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NEMA STANDARDS PUBLICATION NO. IB 5

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Life Testing of Lead-Acid Industrial Storage Batteries (with Free Electrolyte) for Stationary Service

NEMA

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION ■ 2101 L STREET, N.W., WASHINGTON, D.C. 20037

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NEMA IB 5-1987

IB 5

LIFE TESTING OF LEAD-ACID INDUSTRIAL STORAGE BATTERIES (WITH FREE ELECTROLYTE) FOR STATIONARY SERVICE

Published by

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Foreword

The purpose of this Standards Publication is to provide the users and manufacturers of lead-acid storage batteries for stationary applications an accelerated testing procedure that will predict the life potential in service.

User input has been considered throughout the development of this Standards Publication.

This standard has been developed by the Industrial Battery and Charger Section of NEMA, which periodically reviews it for any revisions necessary to keep it up-to-date with advancing technology. Comments or proposed revisions are welcomed and should be submitted to:

Manager, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037

This 1987 edition revises and supersedes IB 5-1979.

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Scope

This Standards Publication covers accelerated life testing requirements and test conditions for determining the life of lead-acid industrial storage batteries with free electrolyte and lead calcium alloy grids, used as a source of standby power.

The test procedure will age the cell element to the predominant aging failure mode, which is based on the degradation of the positive plates.

Life testing of other grid alloys or cell components with age-related failure mechanisms are beyond the scope of this Standards Publication.

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LIFE TESTING OF LEAD-ACID INDUSTRIAL STORAGE BATTERIES (WITH FREE ELECTROLYTE) FOR STATIONARY SERVICE

Section 1

REFERENCED STANDARDS AND DEFINITIONS

1.1 REFERENCED STANDARDS

The following publications are adopted in whole or in part as indicated by reference in this Standards Publication.

Institute of Electrical and Electronics Engineers
345 East 47th Street
New York, NY 10017

IEEE 535-1979 *Standard for Qualification of Class 1E Storage Batteries for Nuclear Power Generating Stations*

National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037

IB 1-1982 *Definitions and Precautionary Labels for Lead-Acid Industrial Storage Batteries*

IB 4-1987 *Determination of Amperehour and Watthour Capacity of Lead-Acid Industrial Storage Batteries for Stationary Service*

1.2 DEFINITIONS

The terms contained within this Standards Publication shall be defined in accordance with NEMA IB 1, as applicable.

NEMA Standard 11-19-1987.

Section 2

TESTS

2.1 TEST CONDITIONS

The following test conditions shall apply:

2.1.1 Cell or cells to be used for determining life performance of a battery shall be selected at random from production.

NEMA Standard 11-19-1987.

2.1.2 Test cells shall conform to the performance requirements in NEMA Standards Publication No. IB 4 when tested at the three hour rate of discharge or at a rate defined by their application.

NEMA Standard 11-19-1987.

2.1.3 Life testing shall be started within 30 days after meeting the initial capacity requirements.

NEMA Standard 11-19-1987.

2.1.4 The ambient temperature during storage of the cells shall not exceed 99 °F (37.2 °C).

NEMA Standard 11-19-1987.

2.1.5 Cells shall be given a freshening charge prior to the initiation of the test.

NEMA Standard 11-19-1987.

2.1.6 The electrolyte level and specific gravity in all cells should be maintained in accordance with the manufacturer's published instructions.

Authorized Engineering Information 11-19-1987.

2.1.7 The container walls of the cell or unit may be supported to prevent excessive bulging throughout the duration of the test.

Authorized Engineering Information 11-19-1987.

2.1.8 Precautions shall be taken to protect test equipment from the possibility of container failure and subsequent electrolyte leakage. The exterior surfaces of the cell shall be kept clean and free of electrolyte spillage.

NEMA Standard 11-19-1987.

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2.1.9 Time-temperature sensitive components, such as those that become stressed to a life beyond that of the element, may be replaced.

Authorized Engineering Information 11-19-1987.

All other cell test conditions shall remain unchanged.

NEMA Standard 11-19-1987.

2.1.10 Cells with lead calcium plates shall be aged at one of two temperatures 145°F (62.8°C) or 160°F (71°C).

The selected aging temperature shall be maintained within a tolerance of −2°F (−1.1°C) and +5°F (2.8°C).

NEMA Standard 11-19-1987.

2.2 TEST PROCEDURE

The following test procedure shall apply:

2.2.1 The test cells shall be placed on a float charge to provide a positive plate potential of 50 to 150 millivolts above open circuit potential for the selected aging temperature.

NEMA Standard 11-19-1987.

2.2.2 The electrolyte temperature shall be maintained at the selected aging temperature within a tolerance of −2°F (−1.1°C) and +5°F (2.8°C).

NEMA Standard 11-19-1987.

2.2.3 The length of the aging period in days is determined from the aging factors listed in Table 2-1 for the appropriate temperature and plate type.

NEMA Standard 11-19-1987.

