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U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

Letter
Circular
LC 659

Washington

(August 20, 1941)

Replacing LC 59,
LC 212, LC 291
and LC 574

PAINT, VARNISH AND BITUMINOUS MATERIALS:

PUBLICATIONS BY MEMBERS OF THE STAFF OF THE NATIONAL BUREAU OF STANDARDS AND A LIST OF FEDERAL SPECIFICATIONS.

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General Information

This letter circular contains brief abstracts of a number of papers on paint, varnish, and bituminous materials published by the National Bureau of Standards. It contains also a list of Letter Circulars and of publications in outside journals reporting work on these subjects by members of the Bureau staff. There is included also a list of Federal specifications covering these materials.

None of the papers listed, except the Letter Circulars, is obtainable from the National Bureau of Standards. Those marked "OP" are out of print, but, in general, may be consulted at the libraries in large cities.

If the price is given, 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 countries that extend the franking privilege. When remitting for delivery to other countries, include in your remittance one-third of the total cost of the publications 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.

Circulars of the Paint Manufacturers' Association of the United States, of the American Paint and Varnish Manufacturers' Association, and of the National Paint, Varnish and Lacquer Association, Inc., that are in print are obtainable from the Institute of Paint and Varnish Research, 1500 Rhode Island Avenue, N. W., Washington, D. C.

Engineering Societies, 29 W. 39th Street, New York City, maintain a duplicating service and are prepared to supply photostated copies of technical articles that are available in any of the large libraries in New York City.

The publications of the National Bureau of Standards and the Federal specifications are designated by series letters followed by numbers. The explanation for these letters is as follows:

RP = "Research Paper". These are reprints of articles appearing in the Journal of Research of the National Bureau of Standards. When applying at a library, the Journal should be asked for, using the volume number as given in the reference. Volumes 1 to 12 were known as Bureau of Standards Journal of Research.

T = "Technologic Paper" of the National Bureau of Standards. This series has been superseded by the "Journal of Research".

C = "Circular" of the National Bureau of Standards.

LC = "Letter Circulars". These are mimeographed circulars issued without charge by the National Bureau of Standards and are designed to answer many requests for information.

BMS = Building Materials and Structures Reports of the National Bureau of Standards.

M = "Miscellaneous Publication" of the National Bureau of Standards.

R = "Simplified Practice Recommendations" of the National Bureau of Standards.

CS = "Commercial Standards" of the National Bureau of Standards.

R-P-, HH-C-, etc. = Federal specifications. These specifications are promulgated by the Director of Procurement, Treasury Department. "Federal Standard Stock Catalog, Section IV, Federal Specifications, Part I, Index", which lists all Federal specifications with prices, can be purchased for 15 cents from the Superintendent of Documents.

Those who wish to keep informed concerning work at the National Bureau of Standards should subscribe to the "Technical News Bulletin". It is a monthly publication which lists all papers published by members of the staff, whether appearing in Bureau publications or in other journals. It contains abstracts of papers appearing in the Journal of Research of the National Bureau of Standards, notes on progress of work in the laboratories, important conferences at the Bureau, and other items of general technical interest. Subscriptions should be sent to the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 50 cents per annum.

Part I - Technologic Papers

Title	Series	Price
The density and thermal expansion of linseed oil and turpentine. H. W. Bearce. The paper describes an experimental determination of the density and thermal expansion of linseed oil and turpentine. The work was undertaken for the purpose of obtaining the necessary data for preparing tables to give the density of these substances at any temperature between 10° and 40° C from the density at any other temperature. The data obtained are herein presented, together with the tables prepared therefrom. There are included also tables for converting pounds to gallons and gallons to pounds. (April 15, 1912). 27 pp.	T9	OP
Iodine number of linseed oil and petroleum oils. W. H. Smith and J. B. Tuttle. The iodine values of raw, boiled, and burnt linseed oils, and petroleum oils, were determined by the Hanus method, varying widely the amounts of oil and iodine used and the time of adsorption. Study of the effect of temperature on the iodine value was made. It is shown that in order to obtain concordant results a prescribed procedure must be followed and exact conditions stated. (April 28, 1914) 17 pp. At the present time the Wijs method is required in the various Federal Specifications for paint.	T37	OP

Title	Series	Price
Determination of oil and resin in varnish. E. W. Boughton. Some existing methods include precipitation of "gums" by petroleum ether and extraction of oxidized films with chloroform to dissolve out the resin, or both of these steps. It is shown that these methods give erroneous results with certain types of varnish. Determinations of the glycerol yield and calculation of the oil content therefrom gave fairly satisfactory results except with varnish that contained tung oil. The proposed method includes saponification of the varnish, separation of unsaponified matter, and separation of fatty acids from resin acids by the Twitchell or Wolff methods of esterification. Ethyl ether is used as solvent after esterification. A correction is applied for resinous matter that is weighed as fatty acids. The greatest error in the average results with the proposed method was 2.2 percent, expressed as percentage of the varnish. (Feb. 19, 1916) 32 pp. Federal Specifications for varnish are now based on physical tests, and the determination of oil and resin is not required.	T65	OP
Detection of resin in drier. E. W. Boughton. For the detection of resin in drier, three steps are proposed: (1) The Liebermann and Storch test for rosin; (2) treatment of the mixture of unsaponifiable matter, fatty acids, and resin acids obtained from the drier with 97-percent alcohol (if the drier contains much kauri or similar resin, a turbidity or insoluble deposit will result); (3) esterification by absolute alcohol and concentrated sulphuric acid with subsequent titration with alkali. (If the resulting acid number - mg of KOH per gram of the mixture of unsaponifiable matter and acids taken - is over 10, the drier contains resin. By this procedure resin can be detected where the amount is at least 6 percent.) (Jan. 15, 1916) 9 pp. The present Federal Specification for drier is based on physical and performance tests, and the detection of resin is not required.	T66	OP

