall be made in accordance with AASHTO T 191.

### 200.4 Method of Measurement

Aggregate Subbase Course will be measured by the cubic meter (m<sup>3</sup>). The quantity to be paid for shall be the design volume compacted in-place as shown on the Plans, and accepted in the completed course. No allowance will be given for materials placed outside the design limits shown on the cross-sections.

### 200.5 Basis of Payment

The accepted quantities, measured as prescribed in Section 200.4, shall be paid for at the contract unit price for Aggregate Subbase Course which price and payment shall be full compensation for furnishings and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment will be made under:

Pay Item Number	Description	Unit Of Measurement
200	Aggregate Subbase Course	Cubic Meter

## ITEM 404

### REINFORCING STEEL BAR

#### 404.1 Scope

All reinforcing steel bars required for the works as detailed in the Construction Drawings or as directed by the Project Engineer shall be furnished by the DA Western Visayas unless otherwise specified in the Bill of Quantities.

The Length of each size of reinforcing steel bars to be furnished is computed by taking the theoretical length of steel bars shown in the Drawings multiplied by 1.07 to get the actual length required for the work.

All reinforcing steel bars will be furnished in commercial standard lengths and the Contractor shall cut and bend reinforcing steel bars to the details and dimensions shown on the Drawings.

#### 404.2 Construction Materials

All reinforcing steel bars shall be Grade 40 or PS 275, deformed type and conforming to the requirements of ASTM Designation A-615 or its latest revision. The nominal dimensions and unit weights of bar designation shall be in accordance with the following table:

Bar Number	Designation	Unit (kg/m)	Wt.	Diameter (mm)	Nominal Dimensions Cross-Section Area (mm <sup>2</sup> )	Perimeter (mm)
10 mm		0.616	10		78.54	31.42
12 mm		0.888	12		113.1	37.7
16 mm		1.579	16		201.1	50.27

Bar number are based on the number of weights of an inch included in the nominal diameter of bars. The nominal diameter of a deformed bar is equivalent to the diameter of a plain bar having the same weight per foot of the deformed bar.

#### 404.3 Construction Requirement

Workmanship shall be at the highest grade and quality, and shall be in accordance with the latest standard practice of the industry. Workmanship shall conform to the following conditions:

a. Cutting and Bending

Cutting and bending of reinforcing bars may be done in shop or at the jobsite. All bending works shall be in accordance with the latest standard practice and be approved machine methods. Radii for bends and hooks will be specified on the approved detailed reinforcement Drawings in accordance with sound design procedures.

All reinforcing bars requiring bending shall be cold-bent to the shapes shown on the Plans or required by the Engineer. Bars shall be bent around a circular pin having the following diameters (D) in relation to the diameter of the bar (d):

Nominal diameter, d, mm	Pin diameter (D)
10 to 20	6d

b. Placing

Reinforcement shall be laid, anchored and embedded in the concrete as shown on the Drawings or as directed by the Project Engineer. Unless otherwise directed, the spacing of reinforcement bars shall be measured along the center line of the bars. Reinforcement shall be inspected for compliance with requirements as to size, length, splicing, position and number after placement based on the approval reinforcement Drawings has been done. Before reinforcement are placed, the surfaces of the bars and the surfaces of any metal bar support shall be cleaned of heavy flaky rust, loose scales, dirt, grease or other foreign substance which in the opinion of the Project Engineer are objectionable. After being placed, the reinforcing bars shall be maintained in a clean condition until completely embedded in concrete.

Reinforcing bars shall be accurately placed and secured in position so as to avoid displacement during pouring of concrete. Special care shall be exerted to prevent any disturbance of the embedded reinforcement during the setting of the concrete. Metal chairs, hangers, spacers or other approved support may be used by the Contractor for supporting reinforcing bars. Metal supports shall be galvanized when they are to be exposed to view on completed concrete surfaces or where its use will contribute in any way to the discoloration or deterioration of the concrete.

c. Relation of Bars to Concrete Surfaces

The minimum cover for all reinforcements shall conform to the dimensions shown on the detailed reinforcement Drawings.

d. Splicing

All splices in reinforcement shall be as shown on the Drawings or as directed by the Project Engineer. The lapped ends to bars shall be either supported sufficiently to permit the embedment of the entire surface of each bar in concrete or shall be securely wired.

Unless otherwise shown on the Plans, bars shall be lapped a minimum distance of:

Splice Type	Grade 40 min. lap	Grade 60 min. lap	But not less than
Tension	24 bar dia	36 bar dia	300 mm



Compression	20 bar dia	24 bar dia	300 mm
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e. **Welding**

Welding of bars shall be performed only where shown on the Drawings or as authorized in writing by the Project Engineer and shall conform to the requirements of AWS: D12.1, latest revision. All welders employed shall show proof of their welding qualifications to the Project Engineer. All welding shall be done using metal arc welding, pressure gas welding, submerged arc welding or thermit welding.

Coverings of low hydrogen electrodes must be thoroughly dry when used. The surfaces to be welded shall be clean and shall be free from rust and dirt. All welds shall develop the full strength of the bar on the smaller bar when two different sizes are welded. Test will be required of not more than five per cent (5%) of the welds. Approved resting equipment for testing welds shall be furnished by Contractor.

f. **Protection**

Reinforcement to remain exposed and intended for future concrete embedment shall be protected from corrosion or other damages in an approved manner where directed. The reinforcement protection shall be of such nature that it can be thoroughly cleaned without difficulty prior to encasement in concrete.

