Solar Flashers: How to draw up clear, concise specifications

by Joseph Wise

I always meet one or two people in my travels who tell me "...solar-powered traffic equipment does not work." When I inquire as to their experience with a solar-powered project, I discover the specifications were either too vague, incomplete, contradictory, non-existent or even worse, there was a failure to obtain supporting engineering documentation.

We continually receive confusing specs from DOT agencies around the country. When we call to clarify items, the bidding parties do not respond to the errors or contradictions which we flag. Our calls often go unanswered and addendums to the specs are not issued. As a vendor attempting to assist in the process, I am frustrated when solar power unnecessarily takes a bad rap. As taxpayers, this should disturb us all.

Solar-powered traffic systems are a viable, low-cost alternative to expensive hardwired installations. The scope of traffic applications has broadened from traffic counters to flashing beacons, to portable traffic signals. However, the baseline specifications for solar-powered systems remain consistent, i.e., three basic items:

1. Location - Specify the geographic location of the application site so respondents can provide accurate solar radiation data. For example, the State of Arizona is too general. The City of Flagstaff (in Arizona) would be more specific.

2. Load - Quantify the electrical load. A typical school zone flasher project may list either two 8-inch or 12-inch DC amber LED lamps, a time clock and a control circuit. The solar equipment provider usually furnishes these items and knows the power draw of each piece of equipment. You, the specifier, must identify the lamp configuration so the respondent can calculate the load's power draw.

A properly working solar-powered flasher system begins with a clear definition of the desired result.

3. Duty Cycle - The number of hours per day each piece of equipment in the load will be operated. For a school zone flasher this may break down to 2 to 4 hours per day for the lamps; for five school days with the controls being on continuously.

This critical information—location, load and duty cycle—enables the prospective vendor to submit an accurate sizing report. The accuracy of the sizing report sustains your quote and forms the basis of your warranty. Be certain to obtain a sizing report as this is the necessary proof you need that the equipment being offered will work correctly.

Details such as mounting the enclosure and solar array, type of door lock and days of battery autonomy should also be carefully itemized.

At this point, the agency overseeing the project may proceed to a public bid. Relying on input from potential bidders, the bidding agency will prepare a written specification to move the bid process forward.

Often the bidding agency combines information from a number of specifications into one document. When the specification is released it may be a hodgepodge of information spelling poor results for the project. To highlight these problems I have included a sampling of specs that have come across my desk in the last couple of years.

The Loose or Subject-to-Interpretation Specification

The following specification for school zone flashers came from a mid-Atlantic state:

All items within the brackets are verbatim.

[15 School Flasher System
1 ea - Cabinet with NEMA flasher, and paging system device
1 ea - Manual on/off switch
1 ea - Battery
1 ea - Solar panel 65W with bracket
1 ea - Pole 12-feet with sign
day-fluorescent-yellow-green background, 2 each
beacons 12-inch aluminum with Amber LED lamps.]

No sizing report was requested, nor run time stated.

Most systems use a single enclosure for the battery and controls so the first line should be changed to reflect this **or** the third item should be altered to include a battery and enclosure. No specifics are provided for the battery. Without a sizing report or detailed specifications, an unscrupulous vendor could offer an undersized battery for the system and come in as the low bidder.

The solar array is vague. It specifies a module and mount yet no details.

Since the pole is only 12 feet, the type of mount is critical. Using a side-of-pole mount is cheaper yet it takes up vertical distance on the pole: 1.5 to 1.8 feet depending on tilt; while a top-of pole mount preserves more of the vertical work area on the pole for signal heads and signs. Also note: a charge controller should be considered in this RFQ.

Fortunately, the bidding agency cancelled the bid. It was revised several months later requiring a sizing report; specifications to match their existing DC LED lamps and a standardized run time for the systems. Subsequently, the system purchased included a 110W solar module, top-of-pole solar array and two 95 amp-hour sealed batteries. Systems previously purchased use a 65W solar array but run substantially less time per day than the newer ones. The agency saved money and trouble by revising their specifications to match existing equipment and by detailing what they really needed.

The Contradictory Specifications

A common problem with specifications: Items outlined contradict each other and are fairly obvious. The first example is from a mid-western agency which sought to install a solar-powered, high water warning system on a roadway and wanted to define the sensor.

