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Electric Batteries and Standard Cells:  
Publications by the Staff of the National Bureau of  
Standards and references to other sources of  
information

Contents

	Page
General Information - - - - -	1
Dry cells - - - - -	2
Storage batteries - - - - -	3
Rectifiers - - - - -	4
Standard cells and potential measurements -	5
References to books and specifications, not Government publications - - - - -	6

General Information

Some of the publications in this list have appeared in the regular series of publications of the Bureau and others in various scientific and technical journals. Unless specifically stated, papers are not obtainable from the National Bureau of Standards.

Where the price is stated, the publication can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. The prices quoted are for delivery to addresses in the United States and its territories and possessions and in certain foreign countries which extend the franking privilege. In the case of all other countries, one-third the cost of the publication should be added to cover postage. Remittances should be made either by coupons (obtainable from the Superintendent of Documents in sets of 20 for \$1.00 and good until used), or by check or money order payable to the "Superintendent of Documents, Government Printing Office" and sent to him with order.

Publications marked "OP" are out of print, but, in general, may be consulted at technical libraries.

For papers in other scientific or technical journals, the name of the journal or of the organization publishing the article is given in abbreviated form, together with the volume number (underscored), page, and year of publication in the order named. The Bureau cannot supply copies of such journals nor reprints from them, and it is unable to furnish information as to their availability or price. They, too, can usually be consulted at technical libraries.

Series letters with serial numbers are used to designate Bureau publications:-

S = "Scientific Paper". S1 to S329 are "Reprints" from the "Bulletin of the Bureau of Standards". S330 to S572 were published as "Scientific Papers of the Bureau of Standards". This series was superseded by the "Bureau of Standards Journal of Research" in 1928.

T = "Technologic Paper". T1 to T370. This series was superseded by the "Bureau of Standards Journal of Research" in 1928.

RP = "Research Paper". These are reprints of articles appearing in the "Bureau of Standards Journal of Research" and the "Journal of Research of the National Bureau of Standards". The latter is the title of this periodical since July 1934 (volume 13, number 1).

C = "Circular".

Federal Specifications, relating to dry cells and storage batteries, are listed under the symbols WB and OA. These specifications have been approved by the Director of Procurement, Treasury Department, and are a part of the Federal Standard Stock Catalogue.

Circular C24 and supplements, the complete list of the Bureau's publications (1901-1936), is sold by the Superintendent of Documents for 55 cents. Announcement of new publications is made each month in the Technical News Bulletin which is obtainable by subscription at 50 cents per year.

#### Dry Cells

<u>Title</u>	<u>Series</u>	<u>Price</u>
Electrical characteristics and testing of dry cells. (2nd ed.) (1923)	C79	OP
Relation of voltage of dry cells to the hydrogen-ion concentration. H.D. Holler and L.M. Ritchie. Sci.Pap.BS <u>15</u> , 659 (1919-1920)	S364	OP
Automatic apparatus for intermittent testing. G.W. Vinal and L.M.Ritchie (1920)	T171	OP

- Electromotive force of cells at low temperatures. G.W.Vinal and F.W.Altrup. Sci.pap.BS 17, 627 (1922) S434 5¢
- American Standard Specification for dry cells and batteries. (1937) C414 5¢
- Government specifications for dry cells. G.W.Vinal. Commercial Standards Monthly (Natl.Bureau of Standards, Wash.,D.C.) 7, 35 (1930) OP
- Batteries and cells, dry. Federal Standard Stock Catalogue, Specification Symbol W-B-101a (May 7, 1935) W-B-101a 5¢
- Electrical characteristics of dry cells. G.W.Vinal and L.M.Ritchie. Chem. and Met. Eng. (McGraw-Hill Publishing Co., New York, N.Y.), 27, 546 and 603 (1922).
- The Government specification for dry cells, No. 3. G.W.Vinal (National Association of Purchasing Agents, New York, N.Y.) (1930)
- ASA Committee keeps standard on dry cells up-to-date. G.W.Vinal. Industrial Standardization (American Standards Association, 29 West 39th Street, New York) 8, 49 (1937)