#### 404.4 Preparation of Reinforcement Drawings

Contractor shall submit for the approval of DA Western Visayas detailed reinforcement drawings in accordance with Article SC-8. These drawings will include bar-placing drawings, bar bending drawings, bar list, and any other reinforcement drawings, as may be required to facilitate placement and checking of reinforcing bars. No work shall be done by Contractor until such approval has been given.

The reinforcement Drawings submitted shall show the name of the structure location by stationing where the reinforcement drawings is intended and all the necessary information required by DA Western Visayas. It shall likewise bear the stamp or seal of Contractor as evidenced that the Drawings have been checked by Contractor.

Contractor shall be held responsible for any delay in the progress of the work occasioned by his failure to observe the requirements and the time for the completion of the contract will not be extended on account of his failure to promptly submit said drawings in strict adherence herewith.

#### 404.5 Sampling for Testing and Acceptance of Materials

Sampling for testing and acceptance of all reinforcement steel bars furnished shall be the responsibility of DA Western Visayas being the supplier of the materials. Thus, the Contractor shall not undertake sampling for tests except upon instruction by DA Western Visayas.

#### 404.6 Method of Measurement

The quantity of reinforcing steel to be paid for will be the final quantity placed and accepted in the completed structure. No allowance will be made for tie-wires, separators, wire chairs and other material used in fastening the reinforcing steel in place. If bars are substituted upon the Contractor's request and approved by the Engineer and as a result thereof more steel is used than specified, only the mass specified shall be measured for payment. No measurement or payment will be made for splices added by the Contractor unless directed or approved by the Engineer.

When there is no item for reinforcing steel in the Bill of Quantities, costs will be considered as incidental to the other items in the Bill of Quantities.

#### 404.7 Basis of Payment

The accepted quantity, measured as prescribed in Section 404.6, shall be paid for at the contract unit price for Reinforcing Steel which price and payment shall be full compensation for furnishing and placing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item. Payment will be made under:

Pay Item Number	Description	Unit of Measurement
404	Reinforcing Steel	Kilogram

## ITEM 414 FORMWORKS

### 414.1 Description

This item shall consist of designing, constructing and removing forms to temporarily support concrete, girders and other structural elements until the structure is completed to the point it can support itself.

### 414.2 Material Requirements

#### 414.2.1 Formwork

The materials used for smooth form finish shall be plywood, lumber or other acceptable materials capable of producing the desired finish for form-facing materials. Form-facing materials with raised grain, torn surfaces, worn edges, patches, dents, or other defect that will impair the texture of concrete surfaces shall not be permitted. No form-facing material shall be specified for rough form finish.

#### 414.2.1.1 Formwork accessories

Formwork accessories that are partially or wholly embedded in concrete, including ties and hangers shall be commercially manufactured. The use of non-fabricated wire form ties shall not be permitted. Where indicated in the Contract, use form ties with integral water barrier plates in walls.

### 414.3 Construction Requirements

#### 414.3.1 Forms

The forms construction shall be in accordance whenever applicable, with Item 407 Concrete Structure subsection 407.3.13 Formwork Construction.

Form panels to be used shall be in good condition free of defects on exposed surfaces. If form panel material other than plywood is used, it shall have flexural strength, modulus of elasticity and other physical properties equal to or greater than the physical properties for the type of plywood specified. Furnish and place form panels for exposed surfaces in uniform widths of not less than 1 meter and in uniform lengths of not less than 2 meters except where the width of the member formed is less than 1 meter. Arrange panels in symmetrical patterns conforming to the general lines of the structure. Place panels for vertical surfaces with the long dimension horizontal and with horizontal joints level and continuous. For walls with sloping footings which do not abut other walls, panels may be placed with the long dimension parallel to the footing. Use form ties and anchors that can be removed without damaging the concrete surface. Construct metal ties or anchorages within the forms to permit their removal to a depth of at least 25 millimeters from the face without damage to the concrete. Fill cavities with cement mortar and finish to a sound, smooth, uniform colored surface.

#### 414.3.2 Removal of Forms

The removal of forms and falsework shall be in accordance whenever applicable with Item 407 Concrete Structure subsection 407.3.14 Removal of forms.

### 414.4 Method of Measurement

When the Contract stipulates that payment will be made for forms on square meter basis, the pay item will include all materials and accessories needed in the work.

Whenever the Bill of Quantities does not contain an item for form, the work will not be paid directly but will be considered as a subsidiary obligation of the contractor under other Contract Items.

### 414.5 Basis of Payment

The accepted quantities measured as prescribed in subsection 414.4, shall be paid for at the Contract square meter price for Forms which price and payment shall be full compensation for designing, constructing and removing forms, all materials and accessories needed and for furnishing all labor equipment tools and incidentals necessary to complete the item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
414	Formworks and Falseworks	Square Meter



## ITEM 405 CONCRETE WORKS

### 405.1 Description

#### 405.1.1 Scope

This Item shall consist of furnishing, bending, placing and finishing concrete in all structures except pavements in accordance with this Specification and conforming to the lines, grades, and dimensions shown on the Plans. Concrete shall consist of a mixture of Portland Cement, fine aggregate, coarse aggregate, admixture when specified, and water mixed in the proportions specified or approved by the Engineer.

#### 405.1.2 Classes and Uses of Concrete

Class A and B of concrete mixture will be used in the construction.

The classes of concrete will generally be used as follows:

Class A - mixture to be used for the construction of power house.

Class B - mixture to be used for the construction of pedestal for mounting structure.

### 405.2 Material Requirements

#### 405.2.1 Portland Cement

It shall conform to all the requirements of Subsection 311.2.1.

#### 405.2.2 Fine Aggregate

It shall conform to all the requirements of Subsection 311.2.2.

