Test #3 Maintenance and Operations.

1. What are the four major maintenance steps for charge controllers?
	1. Visual check (connections, alarms, screen, cleanliness)
	2. Take measurements.
	3. Check settings.
	4. Is it performing as expected?
2. What two pieces of information is required for the maintenance person, along with the charge controller make and model to determine if it is compatible for the system.
	1. The PV input voltage and current
	2. The battery voltage and Ahr capacity
3. Charge controllers typically when they first see PV energy, start to charge battery at the bulk stage. How can this be forced?
	1. This can be forced by cycling the PV power.
4. What tool is a useful tool for checking the operation of the charge controller.
	1. A clip-on ammeter
5. When performing charge controller maintenance, the expected Soc range is fully charged to 50% Soc for normal operation. However, if it is below 20 Soc, there may be a normal reason. What might those reasons be? (Three listed)
	1. A normal reason would be if there has been a load that has drained the battery to this point.
	2. The reason could be a lack of sunlight.
	3. Also, the battery capacity has deteriorated. As older batteries lose capacity.
6. When performing charge controller maintenance, the expected Soc range is fully charged to 50% Soc for normal operation. However, if it is below 20 Soc, there may be an abnormal reason. What might those reasons be? (Four listed)
	1. If an over current supplying PV power or charge controller power to the batteries has operated.
	2. Bad connections in the charging system or failed cell in the battery.
	3. A wrong setting in the charge controller.
	4. Incorrect design criteria.
7. What are battery sensing wires, and what are they used for?
	1. The sense wires are used normally only when there is a long wire run between the controller and the battery.
	2. If there is a voltage drop between the charge controller and the battery, it will raise the controller output slightly to compensate.
8. How often is inverter maintenance usually required?
	1. Annually.
9. Inverter maintenance starts with a visual inspection of the cabinet that houses the inverter if present. What is being looked for?
	1. Check any air filters in the cabinet or on the inverter housing.
	2. Clean or replace, as necessary if readily accessible, otherwise wait to remove energy from the inverter.
	3. Verify the status of any and all indicators.
10. Inverter physical maintenance requires both the DC and AC disconnection means to be opened if present. Otherwise remove both DC and AC sources. Then what is performed? (Eight listed)
	1. Use DC voltmeter to verify the DC terminals are at a safe level before proceeding (below 30V).
	2. Check the torque of the terminals (AC and DC).
	3. The maintenance includes checking the torque of the mounting bolts.
	4. If there are cooling fins they shall be examined and cleaned, as necessary.
	5. Record the condition of the cooling fins.
	6. Dirt / dust and airborne contaminants are site specific and a record of these is required.
	7. If there is a cooling fan look for dirt and clean as required.
	8. Turn the cooling fan with your finger to check for stiffness.
11. To measure the performance of an inverter what are the major steps / values to be collected?
	1. Measured irradiance.
	2. Measured DC voltage in.
	3. Measured DC amperage into inverter.
	4. Measured AC voltage out.
	5. Measured AC amperage out.
12. What calculations are used to measure the performance of the inverter?
	1. Power into the inverter divided by the power out of the inverter.
13. If the inverter’s efficiency is lower than expected what might be the cause?
	1. Inverters will derate if their temperature is above the manufacturer’s specifications.
	2. Due to low irradiance or fluctuating irradiance?