Manufacturer:		
Test item:		
Identification:		*Serial No.:*
Receipt No.:		*Date of receipt:*
Testing laboratory and its address:		
Test specification:	**IS 16270:2014**	
Test Result:	*The test item passed / failed-the test specification(s).*	
Other Aspects:	*Nil*	
	This test report relates to the test sample submitted.	

Tested by:	**Approved by / Authorized Signatory:**	**Issued by:**
Date:	**Date:**	**Date:**

TEST REPORT IS 16270:2014 Secondary Cells and Batteries for Solar Photovoltaic Application- "General Requirements and Methods of Test"	
Report No. .....:	
Date of issue.....:	
Total number of pages	30
Testing Laboratory.....:	
Address .....:	
Manufacturer's name .....:	
Address .....:	
Test specification:	
Standard.....:	**IS 16270:2014**
Test procedure .....:	Compliance Report
Non-standard test method……..:	N/A
Test Report Form No.....:	**BIS_BSPV_16270_V1.0**
Test Report Form(s) Originator	**BIS**
Master TRF.....: 17.05.2018	
Test item description .....:	
Trade Mark .....:	
Model/Type reference .....:	
Ratings .....:	
Other Documents submitted.....:	Please refer to Table – List of Attachments at Page No. --

Tested by:	**Approved by / Authorized Signatory:**	**Issued by:**
Date:	**Date:**	**Date:**

TEST SUMMARY:		
Description	**Measurement/ testing**	**Page No.**
General condition	Condition of use (Cl. No. 4)	
General requirements	Mechanical endurance (Cl. No. 5.1)	
General requirements	Charge efficiency (Cl. No. 5.2)	
General requirements	Deep discharge protection (Cl. No. 5.3)	
Marking requirements	Marking (Cl. No. 5.4)	
General requirements	Safety (Cl. No. 5.5)	
General requirements	Documentation (Cl. No. 5.6)	
Electrical performance	Functional characteristics (Cl. No. 6.0)	
General conditions	General test conditions (Cl. No. 7.0)	
Electrical performance	Capacity test (Cl. No. 8.1)	
Electrical performance	Endurance test (Cl. No. 8.2)	
Electrical performance	Charge retention test (Cl. No. 8.3)	
Electrical performance	Cycle endurance in Photovoltaic application(Extreme conditions) (Cl. No. 8.4)	
Electrical performance	Sulphation Test (Applicable to lead acid batteries only) (Cl. No. 8.5)	
Electrical performance	Water loss Test (Valid for flooded lead acid batteries only) (Cl. No. 8.6)	
Electrical performance	Non spillability/Semi Non spillability/splash proof test (Cl. No. 8.7)	
Electrical performance	Type tests (Cl. No. 9.1)	
Electrical performance	Acceptance test (Cl. No. 9.2)	

Certificate: It is certified that the above tests were performed and found to be passing/Failing in the requirement tested.

.....

(Approving Authority)

Copy of marking plate(s):

Table – List of Attachments

Attachment No.	Attachment Description	No. of pages in Attachment
Attachment – 1	Pictorial view of the equipment	---

General remarks:

The test results presented in this report relate only to the object tested.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

Test item particulars .....:

Classification of installation and use .....:

Connection to the mains.....:

Possible test case verdicts:

- test case does not apply to the test object ..... : N/A
- test object does meet the requirement ..... : P (Pass)
- test object does not meet the requirement ..... : F (Fail)

Testing .....:

Date of receipt of test item ..... :

Date(s) of performance of tests..... :

Laboratory conditions .....:

Ambient Temperature..... :

Ambient Humidity ..... :

General product information:

1) Application details / Description of the product:

2) Differences between the models:

Model No. tested with-in the family series:

3) Options:

The equipment was tested without any optional accessory installed. Hence, this report does not cover parameters that are influenced by the installation of optional accessory that might affect safety in the meaning of this standard.

