NBS CIRCULAR 552
3d Edition

Standard Materials

Issued by the National Bureau of Standards

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards

Functions and Activities

The functions of the National Bureau of Standards are set forth in the Act of Congress, March 3, 1901, as amended by Congress in Public Law 619, 1950. These include the development and maintenance of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods and instruments for testing materials, devices, and structures; advisory services to government agencies on scientific and technical problems; invention and development of devices to serve special needs of the Government; and the development of standard practices, codes, and specifications. The work includes basic and applied research, development, engineering, instrumentation, testing, evaluation, calibration services, and various consultation and information services. Research projects are also performed for other government agencies when the work relates to and supplements the basic program of the Bureau or when the Bureau's unique competence is required. The scope of activities is suggested by the listing of divisions and sections on the inside of the back cover.

Publications

The results of the Bureau's work take the form of either actual equipment and devices or published papers, these papers appear either in the Bureau's own series of publications or in the journals of professional and scientific societies. The Bureau itself publishes three monthly periodicals, available from the Government Printing Office: The Journal of Research, which presents complete papers reporting technical investigations; the Technical News Bulletin, which presents summary and preliminary reports on work in progress; and Basic Radio Propagation Predictions, which provides data for determining the best frequencies to use for radio communications throughout the world. There are also five series of nonperiodical publications: The Applied Mathematics Series, Circulars, Handbooks, Building Materials and Structures Reports, and Miscellaneous Publications.

Information on the Bureau's publications can be found in NBS Circular 460, Publications of the National Bureau of Standards ($1.25) and its Supplement ($1.50), available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

UNITED STATES DEPARTMENT OF COMMERCE • Lewis L. Strauss, *Secretary*
NATIONAL BUREAU OF STANDARDS • A. V. Astin, *Director*

Standard Materials

Issued by the National Bureau of Standards

National Bureau of Standards Circular 552 (Third Edition)

Issued April 8, 1959

Supersedes Circular 552, 2d Edition, April 15, 1957

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

Price 35 cents

CONTENTS

Standard Materials

Issued by the National Bureau of Standards

A descriptive listing of the various Standard Materials issued by the National Bureau of Standards is given. A schedule of fees and weights, as well as directions for ordering, is included. Summarized tables of analyses are presented, to indicate the type of standards of composition presently available. Announcements of new standards will be made in scientific and trade journals, and the current status of the various standards will be indicated by an *insert sheet* issued with this Circular.

1. General Information

1.1. Introduction

This Circular lists the standard materials issued by the National Bureau of Standards and provides information on their procurement. Each of these materials bears a distinguishing name and number, by which it is permanently identified, and each sample bearing a given designation is of identical composition or properties (within the limits required by the use for which the material is intended) with every other sample bearing the same designation.

The first standard materials issued by this Bureau were a small group of metals certified with respect to their chemical composition. Because of their use as standards in chemical analysis, the term *Standard Samples* was applied to them. This term was extended first to similar composition standards, and later to cover materials certified with respect to chemical purity or to some physical or chemical property. By usage the term has been extended also to certain materials that are issued without certification of composition or properties. In this Circular the materials are classified into groups according to the purposes for which they are intended and the kind of certification, if any, that applies to them.

More than 550 different standards of metals, ores, ceramics, chemicals, and hydrocarbons are now available for distribution. About 250 of these are certified for chemical composition. Some 100 of the composition standards have been prepared specifically for use in spectroscopic analysis. Other standard materials include those certified for such properties as acidity (pH), viscosity, freezing-point, density, index of refraction, and heat of combustion. Recent additions include a number of radioactive materials, uranium isotopes, lithium ores, aluminum refractories, and phosphor materials.

Some of the principal uses of NBS standard materials are: Checking methods of analysis and analytical techniques; standardizing solutions for volumetric analysis; developing new or improved methods of analysis; evaluating the accuracy of analytical methods; and calibrating and standardizing spectrometers, spectrographs, colorimeters, pH meters, Geiger counters, scintillaters, ionization chambers, pyrometers, polarimeters, refractometers, viscometers, and other laboratory and plant instruments.

Standard hydrocarbons, certified for degree of purity, serve to calibrate instruments used in controlling the production of plastics, synthetic rubber, and motor fuels.

Also listed in the Circular are a number of standard materials for which it is not feasible to supply numerical values of composition or properties or for which such certification would not be useful. These materials nevertheless provide assurance of identity among all samples bearing a given designation and thus permit standardization of test procedures and referral of physical or chemical data on unknown materials to a common basis.

For information on certain physical standards, individually certified and intended primarily for the calibration of instruments, consult "Test Fee Schedules of the National Bureau of Standards". Copies are available free on request.

