

(February 12, 1937)

THE AVAILABILITY TO THE PUBLIC OF THE RESEARCH AND TESTING  
FACILITIES OF THE NATIONAL BUREAU OF STANDARDS

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FUNCTIONS OF THE BUREAU AS DEFINED BY LAW

It is a well recognized policy on the part of manufacturers, testing laboratories and others to require that instruments which serve as controls for uniformity and quality of production in industry or the standards which they use to check uniformity or quality, shall be tested by an institution other than the manufacturer of such instruments to determine their precision characteristics. The need for a national laboratory which would at one and the same time furnish this service in the United States to the Federal Government, the States, and the public was one reason - perhaps the principal one - for the Act of Congress establishing the National Bureau of Standards which provides:

"Sec. 2. That the functions of the bureau shall consist in the custody of the standards: the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce and educational institutions with the standards adopted or recognized by the Government; the construction, when necessary, of standards, their multiples and subdivisions; the testing and calibration of standard measuring apparatus: the solution of problems which arise in connection with standards; the determination of physical constants and the properties of materials, when such data are of great importance to scientific or manufacturing interests and are not to be obtained of sufficient accuracy elsewhere.

"Sec. 3. That the bureau shall exercise its functions for the Government of the United States: for any State or municipal government within the United States; or for any scientific society, educational institution, firm, corporation, or individual within the United States engaged in manufacturing or other pursuits requiring the use of standards or standard measuring instruments. All requests for the services of the bureau shall be made in accordance with the rules and regulations herein established."

(31 Stat. L., p. 1449; March 3, 1901)

#### STATEMENT OF TEST POLICY

In accordance with a ruling promulgated by the Department of Commerce on June 26, 1936, no tests, experiments or investigations will be made or special services performed for the public, unless such services cannot be obtained elsewhere and then only upon full payment of the cost thereof, including the salaries of the employees engaged therein and a proper proportion of the overhead expenses.

In this connection, Section 8 of the Act establishing the Bureau, as amended June 30, 1932 (47 Stat. L., p. 410) concerning charges to be made to the public for tests, should be noted:

"Sec. 8. For all comparisons, calibrations, tests, or investigations, performed by the National Bureau of Standards under the provisions of this Act, as amended and supplemented, except those performed for the Government of the United States or State governments within the United States, a fee sufficient in each case to compensate the National Bureau of Standards for the entire cost of the services rendered shall be charged, according to a schedule prepared by the Director of the National Bureau of Standards and approved by the Secretary of Commerce. All moneys received from such sources shall be paid into the Treasury to the credit of miscellaneous receipts."

### Permissible Tests

The following classes of work within the Bureau's field may be taken up when in the judgment of the Bureau the conditions warrant:

1. Fundamental tests for National or State Governments or to aid science and industry or the general public, especially fundamental investigations involving standards which the Bureau is uniquely fitted to conduct.
2. Routine tests and other services authorized by law where funds, facilities, and personnel are available, for example, the testing and certification of weights and measures, materials, and devices, provided such work does not involve competition with qualified commercial laboratories.
3. Referee tests or investigations to settle disputes where private laboratories are unable to agree on fundamental measurements, test results, or interpretation of such results, provided (1) the importance of the case justifies the time and outlay, and (2) all parties agree in writing to accept and abide by the Bureau's report.
4. Informal tests the results of which promise to be of sufficient value to the Bureau in solving some Bureau problem relating to similar materials, processes, or device.
5. Cooperative tests (without fee) the results of which are desired both by the Bureau and cooperating agencies, in so far as funds and staff permit. In many cases the research associate of the organization concerned is detailed to work with the Bureau's expert in solving a problem. If done primarily for the information of a manufacturer in improving his product or process, a fee will be charged to cover the test.

### Non-permissible Tests

The Bureau reserves the right to refuse any work temporarily or permanently if such work would delay other research or testing which it may consider relatively more important. (In view of the wide range of the Bureau's activities and the great variety of tests called for, such cases occur almost daily.)

The following are examples of non-permissible tests:

1. Investigations of secret processes.
2. Tests of inadequately described materials, devices, or processes.
3. Assays, analyses, and tests to be made by methods already standard, for which private laboratories are equipped.

4. Unnecesssary tests or duplication of previous work, such as further tests on a given class of material already well studied, and on which there is no imperative need for further information.