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
4.0	Conditions Of Use		
	This clause specifies the particulars operating conditions experienced by secondary batteries in photovoltaic applicants during their use.		
4.1	Photovoltaic Energy System		
	The photovoltaic energy system with secondary batteries referred to in this standard can supply a constant, variable, or intermittent energy to the connected equipment (lighting systems, communication systems, etc.		
4.2	Secondary Cells and Batteries		
	Secondary cells and batteries mainly used in photovoltaic energy systems are of the following types: a) Vented (Flooded) b) Valve-regulated		
	The cells and batteries are normally delivered in filled and charged or unfilled and uncharged.		
	In case of partial gas, Ni-Cd cells and batteries shall be delivered in filled and charged or filled and discharged.		
	For optimum service life, the battery manufacturer's instructions for initial charge of the battery shall be followed.		
4.2.1	Material and Constructions		
	All the materials used in the manufacture of stationary batteries for photovoltaic system shall be the best of their respective kind, free from flows and defects and shall conform to the relevant Indian standard, if any.		
	The quality of row material used and the manufacturing method employed for construction the cell/Battery must ensure that parameter important for the SPV application such as water loss (related to service interval), charge acceptance and self discharge loss are kept at the optimal level for the application.		
4.3	General operating condition		
	Batteries in a typical PV system operating under average site weather conditions may be subjected to following conditions:		
4.3.1	Autonomy Time		
	The battery is design to supply energy under specified condition for a period of time, typically from 3 days to 15 days, with or without solar radiation.		
4.3.2	Typical charge and Discharge currents		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
	The typical charge and discharge currents are the following a) Maximum boost charge current: C/10A b) Average float/trickle charge : C/50A c) Average discharge current determined by the load: C/120A		
4.3.3	Daily cycle		
	The battery is normally exposed to a daily cycle as follows		
	a) Charge during daylight hours		
	b) Discharging during night-time hours		
	A typical daily usage results in a discharge between 2 percent and 20 percent of the battery capacity		
4.3.4	Seasonal cycle		
	The battery may be exposed to a seasonal cycle of state of charge. This arises from varying average charging conditions as follows:		
	a) Period with low solar irradiation, for instance during rainy season/monsoon season causing low energy production. the state of charge can go down to 20 percent of the rated capacity b) Period with high solar irradiation, for example in during other seasons, this will bring the battery up to the fully charged condition, with the possibility that the battery could be overcharged		
4.3.5	Period of High state of charge		
	During summer batteries will be operated at high state of charge between 80 to 100 percent of rated capacity during seasons other that monsoons.		
	A voltage regulator system normally limits the maximum battery voltage during the recharge period.		
	When the generation voltage exceeds beyond the limits, the controller should trip-off and reconnect back as soon as the generation voltage comes to normal range to avoid any delay in charge cycle.		
	Charge controller should be sized accordingly to keep the battery and load always safe and getting charged.		
	The system designer normally chooses the maximum charge voltage of the battery as a compromise allowing to recover to a maximum state of charge (SOC) as early as possible in the seasons other than the monsoon but without substantially overcharging the battery.		
	The overcharge increases the gas production resulting in water consumption in vented cells.		
	In valve regulated lead acid cells the overcharge will cause a lesser increase of water consumption and the battery internal temperature there by reduction in battery life.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
	Typically the maximum charge voltage is 2.4V/cell for lead-acid batteries and 1.55V per cell for vented nickel-cadmium (refer manufacturers recommendations) these valves are applicable for the reference temperature specified by the manufacturer.		
	The expected life time of a battery in a PV system even kept regularly at a high state of charge may be considered less than the published life of the battery used under continuous float charge.		
4.3.6	Period for sustained low state of charge		
	During period of low solar radiation, the energy produced by photovoltaic array may not be sufficient to fully recharge the battery.		
4.3.7	Electrolyte Stratification		