Title	Series	Price
Effect of certain pigments on linseed oil. E. W. Boughton. The effect of storage of white-lead and linseed-oil paste on the constants of the oil is shown. Effect of storage of mixtures of various pigments with linseed on the constants of the oil is shown. An examination was made of oils from partially oxidized films of pigment and linseed-oil mixtures. The action of linseed-oil fatty acids on white lead and white zinc was investigated. The relative effects of certain pigments on the oxidation of linseed oil in paint films are shown. (April 13, 1916) 16 pp.	T71	OP
Determination of volatile thinner in oil varnish. E. W. Boughton. With samples of varnish containing turpentine or "mineral spirits" (light petroleum oil), methods based on (1) steam distillation, (2) on evaporation of the thinner from a film at 115° C, and (3) on evaporation of the thinner from a very thin film at room temperature, were all found to be sufficiently accurate for practical purposes. The results should be reported as the whole percentages next above the figures obtained. (June 21, 1916) 6 pp. The present Federal Specification for varnish uses method (2) and a temperature of 105-110° C.	T76	OP
Slushing oils. Percy H. Walker and Lawrence L. Steele A description of the general composition, properties, and uses of slushing oils is given. It is pointed out that these nondrying oily materials are intended for the protection of metal parts from corrosion in cases where it is not practical to galvanize, paint, or coat with some similar permanent protective agent. Comparative tests upon many commercial rust-preventive oils are given, and a proposed specification has been drawn up. It is believed that satisfactory slushing oils may be purchased upon the results of simple laboratory tests given in the proposed specification. (Oct. 14, 1920) 23 pp. Nothing more recent has been done on this subject at the Bureau. However, both the War and Navy Departments have specifications for rust-preventive compounds.	T176	OP

6. LC 659, Paint, Varnish and Bituminous Materials

Title	Series	Price

Shellac. Percy H. Walker and Lawrence L. Steele. Tech. Pap. BS 17, 277-296 (1923). A description is given of the source, manufacture, uses, and common methods of testing shellac. Emphasis is laid on the extent to which shellac spirit varnishes are adulterated, and the inadequacy of present methods for detecting such adulteration is shown. A new method for detecting adulteration in either flake or spirits shellac is described, and data are given on many samples of different grades. A suggested table for rating shellac samples from the data of this method is given. Recommended methods are given for the determination of such material in shellac as is insoluble in hot alcohol and for the determination of the shellac-alcohol ratio in a spirit varnish. Suggested specifications for pure orange flake shellac and pure orange shellac varnish are given. (March 12, 1923) 20 pp. — T232 — OP

Subsequent to this paper, Federal Spec. TT-V-91a for Shellac Varnish has appeared. Likewise RP 391 gives a more satisfactory method for insoluble matter.

Exposure tests on colorless waterproofing materials. D. W. Kessler. Tech. Pap. BS 18, 1-33 (1924-25). This paper describes a series of tests of several colorless waterproofing materials on different types of natural stone. The tests were made to determine the relative effectiveness of the materials, their durability under exposure to the weather, and their effect on the appearance of the stone. — T248 — OP

The results indicate that certain types of waterproofing materials are quite effective in preventing the absorption of water and some of these showed practically no deterioration during the two years covered by the tests. (Jan. 7, 1924) 33 pp.

Emissive tests of paints for decreasing or increasing heat radiation from surfaces. W. W. Coblentz and C. W. Hughes. Tech. Pap. BS 18, 171-187 (1924-25). Data are given on the emissivity of sheet iron, cotton duck, roofing material, artificial leather, etc., covered with white paint, vitreous enamel, aluminum paint, etc. A coat of aluminum paint emits only 30 to 50 percent as much thermal radiation as white paint, vitreous enamel, or other nonmetallic surfaces. The data are of interest in reducing the heat emitted from the under sides of roofs, awnings, tents, automobile tops, etc. — T254 — OP

Title	Series	Price

As applied to house radiators, which are convectors of heat, a gain of 15 to 20 percent in heat dissipation may be expected by covering the surface with a paint which is free from flakes of a metal, such as aluminum or bronze. (March 13, 1924) 17 pp.

Use of United States Government specification paints and paint materials. P. H. Walker and E.F. Hickson. Tech. Pap. BS 19, 27-46 (1925). A brief description is given of the various materials covered by the specifications. It is believed that the existing specifications are sufficient for practically all necessary painting operations of the Government. The system of using semipaste paint, whenever possible, is recommended, and suitable thinning formulas applicable for the average painting conditions have been developed. The proper method of breaking up and thinning stiff pastes in oil, semipastes, and mixed paints is discussed. The practical application of the various paints to all of the ordinary surfaces, such as wood, metal, cement, plaster, concrete, etc., is brought out and recommendations are made. The care of brushes and the brushing of paint are described. (Dec. 15, 1924) 20 pp. — T274 — OP

Government specifications for paints and paint materials have been much changed and diversified since the date of this publication.

A photometric method for measuring the hiding power of paints. H. D. Bruce. Tech. Pap. BS 20, 173-190 (1925). 28 pp. In this paper is described a method for measuring the hiding power of paints. Measurements are made upon the dry paint film. A black and white plate is mechanically coated with paint. The contrast between the black and white portions of the plate is then measured with a Martens photometer. The thickness of the paint film is measured by a direct-reading gage. Formulas are developed and presented for the calculation of the hiding power. The method is applicable to all but very opaque paints. Laboratory data are tabulated showing the accuracy of the method to be quite satisfactory. (Jan. 16, 1926) 18 pp. — T306 — OP

Reference is made to the more recent Federal Specifications for paints, for example TT-P-51a, where a wet hiding power method is described, and to TT-P-88, where a dry hiding power method is described.

8. LC 659, Paint, Varnish and Bituminous Materials

Part II - Circulars of General Information

Title	Series	Price
Paint and varnish. This publication is intended to give without unnecessary detail, information which should be of value to those interested in the use of paint and varnish. After a general discussion and classification of paints and varnishes and an explanation of the process of "drying", the raw materials, including oils, driers, thinners, resins, and pigments that enter into the composition of paint or varnish, are individually described. The methods of manufacture and of testing varnishes are presented, ready-mixed or prepared paints are discussed, and somewhat detailed instructions on mixing paints and stains, on color blending, and on the application of paint and varnish to various surfaces are given. Specifications in common use for many of the materials treated, and a glossary of painters' terms also appear. (Nov. 17, 1917) 85 pp.	C69	OP

While this publication is out of print, much of the information, brought up to date, is given in the various Letter Circulars and the Federal Specifications.

