File No. 223/28/2018 - R&D Coord. (QC)

Ministry of New & Renewable Energy
(Standards & Quality Control Division)

Block 14, CGO Complex
Lodi Road, New Delhi-110003

8.04.2019

Subject: Guidelines for series approval of Storage Batteries for conducting testing in test labs for Implementation of Quality Control Order on SPV Systems, Devices and Components Goods 2017

Ministry of New & Renewable Energy (MNRE) on 5/9/2017 under the BIS Act had notified the Solar Photovoltaics Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order 2017 for quality control in SPV Power Projects. Implementation of the above mentioned order commenced on 16.04.2018 vide notification dated 16.04.2018 published in Gazette of India. It includes SPV Modules, Inverters and Batteries. As per the order, no person shall manufacture or store for sale, import, sell or distribute goods, which do not conform to Indian Standards specified in the Order.

2. The specified standards for storage batteries is IS 16270:2014(Secondary Cells and Batteries for Solar Photovoltaic Applications-General Requirements and Methods of Test). Manufacturers of these products are required to apply for registration from Bureau of Indian Standards (BIS), New Delhi after getting their products tested from BIS recognised test labs.

3. As the batteries are of varying sizes, ratings, varieties, etc. the batteries in each category are to be grouped for submitting samples to test labs, and shall be granted series approval for series of products based on testing of representatives models. Accordingly, draft guidelines for series approval of Storage Batteries for conducting testing in test labs has been prepared in consultation with related stakeholders, including experts from test labs, Bureau of Indian Standards(BIS), New Delhi and Battery Storage Industry. Enclosed is the said draft guidelines for comments of public and related stakeholders. The comments may please be provided by 18th April, 2019 at the following address:

Encl: a/a

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8th April 2019

Guidelines for series approval of Storage Batteries for conducting testing in test Labs for implementation of Solar Photovoltaics Systems, Devices and Component Goods Order 2017(CRO).

The guidelines are issued to facilitate labs/manufacturers in formation of series of products for approval of product family for performance testing of storage batteries (lead acid and nickel based chemistry type) in test labs for compulsory registration with BIS for implementation of the Solar Photovoltaics Systems, Devices and Component Goods Order 2017. The following series guidelines will be followed for conducting tests on storage batteries as per IS 16270(2014) by test labs.

Guidelines for Quantitative Selection of Samples

IS 16270:2014 Secondary Cells and Batteries for Solar Photovoltaic Application – General Requirements and Methods of Test

1. Material and Construction

1.1. Lead-Acid Batteries

The cells/ batteries shall be manufactured with raw materials of good quality and should be free from any defects that can affect their performance. For Lead-Acid Batteries, the containers shall have been made using hard rubber, transparent SAN, fibre-reinforced plastic or polypropylene for vented type and polypropylene co-polymer, acrylonitrile butadiene styrene, styrene-acrylonitrile or any other acid resistant plastic material for sealed batteries. The plastic containers, sulphuric acid, water and separators used shall conform to the requirements as per applicable standards in Cl. 7.2 of IS 16270.

1.2. Nickel-Cadmium and Nickel-Metal Hydride Batteries

The containers shall have been made using high strength alkali resistant material such as nickel-plated mild steel, stainless steel or nonporous plastic. The potassium hydroxide and distilled water with lithium hydroxide additive shall be used for preparation of the electrolyte and will be made up to a specific concentration as specified by the manufacturer. Separators used shall be alkali-resistant having insulating capacity.

2. Procedure for submitting batteries for testing

The information regarding material of the containers, separator used, and type of sealing adopted (in case of sealed batteries) and the overall dimensions shall be provided by the manufacturer while submitting the batteries for testing at test laboratories. For vented type lead-acid batteries, suitable level indicators for batteries made in opaque containers, minimum and maximum marking for transparent containers to indicate the electrolyte

level and connectors shall be provided for each cell by the manufacturer at the test laboratory.

2.1. Charging of batteries

The manufacturer shall recommend the procedure to be followed for charging of the cells/ batteries to the test laboratory. If the information is not provided by the customer, the procedure described in applicable standards mentioned in Cl. 7.2 shall be followed. Variations in temperature and humidity can affect the performance and life of the cells/ batteries. Manufacturer's recommendations on the operating temperature and humidity limits during testing of batteries shall be observed as mentioned in Cl. 4.3.9 of IS 16270. If information is not provided, conditions mentioned in Table 2 shall be observed.