	Electrolyte Stratification may occur in lead-acid batteries		
	In vented lead-acid batteries electrolyte Stratification can be avoided by electrolyte agitation/recirculation or periodic overcharge whilst in service.		
	In Valve regulated lead-acid (VRLA) batteries, electrolyte stratification can be avoided by design or by operating them according to the manufacture instructions.		
4.3.7.1	Specific gravity		
	Specific gravity of electrolyte for flooded lead acid battery shall be 1.240±0.005. This is specific requirement for cells/batteries for SPV application and shall override all other requirements specified in any other standard.		
4.3.8	Storage		
	Manufacturers' recommendations for storage shall be observed. In the absence of such information, the storage period may be estimated according to the climatic conditions as shown in Table 1 as below;		
	With electrolyte, a lead-acid battery shall be stored at full state of charge. Nickel cadmium cells/ batteries, on the other hand may be stored in discharged condition.		
	A loss of capacity may result from exposure of a battery to high temperature and humidity during storage.		
4.3.9	Operating Temperature		
	The temperature range during operation experienced by the battery at the site is an important factor for the battery selection and the expected lifetime.		
	Manufacturers' recommendations for operating temperatures and humidity shall be observed. In the absence of such information, operating temperatures and humidity may be those shown in Table 2.		
4.3.10	Charge control		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
	Excessive overcharge does not increase the energy stored in the battery. Instead, overcharge affects the water consumption in vented batteries and consequently the service interval. In addition, valve-regulated lead-acid batteries may dry out resulting in a loss of capacity and / or overheating.		
	Overcharge can be controlled by use of proper charge controllers. The parameter of the regulator shall take into account the effect of PV generator design.		
	The load, temperature and the limiting values for the battery as recommended by the manufacturer.		
	Vented lead-acid or nickel-cadmium batteries including those with partial gas recombination shall have sufficient electrolyte to cover at least the period between planned service visits. Overcharge in valve-regulated lead-acid batteries shall be carefully controlled to reach optimum lifetime.		
	Recommended voltage setting in charge controller shall be as per manufacturer's recommendations. Voltage compensation shall be applied when operation at different temperatures.		
4.3.11	Physical Protection.		
	Physical protection shall be provided against consequences of adverse site conditions, for example, against the effects of: - uneven distribution and extremes of temperature; - exposure to direct sun light (UV radiation); - air-borne dust or sand; - explosive atmospheres; - flooding, water vapor condensation and water spray; - earthquakes; - shock and vibration (particularly during transport		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
5	General Requirements		
5.1	Mechanical Endurance		
	Batteries for photovoltaic application shall be designed to withstand mechanical stresses during normal transportation and handling. Additional packing or protection shall be used for off-road conditions.		
	Particular care shall be taken while handling unpacked batteries. Manufacturer's instructions shall be observed.		
	In case of specific requirements regarding mechanical stresses, such as earthquakes, shock and vibration, these shall be individually specified or referred to the relevant standard.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
5.2	Charge efficiency		
	The charge efficiency is the ratio between the quantity of electricity delivered during the discharge of a cell or battery and the quantity of electricity necessary to restore the initial state of charge under specified conditions.		
	Where no data are available from the battery manufacturer, the following efficiencies as given in Table 3 may be assumed.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
5.3	Deep Discharge Protection		
	Lead-acid batteries shall be protected against deep discharge to avoid loss of capacity due to irreversible sulphation. This could be achieved by using a system, which monitors the battery voltage and automatically disconnect the battery before it reaches its maximum depth of discharge.		
	Vented and partial gas recombination's nickel-cadmium batteries do not normally requires this type of protections.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
5.4	Marking		
	Cells or monobloc batteries shall follow the instructions of the applicable standards defined in clause 7.2.		
5.4.1	BIS Certification Marking		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
5.5	Safety		