Miscellaneous Publications

Title	Series	Price
Some technical methods of testing miscellaneous supplies, including paints and paint materials, inks, lubricating oils, soaps, etc. In this publication are assembled methods, chiefly chemical, which have been found useful in a large number of cases in testing miscellaneous materials purchased either under definite specifications or examined for prospective purchases in competition with other samples of a similar nature. As a general rule, the methods described are not original but have been compiled from a variety of sources, and modifications have been introduced when necessary. (Nov. 15, 1916) 68 pp.	M15	OP

Newer methods for paint and paint materials can be found in the various Federal Specifications. In other respects, also, the publication is obsolete.

Title	Series	Price

Paint for priming plaster surfaces. Percy H. Walker and E. F. Hickson. In response to demands from several branches of the Government service for information and specifications for priming paints for plaster surfaces, a number of commercial and experimental paints were tested on plaster, concrete, and other porous surfaces. Several novel methods of test are described and results oobtained with 40 priming paints are recorded. It is found that a number of primers are commercially available which satisfactorily meet the requirements for a good material for this purpose with respect to hiding power, ability to so effectively seal a porous surface with one coat that the appearance of a second (finishing coat) of either flat or glossy oil or varnish paint will after drying have the same appearance as when applied to an impervious surface. It was found that the appearance or adherence of paint applied to any of the primers is materially affected by excessive moisture. A suggested specification based upon physical tests and comparison with a primer that can be readily mixed from specified materials is given in an appendix. (Aug. 31, 1932) 13 pp. — M137 — OP

This paper was the basis of the subsequent Federal Specification TT-P-56.

Part III - Research Papers

Title	Series	Price

Accelerated tests of organic protective coatings. Percy H. Walker and E. F. Hickson. BS J. Research 1, 1-17 (1928). This paper describes the equipment used at the National Bureau of Standards in accelerated tests of paints, varnishes, lacquers, bitumens, etc. — RP 1 — OP

A great variety of organic coatings, when subjected to a cycle of alternate exposure to light from an enclosed carbon arc, water spray and ozonized air, were shown to exhibit the same kind of decay as observed on exposure to the weather.

The difficulty of determining the relative condition of exposure tests is discussed, and methods for quantitatively determining when the coating ceases to protect are described. (July 1928) 18 pp.

Title	Series	Price

Tinting strength of pigments. H. D. Bruce. BS J. Research 1, 125-150 (1928). RP 7 10¢

In this paper there is presented a discussion of the tinting strength of pigments. It is not primarily proposed herein to offer a new method for estimating and expressing tinting strength, but rather to aid in clarifying ideas on the subject, so that when the science of colorimetrics has been further advanced a rational means for appraising this valuable property may be the more easily developed.

The necessity for considering the tinting strength of chromatic pigments as a two-factor property is shown. A distinction between the tinting strength of whites and of blacks is drawn. New names for three differentiated factors involved in tinting are offered, namely, chromatic, darkening, and brightening strengths. A method for treating these properties photometrically or spectrophotometrically and of indicating their relative magnitude by numerical indices is suggested. Tabular and graphical data are presented.

In connection with and incidental to the subject of tinting, certain empirical formulas have been developed in the argument, which may be used for computing the proper mixture of white pigment with pigment of another color in order to obtain a tint of some desired brightness or colorimetric purity.

The procedure employed in this work for specifying color in the monochromatic terms of dominant wave length, purity, and brightness is set forth with concise explanation in an appendix. (Aug. 1928) 26 pp.

The ring and ball method of test for softening point of bituminous materials, resins, and similar substances. Percy H. Walker. BS J. Research 4, 195-201 (1930). RP142 OP

The softening point of materials which, like asphalt, have no definite melting point, but which when heated gradually change from brittle or very thick and slow-flowing materials to more mobile liquids, can be determined only by some arbitrary method. The ring and ball method, which briefly consists in determining the temperature at which a disk of the material held in a ring and loaded with a ball will flow through a definite distance when heated at a prescribed rate, is one of the

Title	Series	Price

best methods for such tests. Published directions for making the test are, however, open to very serious objections, and this paper describes the apparatus and procedure used at the National Bureau of Standards. The principal modifications in the apparatus are a beveled instead of a cylindrical ring, and a centering device for the ball. The procedure is so described that some latitude in non-essential details is permitted. (Feb. 1930) 7 pp.

Durability tests of spar varnish. C. L. Came. B.S. J. Research 4, 247-259 (1930). Fifty commercial spar varnishes, which had been tested for conformity to Federal Specification No. 18b, were exposed to several accelerated weathering cycles and outdoors. Kauri reduction values were also determined. The varnish was applied both by whirling and brushing. Sandblasted and non-sand-blasted panels were used. RP146 OP

This paper correlates the tests mentioned above and also gives the results of similar tests made on experimental varnishes, prepared in the laboratory from various oils and resins.

A short bibliography pertaining to the subject matter of this paper is appended. (Feb. 1930) 13 pp.

Accelerated tests of asphalts. O. G. Strieter. BS J. Research 5, 247-253 (1930). Equipment and methods for testing asphalt by accelerated weathering are described. RP197 OP

A variety of asphalts are shown to exhibit the same type of changes when exposed alternately to a cycle consisting of light from an inclosed carbon arc, water spray, and sudden temperature changes as when exposed outdoors under actual weather conditions. (Aug. 1930) 7 pp.

A new test for predicting the durability of varnishes (The photochemical embrittling test). J. H. Wilson. BS J. Research 7, 73-83 (1931). The test described in this paper for evaluating varnishes consists in two operations. A varnish film is first exposed to an intense source of light for a definite period of time, after which it is bent double at a prescribed temperature over a rod of fixed diameter. The data presented show that the more durable the varnish, the longer it may be exposed to the light before it will crack on bending. RP333 OP

Title	Series	Price

This test possesses a number of advantages over those now in use for this purpose, owing to the simplicity of preparing the samples and making the test, and the speed with which results can be obtained. (May 14, 1931) 11 pp.