#### 405.2.3 Coarse Aggregate

It shall conform all the requirements of Subsection 311.2.3 except that gradation shall conform to Table 405.1.

Table 405.1 - Grading Requirements for Coarse Aggregate

Sieve Standard Mm	Designation Alternate US Standard	Mass Percent Passing	
		Class A	Class B
63	2-1/2"		100
50	2"	100	95 - 100
37.5	1-1/2"	95 - 100	-
25	1"	-	35 - 70
19.0	3/4"	35 - 70	-
12.5	1/2"	-	10 - 30
9.5	3/8"	10 - 30	-
4.75	No. 4	0 - 5	0 - 5

\* The measured cement content shall be within plus (+) or minus (-) 2 mass percent of the design cement content.

#### 405.2.4 Water

It shall conform to the requirements of Subsection 311.2.4

#### 405.2.5 Reinforcing Steel

It shall conform to the requirements of Item 710, Reinforcing Steel and Wire Rope.

#### 405.2.6 Admixtures

Admixtures shall conform to the requirements of Subsection 311.2.7

#### 405.2.7 Curing Materials

Curing materials shall conform to the requirements of Subsection 311.2.8.

#### 405.3 Sampling and Testing of Structural Concrete

As work progresses, at least one (1) sample consisting of three (3) concrete cylinder test specimens, 150 x 300mm (6 x 12 inches), shall be taken from each seventy five (75) cubic meters of each class of concrete or fraction thereof placed each day.

Compliance with the requirements of this Section shall be determined in accordance with the following standard methods of AASHTO:

Sampling of fresh concrete	T 141
Weight per cubic metre and air content (gravi- Metric) of concrete	T 121
Sieve analysis of fine and coarse aggregates	T 27
Slump of Portland Cement Concrete	T 119
Specific gravity and absorption of fine aggregate	T 84
Tests for strength shall be made in accordance with the following:	
Making and curing concrete compressive and flexural tests specimens in the field	T 23
Compressive strength of molded concrete Cylinders	T 22

#### 405.4 Production Requirements

##### 405.4.1 Proportioning and Strength of Structural Concrete

The concrete materials shall be proportioned in accordance with the requirements for each class of concrete as specified in Table 405.2, using the absolute volume method as outlined in the American Concrete Institute (ACI) Standard 211.1. "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete". Other methods of proportioning may be employed in the mix design with prior approval of the Engineer. The mix shall either be 213 designed or approved by the Engineer. A change in the source of materials during the progress of work may necessitate a new mix design.

The strength requirements for each class of concrete shall be as specified in Table 405.2.

Table 405.2 - Composition and Strength of Concrete for Use in Structures

Class Of Concrete	Minimum Cement Content Per m <sup>3</sup> kg (bag**)	Maximum Water/Cement Ratio kg/kg	Consistency Range Slump mm (inch)	Designated Size of Coarse Aggregate Square Opening Std. mm	Minimum Compressive Strength of 150x300mm Concrete Cylinder Specimen at 28 days, MN/m <sup>2</sup> (psi)
A	360 (9 bags)	0.53	50 - 100 (2 - 4)	37.5 - 4.75 (1-1/2" - No. 4)	20.7 (3000)
B	320 (8 bags)	0.58	50 - 100 (2 - 4)	50 - 4.75 (2" - No. 4)	16.5 (2400)

\* The measured cement content shall be within plus or minus 2 mass percent of the design cement content.

\*\* Based on 40 kg/bag

##### 405.4.2 Consistency

Concrete shall have a consistency such that it will be workable in the required position. It shall be of such a consistency that it will flow around reinforcing steel but individual particles of the coarse aggregate when isolated shall show a coating of mortar containing its proportionate amount of sand. The consistency of concrete shall be gauged by the



ability of the equipment to properly place it and not by the difficulty in mixing and transporting. The quantity of mixing water shall be determined by the Engineer and shall not be varied without his consent. Concrete as dry as it is practical to place with the equipment specified shall be used.

#### 405.4.3 Mixing and Delivery

Concrete mixers may be of the revolving drum or the revolving blade type and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. The pick-up and throw-over blades of mixers shall be restored or replaced when any part or section is worn 20mm or more below the original height of the manufacturer's design. Mixers and agitators which have an accumulation of hard concrete or mortar shall not be used. When bulk cement is used and volume of the batch is 0.5m<sup>3</sup> or more, the scale and weigh hopper for Portland Cement shall be separate and distinct from the aggregate hopper or hoppers. The discharge mechanism of the bulk cement weigh hopper shall be interlocked against opening before the full amount of cement is in the hopper. The discharging mechanism shall also be interlocked against opening when the amount of cement in the hopper is underweight by more than one (1) mass percent or overweight by more than 3 mass percent of the amount specified. When the aggregate contains more water than the quantity necessary to produce a saturated surface dry condition, representative samples shall be taken and the moisture content determined for each kind of aggregate. The batch shall be so charged into the mixer that some water will enter in advance of cement and aggregate. All water shall be in the drum by the end of the first quarter of the specified mixing time. Cement shall be batched and charged into the mixer so that it will not result in loss of cement due to the effect of wind, or in accumulation of cement on surface of conveyors or hoppers, or in other conditions which reduce or vary the required quantity of cement in the concrete mixture. The entire content of a batch mixer shall be removed from the drum before materials for a succeeding batch are placed therein. The materials composing a batch except water shall be deposited simultaneously into the mixer. All concrete shall be mixed for a period of not less than 1-1/2 minutes after all materials, including water, are in the mixer. During the period of mixing, the mixer shall operate at the speed for which it has been designed. Mixers shall be operated with an automatic timing device that can be locked by the Engineer. The time device and discharge mechanics shall be so interlocked that during normal operation no part of the batch will be charged until the specified mixing time has elapsed. The first batch of concrete materials placed in the mixer shall contain a sufficient excess of cement, sand, and water to coat inside of the drum without reducing the required mortar content of the mix. When mixing is to cease for a period of one hour or more, the mixer shall be thoroughly cleaned.

