

SECTION 00989 - PHOTOVOLTAIC EQUIPMENT INSTALLATION

(Follow all instructions and make all edits with “Track Changes” turned on. This Section is not published in the Oregon Standard. If there are no instructions [purple text] above a subsection, paragraph, sentence, or bullet, then include it in the Project, unless the item(s) that are included in the subsection, paragraph, sentence, or bullet are not required on the Project and then they should be deleted. In general do not re-number or re-letter subsections when item(s) are deleted. Delete all purple text before preparing the final document.)

The Work covered under this Section is diverse and this boilerplate may not include Specifications for all the Work or ITS elements on the Project. Modify as necessary by adding, deleting, or revising language for the specific Project requirements. Modifications to this Section, other than deleting language not required, will require ODOT Technical Resource and State Specifications Engineer approval.)

Section 00989, ~~which~~ is not a Standard Specification and, is included in this Project by Special Provision.

Description

(In the following subsection .00, delete the language in purple parentheses that does not apply and delete the purple parentheses.)

00989.00 Scope - In addition to requirements of Section (00960,) (and) (00985) install ITS photovoltaic systems as shown or specified.

00989.01 Regulations, Standards, and Codes - Comply with the following standards where applicable:

- Underwriters Laboratories (UL)
 - 50-2015 - Enclosures for Electrical Equipment, Non-Environmental Considerations
 - 83-2017 - Thermoplastic-Insulated Wires and Cables
 - 498-2016 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
 - 508-2018 – Standard for Industrial Control Equipment
 - 508A-2018 - Standard for Industrial Control Panels
 - 1059-2001 – Standard for terminal
 - 1561-2011 - Standard for Dry-Type General Purpose and Power Transformers
 - 1581-2001 - Reference Standard for Electrical Wires, Cables, and Flexible Cords
 - 1685-2015 - Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
 - 1703-2002 - Standard for Flat-Plate Photovoltaic Modules and Panels

- 1741-2010 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

(In the following subsection .02, delete the language that does not apply.)

00989.02 Submittals - Submit according to 00150.37, at least 30 Calendar Days after execution of the Contract, the following:

- Photovoltaic Modules according to 00989.10
- Module Mounting Bracket according to 00989.11
- Photovoltaic Module Combiner Cabinet according to 00989.12
- DC Disconnect according to 00989.13
- DC Circuit Breakers according to 00989.14
- Photovoltaic Charge Controller according to 00989.15
- DC Load Controller according to 00989.16
- Batteries according to 00989.17
- Battery Enclosure according to 00989.18
- Controller cabinet according to 00989.19

Include the manufacturer's name, model numbers, catalog sheets and other descriptive literature of proposed materials. Provide the catalog sheets and literature including technical data, physical properties and operational description in sufficient detail to demonstrate the equipment meets these specifications.

Materials

(Use the following subsection .10 when photovoltaic modules are required. Fill in the appropriate blanks.)

00989.10 Photovoltaic Modules - Furnish photovoltaic modules with cables that meet the following requirements:

Module Characteristic Table	
Maximum Power:	___ Watts or greater
Maximum Voltage:	___ Volts or greater
Maximum Power Point Current:	___ Amps or greater
Open Circuit Voltage:	___ Volts or less
Short Circuit Current:	___ Amps or less
Maximum System Voltage:	___ V
Length:	___ inches maximum
Width:	___ inches maximum
Weight:	___ lbs. maximum
Wind Load Rating:	___ mph minimum

Furnish photovoltaic modules with a minimum combined total of ____ watts at rated maximum power that are UL 1703 listed and be constructed using an anodized aluminum or similar frame.

(Use the following subsection .11 when module mounting brackets are required. Fill in the appropriate blanks.)

00989.11 Module Mounting Bracket - Furnish mounting hardware to mount the photovoltaic modules on the side-of-pole. Furnish bracket sized to fit the modules selected and mount to the metal pole selected. Mount the modules as ____ arrays, with ____ panels on the first array, and ____ panels on the second array. Furnish stainless steel nuts, bolts, washers, and band clamps. The mounting assembly is to be rated for wind loads up to 120 mph and be constructed from anodized aluminum, powder coated aluminum, 304 stainless steel, or 316 stainless steel.

(Use the following subsection .12 when Photovoltaic module combiner cabinet is required.)

00989.12 Photovoltaic Module Combiner Cabinet - Furnish NEMA Type 3R rated, UL 1741 listed enclosures with terminals to combine the photovoltaic modules into one circuit. Protect each photovoltaic module input circuit with an overcurrent protection device sized as shown. Furnish cabinet constructed from anodized aluminum, powder coated aluminum, 304 stainless steel, or 316 stainless steel.

(Use the following subsection .13, when DC disconnects are required.)

00989.13 DC Disconnect - Furnish DC Disconnect that is UL 508 listed for overcurrent protection and has a means for disconnecting the photovoltaic and battery system's circuits. Include DC circuit breakers for protecting the photovoltaic, battery, and load distribution circuits, circuit breaker sizing as shown. ~~Provide~~Furnish a DC bonding block for grounding.

(Use the following subsection .14, when DC circuit breakers are required.)

00989.14 DC Circuit Breakers - Furnish DC circuit breakers rated for 150V DC minimum, UL 489 listed, and DIN rail mounted. Size circuit breakers and label as shown.