Determination of insoluble matter in shellac. C. C. Hartman. BS J. Research 7, 1105-13 (1931) RP391 OP

In existing specifications for shellac, the insoluble content is generally defined as that portion which is insoluble in hot 95 percent ethyl alcohol, denatured with methyl alcohol. The standard methods now employed are shown to give erroneous results, caused by (a) incomplete solubility of the shellac wax in hot 95 percent alcohol, (b) possible loss of fine particles of insoluble matter, and (c) retention of some of the solvent by the filter medium.

Butanol (normal butyl alcohol) and ethylene glycol monoethyl ether (Cellosolve) are shown to be more satisfactory solvents for both the shellac resin and shellac wax than 95 percent denatured alcohol. A glass-filter crucible with a disk of filter paper and an asbestos mat is a more satisfactory and efficient filtering medium than a paper extraction thimble or a series of cotton pads.

A new method is proposed in which a filter crucible and either butanol or Cellosolve are used. This method is simple and rapid and yields reproducible and accurate results. (Dec. 1931) 9 pp.

A modified accelerated weathering test for asphalts and other materials. O. G. Strieter and H. R. Snoke. BS J. Research 16, 481-485 (1936). RP886 OP

A modified method for testing asphalts and similar complex materials by accelerated weathering is described.

A variety of materials are shown to exhibit the same type of chemical changes when exposed to the accelerated weathering cycle. The experiments show that the weathering process gradually transforms these materials into products that are largely soluble in water, and that these soluble products may be collected quantitatively for examination and identification. The function of light and oxygen in the weathering process is explained, and data are given to show that the products of accelerated weathering are similar to those obtained in outdoor exposures. New applications of accelerated weathering are suggested. (May 1936) 5 pp.

Title	Series	Price
A study of the weathering quality of roofing felts made from various fibers. O. G. Strieter. J. Research NBS 16, 511-523 (1936). An investigation to determine the relative effect of different fibers on the life and serviceability of asphalt-saturated and coated felts has been in progress at the National Bureau of Standards since 1926. Experimental felts composed of varying proportions of the usual felt-making fibrous materials and some with a high content of substitutes not employed commercially in roofing felts, were made for the investigation. The papermaking materials employed were no. 2 roofing rags, old jute and manila bagging, old newspapers, sulphite pulp, and finely ground wood sawdust. Some of the felts were made on a commercial, cylinder felt-making machine, while others were made on a small Fourdrinier paper machine, but all the felts were saturated and coated in commercial roofing mills, and thus converted into roofing material. Measurements were made on the dry or unsaturated felts, on the saturated felts, and on the finished roofing. On the last two products the measurements were made before and after exposure outdoors. These measurements show that there was no significant difference in the resistance to weathering of asphalt roofing which may be attributed to the kind of fiber or combination of fibers employed. (May 1936) 13 pp.	RP888	OP
Accelerated weathering tests of mineral-surfaced asphalt shingles. Hubert R. Snoke and Braxton E. Gallup. J. Research NBS 18, 669-681 (1937). A method for testing mineral-surfaced asphalt-prepared roofing by accelerated weathering is described, and the results of tests by this method on 39 samples of standard-weight strip shingles, from eight manufacturers, are reported. All of the types of failure encountered in long outdoor exposures of these roofings have been produced in exposures of 7 months or less, the samples furnished by each manufacturer showing a characteristic behavior, largely independent of the granular surfacing materials used.	RP1002	10¢

14. LC 659, Paint, Varnish and Bituminous Materials.

Title	Series	Price

Except that the samples containing fine mineral filler in the asphalt coatings appear to be the most resistant to weathering, analyses of the samples under test, including fiber analyses of the felts and petrographic examination of the mineral fillers and fine surfacing materials, show no differences in composition sufficiently great to warrant the prediction of decided differences in their behavior to weathering.

The results of water absorption tests on unweathered samples and on samples exposed 1, 5, and 7 months to accelerated weathering are given. Accelerated blister, slide, and abrasion tests developed by the industry are briefly described, and the results of these tests on the samples in this investigation are reported.

Some properties and tests of traffic or zone paints. RP1007 10¢
Eugene F. Hickson. J. Research NBS 19, 21-30 (1937). This publication describes some properties and tests of traffic paints. These paints are of a different type from ordinary paints and vary greatly in abrasion resistance. Experience gained from actual road tests is cited. An accelerated wearing test is described. A distinct improvement in durability of the traffic paints in actual service has resulted. Specifications for white and yellow traffic paints are suggested.

Weathering tests on filled coating asphalts. RP1073 10¢
O. G. Strieter. J. Research NBS 20, 159-171 (1938). The durabilities of filled and unfilled coating asphalts were determined both in outdoor and in accelerated exposures. The results show that, in general, the durability of coating asphalt to weathering can be improved by the addition of mineral fillers, and that there is a difference in the effectiveness of various sizes and types of fillers. The data demonstrate the similarity between outdoor and accelerated weathering.

Title	Series	Price
Hue, saturation and lightness of surface colors with chromatic illumination. Deane B. Judd. J. Research NBS 24, 293-333 (1940). The visual mechanism of a normal observer is so constructed that objects keep nearly their daylight colors even when the illuminant departs markedly from average daylight. The processes by means of which the observer becomes adapted to the illuminant or discounts most of the effect of a nondaylight illuminant are complicated; they are known to be partly retinal and partly cortical. By taking into account the various fragments of both qualitative and quantitative information to be found in the literature, relations have been formulated by means of which it is possible to compute approximately the hue, saturation, and lightness reflected from the surfzce color from the tristimulus specifications of the light reflected from the surface of the light reflected from the background against which it is viewed. Preliminary observations of 15 surfaces under each of 5 different illuminants have demonstrated the adequacy of the formulation, and have led to an approximate evaluation of the constants appearing in it. More detailed and extensive observations have been carried out in the psychological laboratories of Bryn Mawr College, and these observations have results in an improved formulation.	RP1285	10¢
Effect of paint on the sound absorption of acoustic materials. V. L. Chrisler. J. Research NBS 24, 547-553 (1940). A brief discussion is given of the properties of a material that cause it to absorb sound. Photographs are shown and the results of sound-absorption measurements are given for a number of different types of materials before and after painting. A brief discussion is given of the kind of paint which should be used and how it should be applied to minimize the effect of the paint on the acoustical properties.	RP1298	10¢
Apparatus for the study of the photochemistry of sheet materials. Herbert F. Launer. J. Research NBS 24, 567-577 (1940). An apparatus is described which was developed for studies of the photochemistry of organic materials in sheet form. The problems involved in such studies are discussed, and data are presented to show the extent to which various important requirements have been met in the design of the apparatus.	RP1300	10¢