5. Tests, the primary object of which is sales promotion.

Most of the tests made by the Bureau for the Government are to determine whether material supplied on contract meets the Federal Specification under which it is being purchased. A list of these Federal Specifications (Price List No. 75) can be obtained free by writing to the Superintendent of Documents, Government Printing Office, Washington, D. C. Through its "Certification Plan" the Bureau is enabling purchasing officers of tax-supported agencies and other individuals who are sufficiently interested to request the information, to buy material on a specification basis and of the same quality as that received by the Federal Government. On application, the Bureau will furnish lists of manufacturers who have expressed their desire to supply material under contracts based upon certain selected Federal specifications and commercial standards, and their willingness to certify to the purchaser, upon request, that the material thus supplied complies with the requirements and tests of the specifications and is so guaranteed.

The results of the test of any article, instrument or material for the public for which a fee is charged are reported only to the party requesting the test, unless the Bureau is authorized otherwise.

Results of cooperative tests in connection with an investigation or research project and which are of general interest are made available either in the "Journal of Research of the National Bureau of Standards" or in outside scientific and technical journals. The "Technical News Bulletin", also issued by the Bureau, carries abstracts of papers in advance of their publication in the Journal of Research. Both the Journal and the Bulletin are obtainable by subscription, at \$2.50 and 50 cents per year, respectively, from the Superintendent of Documents, Government Printing Office, Washington, D. C. Copies of these periodicals as well as of other publications of this Bureau, including the complete list of publications (Circular C24, 7th edition, and Supplements) can be consulted at the libraries in the larger cities and at many university and college libraries. The complete list, or the separate sections, may be purchased from the Superintendent of Documents at the following prices:

Circular C24, 7th edition (covering the period 1901 to June 30, 1925).....	25 cents
1925-1931 Supplement to C24 (covering the period July 1, 1925 to December 31, 1931).....	25 cents
1932-1936 Supplement to C24 (covering the period January 1, 1932 to June 30, 1936).....	5 cents

Mimeographed lists inserted in the second supplement bring the list practically up to date.

## EQUIPMENT

The Bureau is the custodian of the national standards of length and mass and maintains other standards of national and industrial importance. There is an advantage in certain fundamental research in having access to the standards of measurement upon which applied science must depend.

The laboratories of the Bureau occupy more than a dozen permanent buildings on a site of 56 acres in Washington. These laboratories are equipped for many kinds of measurements, research and testing. For certain lines of work the Bureau is equipped with experimental plants where manufacturing processes can be conducted on a reduced scale. The Bureau has facilities for making paper pulp and papers, portland cement, lime, gypsum, clay products of the widest range from brick to the finest porcelain, glazes and glass, enameled ware, sugars, highly pure chemicals, special metals and alloys, rubber products, and leather. New processes may be tried on a semi-industrial scale by varying each factor under measured control and studying the effect. It has an instrument shop, pipe shop, glassblowing shop, precision glass-grinding shop for producing optical parts, gage shop, photographic laboratory and shop, an experimental foundry, rolling mill, and drawbench.

## ORGANIZATION OF RESEARCH AND TESTING WORK

List of Divisions and Sections

## ELECTRICITY

Resistance measurements.  
Inductance and capacitance.  
Electrical instruments.  
Magnetic measurements.  
Photometry.  
Radio.  
Underground corrosion.  
Electrochemistry (batteries).  
Telephone standards.

## HEAT AND POWER

Thermometry.  
Pyrometry.  
Heat measurements.  
Heat transfer.  
Cryogenics.  
Fire resistance.  
Automotive power plants.  
Lubrication and liquid fuels.

## WEIGHTS AND MEASURES

Length.  
Mass.  
Time.  
Capacity and density.  
Gas measuring instruments.  
Thermal expansivity, dental research, and identification.  
Weights and measures laws administration.  
Large-capacity scale testing  
Limit gages.

## OPTICS

Spectroscopy.  
Polarimetry.  
Colorimetry.  
Optical instruments.  
Radiometry.  
Atomic physics, radium, and X-rays.  
Photographic technology.  
Interferometry.

## CHEMISTRY

Paints, varnishes, etc.  
 Detergents, cement, etc.  
 Organic chemistry.  
 Metal and ore analysis  
 and standard samples.  
 Reagents and platinum metals.  
 Electrochemistry (plating).  
 Gas chemistry.  
 Physical chemistry.  
 Thermo-chemistry and consti-  
 tution of petroleum.

## MECHANICS AND SOUND

Engineering instruments and  
 mechanical appliances.  
 Sound.  
 Aeronautic instruments.  
 Aerodynamics.  
 Engineering mechanics.  
 Hydraulics.

## ORGANIC AND FIBROUS MATERIALS

Rubber.  
 Textiles.  
 Paper.  
 Leather.  
 Testing and specifications.  
 Fiber structure.  
 Organic plastics.