3. Sampling and Sequence of tests

3.1. Stationary Lead Acid Batteries (Vented types):

A total of eight cells/ batteries shall be taken from the production batch for testing. All the cells/ batteries submitted as a batch shall have the same nominal voltage, rated capacity, electrolyte composition and specific gravity and overall dimensions as mentioned in IS 13369/ IS 1651. The cells/ batteries shall be indelibly and durably marked on the outside of the cells or batteries with source of manufacture, Ah capacity, Year of Manufacture and Country of Origin and other details as per the relevant clauses of IS 13369/ IS 1651. The testing sequence for stationary lead acid batteries (vented type) is provided in Table 1.

Table 1. Sequence of tests for Stationary Lead Acid Batteries

Sl. No.	Type Test	Clause No.	Cells							
			1	2	3	4	5	6	7	8
1	Physical Verification (Verification of Marking & Dimensions)	4.2.1, 5.4	✓	✓	✓	✓	✓	✓	✓	✓
2	Capacity test @ C/10 Rate	8.1 & 7.2	✓	✓	✓	✓	✓	✓		
3	Endurance test	8.2 & 7.2							✓	✓
4	Charge Retention Test	8.3 & 7.2	✓	✓						
5	Cyclic Endurance in photovoltaic application	8.4			✓	✓				
6	Sulphation Test	8.5					✓	✓		
7	Water Loss Test	8.6 & 7.2	✓	✓						

3.2. Stationary Lead Acid Batteries (Valve Regulated types) & Tubular Gel VRLA Batteries:

A total of eight cells/ batteries shall be taken from the production batch for testing. All the cells/ batteries submitted as a batch shall have the same nominal voltage, rated capacity, electrolyte composition and specific gravity and overall dimensions as mentioned in IS 15549. Cells/ batteries shall be indelibly and durably marked on the outside of the cells with source of manufacture, Ah capacity, Year of Manufacture and Country of Origin as per Cl. 8 of IS 15549. The testing sequence for stationary lead acid batteries (valve regulated

type) is provided in Table 2.

Table 2. Sequence of tests for Stationary Lead Acid Batteries (Valve Regulated types)										
Sl. No.	**Type Test**	**Clause No.**	**Cells**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	Physical Verification (Verification of Marking & Dimensions)	4.2.1, 5.4	✓	✓	✓	✓	✓	✓	✓	✓
2	Capacity test @ C/10 Rate	8.1 & 7.2	✓	✓	✓	✓	✓	✓	✓	✓
3	Endurance test	8.2 & 7.2							✓	✓
4	Charge Retention Test	8.3 & 7.2	✓	✓						
5	Cyclic Endurance in photovoltaic application	8.4			✓	✓				
6	Sulphation Test	8.5					✓	✓		

3.3. Vented Nickel-Cadmium Batteries:

A total of six cells/ batteries shall be taken from the production batch for testing. All the cells submitted as a batch shall have the same nominal voltage, rated capacity, electrolyte composition and overall dimensions. The cells/ batteries shall be marked on the outside of the cells with source of manufacture, nominal voltage, rated capacity, month and year of manufacture and cell designation as per Clause 6 of IS 10893:1984 (Single Cells) or Clause 6 of IS: 10918-1984 (Vented Nickel-Cadmium Batteries). The markings on the cells/ batteries shall be permanent and non-deteriorating. The testing sequence for vented nickel-cadmium batteries is provided in Table 3.

Table 3. Sequence of tests for Vented Nickel-Cadmium Batteries								
Sl. No.	**Type Test**	**Clause No.**	**Cells**					
			1	**2**	**3**	**4**	**5**	**6**
1	Physical Verification (Verification of Marking & Dimensions)	4.2.1, 5.4	✓	✓	✓	✓	✓	✓
2	Capacity test @ C/5 Rate	8.1 & 7.2	✓	✓	✓	✓	✓	✓
3	Endurance test	8.2 & 7.2					✓	✓
4	Charge Retention Test	8.3 & 7.2			✓	✓		
5	Cyclic Endurance in photovoltaic application	8.4	✓	✓				

3.4. Nickel-Cadmium Prismatic Rechargeable Single Cells with Partial Gas Recombination

A minimum of twelve cells as per Clause 10.1 of IS 15767:2008 shall be taken for testing. All the cells submitted as a batch shall have the same nominal voltage, rated capacity, electrolyte composition and overall dimensions. The cells/ batteries shall be durably marked on the outside of the cells with source of manufacture and cell designation and be fitted with red washer or indented or raised symbol for positive terminal as per Clause 5.3

of IS 15767:2008. The testing sequence for Nickel-Cadmium Prismatic Rechargeable Single Cells is provided in Table 4.