Title | Series Price

One of the most important problems involved in such studies is the elimination of concurrent temperature effects. Temperatures of thin sheet materials - such as paper, cellulose acetate, Cellophane, rubber, felt cloth, and a paint film- under various conditions of irradiation with the Pyrex-enclosed electric arc, were measured with thermocouples. Temperatures as high as 280° C were found in white paper exposed to a 2,080-watt arc, at a distance of 16 cm. Under less severe conditions, some of which were similar to those of the artificial "weathering" and "light" stability tests, in use at the National Bureau of Standards and elsewhere, temperatures between 80° and 150° C were found in the various sheet materials. Since most of the materials named are known to undergo marked thermal decomposition at these higher temperatures, the control of temperature is important.

Determination of nonvolatile matter and the calculation of "cut" of shellac varnish. Charles C. Hartman. J. Research NBS 25, (1940). Using the three recognized methods for determining the nonvolatile content of shellac varnish, 70 varnishes, made by cutting 33 dry orange shellacs and 6 dry bleached shellacs in 5 different solvents, were examined and a summary of the results was prepared. This summary shows: (1) That the method given in Federal Specification TT-V-91 is most convenient and simple in operation, and that the results obtained thereby are in closer agreement than those obtained by the methods given in the specifications of the American Society for Testing Materials and of the U. S. Shellac Importers Association, Inc.; (2) That the presence of volatile matter in dry shellac and the use of solvents with high end points influence, decidedly, the nonvolatile determination; and (3) That, in calculating the "cut" of a shellac varnish, a positive correction must be made to the percentage of nonvolatile residue for the volatile content of the dry shellac determined at 105° C. RP1333 5¢

Title	Series	Price
A multipurpose photoelectric reflectometer. Richard S. Hunter. J. Research NBS 25, 581-618. The multipurpose reflectometer was developed primarily to measure apparent reflectance, specular gloss, and trichromatic coefficients. These measurements are useful in the ceramic, paint, textile, paper, and chemical industries to indicate lightness, gloss, and color of finished articles. In the reflectometer, two light beams from a single source are directed along separate paths to two barrier-layer photocells. Various types of these photocells were studied to find which could be used most advantageously. The reflectometer employs a substitution null method and requires a galvanometer to indicate equality of the currents generated by the two photocells. For each sample tested, there is a photometric adjustment to restore equality of the currents. The amounts of photometric adjustment are measured on the direct-reading scale, one of which is used for apparent reflectance and the other for specular gloss. Because of its high precision, the instrument is well suited for measuring small differences in apparent reflectance, gloss, or color of nearly identical samples. However, for greatest accuracy, it is necessary to correct the scale readings by calibration.	RP1345	10¢
Method for determining the components of asphalts and crude oils. O. G. Strieter. J. Research NBS 26, (1941). The ordinary procedure for the analysis of asphalts, which uses petroleum naphtha and carbon bisulfide as solvents, does not yield satisfactory results. Recently it has been found that by substituting pentane for the petroleum naphtha and ether for the carbon bisulfide, accurately reproducible results can be obtained for the content of asphaltenes, resins, and the oily constituents.	RP1387	5¢

Part IV - Building Materials and Structures Reports

Title	Series	Price
Survey of roofing materials in the southeastern states. Hubert R. Snoke and Leo J. Waldron. Building Materials and Structures Report, BMS6, 23 pp. November 4, 1938. A survey of the weathering qualities and extent of use of the various roofing materials on dwellings in the Southeastern States is described. Detailed studies of roofing materials in Greensboro, N.C., Columbia, S. C., Savannah and Atlanta, Ga., Jacksonville and Orlando, Fla., Birmingham, Ala., Knoxville, Tenn., and Charleston, W. Va., are reported. A tabulation, by States, of the kinds of roofing materials used on more than 10,000 rural and small town dwellings, along approximately 2,500 miles of highway, is included. Forty-eight photographs, illustrating types of weathering of roofing materials, and features of design and construction of roofs, are shown.	BMS6	15¢
Methods of investigation of surface treatment for corrosion protection of steel. Rolla E. Pollard and Wilbur C. Porter, Building Materials and Structures Report, BMS 8, 10 pp., October 11, 1938. Some of the factors affecting the protective value of paints for steel and galvanized surfaces are being studied by accelerated laboratory corrosion tests supplemented by outdoor exposure tests. Short descriptions are given of the various methods of testing. The significance and the limitations of such tests as compared with actual service tests are briefly discussed and the materials, pretreatment processes, and paint included in the testing program are outlined. Special attention is being given to the severity of corrosion which may result from condensed moisture.	BMS8	10¢
Survey of roofing materials in the Northeastern States. Hubert R. Snoke and Leo J. Waldron. Building Materials and Structures Report, BMS 29, 27 pp. October 11, 1939. A survey of the weathering qualities and extent of use of the various roofing materials on dwellings in the Northeastern States is described, with numerous comparative references to a similar survey in the Southeastern States.	BMS29	10¢

Title	Series	Price

Detailed studies of roofing materials in Wilmington, Del.; Philadelphia, Pa.; New Haven, Conn.; Boston, Mass.; Manchester, N. H.: Portland, Maine; Rutland, Vt.; and Albany and Syracuse, N. Y., are reported.