Storage Batteries

<u>Title</u>	<u>Series</u>	<u>Price</u>
Cadmium electrode for storage-battery testing. H.D.Holler and J.M.Braham. (1919)	T146	OP
Estimation of nitrates and nitrites in battery acid. L.B.Sefton. (1920)	T149	OP
Operation and care of vehicle-type batteries. (1920)	C92	OP
Oscillograph measurements of current and voltage in the battery circuit of automobiles. G.W.Vinal and C.L.Snyder. (1921)	T186	OP
A new method for determining the rate of sulphation of storage-battery plates. G.W.Vinal and L.M.Ritchie. (1922)	T225	5¢

Electromotive force of cells at low temperatures. G.W.Vinal and F.W.Altrup. Sci.Pap.BS <u>17</u> 627 (1922)	S434	5¢
Measurement of electrical resistance and mechanical strength of storage battery separators. C.L.Snyder. Tech.Pap.BS <u>18</u> , 619 (1924-1925)	T271	10¢
Storage batteries, ignition, lighting and starting. Federal Standard Stock Catalogue, Specification Symbol W-B-131b, 1939.	W-B-131b	5¢
Determination of small quantities of volatile organic acids in sulphuric-acid solutions. D.N.Craig. BS J.Research <u>6</u> , 169 (1931)	RP267	5¢
Viscosity of sulphuric acid solutions used for battery electrolytes. G.W.Vinal and D.N.Craig. BS J. Research <u>10</u> , 781 (1933)	RP566	5¢
Composition of grids for positive plates of storage batteries as a factor influencing the sulphation of negative plates. G.W.Vinal, D.N.Craig and C.L.Snyder. BS J.Research <u>10</u> , 795 (1933)	RP567	5¢
Resistivity of sulphuric-acid solutions and its relation to viscosity and temperature. G.W.Vinal and D.N.Craig. J. Research NBS <u>13</u> , 689 (1934)	RF738	5¢
Chemical reactions in the lead storage battery. G.W.Vinal and D.N.Craig. J.Research NBS <u>14</u> , 449 (1935)	RP778	OP
Acid, sulphuric, (for) storage batteries. Federal Standard Stock Catalogue, Specification Symbol OA 111, 1935 (December 18, 1935)	OAll1	5¢
Solubility of lead sulphate in solutions of sulphuric acid, determined by dithizone with photronic cell. D.N.Craig and G.W.Vinal. J.Research NBS <u>22</u> , 55 (1939)	RP1165	5¢
Hydrometers, Syringe (for lead-acid storage batteries) Federal Standard Stock Catalogue, Specification Symbol GG-H-941, 1940 (March 7, 1940)	GG-H-941	5¢

- Thermodynamic properties of sulfuric-acid solutions and their relation to the electromotive force and heat of reaction of the lead storage battery. D.N.Craig and G.W.Vinal. J.Research NBS 24, 473 (1940) RF1294 5¢
- Note on the effect of Cobalt and Nickel in Storage Batteries. G.W.Vinal, D.N.Craig and C.L.Snyder. J.Research NBS 25, (1940) RP1335 (In press)
- Storage battery electrolytes. G.W.Vinal and G.N.Schramm. Trans. Am. Inst. Elec. Eng. (Am. Inst. Elec. Engineers, New York, N.Y.), 44, 288 (1925)
- Storage batteries. G.W.Vinal. (John Wiley and Sons, New York, N.Y.) 2nd ed. 1930 (see entry on page 6 of this circular).
- Storage batteries. G.W.Vinal. J.Opt.Soc. and Rev.Sci.Instruments. (Ithaca, N.Y.), 11, 263 (1925).
- Effect of temperature and other factors on the performance of storage batteries. G.W.Vinal and C.L.Snyder. Trans.Am.Electrochemical Soc. (Am. Electrochemical Soc., New York, N.Y.), 53, 233 (1928).

### Rectifiers

- Theory and performance of rectifiers. H.D.Holler and J.P.Schrodt. Tech.Pap.BS 18, 465 (1924-1925) T265 20¢

### Standard Cells and Potential Measurements

<u>Title</u>	<u>Series</u>	<u>Price</u>
Preliminary specifications for Clark and Weston cells. F.A.Wolff and C.E.Waters. Bul. BS <u>3</u> , 623 (1907)	S67	OP
Clark and Weston standard cells. F.A.Wolff and C.E.Waters. Bul. BS <u>4</u> , 1 (1907)	S70	OP
The electrode equilibrium of the standard cell. F.A.Wolff and C.E.Waters. Bul. BS <u>4</u> , 81 (1907-1908)	S71	OP