## METALLURGY

Optical metallurgy.  
 Thermal metallurgy.  
 Mechanical metallurgy.  
 Chemical metallurgy.  
 Experimental foundry.

## CLAY AND SILICATE PRODUCTS

Whiteware.  
 Glass.  
 Refractories.  
 Enameled metals.  
 Heavy clay products.  
 Cement and concreting  
 materials.  
 Masonry construction.  
 Lime and gypsum.  
 Stone.

## FEE SCHEDULES

The Bureau is equipped to make tests which come within the class of permissible tests described on page 3 of this letter circular. Before shipping any instrument or material, a letter should be sent to the Bureau describing it and the kinds of tests desired. If the Bureau can undertake the work, the reply will so state and will give other information (shipping instructions, probable time test will be completed, etc.). No tests or investigations will be undertaken for the public unless such services can not be obtained elsewhere (see page 13 regarding publication listing other laboratories).

The fees which are charged for testing are made to cover the actual cost of the work. The money received is not available for use by the Bureau and must be turned into the Treasury. Copies of fee schedules bearing the following titles are available in mimeographed form, and will be furnished to those interested in having tests made. Both the "Test Fee Number" and accompanying title should be quoted when requesting copies.

Test Fee  
Schedule

Title

113	Precision resistance standards.
114	Precision resistance apparatus.
117	Standards and check samples for conductivity bridges.
121	Inductors: Tests at low frequencies.
122	Two-terminal resistors: Determination of effective inductance.
123	Condensers: Tests with direct voltage.
124	Condensers: Tests with low-frequency alternating current.
131	Resistance standards for current measurements.
132	Direct-current ammeters.
133	Direct-current voltmeters and millivoltmeters.
134	Alternating-current ammeters.
135	Alternating-current voltmeters.
136	Wattmeters.
137	Direct-current watt-hour meters.
138	Alternating-current watt-hour meters.
139	Frequency meters for power and lighting frequencies.
1310	Current transformers.
1311	Voltage (potential) transformers.
1312	Volt boxes.
143	Magnetic materials.
151	Incandescent electric lamps as standards of candlepower or light flux.
152	Calibration of photometric instruments and accessories.
153	Miscellaneous photometric measurements and tests.
154	Photometric tests on aviation and floodlighting projectors.
155	Miscellaneous photometric tests on airport and airplane lighting devices.
156	Rating and life testing of incandescent lamps.
181	Fire-alarm apparatus.
191	Standard cells.
211	Reference line standards of length.
212	Working line standards of length.
213	Commercial line standards of length.
214	Steel tapes.
215	Invar base line tapes.
216	Surveyor's measuring instruments (other than tapes).
217	Standard sieves and sieve cloth.
218	Haemocytometers.
219	Areas and area-measuring instruments.
221	"Class A" standard weights (new).
222	"Class A" standard weights (not new).
223	"Class B" standard weights.
224	"Class C" standard weights.
225	"Class M" laboratory standards of mass.
226	"Class S" laboratory weights.
227	"Class S2" laboratory weights.
228	Balances.
231	Timepieces.

Test Fee Schedule	Title
241	Volumetric apparatus.
242	Metal capacity standards.
243	Hydrometers and thermohydrometers.
244	Density of solids and liquids.
251	Gas measuring instruments.
261	Thermal expansion of solids.
263	Dental materials.
281	Large capacity scales.
291	End standards of length and gage blocks.
292	Plain and taper plug and ring gages.
293	Plain snap gages.
294	Thread plug and ring gages.
295	Steel balls.
296	Micrometers and lead screws.
297	Standardized instrument parts.
311	Laboratory thermometers.
312	Clinical thermometers.
313	Certain types of industrial thermometers.
321	Thermocouples and pyrometer indicators.
322	Optical pyrometers.
331	Gas calorimeters.
341	Thermal conductivity tests.
351	Low temperature thermometers.
361	Fire resistance.
371	Motor car fuels.
386	Viscometers.
387	Viscosity determinations.
388	Referee tests on lubricants and liquid fuels.
411	Spectroscopic tests.
421	Polariscopes for absolute measurement (with circular scales).
422	Elliptic analyzers and physical properties of glass.
423	Quartz control plates and polariscope cover glasses.
424	Saccharimeters.
425	Sugars and other materials.
431	Spectrophotometry.
432	Lovibond glasses.
433	Colorimetry.
441	Optical instruments.
442	Photographic objectives.
443	Optical components.
444	Refractometric instruments and sextants.
445	Refractive indices.
451	Radiometry.
461	Radioactivity.
462	X-ray protective materials.
463	X-ray instruments (ionometers, dosimeters, dosage meters, etc.).
471	Photography.
481	Interferometry.