A tabulation, by States, of the kinds of roofing materials used on more than 10,000 rural and small town dwellings, along approximately 1,600 miles of highway between the cities listed above, is included; also a summary of the kinds of roofing materials used on almost 21,000 rural and small-town dwellings along 4,000 miles of highway in 20 Eastern States.

Forty-eight photographs, illustrating types of weathering of roofing materials, and features of design and construction of roofs, are shown.

Surface treatment of steel prior to painting. Rolla E. Pollard and Wilbur C. Porter. Building Materials and Structures Report, BMS44, 17 pp. (1940). BMS44 10¢ A number of surface-treatment processes are described for both plain and galvanized steel. Among such treatments subjected to accelerated weathering, salt spray, and condensation corrosion tests, the hot-dip phosphate treatments for both plain and galvanized surfaces showed outstanding merit in improving the protective value of paints. Particularly effective protection was obtained when such treatments were used, under severely corrosive conditions, in combination with a primer of the inhibitive type. A phosphate cold wash for galvanized steel and two phosphate-chromate cold-wash treatments for plain steel also appeared to improve paint protection.

Roofing in the United States - results of a questionnaire. Leo J. Waldron and Hubert R. Snoke. Building Materials and Structures Report, BMS 57, 7 pp. September 18, 1940. BMS57 10¢ In an effort to obtain a general picture of roofing practices and conditions throughout the country, a questionnaire was circulated to 148 field offices of the Home Owners' Loan Corporation and Federal Housing Administration in 48 states and the District of Columbia. This report summarizes the combined results of these replies.

The questionnaires covered the following items: Distribution, durability, unsuitability, and restrictions of various roofing materials; customary roofing practices; materials for nails, valleys, flashings, gutters, and downspouts; causes of premature roof failures; and the use of new types of roofing materials.

The data are presented graphically where possible.

Title	Series	Price
Solar heating of various surfaces. Herman V. Cottony and Richard S. Dill. Building Materials and Structures Report, BMS 64, 5 pp. January 23, 1941. Measurements were made on the temperatures attained by a number of painted and other surfaces exposed to the sun, and it was found that surfaces covered with white or light-colored paint remained cooler under this condition than those covered with dark paint. A surface covered with glossy white paint was cooler than any other tried, while one covered with flat white paint was nearly as cool. A lampblack surface was the warmest of the surfaces tried, and one covered with green trim paint was nearly as warm. The temperature attained by surfaces painted with various shades of gray, yellow, and ivory paint fell between those reached by the white and the green surfaces.	BMS64	10¢
Asphalt-prepared roll roofings and shingles. Hubert R. Snoke, Building Materials and Structures Report, BMS 70, 34 pp. (1941). Asphalt-prepared roofings are defined, their development is sketched briefly, and recent statistics of production are presented. Factors which influence the choice of roofing materials generally are discussed. Materials used in the manufacture of asphalt-prepared roofings and the processes of manufacture are described. Analyses of typical roofings are shown. Factors which should be considered in purchasing asphalt-prepared roll roofings and shingles are discussed, and illustrated graphically for types of shingles that are used most generally. Methods of application and maintenance are described, and the weathering of asphalt-prepared roofings is discussed.	BMS70	15¢
Survey of roofing materials in the North Central States. Hubert R. Snoke and Leo J. Waldron, Building Materials and Structures Report, BMS 75, (1941). A survey of the weathering qualities and extent of use of the various roofing materials on dwellings in the North Central States is described, with numerous references to similar surveys made previously in the Southeastern and Northeastern States.	BMS75	15¢

Detailed studies of roofing materials in Pittsburgh, Pa.; Cincinnati and Toledo, Ohio; Grand Rapids and Lansing, Mich.; Chicago, Ill.; Milwaukee, Wis.; St. Paul, Minn.; Bismarck, N. Dak.; Sioux Falls, S. Dak.; Omaha, Neb.; Kansas City, Moberly and St. Louis, Mo.; and Indianapolis, Ind., are reported.

A tabulation, by States, of the kinds of roofing materials used on more than 8,000 rural and small-town dwellings, along approximately 3,000 miles of highway between the cities listed above, is included; also a summary of the kinds of roofing materials used on almost 29,000 rural and small-town dwellings along 7,000 miles of highway in the 32 states covered by the three surveys.

Forty-eight photographs, illustrating types of weathering of roofing materials, and features of design and construction of roofs, are shown.

Part V - Letter Circulars

Title	Series
Acid-proof coatings for concrete surfaces	LC 42
Protection of track scale parts from corrosion	LC 54
Specification for paint for use on R.R. track scale	LC 81
Polishes	LC 275
Painting plaster	LC 304
Spray painting	LC 334
Luminous paint	LC 336
Painting water tanks	LC 337
The painting of structural metal	LC 422
Painting of steam and hot water radiators	LC 445
Quality of linseed oil for Government use	LC 457
Wood and shingle stains	LC 464
The reflectance of paints and pigments	LC 470
Inside wall paint for chemical laboratories (heat- and fume-resisting enamel paint)	LC 489

Title	Series
Roofing materials for low-cost housing construction	LC 502G
Surface treatment for corrosion protection of steel members for low-cost housing construction	LC 502H
Methods of investigation of cement-water paints	LC 502M
Dampness in masonry walls above grade	LC 514
Color harmony	LC 525
Color charts	LC 526
Color and legibility	LC 351
List of publications relating to paint, painting, varnish, lacquer, bitumens and allied subjects (includes reference books)	LC 542
oxide reflectance std. Preparation & colorimetric properties of a magnesium/	LC 547
Fluorescence and phosphorescence	LC 550
Outside house painting	LC 603
Care of floors	LC 627
Fluorescent lamps	LC 652

Part VI - Simplified Practice Recommendations

Title	Series	Price
Paint and varnish brushes	R43-28	5¢
Color for school furniture	R111-30	5¢
Paints, varnishes and related products	R144-37	5¢
Color code for marking steel bars	R166-37	5¢
Color marking for anesthetic gas cylinders	R176-41	5¢

Part VII - Commercial Standards

Title	Series	Price
Colors for sanitary ware	CS30-31	20¢
Colors for kitchen accessories	CS62-38	5¢
Colors for bathroom accessories	CS63-38	5¢

Part VIII - Outside Publications

Some tests of paints for steel subjected to alternate exposure to air and fresh water, Percy H. Walker and S. S. Voorhees, J. Ind. Eng., Chem. 5, 899 (Nov. 1913).