Table 4. Sequence of tests for Nickel-Cadmium Prismatic Rechargeable Single Cells

Sl. No.	Type Test	Clause No.	Cells											
			1	2	3	4	5	6	7	8	9	10	11	12
1	Physical Verification (Verification of Marking & Dimensions)	4.2.1, 5.4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Capacity test @ C/5 Rate	8.1 & 7.2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Endurance test	8.2 & 7.2						✓	✓	✓	✓	✓		
4	Charge Retention Test	8.3 & 7.2	✓	✓	✓	✓	✓							
5	Cyclic Endurance in photovoltaic application	8.4											✓	✓

3.5. Portable Nickel-Cadmium Batteries

A minimum of thirteen cells/ batteries as per Clause 9.1 of IS 16048 (Part 1):2013 shall be taken for testing. All the cells submitted as a batch shall have the same nominal voltage, rated capacity, nominal Ah rating, electrolyte composition and overall dimensions. The cells shall be marked on the outside of the cells with name of manufacturer/ supplier, nominal voltage, rated capacity, polarity, date of manufacture and cell designation as per Clause 5.3 of IS 16048 (Part 1):2013. The markings on the cells shall be permanent and non-deteriorating. The testing sequence for Nickel-Cadmium Prismatic Rechargeable Single Cells is provided in Table 5.

Table 5. Sequence of tests for Nickel-Cadmium Prismatic Rechargeable Single Cells

Sl. No.	Type Test	Clause No.	Cells												
			1	2	3	4	5	6	7	8	9	10	11	12	13
1	Physical Verification (Verification of Marking & Dimensions)	4.2.1, 5.4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Capacity test	8.1 & 7.2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Endurance test	8.2 & 7.2							✓	✓	✓	✓	✓		
4	Charge Retention Test	8.3 & 7.2	✓	✓	✓	✓	✓	✓							
5	Cyclic Endurance in photovoltaic application	8.4												✓	✓

3.6. Portable Nickel-Metal Hydride Batteries

A minimum of thirteen cells/ batteries as per Clause 10.1 of IS 16048 (Part 2):2013 shall be taken for testing. All the cells submitted as a batch shall have the same nominal voltage, rated capacity, electrolyte composition and overall dimensions. The cells shall be durably marked on the outside of the cells with name of manufacturer/ supplier, nominal voltage, rated capacity, polarity, date of manufacture and cell designation as per Clause 5.3 of IS 16048 (Part 2):2013. The testing sequence for Portable Nickel-Metal Hydride Batteries is provided in Table 6.

Table 6. Sequence of tests for Portable Nickel-Metal Hydride Batteries

Sl. No.	Type Test	Clause No.	Cells												
			1	2	3	4	5	6	7	8	9	10	11	12	13
1	Physical Verification (Verification of Marking & Dimensions)	4.2.1, 5.4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Capacity test	8.1 & 7.2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Endurance test	8.2 & 7.2							✓	✓	✓	✓	✓		
4	Charge Retention Test	8.3 & 7.2	✓	✓	✓	✓	✓	✓							
5	Cyclic Endurance in photovoltaic application	8.4												✓	✓

4. Requirement

The pass criterion shall be strictly followed in accordance with the relevant clauses of IS 16047(Part 3):2018/ IEC 61960-3:2017 and IS 16270:2014.

5. Selection of Representative Model for Stationary Lead Acid Batteries:

The short-term tests (Capacity test, Retention of charge, sulphation test and water loss test) shall be performed on all ratings included in the series. In case any test sample fails any one of the short terms test, the particular rating shall be resubmitted for the testing.

Among the product range of cells / batteries from a manufacturer, the representation model of cell/battery (described in table 8) shall be tested as per type tests mentioned in the Table 1 to 6. The highest rated capacity sample will be subjected to all type test (including endurance tests) and the product qualifying will be issued test reports to all samples covered in the series.

For cells / batteries to be considered in the same series, the manufacturer has to submit an undertaking to the test lab that all the models have been manufactured with no change in the grid alloy composition, grid purity, grid thickness, ingredients used in the electrode preparation, method of preparation and thickness of the electrodes and quality systems

followed for manufacturing. Table 7 gives the series of batteries for type testing of secondary lead acid cells/ batteries as per IS 16270.