	Applicable local regulations and the manufactures instructions for procedure to be observed during installation, commissioning, operation, taking out of service and disposal shall be followed.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
5.6	Documentation:		
	Manufacturers documentation for the transport and storage, commissioning, putting into service, operation and maintenance shall be followed. Generally, the initial charging of the battery at site shall be done as per manufacturers general guideline with proper charges provided.		
	However, for initial charging at site where only SPV array are available as power source, specific instructions to be obtained from the manufacturers for initial charging on a case to case basis.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
6.0	Functional characteristics		
	The following parameters need to be tested for qualification of cell/battery according to this standard		
	a) Rated capacity		
	b) Endurance		
	c) Charge retention		
	d) Cycling endurance in photovoltaic application (extreme conditions)		
	e) Recovery from Suphation test		
	f) Water loss on float charge		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
7.0	General Test conditions		
7.1	Accuracy of measuring instruments		
	When testing batteries, the parameters and accuracy values shall be in accordance with relevant clauses of the standard listed in 7.2.		
	The accuracy of the measuring instruments shall be in compliance with the relevant standard listed in 7.2		
7.2	Standard to be Referred for testing		
	Tests for which detailed procedures are not given in this standard established procedure given in the standards as mentioned in clause 7.2 of this standard are to be adopted.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
8.0	Test Method		
8.1	Capacity test		
	Test sample shall be set up in accordance with the applicable standard in 7.2. Test to verify the rated capacity shall be performed using a current of I_{10} (A) for lead-acid batteries and $I_t/5$(A) for nickel-cadmium and NIMH batteries , according to the relevant clauses in the Indian Standard listed in chause 7.2.		
8.1.1	Requirement		
	As per the standards mentioned in clause 7.2		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
8.2	Endurance Test		
	Test samples shall be tested according to the applicable standards described in clause 7.2.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
8.3	Charges Retentions Test		
	Test samples shall follow the procedure of applicable standards described in 7.2.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
8.4	Cycle Endurance in Photovoltaic Applications (Extreme conditions)		
	In photovoltaic applications the battery will be exposed to large number of shallow cycles but at different states of charge. The cells or batteries shall therefore comply with the requirement as tested below, which is a simulation of the photovoltaic energy system operation.		
	The cycle's endurance test is an accelerated simulation in extreme conditions of the battery operations in a photovoltaic energy system and shall be conducted by submitting the cells or monobloc batteries to a period of 150 cycles (50 cycles with the phase A and 100 cycles with the phase B).		
	Samples shall be selected for conducting this test as per 9.1 Start the test with fully charged battery. Bring the battery to a temperature of 40±3°C and stabilize for 16h. Maintain the battery as 40±3°C throughout the test. Total cycles per unit=150 (Phase A 50 cycles + Phase B 100 cycles).		
8.4.1	Phase A: Shallow Cycling at low state of charge a) Lead-acid batteries : 1) Discharge the batteries with a current I_{10} (A) during 9h or until 1.75 V/cell is reached whichever is earlier. 2) Recharge 3h with a current $1.03xI_{10}$ (A) 3) Discharge 3h with a current I_{10} (A)		
	b) Nickel-Cadmium and Ni-MH batteries: 1) Discharge the batteries with a current $I_t/10$(A) during 9h or until 1.0 V/cell is reached. 2) Recharge 3h with a current $1.03xI_t/10$(A). 3) Discharge 3h with a current $I_t/10$(A). Phase A is summed up in Table 4.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
8.4.2	Phase B: Shallow cycling at High State of Charge a) Lead-Acid batteries: 1) Discharge the battery for 2h with a current 1.25xI_t/10(A). 2) Recharge 6hrs with a current I_{10}(A). The charge voltage shall be limited to 2.4 V/cell unless otherwise specified by the manufacturer.		
	b) Nickel-cadmium and Ni-MH batteries. 1) Discharge the battery for 2h with a current 1.25xI_t/10(A) 2) Recharge 6h with a current I_t/10(A). The charge voltage shall be limited to 1.55 V/cell unless otherwise specified by the manufacturer.		
	For both battery types, repeat 1) and 2) 99 times and then perform a capacity determination according to 8.4.3. Phase B is summed up in Table 5.		
8.4.3	Capacity check:		