Test Fee  
Schedule

## Title

611	Engineering instruments.	
621	Acoustic measurements.	
631	Mercurial barometers.	
632	Aneroid barometers, barographs, altimeters and altigraphs.	
634	Sphygmomanometers.	
635	Aeronautic instruments (except altimeters and engine instruments).	
636	Aircraft engine instruments.	
641	Aerodynamical measurements.	
651	Tensile tests.	
652	Compressive tests.	
653	Transverse tests.	
654	Torsional tests.	
655	Hardness tests.	
656	Ductility tests.	
657	Impact tests.	
658	Fatigue tests.	
6510	Calibration of load-measuring devices, such as proving rings, Amsler boxes, etc.	
6511	Special tests (all mechanical tests of materials and structures not covered by other fee schedules).	
721	Textile fabrics.	
722	Identification of textile fibers.	
723	Yarns.	
731	Paper.	
7510	Tires and tubes (physical tests).	)
7511	Hose (physical tests).	)
7512	Packing (physical tests).	)
7513	Mechanical rubber goods (physical tests)	) Tested for
7514	Rubber hospital supplies (physical tests).	) compliance
		) with Federal
7520	Textile fabrics.	) Specifications.
7521	Cordage.	)
7522	Brooms and brushes.	)
7523	Hospital supplies.	)
7530	Paper.	)
7540	Leather.	)
811	Metallographic examination.	
812	Corrosion resistance of metals.	
813	Examination of metals failed in service.	
821	Heat treatment of metals and alloys.	
822	Thermal analysis of metals and alloys submitted.	
823	Mechanical properties of metals at high and low temperatures.	
831	Mechanical working of metals.	
832	Safety plugs for boilers.	
841	Determination of gases in metals (oxygen, nitrogen, hydrogen).	

Test Fee Schedule	Title
842	Preparation of special melts of metals and alloys.
851	Testing of foundry sands.
852	Special castings from patterns furnished.
911	Chinaware.
921	Glassware.
931	Refractories.
951	Clay.
961	Physical tests of cement.
962	Fineness determination of materials.
963	Concrete, concrete aggregate and admixtures.
964	Testing cement laboratory apparatus in accordance with the tolerances given in the A.S.T.M. Specification C77-30 and subsequent revisions.
971	Masonry building units, sewer pipe and drain tile.
981	Calcined gypsum and gypsum plaster.
982	Gypsum wall and plaster board.
983	Quicklime.
984	Hydrated lime.
985	Sand-lime brick.
991	Commercial building stone.

#### STANDARD MATERIALS AVAILABLE FOR ANALYTICAL AND OTHER PURPOSES

The Bureau has for sale approximately 120 different kinds of Standard Samples which serve as standards for chemical and physical measurements. These samples consist of analyzed materials for checking chemical analytical methods (irons and steels, bearing metals, ores, ceramic materials, pure chemicals, etc.), samples of known heats of combustion (benzoic acid, sucrose, and naphthalene), pure metals (aluminum, copper, etc.) of known melting points for calibrating thermometers and pyrometers, alumel and chromel wires for use in testing the thermoelectric properties of this class of materials, and cement samples for fineness and turbidimetric determinations. A complete list of these samples, "Supplement to Circular C398", will be sent free on request to the Bureau. New samples are added to this list from time to time.

#### STANDARDS OF REFERENCE

In addition to the standards referred to in the previous chapter, the Bureau has for sale the following standards of reference which have been compared with master samples at the Bureau or measured for compliance with an arbitrary standard.

Precision line standards (metric and English); electric incandescent lamps which have been calibrated for use as standards of candlepower, light flux (lumens), radiation intensity, and color temperature; standards of spectral transmission (glass disks) to calibrate spectrophotometers; railway signal glasses; opacity standards of opal glass; color reference samples for sanitary ware; and standard viscosity samples (oils). Information concerning these standards can be obtained by applying to the Bureau.

## PERSONNEL

The value of the services which any testing or research laboratory is able to render is determined very largely by the scientific character of its personnel. The National Bureau of Standards is fortunate in having a staff composed of experts in every line of work with which it deals.

All appointments to positions on the staff of the Bureau are subject to the competitive requirements of the civil-service rules and regulations. Consideration can be given only to those candidates who have passed appropriate examinations and who are certified by the United States Civil Service Commission among the three highest eligibles on the register as vacancies arise. Applicants for positions of the higher grades are rated on their education, training, experience, writings (publications, reports, or thesis), and corroborative evidence.