#### 405.5 Method of Measurement

The quantity of structural concrete to be paid for will be the final quantity placed and accepted in the completed structure. No deduction will be made for the volume occupied by pipe less than 100mm (4 inches) in diameter or by reinforcing steel, anchors, conduits, weep holes or expansion joint materials.

#### 405.6 Basis of Payment

The accepted quantities, measured as prescribed in Section 405.5, shall be paid for at the contract unit price for each of the Pay Item listed below that is included in the Bill of Quantities. Payment shall constitute full compensation for furnishing, placing and finishing concrete including all labor, equipment, tools and incidentals necessary to complete the work prescribed in the item. Payment will be made under:

Pay Item Number	Description	Unit of Measurement
405 (1)	Structural Concrete, Class A	Cubic Meter
405 (2)	Structural Concrete, Class B	Cubic Meter

### SUBTOPIC REFERENCES FOR ITEM 405

#### ITEM 311 - PORTLAND CEMENT CONCRETE PAVEMENT

##### 311.1 Description

This item shall consist of pavement of Portland Cement Concrete, with or without reinforcement, constructed on the prepared base in accordance with this Specification and in conformity with lines, grades, thickness and typical cross-section shown on the Plans.

##### 311.2 Material Requirements

###### Portland Cement

It shall conform to the applicable requirements of Item 700, Hydraulic Cement. Only Type I Portland Cement shall be used unless otherwise provided for in the Special Provisions. Different brands or the same brands from different mills shall not be mixed nor shall they be used alternately unless the mix is approved by the Engineer. Cement which for any reason, has become partially set or which contains lumps of caked cement will be rejected. Cement salvaged from discarded or used bags shall not be used.

Samples of Cement shall be obtained in accordance with AASHTO T 127.

#### **ITEM 311.2.2 FINE AGGREGATE**

It shall consist of natural sand, stone screenings or other inert materials with similar characteristics, or combinations thereof, having hard, strong and durable particles. Fine aggregate from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of concrete without the approval of the Engineer. It shall not contain more than three (3) mass percent of material passing the 0.075 mm (No. 200 sieve) by washing nor more than one (1) mass percent each of clay lumps or shale. The use of beach sand will not be allowed without the approval of the Engineer. The fine aggregate shall be free from injurious amounts of organic impurities.

#### **ITEM 311.2.3 COARSE AGGREGATE**

It shall consist of crushed stone, gravel, blast furnace slag, or other approved inert materials of similar characteristics, or combinations thereof, having hard, strong, durable pieces and free from any adherent coatings. It shall not contain more than one (1) mass percent of material passing the 0.075 mm (No. 200) sieve, not more than 0.25 mass percent of clay lumps, nor more than 3.5 mass percent of soft fragments.

#### **ITEM 700 - HYDRAULIC CEMENT**

##### **700.1 Portland Cement**

Cement shall conform to the requirements of the following cited Specifications for the type specified or permitted.

Type	Specifications
Portland Cement	AASHTO M 85 (ASTM C 150)

When Types IV and V (AASHTO M 85), P and PA (AASHTO M 150) cements are used, proper recognition shall be given to the effects of slower strength gain on concrete proportioning and construction practices. Types S and SA cements will be permitted only when blended with Portland Cement in proportions approved by the Engineer. Unless otherwise permitted by the Engineer, the product of only one mill of any one brand and type of Portland Cement shall be used on the project. The Contractor shall provide suitable means of storing and protecting the cement against dampness. Cement which, for any reason, has become partially set or which contains lumps of caked cement will be rejected. Cement salvaged from discarded or used bags shall not be used.

#### **ITEM 1046 MASONRY WORKS**

##### **1046.1 Description**

This item shall consist of furnishing of all necessary materials, tools, equipment and labor necessary to complete the execution of the masonry works using Concrete Hollow Blocks and Louver Blocks as shown on plans and herein specified.

##### **1046.2 Material Requirements**

###### **1046.2.1 Hydraulic Cement**

Hydraulic cement shall conform to the applicable requirements of Item 700, Hydraulic Cement.

###### **1046.2.2 Aggregates**

Aggregates shall conform to the applicable requirements of Item 405, Structural Concrete.

###### **1046.2.3 Water**

Water shall conform to the applicable requirements of Item 714, Water.

###### **1046.2.4 Reinforcing Steel**

Reinforcing steel shall conform to the applicable requirements of Item 404 Reinforcing Steel.

###### **1046.2.5 Mortar**

Mortar shall consist of sand, cement and water conforming to the requirements of item 405, Structural Concrete, mixture must be Class B. Mixture must have sufficient water to obtain the required consistency.

###### **1046.2.6 Concrete Hollow Blocks**

Width, height and length of concrete hollow blocks is shown on detailed engineering plans.

###### **1046.2.6.1 Load-Bearing Concrete Hollow Blocks**



Load bearing concrete hollow blocks shall conform to the physical requirements as prescribed on the ASTM C 90, Standard Specification for Load-bearing Concrete Masonry Unit.