- Temperature formula of the Weston standard cell. F.A.Wolff. Bul. BS 5, 309 (1908-1909) S104 OP
- Announcement of a change in the value of the international volt. (1910) C29 OP
- The two common failures of the Clark standard cell. M.P.Shoemaker and E.C.McKelvy. Sci.Pap. BS 16, 409 (1920) S390 OP
- A method of studying electrode potentials and polarization. H.D.Holler. Sci.Pap. BS 20, 153 (1924-1926) S504 OP
- International comparison of electrical standards. G.W.Vinal. BS J. Research 8, 729 (1932) RP448 5¢
- Effect of service temperature conditions on the electromotive force of unsaturated portable standard cells. J.H.Park. BS J. Research 10, 89 (1933) RP518 5¢
- A temperature controlled box for saturated standard cells. E.F.Mueller and H.F. Stimson. J.Research NBS 13, 699 (1934) RP739 5¢
- Effect of glass containers on electromotive force of Weston normal cells. G.W.Vinal and M.L.Howard. BS J. Research 11, 255 (1933) RP588 5¢
- Solubility of mercurous sulphate in sulphuric-acid solutions. D.N.Craig and G.W.Vinal and F.E.Vinal. J.Research NBS 17, 709 (1936) RP939 5¢
- Electromotive force of saturated Weston standard cells containing deuterium oxide. L.H.Brickwedde and G.W.Vinal. J.Research NBS 20, 599 (1938) RP1094 5¢
- Maintenance of the volt. G.W.Vinal. Trans.Am.Electrochemical Soc. (Am.Electrochemical Soc., New York,N.Y.) 54, 247 (1928).
- Units of electrical measurement. G.W.Vinal. Trans.Am.Electrochemical Soc. (Am.Electrochemical Soc., New York, N.Y.) 55, 43 (1929).
- The definition of polarization, overvoltage and decomposition potential. W.Blum and G.W.Vinal. Trans. Electrochemical Soc. (Electrochemical Soc. Inc., New York,N.Y.) 66, 359(1934)

Standards of electromotive force. G.W.Vinal, D.N.Craig and L.H.Brickwedde. Trans.Electrochemical Soc. (Electrochemical Society, Inc., New York, N.Y.) 68, 139 (1935).

#### REFERENCES TO BOOKS AND SPECIFICATIONS ON BATTERY SUBJECTS

The National Bureau of Standards receives frequent inquiries regarding manufacturing processes and requests for other information which is not specifically covered in its publications. To meet the needs of such inquiries a very brief list of recent books relating to primary batteries and storage batteries is given below with a brief statement of the scope of the book and the name of the author and publisher. Specifications issued by Engineering Societies are listed in Section (c) below.

##### (a) Primary Batteries

Primary batteries. W.R.Cooper. (D. Van Nostrand Co., New York, N.Y.) 2nd edition, 1917. Theory, construction and use of the various forms of primary batteries.

##### (b) Storage Batteries

Storage batteries. G.V.Vinal. (John Wiley & Sons, New York, N.Y.) 3rd edition, 1940 (In press). Describes manufacturing processes, properties of the electrolyte, theory of reactions, operating characteristics, and testing. Uses for storage batteries are discussed.

Alkaline accumulators. J.T.Crennell and F.M.Lea. (Longmans Green and Co., New York, N.Y.) 1928. Development, construction and manufacture of alkaline storage batteries including several types. Electrochemical theory, electrical characteristics, operation, maintenance and applications.

Storage batteries. Morton Arendt. (D. Van Nostrand Co. Inc., New York, N.Y.) 1928. A general book on the subject, describing manufacture, assembly, upkeep and care of batteries.

(c) Specifications

(For specifications published by the Government see page 3)

American Standard specification for dry cells and batteries, C 18-1937, approved January 4, 1937 (American Standards Association, 29 West 39th Street, New York, N. Y.)

Standards for storage batteries, No. 36, February 1928 (American Institute of Electrical Engineers, 33 West 39th Street, New York, N. Y.) Approved as American Standard by the American Standards Association, C40-1928, October 1928.

S.A.E. Standard for storage batteries (Automotive types) approved January 1938 (Society of Automotive Engineers, 29 West 39th Street, New York, N.Y.)