Table 7. Series of secondary lead acid cells/ batteries for type testing as per IS 16270

Type	Series	Range of Capacities	Representative Model
2V Flooded Lead Acid Cells	**A**	≤ 400 Ah	400 Ah or Highest rating in series
	B	>400 Ah and ≤ 700 Ah	700 Ah or Highest rating in series
	C	>700 Ah and ≤ 1000 Ah	1000 Ah or Highest rating in series
	D	> 1000 Ah	Highest rating in series
2V VRLA Cells	**A**	≤ 200 Ah	200 Ah or Highest rating in series
	B	> 200 Ah and ≤ 500 Ah	500 Ah or Highest rating in series
	C	> 500 Ah and ≤ 1000 Ah	1000 Ah or Highest rating in series
	D	> 1000 Ah	Highest rating in series
12V Flooded Lead Acid Batteries	**A**	≤ 20 Ah	20 Ah or Highest rating in series
	B	> 20 Ah and ≤ 100 Ah	100 Ah or Highest rating in series
	C	>100 Ah	Highest rating in series
12V VRLA Batteries	**A**	≤ 50 Ah	50 Ah or Highest rating in series
	B	> 50 Ah and ≤ 100 Ah	100 Ah or Highest rating in series
	C	>100 Ah	Highest rating in series

Table 8 give the series of batteries for type testing of secondary cells/ batteries of nickel based chemistry as per IS 16270.

Table 8. Series of secondary cells/ batteries of nickel based chemistry for type testing as per IS 16270

Type	Series	Range of Capacities	Representative Model
Vented Nickel Cadmium/ Nickel Metal Hydride Cells/ Batteries	**A**	≤ 45 Ah	Highest rating in series
	B	> 90 Ah to 500	Highest rating in series
	C	500-1000	Highest rating in series
	D	>1000	Highest rating in series
Nickel Cadmium Prismatic Single Cells with Partial Gas Recombination	**A**	> 90 Ah to 500	Highest rating in series
	B	500-1000	Highest rating in series
	C	>1000	Highest rating in series

6. Safety and other information to be provided by Manufacturer/Supplier for batteries used for Photovoltaic Applications

Batteries can pose fire and explosion risk, chemical and electrical hazard if mistreated. They can also be heavy and difficult to move. They must only be installed out of reach in suitable locations for safe battery operation.

1. Suitable lifting devices shall be used for moving the batteries
2. The temperature of the battery shall be monitored and shall be maintained as per manufacturer's instructions. The terminals, screws, clamps and cables shall be regularly inspected for breakage, damage or loose connections. These should be clean, tight and free of corrosion.
3. Capability of expansion of battery bank capacity must be specified along with precautions to be taken regarding the same
4. Information regarding the level of electric shock hazard should be provided in technical sheet
5. The installation of all battery systems shall be in accordance with the safety data sheet applicable to the battery chemistry and battery system. Procedure to be followed for the regular maintenance of the battery shall be as recommended by the manufacturer.
6. For domestic installations and non-domestic installations upper DC voltages limit should be provided.
7. Exposed components shall be insulated and mechanically protected, including: terminals, Inter battery system cabling and connections.
8. In case of parallel connected batteries, each battery system shall have an isolator.
9. Safe work procedures should be developed to address potential chemical hazards which may include, cracked or damaged battery casings, spillage of electrolyte Inhalation of, and physical exposure to, electrolyte.
10. The equipment may be required for safe handling of battery systems and protection of authorised persons such as acid resistant apron, gloves, goggles, bicarbonate of soda for acid spills, or boric acid for alkaline electrolyte spills, or other suitable neutralising agent recommended by the manufacturer
11. Following information needs to be provided by the manufacturer in an instruction brochure
    i. Electrical Characteristics such as voltage range (Maximum and Minimum) and load pattern
    ii. Charging Condition: Rapid charge, trickle charge, charge time and temperature
    iii. Size, weight, terminal type, operating life and storage period
12. The batteries shall be stored as per manufacturer's instructions. Restricted access shall be provided to battery systems to prevent access by unauthorised persons. Batteries may be placed over wooden or plastic planks on the floor. The batteries shall not be placed in damp conditions, near combustible materials or near any heat source. Suitable ventilation must be provided at storage site.
13. Procedure to be followed for disposal of scrapped batteries and recycling of batteries must be specified by the manufacturer.