Notes on the color designation of oil varnish, F. A. Wertz, J. Ind. Eng. Chem. 10, 475 (June 1918).

A new hexabromide method for linseed oil, L. L. Steele and F. M.Washburn, J. Ind. Eng. Chem. 12, 52 (Jan. 1920).

The determination of acid number of tung and other vegetable oils, L. L. Steele and G. G. Sward, J. Ind. Eng. Chem. 14, 57 (Jan. 1922).

Some physical properties of paint, Percy H. Walker and J. G. Thompson, Proc. Am. Soc. Test. Materials 22, Part 2, 464 (1922).

Abietic acid and certain metal abietates, L. L. Steele, J. Am. Chem. Soc. 44, 1333 (June 1922).

Notes on two fossil coal resins, L. L. Steele, Am. J. Sci. 7, 389 (May 1924).

Importance of position in weather tests, Percy H. Walker, Ind. Eng. Chem. 16, 58 (May 1924).

Some observations on red lead as a paint pigment, E. F. Hickson and H. R. Snoke, Paint Mfrs. Assoc. of the U.S., Circ. 207, (July 1924)

The effect of mineral fillers on the serviceability of coating asphalts, O. G. Strieter, Proc. Am. Soc. Test. Materials 36, Part 2, 486 (1936).

Some properties and tests of traffic or zone paints, E. F. Hickson, National Paint, Varnish and Lacquer Assoc., Inc., Circular No. 532 (1937).

Effect of certain metallic soaps on the drying of raw linseed oil. L. L. Steele, Ind. Eng. Chem. 16, 957 (Sept., 1924).

Paints resistant to sulphide fumes, Percy H. Walker and E. F. Hickson, Ind. Eng. Chem. 16, 1142 (Nov. 1924).

Some observations on aluminum paint, Percy H. Walker and E. F. Hickson, Chem. and Met. Eng. 31, No. 18 (Nov. 3, 1924).

The swinging beam method of testing varnish films, Percy H. Walker and L. L. Steele, Paint Mfrs. Assn. of the U. S., Circ. 229 (March 1925).

Paint and varnish research at the Bureau of Standards, Percy H. Walker, J. Chem. Education 3, 777 (July 1926).

A study of the peroxide and persulphate methods for determining chromium in chrome paint pigments, E. F. Hickson, Am. Paint and Varnish Mfrs. Assn. Circ. 294 (Nov. 1926).

Penetration tests on paste paint, E. F. Hickson, Am. Paint and Varnish Mfrs. Assn., Circ. 300 (Jan. 1927).

A study of commercial flat wall paints (lithopone type), E. F. Hickson, Am. Paint and Varnish Mfrs. Assn., Circ. 305, (March 1927).

The measurement of the gloss of paints by the Ingersoll Glarimeter, E. F. Hickson, Am. Paint and Varnish Mfrs. Assn., Circ. 307 (April 1927).

Some precautions to be observed in using saturated solutions for controlling the humidity of air spaces, Percy H. Walker, L. L. Steele and E. F. Hickson, Am. Paint and Varnish Mfrs. Assn., Circ. 310, 292 (May 1927).

Effect of certain organic bases in plasticized nitrocellulose films, L. L. Steele, Ind. Eng. Chem. 19, 807 (July 1927).

Some methods of testing paint and varnish materials, Percy H. Walker, International Congress for Testing Materials, Part II, 603 (1927).

Accelerated tests of organic protective coatings, Percy H. Walker, and E. F. Hickson, Ind. Eng. Chem. 20, 591 (June 1927).

Unreliability of visual inspection of exposure tests of paints, Percy H. Walker and E. F. Hickson, Ind. Eng. Chem. 20, 997 (Oct. 1928).

Present status of the technic of evaluating paint service, Percy H. Walker, Proc. Wood Painting Conference, Madison, Wis. (Sept. 13 and 14, 1929). (Issued in mimeographed form by Forest Products Laboratory).

Some random suggestions on the purchase of paint, Percy H. Walker Commercial Standards Monthly 7, No. 1 (July 1930).

Preparation of surfaces other than wood and composition board for paint and similar coatings, Percy H. Walker. (Read April 11, 1930, to Paint and Varnish Superintendent's Club of the Philadelphia District. Published by Adelphia Reporting Board, Philadelphia, Pa.)

Advantages of oxide films as bases for aluminum pigmented surface coatings for aluminum alloys, R. W. Buzzard and W. H. Mutchler. Nat. Advisory Com. for Aeronautics Technical Note 400 (November 1931).

Preparation, use and abuse of specifications for paint materials, P. H. Walker. Symposium on paint and paint materials, Am. Soc. Test. Mtls. (March 6, 1935).

Laboratory testing of inside flat wall finishes from the consumer's viewpoint, E. F. Hickson, Symposium on correlation between accelerated laboratory tests and service tests on protective and decorative coatings, Am. Soc. Test. Mtls. (June 29, 1937).

Outdoor exposure test of paints for exterior masonry walls Clara Sentel, National Paint, Varnish and Lacquer Assoc., Inc., Circular 609 (1941).

Part IX - Federal Specifications

(The specifications are grouped in accordance with the classification adopted for the Federal Standard Stock Catalog, Section IV, Part 1, Federal Specifications. The price of this complete list of Federal Specifications is 15 cents. The price of each is five cents. See page 1, fifth paragraph).