(Use the following subsection .15, when photovoltaic charge controllers are required. Fill in the appropriate blanks.)

00989.15 Photovoltaic Charge Controller - Furnish a photovoltaic charge controller that meets the following requirements:

Charge Controller Characteristic Table	
Controller Charge Type	Maximum Power Point Tracking
Voltage Step Down Capability	Convert photovoltaic module voltage selected to 12 VDC nominal for battery charging
Maximum Output Current:	__A DC continuous
Charging Regulation	4 stages minimum
Short Circuit Protection:	Electronic with auto-reset
LCD Meter Module:	Photovoltaic Input Voltage
	Photovoltaic Input Current
	Battery Voltage
	Battery Charging Current
	Cumulative amp/watt hours
Operating Temperature Range:	- __ to __ degrees F
Mounting:	Module/Wall
Wire Size:	Capable of accepting __ AWG conductors
Accepted Battery Type:	Sealed AGM
Temperature Compensation:	Provide <u>Furnish</u> an external battery temperature sensor to the charge control set points.
Listing	UL 1741

(Use the following subsection .16, when DC load controller is required. Fill in the appropriate blanks.)

00989.16 DC Load Controller - Furnish a DC load controller that meets the following requirements:

Load Controller Characteristic Table	
Controller Charge Type	Pulse Width Modulation
Voltage Configuration:	12V DC
Minimum Charging/Load Current:	__A DC continuous
Charge Regulation:	Solid State
Short Circuit Protection:	Electronic with auto-reset
LCD Meter Module:	Battery Voltage
	Load Current
	Cumulative amp/watt hours
Temperature Range:	-40 to 113 degrees F
Mounting:	Module/Wall
Wire Size:	Capable of accepting __ AWG conductors
Load Control:	Low voltage disconnect and reconnect
Listing	UL 1741

(Use the following subsection .17, when batteries are required. Fill in the appropriate blanks.)

00989.17 Batteries - Furnish a system of batteries that meets the following requirements:

Battery Characteristic Table	
Voltage:	6V DC or 12V DC, 6V DC batteries may be used to form a 12V DC base system.
Type:	Absorbed glass mat (AGM) sealed deep cycle lead acid
24 Hour Rate:	___ amp-hours minimum
Designed Maintenance Life:	_ years
Length:	_ inches maximum
Width:	_ inches maximum
Height:	_ inches maximum
Weight:	_ lbs. maximum

~~Furnish~~ Provide a minimum of ___ amp-hours at rated capacity. This includes ___ Days autonomy factoring in temperature de-rating and discharge limit. Include all clamps, connectors, wiring, and other Incidental Materials as needed to wire and secure batteries.

(Use the following subsection .18, when battery enclosures are required.)

00989.18 Battery Enclosure - Furnish a battery enclosure that is UL 50 listed, Type 3R (ventilated), and be constructed from anodized aluminum, powder coated aluminum, 304 stainless steel, or 316 stainless steel. Place vents near the top of the enclosure to prevent the buildup of gases. Size enclosure to fit all of the batteries required for the system plus 2 additional batteries of the same size for future expansion. Include a 2- or 3-point locking mechanism with an integrated interchangeable lock core.

Furnish racks or trays that are rigid metal, designed to support the load, treated to be resistant to deteriorating action by the electrolyte, and included with non-conducting members directly supporting the cells.

The battery trays are frames of nonconductive material and constructed or treated so as to be resistant to deteriorating action by the electrolyte.

Furnish battery enclosure that is ground mounted.

(Use the following subsection .19, when controller cabinets are required.)

00989.19 Controller Cabinet - Furnish enclosure constructed from 14-gauge Type 304 or 316 stainless steel, UL 50 listed, Type 3R ventilated, and with a #4 brushed finish. Remove all sharp edges. Include door with continuous hinge, seamless gasket that is liquid-tight, and padlockable. Enclosure dimensions are location specific and shown on plans.

Construction

00989.40 Installation - Install the Equipment as specified, shown, and according to the manufacturer's instructions. Ground the Photovoltaic Power System according to Article 690 of NFPA 70, the National Electrical Code.

00989.41 Photovoltaic Component Identification and Marking - Photovoltaic modules, module combiner, DC disconnect, circuit breakers, charge controller, load controller, batteries, battery enclosure, and wiring are to be marked according to Article 690 of NFPA 70, the National Electrical Code.

Measurement

00989.80 Measurement - No measurement of quantities will be made for Work performed under this Section.

Payment

(Use one of the following two options for subsection .90)

[Option 1. Use this subsection .90 if site work needs to be broken out by Pay Items]

00989.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

(Add additional Pay Item(s) as required for the Schedule of Items.)

Pay Item	Unit of Measurement
(a) Photovoltaic Equipment Installation, Site _____	 Lump Sum
(b) Photovoltaic Equipment Installation, Site _____	 Lump Sum

Payment will be payment in full for furnishing and placing all Materials, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for:

- **R**Required submittals and documentation
- **A**Assistance for commissioning Equipment and systems

[End Option 1]

[Option 2. Use this subsection .90 if site work does NOT need to be broken out per site.]

00989.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract lump sum amount for the item "Photovoltaic Equipment Installation".

Payment will be payment in full for furnishing and placing all Materials, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for:

- **R**Required submittals and documentation

-  Assistance for commissioning Equipment and systems

[End Option 2]