### 1046.3 Construction Requirements

#### 1046.3.1 Mixing

Concrete shall be mixed well using the proportion specified by the Engineer. mixing shall be done, using one bagger mixer. Mix aggregate and cement until the color is uniform. Spread the mixture out, sprinkle water over the surface and mix. Continue with this process until the right amount of water has been mixed in. Mixture shall be free from impurities such as dirt and grass.

#### 1046.3.2 Installation

All masonry shall be laid true to line, level and neat in accordance with the Plans. Units shall be cut accurately to fit all openings and all holes shall be neatly patched. Masonry unit shall be sound, dry, clean and free from cracks when placed in the structure. Where masonry units cutting is necessary, all cuts shall be neat and true to line. Units shall be placed while the mortar is soft and plastic. Any unit disturbed to the extent that the initial bond is broken after initial positioning shall be removed and re-laid in fresh mortar. Mortar should not be spread too far ahead of units, as it will stiffen and lose plasticity, especially in hot weather. Mortar that has stiffened should not be used. ASTM C 270 requires that mortar to be used within 2 ½ hours of initial mixing.

#### 1046.3.3 Reinforcement for Concrete Hollow Blocks

Reinforcement shall be done in accordance with the structural plans as to size, spacing and other requirements of Item 404, Reinforcing Steel.

#### 1046.3.4 Finish and Appearance

All units shall be sound and free from cracks or other defects that interfere with the proper placement of the unit or significantly impair the strength or permanence of the construction. Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall not show chips or cracks, not otherwise permitted, other imperfections when viewed from a distance of not less than 6.1m under diffused lighting.

#### 1046.3.4 Storage and Handling of Masonry Works

The blocks shall be stored in such a way as to avoid contact with moisture at site. They shall be stock-piled on planks or other supports free from contact with ground and covered to protect against wetting. The block shall be handled with care and damaged units shall be rejected.

#### 1046.4 Method of Measurement

The work to be paid for under this Item shall be the number of square meters of masonry units that are satisfactorily accepted and completed.

#### 1046.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 1046.4, Method of Measurement shall be paid for at the contract unit price for masonry works which price and payment shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1046	Masonry Works	Square Meter

### ITEM 1027 CEMENT PLASTER

#### 1027.1 Description

This Item shall consist of furnishing all cement plaster materials, labor, tools and equipment required in undertaking cement plaster finish as shown on the Plans and in accordance with this Specification. Thickness of plaster is 16mm.

#### 1027.2 Material Requirements

##### 1027.2.1 Cement

Portland cement shall conform with the requirements as defined in Item 700, Hydraulic Cement.

### 1027.2.3 Fine Aggregates

Fine aggregates shall be clean, washed sharp river sand and free from dirt, clay, organic matter or other deleterious substances. Sand derived from crushed gravel or stone may be used with the Engineer's approval but in no case shall such sand be derived from stone unsuitable for use as coarse aggregates.

### 1027.3 Construction Requirements

#### 1027.3.1 Mixture

Finish coat shall be pure Portland Cement properly graded conforming to the requirements of Item 700, Hydraulic Cement and mixed with water to approved consistency and plasticity.

#### 1027.3.2 Surface Preparation

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.

#### 1027.3.3 Application

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. 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, 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.

### 1027.4 Method of Measurement

All cement plaster finish shall be measured in square meters or part thereof for work actually completed in the building.

### 1027.5 Basis of Payment

The work quantified and determined as provided in the Bill of Quantities shall be paid for at the Contract Unit Price which price constitutes full compensation including labor, materials, tools and equipment and incidentals necessary to complete this Item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1027	Cement Plaster Finish	Square Meter

## ITEM 1006

### PRE-FABRICATED DOOR

#### 1006.1 Description

This Item shall consist of furnishing and installing all fabricated steel doors and frames equipped with fixing accessories and locking devices in accordance with the Plans and/or shop drawings and as herein specified.

#### 1006.2 Material Requirements

The materials used shall conform to the specifications shown on the detailed engineering drawing.

Materials to be used for the fabrication of door must be brand new. Fabricated door must be made up of 38mm x 38mm x 4mm angle bar for framing, 0.551mm plain G.I sheet, 10 mm plain reinforcing steel bars and provision of fabricated barrel bolt. Materials must be painted with epoxy primer.

#### 1006.2.1 Anchors and Fasteners

Anchors shall be steel, zinc coated or coated or painted with rust inhibitive paint, of sizes, shapes and design per manufacturer's standards.

Floor anchors shall not be lighter than gauge 18, with exception of jamb anchors for installing door frames in metal latch and plaster assemblies which shall be minimum of gauge 16 and shall not extend no more than 20 mm out of the back of the jamb.

### 1006.3 Construction Requirements



### 1006.3.1 Fabrication

Corner joints of frames shall be mitered and welded conforming to manufacturer's standard manual for metal doors. All contact edges be closed tight. Welds on exposed surface shall be ground smooth and shall be neat in appearance. Joints for knock-down type frame corners shall be designed for simple field assembly of header to jamb members by concealed tenon, splice plates, or other type concealed in interlocking joint that will produce square and rigid corners. Joints shall be securely locked in place during erection and the alignment of adjoining members shall be maintained. All bolted connections shall be provided with lock units.

### 1006.3.2 Shop Finish

All steel doors, frames and louvers shall be cleaned thoroughly, phosphate-treated to assure maximum paint adherence and prime finish, in accordance with the following operations:  
1. After fabrication, grease and dirt shall be removed by a hot alkali solution and rinsed with hot water. The cleaning, phosphate, dipping or spraying of shop primer and even drying shall be done on a continuous operation in the factory.

### 1006.3.3 Installation

Steel doors, frames shall be set plumb and true in 'The joint between frame and masonry shall be carefully contacts between door/frame and adjacent steel shall be sealed with mastic.

