

Common Course Numbering System

Your current Institution is CCCS

Searching Current Courses For Summer 2015

Course: ENY 121

Title: Solar Photovoltaic Components

Long Title: Solar Photovoltaic Components

Course Description: Reinforces basic safety principles and provides detailed knowledge of photovoltaic components. Also covered is an overview of site analysis and special purpose tools. Upon successful conclusion of this course the student will be able to select proper components for a photovoltaic system based on regulatory codes and standards and individual component specifications.

Min Credit: 3

Max Credit:

Course Notes: Entered new course 3/9/09 s@
Origin Notes: CCA

STANDARD COMPETENCIES:

- I. Internalize relevant safety procedures.
- II. Communicate effectively with other solar professionals.
- III. Understand collector specifications and how they relate to assembling a larger array.
- IV. Understand a variety of mounting strategies for optimum photovoltaic array placement.
- V. Select the proper inverter/charge controller for a given photovoltaic system.
- VI. Select the proper batteries for a given photovoltaic system.
- VII. Select the proper disconnects/breakers/fuses/ground fault protection/system protection for a given photovoltaic system.
- VIII. Select the proper wiring for a given photovoltaic system.
- IX. Understand the use of site analysis and special purpose photovoltaic tools.
- X. Comprehend the theory of system operations by successfully demonstrating troubleshooting techniques for simulated problems.
- XI. Demonstrate mastery of these competencies by incorporating them with previous course work to synthesize a complete on-paper photovoltaic system

TOPICAL OUTLINE:

- I. Safety Review
 - A. Electrical

- B. Batteries
- C. Ladders/Harnesses/Climbing/Rigging/Scaffolding
- D. Tools
- E. Other

II. System Overview

- A. Grid-tied
- B. Grid-tied with Battery Backup
- C. DC Only
- D. Multiple Power Sources
- E. Other

III. Photovoltaic Collectors

- A. Thin Film Collector
- B. Crystalline Collector
 - 1. Mono-crystalline Silicon
 - 2. Multi-crystalline Silicon
 - 3. String Ribbon Silicon
 - 4. Other
- C. Ratings
 - 1. Maximum Power (P_{max})
 - 2. Open Circuit Voltage (V_{oc})
 - 3. Short Circuit Current (I_{sc})
 - 4. Operating Voltage (V_{pmax})
 - 5. Current at P_{max} (I_{pmax})
 - 6. Temperature Coefficient Effect
 - a. Voltage
 - b. Current
 - c. Power
 - 7. Panel Size
 - 8. Panel Weight
 - 9. Panel Cost/Watt Produced
 - 10. Other
- D. Manufacturers
 - 1. Conventional
 - 2. Dual Sided (Bifacial) Collectors
 - 3. High Power Modules
 - 4. Other

E. Other

IV. Racking/Mounting/Tracking

A. Roofs

1. Special Considerations
 - a. Pitch
 - b. Barrel Vault
2. Asphalt Shingle
3. Shake
4. Tile
5. Flat
6. Standing Seam Metal
7. Roof Penetration Methods
 - a. Direct Mount
 - b. Stand Off Mount
 - c. Other
8. Other

B. Top-Down Rail Mount or Flush Mount

C. Tilt-Up Mount or Awning Mount

1. Fixed Mount
2. Adjustable Mount

D. Ballast Mount

E. Ground Mount

1. Single Pole
 - a. Fixed Mount
 - b. Tracking Mount
2. Multi-base Array

F. Building-Integrated Photovoltaic (BIPV) Systems

G. Other

V. Inverters/Charge Controllers

A. Distributed Inverters

1. AC Considerations
2. Electrician Services
3. Other

B. Monolithic Inverter

1. Ratings
 - a. Operating Voltage Range

- b. Maximum Input Voltage
 - c. Maximum Watts
 - d. Location
 - e. Temperature
 - 2. Features
 - a. Remote/Online Monitoring
 - b. Combined DC/AC Disconnect
 - c. Internal Fusing
 - d. Ground Fault Protection/Indication
 - 3. Other
- C. Charge Controller
 - 1. Maximum Power Point Tracking (MPPT)
 - 2. Diversion Load
 - a. Resistance Heating

Air

Water

- b. Other
 - 3. Disconnect Feature
 - 4. Other
- D. Other

VI. Batteries

- A. Specifications
 - 1. Voltage
 - 2. Capacity (Ampere-Hours)
 - 3. Specific Gravity
 - 4. Temperature
- B. Charge
 - 1. Normal
 - 2. Float
 - 3. Equalizing
- C. Discharge
 - 1. Depth
 - 2. Rate
 - 3. Cycles
- D. Enclosures
 - 1. Containment

2. Ventilation

E. Other

VII. Disconnects/ Breakers/Fuses/Ground Fault Protection/System Protection

A. DC Disconnect

1. Rating

2. Location

3. Other

B. AC Disconnect

1. Rating

2. Location

3. Other

C. Combined DC/AC Disconnect

D. Over-current Protection

1. Breakers

a. DC

b. AC (Back-Feed Compatibility)

c. Location

d. Other

2. Fuses

a. DC

Single String

Multiple String

b. AC (Back-Feed Compatibility)

c. Other

E. Ground Faults

1. Required Ground Fault Protective Device (GFPD)

2. Back-feed Compatibility Issues

a. Ground Fault Circuit Interrupter (GFCI)

b. Arc Fault Circuit Interrupter (AFCI)

3. Other

F. System Protection

1. Surge Suppressor

2. Lighting Arrestor

3. Other

G. Other

VIII. Wiring/Grounding

- A. DC Wire
 - 1. Color Code
 - 2. Ampacity/Voltage Drop Calculations
 - 3. Insulation
 - 4. Installation Specifications
 - 5. Other
- B. AC Wire Sizing
 - 1. Color Code
 - 2. Ampacity/Voltage Drop Calculations
 - 3. Insulation
 - 4. Installation Specifications
 - 5. Other
- C. Grounding
 - 1. Equipment Grounding
 - 2. System Grounding
 - 3. Wire Sizing
 - 4. Bonding
 - 5. Components (Outdoor Rated)
 - a. Lugs
 - b. Clips
 - c. Screws
 - d. Other
 - 6. Other
- D. Other

IX. System Operation

- A. Theory of Operations
- B. Troubleshooting

X Site Analysis and Special Purpose Tools

- A. Solar Pathfinder
 - 1. Solar Window
 - 2. Shade Mitigation
- B. Magnetic Compass
 - 1. Declination
 - 2. Array Orientation
- C. Inclinator
 - 1. Roof Pitch

- 2. Array Pitch
- D. Roof Anchors (Personal Tie-off Points)
 - 1. Styles
 - 2. Capacity
- E. Pyranometer (Solar Irradiance)
- F. Hydrometer
 - 1. Cell Charge
 - 2. Temperature Compensation
- G. DC Cable Crimper
 - 1. Solarline 1 and 2 Style
 - 2. SolarLok Style
 - 3. Other
- H. Multimeter
 - 1. Volts
 - 2. Ohms
 - 3. Amps
- I. Other

Course Offered At:

Pueblo Community College PCC

RELEASE: 8.5.3

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