Coal Tar and Products

Title	Series
Pitch; coal-tar (for) mineral-surfaced built-up roofing, waterproofing and dampproofing	R-P-381
Tar; cold application (for) roads	R-T-101
Tar; (for) joint filler	R-T-111
Tar; refined, construction (for) roads	R-T-121
Tar; refined (for) crack filler	R-T-126
Tar; refined, hot application (for) roads	R-T-131
Tar; repair work (for) roads	R-T-141

Title	Series
Insulating Materials	
Cotton-fabric; woven, asphalt-saturated flashings	HH-C-581a
Felt; coal-tar-saturated (for) roofing and waterproofing	HH-F-201
Felt; asphalt-saturated (for) flashings, roofing and waterproofing	HH-F-191
Minerals and Products	
Asphalt; (for) built-up roofing, waterproofing and dampproofing	SS-A-666
Asphalt; cut-back (for) road work	SS-A-671
Asphalt; emulsion (for) road work	SS-A-674
Asphalt; petroleum, Type PAF-1-25 (for) joint filler (squeegee or pouring method)	SS-A-696
Asphalt primer (for) roofing and waterproofing	SS-A-701
Asphalt (for use in) road and pavement construction	SS-A-706
Cement; bituminous plastic	SS-C-153
Roof coating; asphalt, brushing consistency	SS-R-451
Roofing; asphalt-prepared, smooth-surfaced	SS-R-501
Roofing; asphalt, (and asbestos), prepared, mineral-surfaced	SS-R-511
Roofing and shingles; asphalt-prepared, mineral-surfaced	SS-R-521
Paints, Pigments, Varnishes and Products	
Aluminum-pigment-paste; (for) paint	TT-A-466
Aluminum powder; (for) paints (aluminum-bronze powder)	TT-A-476
Boneblack; dry, paste-in-japan, paste-in-oil	TT-B-601
Calcimine; hot and cold water	TT-C-96
Chrome, green; pure, dry, paste-in-japan, paste-in-oil	TT-C-?36

Title	Series
Basic lead sulphate, blue (dry and paste-in-oil)	TT-B-486
Chrome, green; oxide	TT-C-231
Chrome, yellow; dry, paste-in-japan, paste-in-oil	TT-C-291a
Drier; paint, liquid	TT-D-651
Enamel; heat-resisting (400° F), black	TT-E-496
Enamel; interior, gloss, light tints and white	TT-E-506a
Enamel; pigmented (air-drying and baking), black	TT-E-521
Enamel; water-resisting, red	TT-E-531a
Filler; wood, paste	TT-F-336
Indian red; dry, paste-in-japan, paste-in-oil	TT-I-511
Lampblack; dry, paste-in-japan, paste-in-oil	TT-L-71
Ocher; dry, paste-in-japan, paste-in-oil	TT-O-111
Oil; flatting	TT-O-356
Paint, blue lead	TT-P-20
Paint; powder, cement-water, white and tints, for interior and exterior use	TT-P-21
Paint, cold water, casein binder, light tints and white	TT-P-23a
Paint, graphite, outside, ready-mixed, black	TT-P-27
Paints; iron-hydroxide and iron-oxide, ready-mixed and semipaste	TT-P-31
Paint; lead-zinc base, ready-mixed and semipaste, white and tinted	TT-P-36a
Paints; oil, interior, eggshell flat finish, ready-mixed and semipaste, light tints and white	TT-P-51a
Paint; medium chrome yellow, outside, ready-mixed	TT-P-53
Paint; (for) priming plaster surfaces (plaster primer and sealer)	TT-P-56
Paint; international orange	TT-P-59

28. LC 659, Paint, Varnish and Bituminous Materials

Title	Series
Paint; (ready-mixed and semipaste) black	TT-P-61
Paints; ready-mixed and semipaste, green	TT-P-71a
Paints; ready-mixed and semipaste, olive drab	TT-P-81
Paint; red-lead base; linseed oil, ready-mixed	TT-P-86
Paint; paste, resin emulsion, interior, light tints and white	TT-P-88
Paint; rubber base for cement floors	TT-P-91
Paints; titanium-zinc-lead and titanium-zinc, outside, ready-mixed and semipaste, white only	TT-P-101a
Paint, varnish, lacquer and related materials; General specifications (methods for sampling and testing)	TT-P-141
Paint; white lead base, basic carbonate, ready-mixed	TT-P-156
Paint; primer, zinc dust-zinc oxide for galvanized surfaces	TT-P-641
Prussian blue; dry, paste-in-japan, paste-in-oil	TT-P-691
Putty; metal sash	TT-P-781a
Putty; pure linseed oil (for) wood sash glazing	TT-P-791a
Radioactive luminous-compound and adhesives	TT-R-58
Red-lead; dry and paste-in-oil	TT-R-191a
Remover; paint and varnish (organic solvent type)	TT-R-251
Sealer,floor, wood	TT-S-176
Shellac, orange	TT-S-271
Thinner; paint (for) semipaste paints	TT-T-271
Ultramarine blue; dry, paste-in-japan, paste-in-oil	TT-U-451
Varnish, asphalt	TT-V-51
Varnish, damar	TT-V-61
Varnish, interior	TT-V-71a

Title	Series
Varnish, mixing (for) aluminum paint	TT-V-81a
Varnish, cabinet, rubbing	TT-V-86
Varnish, shellac	TT-V-91a
Varnish, spar, water-resisting	TT-V-121a
White lead; basic-carbonate, dry, paste-in-oil and semipaste containing volatile thinner	TT-W-251a
White lead; basic sulphate, dry and paste-in-oil	TT-W-261a
Zinc oxide; dry and paste-in-oil	TT-Z-301
Zinc oxide; leaded, dry and paste-in-oil	TT-Z-321

Paper and Products

Title	Series
Paper; sheathing, waterproof	UU-P-536

Vegetable Products

Title	Series
Oil; linseed,boiled	JJJ-O-331
Oil; linseed, raw	JJJ-O-336

Wood Products

Title	Series
Turpentine; (for) paint, Type I	LLL-T-791b
Turpentine; (for) paint, Type II	LLL-T-792a
Wood-preservative; coal-tar-creosote (for) ties and structural timbers	TT-W-556
Wood-preservative; creosote (for) brush and spray treatment	TT-W-561a
Wood-preservative; creosote-coal tar solution (for) ties and structural timbers	TT-W-566