### 1006.3.4 Wall Anchors

A minimum of three anchors shall be provided for each jamb. Anchors shall be located opposite the top and bottom hinges and midway between top and bottom anchors. Anchors for fastening frames to masonry shall be adjustable, and perforated and shall extend not less than 200 mm into masonry. Anchors for fastening frames to metal shall be welded to metal. Anchors for fastening frames to previously placed concrete or masonry shall be secured to existing construction with expansion bolts. Frames shall be fastened securely with anchors. Anchors for fastening frames to partitions of plaster on metal lathe shall be secured firmly to back of frames that shall receive the latch. Adjustable strut anchors shall be provided on each side of frame for fastening to the structural members of the partition and of the ceiling framing above. The size and type of strut anchors shall be as recommended by the metal door manufacturer.

### 1006.3.5 Floor Anchors

Floor anchors shall be provided at the bottom of each jamb member, anchors shall be fixed/ adjustable and drilled for 10mm diameter anchor bolts. Where floor fill occurs, the bottom of frames shall terminate at the indicated finished floor levels and shall be supported by adjustable extension clips resting on and anchored to the structural slab.

### 1006.3.6 Hardware

Side bronze butts for side hung doors, overhead pocket hardware for track and roller types and locksets shall be suitable for the service required and subject to the approval of the Engineer and as provided in Item 1004, Hardware.

### 1006.4 Method of Measurement

Steel doors, frames, accessories and hardware shall be measured in lot as shown on the Plans. A set shall consist of metal door, jambs, anchors, hardware and fabricated bolt barrel.

### 1006.5 Basis of Payment

The lump sum for every steel door installed ready for service shall be the basis of payment based on the unit bid or contract unit price.  
Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1006	Pre-fabricated door	Lot

## ITEM 1601 BACKFILL

### 1601.1 Description

This item shall consist of all operations required to replace excavated and unsuitable materials to fill up to grade in accordance with the approved Plans and Specifications.

### 1601.2 Material Requirements

The selected materials shall be free from grass, roots, brush, or other vegetation, or rocks having maximum dimension larger than 150 mm.

#### **1601.3 Construction Requirements**

Backfill materials shall be laid in horizontal layers, not more than 200 mm in thickness and compacted to 100 percent of maximum density and to be carried to the level of the surrounding ground or to the lines and grades as shown on the drawings.

#### **1601.4 Method of Measurement**

The quantity of backfill and fill materials to be paid for under this item shall be the volume which were actually placed and accepted and computed by the average end-area multiplied by total length.

#### **1601.5 Basis of Payment**

The accepted quantities, measured as prescribed in Section 1601.4, shall be paid for at the Contract unit price for each of the Pay Items listed below that is included in the Bill of Quantities. The payment shall continue full compensation for placing and compacting all materials including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this item.

Payment will be made under:

Pay Item Number	Description	Unit of Measurement
1601	Backfill	Cubic Meter

### **III. MOUNTING STRUCTURES, SOLAR MODULES, INVERTERS & CONTROLLER**

803 STRUCTURE EXCAVATION (Refer to Item II, 803- Pump House)

1707 GRAVEL BEDDING (Refer to Item II, 803- Pump House)

404 REINFORCING STEEL BARS (Refer to Item II, 404- Solar Pump/Array/Mounting Structure)

414 FORMWORKS (Refer to Item II, 414 Pump House)

405 CONCRETE WORKS (Refer to Item II, 405 Pump House)

**SPL4- Solar Power Module Mounting Structures**

**ITEM 403- Storage Tank Metal Frame**

**METAL STRUCTURE**

**(Solar Power Module Mounting Structures and Storage Tank Metal Frame)**

#### **403.1 Description**

This work shall consist of steel structures and the steel structure portions of composite structures, constructed in reasonably close conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer. The work will include the furnishing, fabricating, hauling, erecting, welding and painting of structural metals called for in the Special Provision or shown on the Plans. Structural metals will include structural steel, rivet, welding, special and alloy steels, steel forgings and castings and iron castings. This work will also include any incidental metal construction not otherwise provided for, all in accordance with these Specifications, Plans and Special Provisions.

#### **403.2 Material Requirements**

Materials shall meet the requirements of Item 712, Structural Metal; Item 409, Welded Structural Steel, and Item 409, Welded Structural Steel; and Item 709, Paints. All materials shall be brand new and free from fractures/defects

1. Post and Frames and Other Accessories for solar power mounting structures

- a. Posts

Posts shall be made of 50.8 mm - Schedule 40 Galvanize Iron Pipe, embedded into the pedestal as shown on Plans.



b. Frames  
Support frames shall be 100mm x 50mm x 3mm C-Channel and 50mm x 50mm x 5mm Angle Bar placed as shown on plans.

2. Storage Tank Metal Frame

a. Posts  
Post shall be made of 102 mm GI pipe Schedule 40 embedded into the pedestal as shown on plans.

b. Support frames  
Support shall be made of 102mm G.I pipe schedule 40 and 50mm x 50mm x 6mm, 25mm x 25mm x 6mm and 25mm x 25mm 5mm angle bars placed as shown on plans.

3. Painting

All exposed steel materials must be painted with epoxy primer.

**403.3 Construction Requirements**

**403.3.1 Fabrication**

These Specifications apply to riveted, bolted and welded construction. Workmanship and finish shall be in accordance with the best general practice. Portions of the work exposed to view shall be finished neatly. Structural material, either plain or fabricated, shall be stored above the ground upon platforms, skids or other supports. It shall be kept free from dirt, grease or other foreign matter, and shall be protected as far as practicable from corrosion.