All civil-service appointees to professional positions in the Bureau are required to serve a probationary period of one year. Appointees to nonprofessional positions serve a probationary period of six months. At the expiration of the probationary period, the appointment becomes permanent if the employee's work and conduct have been satisfactory.

The demand is always much greater for junior assistants than for positions in the higher grades, principally because, wherever possible, vacancies in the higher grade positions are filled through promotion. The Bureau's personnel comprises approximately 825 professional, subprofessional, clerical, administrative, fiscal, and custodial positions.

## RESEARCH ASSOCIATE PLAN

Purpose.— The Research Associate Plan provides a method by which the Bureau can do investigational work of interest to an entire industry. The plan is designed to enable organizations to

conduct specific researches on important problems affecting their industry or specialty. The Bureau thus supplements the facilities of organizations conducting research and affords facilities for those which have none. It makes research possible for any organization by providing quarters, lending equipment, and affording facilities, data, and supervision, giving to qualified workers training and experience in research under Bureau auspices and cooperation.

Authority.- On April 12, 1892, Congress authorized (27 Stat. L., p. 395) the use of the scientific and technical research facilities of the Government by scientific investigators and students. Later, on March 3, 1901, (31 Stat. L., p. 1010), Congress extended the privilege to include certain specified and technical establishments of the Government, and "similar institutions hereafter established," and to include "duly qualified individuals," students, and graduates of institutions of learning. The privilege was made subject to such rules and restrictions as the heads of the bureaus and the departments may prescribe.

Beginning a project.- New standards of quality and performance for devices and processes of industry call for experimental research on each factor, to eliminate waste and attain higher efficiency in the product or service. Outstanding problems arise in every industry in great numbers. Some are of such pressing importance that an industry or group of technicians concerned may apply to the Bureau for cooperation. If facilities and other conditions are favorable, the Bureau may authorize the appointment of a research associate. The industrial or technical group allots funds for the purpose.

Selection of worker.- A research worker is then sought either by the Bureau or by the employing organization. If mutually acceptable, he is appointed research associate by the Director of the National Bureau of Standards. Usually the appointee is a technical or scientific graduate qualified to initiate and conduct research. The employing organization is usually an association of an entire industry or a specialized scientific or technical group.

When appointed, the research associate is subject to the same rules and regulations as the personnel of the Bureau and enjoys many of their privileges. He may attend the staff meetings and consult Bureau specialists in pertinent fields of work on technical aspects of his research program. Associates observe the standard schedule of service hours, annual and sick leave, and conform to other administrative rules.

Progress reports, publication of results, and patents.- Each month a progress report is made to the supporting association through the Director. This is transmitted for information, not for publication. Special reports may be made and transmitted in like manner. Original data and records are the property of the Bureau and subject to its use and disposition.

Manuscripts prepared for publication are submitted to the Bureau's editorial committee through the chief of the division to which the associate has been assigned, and are handled exactly as other Bureau publications, except that the manuscript is also submitted to the supporting organization for comment. The research results are immediately available to the industry concerned, and are printed, usually in Bureau publications. The Bureau reserves the decision as to publication and may authorize its printing in the technical journal of an industry. Joint authorship is often called for, and the Bureau expert cooperating may be associated in the preparation of the report and suitably included as co-author on the title page. Correspondence relating to the work of the research associate goes through regular official Bureau channels, like regular Government mail.

Devices developed during the research are for the free use of industry, the Government, and the public, and will not be patented unless the patents are dedicated free for such use.

#### COMMERCIAL AND COLLEGE LABORATORIES AVAILABLE TO THE PUBLIC

On account of the great demand upon the Bureau for its services by the various Government agencies, it is impossible to make all the tests requested by the public. To inform interested persons of the location and facilities of other laboratories, the Bureau has prepared a "Directory of Commercial Testing and College Research Laboratories," Miscellaneous Publication of the National Bureau of Standards M125, a copy of which may be purchased for 15 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C. The directory lists the various laboratories in the United States geographically, and each reference is accompanied by key numbers and letters to indicate the kinds of materials and tests each laboratory is willing to make. The inclusion of the name of any laboratory in this list is not to be construed in any way as a certification by this Bureau of the reliability of the work of that laboratory. The directory simply lists organizations and institutions maintaining testing laboratories which offer their services to the public for a fee. Two hundred and forty-four commercial testing laboratories and 200 colleges maintaining research laboratories are listed.