[High Water Sensor Device
High water sensor device shall use solid-state sensing device. Suitable sensors shall use either direct contact, ultrasonic, or IR sensing methods to activate. Sensors

shall have internal filtering of at least 5 seconds to prevent false Activation....Sensors shall be capable of operating on nominal 12VDC and shall have a current draw of less than10mA ....Device should be by manufacturer Advanced Control Technology, Inc. Model S3000S or approved equal.]

At Advanced Control Technology's Web site (http://www.actsensors.com) Model S3000S is a mechanical float switch. The specification calls for a solid-state/electronic device which is contradictory to a mechanical float switch. The customer ultimately chose the mechanical float switch.

In addition, **the specification requested a school zone timer for the high water flasher systems!!!** Most of the specs were eliminated; the city redesigned the system. The project was awarded to a group experienced in the technology. It was recently installed and met everyone's satisfaction.

Here is a one from out west that is not only contradictory, but physically impossible to meet:

[Solar Power System
10-321 Description...with 2 12-volt/240 amp hour batteries....The "Battery Enclosures" shall be a two battery hinged enclosure with two batteries. The enclosure shall be designed for outdoor use...with sealing gasket and battery tray for group 27 to 31 batteries. A removable aluminum back panel shall be included for attachment of electrical components dimensions HxWxD, 21.75-inches x 16-inches x 15.75-inches.]

When examining the data for Deka® and Concorde batteries, the only battery which meets the first set of criteria is the 4D size battery. This battery is 20.75 x 11 x 10 (LxWxH) for the Deka battery and varies slightly for the Concorde. A typical group 31 battery is roughly 13x 6.75 x 9.375-inches. The choice of batteries conflicts with the enclosure design. Imagine installing the enclosure and then finding out the batteries are too large.

The Quite-Common-Incomplete-and-Contradictory Specification
This spec was on the right track but key issues were omitted and those remaining contradict one another:

[Each assembly should include:
1) Solar powered flashing beacon control cabinet w/mounting kit
2) 12-inch aluminum signal heads with mounting framework
2) 60W solar panel
2) 12V, 75Ah Gel Cell Batteries
1) 50A solar regulator and charge control unit
1) Flasher, 12VDC, 2 circuit, solid-state
1) 10A circuit breaker
1) Pole top mounting bracket for solar panel
1) Solar panel wiring harness and termination kit
1) 10 foot pole, 1B with mounting flange and bolts
Please do not include sign lamps or LED modules in quote.]

I contacted the customer and asked if a sizing had been prepared to determine the suitability of the solar power system outlined in the spec. None had been done; the requirements had been estimated based on discussions with a solar home power provider.

Further inquiry revealed the agency intended to provide its own AC LED lamps for use with the solid-state 12VDC flasher circuit. In order to use an AC LED with a solar power system you must include an inverter to turn 12VDC into 110VAC. This had been overlooked when developing the spec.

Since the inverter has a certain amount of loss, the load requirements would need to be recalculated. Most likely this would push the solar array and battery size up and require the agency to use an AC flasher circuit rather than DC.

The shopping list also includes a 50A charge controller, which is unnecessary for this type system. Typically a 120W solar array will have an output of about 7A which would allow for the use of a 10A charge controller. There is a significant price difference between the two in addition to physical size. The 50A controller is about 3 to 4 times larger.

Note: the short, 10-foot pole recommended in this project positions the solar array too low. It would allow anyone using a full-sized pick up truck to remove the modules. This project is awaiting final disposition.

Misapplication is the culprit not solar
Go back to basics when writing specs for a solar-electric powered system: 1-2-3, location, load, duty cycle. Seek advice from those who have had success with solar-powered projects. Review basic solar design literature on the Internet. Does the spec for the equipment outlined make sense from a physical and electrical standpoint? Finally, if the responses you receive are vague, ask for a sizing report and a full technical outline of the items to be submitted. Low prices turn costly if the equipment meets a poorly designed spec and does not function as a system.

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IMSA member Joe Wise, B.S.E.E. is CEO and founder of Solar Traffic Controls, LLC, (www.solar-traffic-controls.com), an engineering firm which designs and manufactures solar-powered traffic control products. You can reach him by e-mail at jawise@earthlink.net or by phone at 480-449-0222 in Tempe, AZ (MST)

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