**403.3.2 Welding**

Shall conform to the applicable requirements of Item 409, Welded Structural Steel.

**403.3.3 Erection**

1. General

The Contractor shall provide the falsework and all tools, machinery and appliances, necessary for the expeditious handling of the work and shall erect the metal work, remove the temporary construction, and do all work necessary to complete the structure as required by the Contract and in accordance with the Plans and these Specifications.

**403.3.4 Handling and Storing Materials**

Materials to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. If the Contract is for erection only, the Contractor shall check the material turned over to him against the shipping lists and report promptly in writing any shortage or damage discovered. He shall be responsible for the loss of any material while in his care, or for any damage caused to it after being received by him.

**403.3.5 Method and Equipment**

Before starting the work of erection, the Contractor shall inform the Engineer fully as to the method of erection he proposes to follow, and the amount and character of equipment he proposes to use, which shall be subject to the approval of the Engineer. The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety of his method or equipment or from carrying out the work in full accordance with the Plans and Specifications. No work shall be done until such approval by the Engineer has been obtained.

**403.3.6 Assembling Steel**

The parts shall be accurately assembled as shown on the working drawings and any match marks shall be followed. The material shall be carefully handled so that no parts will be bent, broken or otherwise damaged. Hammering which will injure or distort the members shall not be done. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.

**403.3.7 Painting**

All surfaces of new structural steel shall be cleaned before applying Epoxy Primer.

**403.4 Basis of Payment**

**403.4.1 Structural Steel**

Lump Sum/ lot/ square meters  
When the Bill of Quantities calls for lump sum/lot/square meters price for "Structural Steel, furnished, fabricated and erected", the Item will be paid for at the contract lump sum price and payment shall be full compensation for furnishing, fabricating and erecting material and for all work herein before prescribed in connection therewith, including all labor, equipment, tools and incidentals necessary to complete the work. Payment will be made under:

Pay Item Number	Description	Unit of Measurement
403	Solar Power Module Mounting Structure	Lot
403	Storage Tank Metal frame	Lot

## **SPL 5 - SOLAR POWER MODULE**

### **1.1 Scope**

Work under this Item shall consist of furnishing, placing, fixing, aligning of solar modules required for the solar array included in the works.

### **1.2 Materials and Method of Construction**

Solar power module must be brand new. Total of 9900 WP Solar Power Module (minimum) 18 pieces Solar Modules at 550 WP or its equivalent. Modules must be manufactured in ISO 9001 - Certified Factories, must be CE marked and TUV Certification (IEC 61215). Cell type shall be mono-crystalline. Solar Power Modules shall be clamped properly to the Mounting structure. The installation of solar power module shall be in accordance with the approved Plans or agreed by the Project Engineer of the Department of Agriculture Western Visayas.

The number of panels may change based on the actual power of the pump used.

### **1.3 Warranty**

The Solar Power Modules shall have a minimum of Five (5) years warranty from the date of acceptance by the DA-WV.

### **1.4 Method of Measurement**

The accepted quantities of solar modules completed in place will be paid for at the contract in per unit as indicated on the Bid Schedule.

### **1.5 Basis of Payment**

Payment of works under this item shall be in Lump Sum of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Pay Item Number	Description	Unit of Measurement
SPL 5	Solar Power Module	lot

## **SPL 6 - INVERTER AND CONTROLLER**

### **2.1 Scope**

Work under this Item shall consist of furnishing, placing, fixing, aligning of inverter controller and other materials and devices needed to complete the item work of this project.

### **2.2 Materials and Method of Construction**

The Inverter Controller shall be aligned, fixed on the pump/power house wall as specified by the Project Engineer. The inverter controller shall have the minimum specifications as follows:

1. Brand new;
2. (7.5) kW minimum inverter with system monitoring;
3. Pump is running;
4. Input power and alarm indication for, over voltage, over temperature and overload;
5. Maximum Power Point Tracking (MPPT);



- 6.AC/DC compatibility;
- 7.Over current protection;
- 8.No load protection
- 9.Operating History Memory;
10. Enclosure Class IP66;
11. Sinewave filter;
12. RS485/Ethernet capability
13. Motor Protection

The built-in electronic unit must protect motor in case of as standard, without additional equipment)

- a. Over and under voltage;
- b. Overload

#### Motor Protection

The built-in electronic unit must

### 2.3 Warranty

The Inverter shall have a minimum of Five (5) years warranty from the date of acceptance by the DA-WV.

### 2.4 Method of Measurement

The accepted quantities of inverter controller completed in place will be paid for at the contract in per set as indicated on the Bid Schedule.

### 2.5 Basis of Payment

Payment of works under this item shall be in units of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Pay Item Number	Description	Unit of Measurement
SPL 6	Inverter and Controller	unit

## SPL 6 - SOLAR PUMP (SURFACE)

### 3.1 Scope

Work under this Item shall consist of installation, placing, fixing, aligning of solar pumps, electrical wirings/cables and other materials and devices needed to complete the item work of this project. The whole systems of SPIS shall be tested by the AMTEC prior to turn-over and acceptance by the recipient or DA-WV. All expenses incurred during testing shall at the expense of the contractor.