	After the phase B, the battery is cooled down to the temperature defined in the relevant standard as described in 7.2 and stabilized at this value for 16h. The capacity test C10 for lead acid and C5 for Nickel-Cadmium and Ni-MH batteries is carried out according to the relevant standard as described 7.2		
8.4.4	End of Test Condition :		
	a) Capacity is checked after each period of 150 cycles (Phase A+B)		
	b)The value of actual capacity determined in 8.4.3 shall be recorded.		
	c)The cycles life shall be expressed in number of 150 cycle (A+B) sequences completed.		
	d)The test if finished:		
	1) During the phase A- When the cell voltage measured in discharge is lower than 1.5V/cell for a lead acid batteries and 0.8V/cell for Ni-Cd and Ni-MH batteries.		
	2) After the phase B- When the checked capacity measured in 8.4.3. is lower than 80 percent of the rated capacity.		
8.4.5	Water Consumption of Flooded Battery Types and Cells with Partial Gas recombination. During the endurance test, vented type batteries may be topped up with water. The amount of water added shall be measured and reported.		
8.4.6	Requirements		
	The minimum number of complete (A+B) sequences (150 cycles) achieved shall be 3 at the end of the test C_{120} capacity shall not be less than 80 percent of the rated.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
8.5	Sulphation test: (Applicable for lead Acid batteries only)		
	The test is to be carried out on a fully charged cell/battery. The test shall be carried out as described in 8.5.1 and 8.5.2.		
8.5.1	Flooded type batteries		
	a) Discharge at a rate of 0.0135xC_{10} for a period of 24 h. b) Leave the battery for 120 h c) Recharge of 0.056 x C10 for 4h followed by 0.0135 xC10 for 12h d) Discharge at 120h rate (that is 0.0125 XC_{10} to an end voltage of 1.9V/Cell)		
8.5.1.1	Requirement		
	The batteries shall give at least 108 h.		
8.5.2	VRLA Batteries:		
	a) Discharge at the rate of C C_{80} for a period of 24 h		
	b) Leave the battery on open circuit for 120 h (5 days)		
	c) Recharge in constant current mode at C_{20} for 4 h followed by C_{80} for 12 h		
	d) Discharged at C10 rate to and an end voltage of 1.900 V/cell/ or 11.40Vmono-block		
8.5.2.1	Requirement:		
	The cell mono-block/battery should give at least 108h		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
8.6	Water loss test (valid for flooded lead acid batteries only)		
	The water loss test shall be done as per the latest version of the relevant specification with all its amendments mentioned in clause 7.2 of this specification.		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
8.7	Non Spill ability/Semi Non Spill ability/ Splash Proof Test:		
8.7.1	Applicability Lead Acid Batteries(BSLA)		
8.7.2	Requirement:		
	The vent plug shall be of the anti splash/nonspillable/semi non spillable type with more than one exist hole and shall allow the gases to escape freely.		
8.7.3	Method:		
	Immediately after capacity discharge at 1h rate adjust the electrolyte level to the height stated by the manufacture on the instruction label.		
	The battery shall then be put on charge at normal rate with the vent plug, screwed tightly. When the battery is fully charged as obtained from voltage reading, allow the battery to stand on open circuit for 30 min after which battery shall be subjected to the following rest as applicable for 2h:		
	a) Kept upside down for non-spill ability:		
	b) Laid on any one of its for semi-non-spill ability:		
	c) Tilted at an angle of 45° from the plane for splash test.		
8.7.4	Observations:		
	No leakage from vent plug and battery		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
9	Recommended use of tests		
9.1	Type Test		
	Types test are		
	a) Rated capacity test and the charge retention test		
	b) Endurance test		
	c) Cycling endurance test in photovoltaic application (extreme condition)		
	d) Sulphation test		
	e) Water loss test (valid for flooded lead acid cells/batteries only)		
	The minimum number of samples shall be specified in the relevant standards listed in 7.2		
	The endurance test in photovoltaic application shall be performed on two cells (or two battery packs, or two 6-cells block for lead-acid batteries).		

Cl. No.	Test / Requirement name	Test result/ observation	Verdict
9.2	Acceptance Test		
9.2.1	Factory test		
	The acceptance test shall be agreed between the customer and the supplier. Compliance to marking, labeling rated capacity may be verified.		
9.2.2	Commissioning test		
	A commissioning test is recommended to prove the integrity of the installed battery system by means of a capacity test at 10h.		

	List of critical Components				
Object/ part No.	**Manufacturer/ trademark**	**Type/ Model**	**Technical Data**	**Standard**	**Marks of Conformity[1]**
Supplementary information:					

ATTACHMENT 1

PICTORIAL VIEW OF THE EQUIPMENT

---------END OF THE TEST REPORT---------