Global LEAP Solar Water Pump Test Method Summary

Draft Version 1 | May 2019

Test	Purpose / Description	Test Conditions	Referenced Test Method	Resulting Metric

1. Visual Screening	• Inspect and assess the workmanship of the product and all components, (e.g. water pump, PV modules, controller, user manual, etc.) and record any defects or quality concerns.
	• Take pictures and record all information presented with the product including:
	  ○ dimensions of the components;
	  ○ any warning labels; and
	  ○ warranty terms, limitations, and how it is accessed.
	• Review the manufacturer's website, user manual, and packaging, and record any ratings or advertisements about the product.
	• Assess and record internal workmanship (bearings, motor, wiring, etc.).[1]
		n/a	– IEC 62257-9-5: Annex F, Visual Screening
			– IEC 62253: 4 (Requirements for system components) & 6 (Design qualification for a pumping system)
				• Qualitative assessment of the product
				• Record of workmanship, warranty, and advertising claims

2. Cold-Start Test	• Measure the minimum power required to start the pump, evaluated based on the static head values manufacturer provided.[2] • At 0 m head, slowly increase the simulated PV power until the minimum power required to start the pump is reached.	n/a	– IEC 62253: Start-up power measurements (5.3.4)	• Minimum power [W] required to start the pump

[1] Conducted at the end of the testing process

[2] For the Global LEAP Awards competition, manufacturers select the Awards categories they would like their pump considered in and what static head within each category they would like to be simulated.

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3. Total Volume of Water Moved per Solar Day Test	• Determine daily service rendered by each pump. This will be measured for three different typical solar days: high irradiance, average irradiance, low irradiance. • Conduct the test based on the static head values manufacturer provided.[3]	• Simulate power of the included or recommended PV array with a cell temperatures of 50° C.[4] • Specifications for three types of solar day test conditions forthcoming.	– IEC 62253: P-Q characterization (5.3.2)	• Total volume of water moved per solar day [m^3/day] • Maximum flow rate for each solar day [lpm] • Hours of operation for each solar day [hr] • Hydraulic energy provided for each solar day [Wh]
4. Useful Operating Head Range Test	• Determine the head range at which the pump operates at a useful flow rate level[5] for each solar day. • Increase the head simulation and take a flow measurement once the pump has stabilized at each simulated head until the pump no longer provides flow.	• Simulate power of the included or recommended PV array with a 50° C cell temperature. • Simulate solar irradiance corresponding to 700 W/m^2.	– IEC 62257-9-5: Annex S, I-V Characteristics Test – IEC 62253: H-Q characterization (5.3.3)	• Static head range [m] • Maximum static head [m] • Useful operating head range per solar day [m] • Pump system efficiency over its useful operating head range [%]
5. Dry Run Protection Test	• Evaluate if the pump's dry run protection device is functional and determine time for the product to stop pumping when water source is dry. • Once the pump has stabilized, test how the pump reacts to a situation where the water table lowers, and the pump is either no longer submerged, or its input piping no longer has access to water.	• Simulate power of the included or recommended PV array with a 50° C cell temperature. • Simulate solar irradiance corresponding to 700 W/m^2 and a 50° C cell temperature. • Static head value of 0 m.	– IEC 62257-9-5: Annex S, I-V Characteristics Test	• Time for pump to stop when water source runs dry [s]

[3] For the Global LEAP Awards competition, manufacturers select the Awards categories they would like their pump considered in and what static head within each category they would like to be simulated.

[4] Calculated based on the provided PV module's power ratings, measured in standard test condition (STC), combined with the temperature coefficient. If no temperature coefficient is provided, apply a standard temperature coefficient based off of the cell material.

[5] Defined as a percentage of the maximum flow rate at consistent, standard power input. Exact percentage value forthcoming.

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6. Tank Sensor Test (if applicable)	• Evaluate if the tank sensor is functional and determine time for the product to stop pumping when water storage, e.g. water tank, is full. • Once the pump has stabilized, test how the pump reacts to a situation where the water tank being filled reaches max capacity.	• Simulate power of the included or recommended PV array with a 50° C cell temperature. • Simulate solar irradiance corresponding to 700 W/m^2 and a 50° C cell temperature. • Static head value of 0 m.	– IEC 62257-9-5: Annex S, I-V Characteristics Test	• Time for pump to stop when its water storage is full [s]
7. Battery Capacity Test (if applicable)	• Measure battery capacity and efficiency • Using a battery analyser, cycle the battery five times and calculate the capacity based off of the last discharge cycle.	• The test will be carried out at 22°C ± 5°C.	– IEC 62257-9-5: Annex K, Battery Test	• Battery capacity [mAh] • Round-trip energy efficiency [%]
8. Mechanical Durability Test	• Evaluate durability of switches, connectors, and moving parts • Cycle each unique switch or connector intended for regular use 1000 times and examine for functionality.	n/a	– IEC 62257-9-5: Annex W.4.2, Switch and Connector Test	• Number of cycles achieved • Safety hazard after test [yes/no] • Damaged after test [yes/no] • Functional after test [yes/no]