### 3.2 Materials and Method of Construction

The solar pumps shall be installed, aligned, fixed on the pump/power house as specified in the plans and as directed by the Project Engineer. The solar pumps (surface pumps) should have the minimum specifications as follows:

- 1.Brand new;
- 2.Five and five tenths (5.5) Kw Electric Motor Surface Pump, Coupled (minimum);
3. Pump Specifications;

- a. 3 inches surface pump coupled into the electric motor
- b. Capacity of 32.86 cubic meter per hour
- c. Total dynamic head of 30.406 meters (minimum)
- d. Pump Efficiency of 78 percent

#### 4.Electric Motor Specifications

- a. 5.5Kw coupled into the pump
- b. Built-in Frequency converter
- c. Can be supplied by either DC or AC voltage source
- d. Enclosure Class: IP 68

The design system for the 5.5Kw pump is correspond to the minimum Watt Peak (WP) of Solar Power Module. Any design higher than these specifications require additional WP and inverter capacity in correspond to the minimum

Electrical cables/wirings must be free from any defects. Wires and cables shall be of approved type meeting all the requirements of the Philippine Electrical Code bearing the PSA mark. All wires shall be copper, soft drawn and annealed, smooth and cylindrical form and shall be centrally located inside the insulation. All wiring devices shall be standard products of reputable electrical manufacturers.

### 3.3 Warranty

The Electric Motor Surface Pump shall have a minimum of Five (5) years warranty from the date of acceptance by the DA-WV.

### 3.4 Method of Measurement

The accepted quantities of solar pumps completed in place will be paid for at the contract in per set as indicated on the Bid Schedule.

### 3.5 Basis of Payment

Payment of works under this item shall be in set of assembly of works installed as shown in the Bid Proposal of the Contractor which price shall constitute the cost of labor, equipment and all other incidentals incurred by the Contractor in the fabrication, delivery and installation of these items of works.

Pay Item Number	Description	Unit of Measurement
SPL7	Solar Pump (Surface)	unit

## IV. ELEVATED TANK

803 STRUCTURE EXCAVATION (Refer to Item II, 803- Pump House)

404 REINFORCING STEEL BARS (Refer to Item II, 404- Pump House)

405 CONCRETE WORKS (Refer to Item II, 405 Pump House)

403 STORAGE TANK METAL FRAME (Refer to Item III, 403 Mounting Structures, Solar Modules, Inverters and Controller)

## ITEM 1201 (8) INSTALLATION OF PIPELINE & WATER TANK (PIPES, FITTINGS AND OTHER ACCESSORIES)

### Description

This item shall consist of furnishing and installation of all pipes, fittings, closure pieces, bolts, nuts, gaskets, jointings materials, flanges and appurtenances as shown and specified on the drawings, and as required by the designated assigned Engineer for a complete and workable piping system.

### 1602.2 Material Requirements

Materials shall be in accordance with the approved Plans. Materials used must be brand new and in good condition. All pipes shall be G.I pipe 3 inches Schedule 40 with necessary fittings for proper connection.

### 1602.3 Construction Requirements

After a section of a pipe has been lowered into the prepared trench and immediately before joining the pipe, the ends of the pipe to be joined shall be cleaned, and the rubber gasket lubricated, with a vegetable compound soap all in accordance with the pipe manufacturer's instructions. Assembly of the pipe length shall be in accordance with the recommendation of the manufacturer of the type of the joint used. All special tools and appliances required for joining



the pipe shall be provided by the Contractor. When cutting or machining of the pipe is necessary, only tools and methods recommended by the pipe manufacturer and approved by the Engineer shall be employed.

#### 1602.4 Method of Measurement

The quantity to be paid under this item shall be in lump sum place completed and accepted in this item.

#### 1602.5 Basis of Payment

The quantity determined as provided above, shall be paid for or the contract price for pipe actually installed and payment shall constitute full compensation for furnishing and installation of all pipes, fittings, closure pieces, bolts, nuts, gaskets and jointing materials and for all labor, equipment, tools and incidentals necessary to complete the work.

Pay Item Number	Description	Unit of Measurement
1602	Pipes, Fittings and other Accessories	Lot

### ITEM 1603 INSTALLATION OF VALVES AND TANK

#### 1603.1 Description

This item shall consist of the installation of valves and water tank in accordance with the plans/drawings or as directed by the Engineer.

#### 1603.2 Material Requirement

All materials shall conform to AWWA and ISO specification for valve installation. Valves used are the following:  
2-1/2" diameter Gate Valve with female threaded to be attached to the distribution pipe; and

Storage Tank shall be a 1-2000 liters Dark Color Vertical Polyethylene Tank, as shown on the plans. It must be brand new.

#### 1603.3 Construction Requirements

Valves shall be installed as specified herein and as shown on the drawings. All valves shall be new and of current manufacture.

#### 1603.4 Method of Measurement

The work to be paid item shall be the installation and the number of lot/units installed.

#### 1603.5 Basis of Payment

Pay Item Number	Description	Unit of Measurement
	2-1/2 in diameter GI Ball valve- Female threaded	lot
	2000 liters Dark Color Vertical Polyethylene Tank	Unit

#### DELIVERY PIPE (3"Ø G.I. PIPE, SCH. 40), FITTINGS, AND OTHER ACCESSORIES

1. Delivery Pipe: 3" dia. G.I. Pipe, Sch. 40
2. Fittings (Couplings, Elbows): G.I. Pipe, Sch. 40

#### DISTRIBUTION PIPE (3"Ø HDPE, SDR 13.6), FITTINGS, AND OTHER ACCESSORIES

1. Delivery Pipe: 2-1/2" dia. HDPE, SDR 13.6
2. Fittings (Couplings, Elbows): G.I. Pipe, Sch. 40

References:

- DPWH – Standard Specifications for Public Works Structures Volume III  
(Buildings, Ports and Harbors, Flood Control and Drainage Structures and Water Supply Systems)
- DPWH – Standard Specifications for Public Works and Highways Volume II  
(Highways, Bridges and Airports)