Table 2-1 is based on results of tests performed by battery manufacturers on cells with nominal 1.215 specific gravity.

Authorized Engineering Information 11-19-1987.

Table 2-1
ACCELERATED THERMAL AGING FACTORS

Plate Construction	Test Days at 145°F (62.8°C) to Equal 1 Yr. at 77°F (25°C)	Test Days at 160°F (71°C) to Equal 1 Yr. at 77°F (25°C)
Lead calcium — pasted (Faure)	20	10

2.2.4 The average temperature over the life of the test shall meet the criteria of Table 2-1.

NEMA Standard 11-19-1987.

2.2.5 At intervals of not more than five equivalent life years, as defined in Table 2-1, the test cells shall be cooled and maintained on float until a capacity test can be performed. The capacity test shall be conducted in accordance with NEMA IB 4. The capacity test discharge rate(s) shall be at the same rating as initially performed in 2.1.2.

NEMA Standard 11-19-1987.

2.2.6 After the last recharge, the test cells shall be returned to the conditions described in 2.2.1 and 2.2.2, and the aging procedure continued.

NEMA Standard 11-19-1987.

2.2.7 The test cells shall deliver a minimum of 80 percent of their rated capacity. If this requirement is not met, the test cells shall be charged according to the manufacturer's instructions, returned to float for a minimum period of 72 hours and retested. If the test cells fail the second capacity test, the life test shall be considered completed.

NEMA Standard 11-19-1987.

2.2.8 All test conditions and data shall be recorded.

NEMA Standard 11-19-1987.

2.2.9 If a cell is damaged as a result of accident or equipment malfunction, its life tests shall be considered void.

NEMA Standard 11-19-1987.

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Industrial and Battery Charger Section of the National Electrical Manufacturers Association

Member Companies

C & D Power Systems, Inc.
Plymouth Meeting, PA 19462

Chloride Electro Networks
Caledonia, NY 14423

Douglas Battery Mfg. Company
Winston-Salem, NC 27117

East Penn Mfg. Company, Inc.
Lyon Station, PA 19536

Exide Corporation
Reading, PA 19612

Ferro Magnetics Corporation
Bridgeton, MO 63044

General Battery Corporation
Industrial Products Group
Reading, PA 19603

GNB Industrial Battery Company
Langhorne, PA 19047

Hobart Brothers Company
Troy, OH 45373

Johnson Controls, Inc.
Battery Division
Milwaukee, WI 53212

KW Battery Company
Skokie, IL 60076

La Marche Manufacturing Company
Des Plaines, IL 60018

Pacific Chloride Incorporated
Kansas City, KS 66115

Pluskota Electric Company
Worth, IL 60482

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NEMA STANDARDIZATION

The purpose of NEMA Standards, their classification and status, are set forth in certain clauses of the NEMA *Standardization Policies and Procedures* manual and are referenced below.

Purpose of Standards

National Electrical Manufacturers Association Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for its particular need. Existence of a National Electrical Manufacturers Association Standard does not in any respect preclude any member or nonmember from manufacturing or selling products not conforming to the standard. *(Standardization Policies and Procedures, p. 1)*

Definition of a Standard

A standard of the National Electrical Manufacturers Association defines a product, process, or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Standardization Policies and Procedures, p. 2)

Dimensions

Where dimensions are given for interchangeability purposes, alternate dimensions satisfying the other provisions of the standards publication may be capable of otherwise equivalent performance.

(Standardization Policies and Procedures, p. 9)

Classes of Standards

National Electrical Manufacturers Association Standards are of two classes:

1. NEMA Standard, which relates to a product commercially standardized and subject to repetitive manufacture, which standard has been approved by at least 90 percent of the members of the Subdivision eligible to vote thereon;
2. Suggested Standard for Future Design, which may not have been regularly applied to a commercial product, but which suggests a sound engineering approach to future development, which standard has been approved by at least two-thirds of the members of the Subdivision eligible to vote thereon.

(Standardization Policies and Procedures, pp. 8 & 17)

Authorized Engineering Information

Authorized Engineering Information consists of explanatory data and other engineering information of an informative character not falling within the classification of NEMA Standard or Suggested Standard for Future Design, which standard has been approved by at least two-thirds of the members of the Subdivision eligible to vote on the standard.

(Standardization Policies and Procedures, pp. 8 & 17)

Official Standards Proposal

An Official Standards Proposal is an official draft of a proposed standard which is formally recommended to an outside organization(s) for consideration, comment, and/or approval, and which has been approved by at least 90 percent of the members of the Subdivision eligible to vote thereon.

(Standardization Policies and Procedures, pp. 8 & 17)

Identification of Status

Standards in NEMA Standards Publications are identified in the foreword or following each standard as "NEMA Standard" or "Suggested Standard for Future Design." These indicate the status of the standard. These words are followed by a date which indicates when the standard was adopted in its present form by the Association.

The material identified as "Authorized Engineering Information" and "Official Standards Proposal" is designated similarly.

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