1.2. Standards Out of Stock

The preparation of "renewal" standards is intended to be completed at the time each kind of standard becomes exhausted, but owing to delays encountered in obtaining a proper grade of material and for other reasons, this is not always possible. If orders are received for standards that are out of stock, notice will be mailed to that effect. The composition of a "renewal" of an analyzed standard will not usually be identical with that of its predecessor, but it will be quite similar, especially with regard to the characteristic constituent or constituents.

1.3. New Standards

When new standards or renewals of old ones are issued, announcement will be made in scientific and trade journals and in the *Federal Register*.

Standard Materials

Issued by the National Bureau of Standards

A descriptive listing of the various Standard Materials issued by the National Bureau of Standards is given. A schedule of fees and weights, as well as directions for ordering, is included. Summarized tables of analyses are presented, to indicate the type of standards of composition presently available. Announcements of new standards will be made in scientific and trade journals, and the current status of the various standards will be indicated by an *insert sheet* issued with this Circular.

1. General Information

1.1. Introduction

This Circular lists the standard materials issued by the National Bureau of Standards and provides information on their procurement. Each of these materials bears a distinguishing name and number, by which it is permanently identified, and each sample bearing a given designation is of identical composition or properties (within the limits required by the use for which the material is intended) with every other sample bearing the same designation.

The first standard materials issued by this Bureau were a small group of metals certified with respect to their chemical composition. Because of their use as standards in chemical analysis, the term *Standard Samples* was applied to them. This term was extended first to similar composition standards, and later to cover materials certified with respect to chemical purity or to some physical or chemical property. By usage the term has been extended also to certain materials that are issued without certification of composition or properties. In this Circular the materials are classified into groups according to the purposes for which they are intended and the kind of certification, if any, that applies to them.

More than 550 different standards of metals, ores, ceramics, chemicals, and hydrocarbons are now available for distribution. About 250 of these are certified for chemical composition. Some 100 of the composition standards have been prepared specifically for use in spectroscopic analysis. Other standard materials include those certified for such properties as acidity (*p*H), viscosity, freezing-point, density, index of refraction, and heat of combustion. Recent additions include a number of radioactive materials, uranium isotopes, lithium ores, aluminum refractories, and phosphor materials.

Some of the principal uses of NBS standard materials are: Checking methods of analysis and analytical techniques; standardizing solutions for volumetric analysis; developing new or improved methods of analysis; evaluating the accuracy of analytical methods; and calibrating and standardizing spectrometers, spectrographs, colorimeters, *p*H meters, Geiger counters, scintillaters, ionization chambers, pyrometers, polarimeters, refractometers, viscometers, and other laboratory and plant instruments.

Standard hydrocarbons, certified for degree of purity, serve to calibrate instruments used in controlling the production of plastics, synthetic rubber, and motor fuels.

Also listed in the Circular are a number of standard materials for which it is not feasible to supply numerical values of composition or properties or for which such certification would not be useful. These materials nevertheless provide assurance of identity among all samples bearing a given designation and thus permit standardization of test procedures and referral of physical or chemical data on unknown materials to a common basis.

For information on certain physical standards, individually certified and intended primarily for the calibration of instruments, consult "Test Fee Schedules of the National Bureau of Standards". Copies are available free on request.

1.2. Standards Out of Stock

The preparation of "renewal" standards is intended to be completed at the time each kind of standard becomes exhausted, but owing to delays encountered in obtaining a proper grade of material and for other reasons, this is not always possible. If orders are received for standards that are out of stock, notice will be mailed to that effect. The composition of a "renewal" of an analyzed standard will not usually be identical with that of its predecessor, but it will be quite similar, especially with regard to the characteristic constituent or constituents.

1.3. New Standards

When new standards or renewals of old ones are issued, announcement will be made in scientific and trade journals and in the *Federal Register*.

2. Purchase Procedure

2.1. Identification of Standards

The standards are listed by groups; the numbers represent the order of issuance of the first representative of each kind. Renewals are indicated by the original number, with an added letter to denote its intended relation. Thus, 10a is the first, 10b the second, and 10c the third renewal of No. 10 Bessemer 0.4 C steel. In this way, a given number will always represent a material of fixed or approximately fixed composition.

2.2. Ordering

Orders should give both the *number and name* of the standard wanted. Example: No. 10g, steel, Bessemer, 0.4 C. The list of standard materials their numbers, prices, and analyses are to be found in the succeeding pages. No samples of smaller size than those listed are distributed.

For oils and hydrocarbons, see special order procedure indicated on pages 12 and 13.

2.3. Terms and Shipping

2.3.1. Domestic Shipments

Shipments of material (other than hydrocarbons, organic sulfur compounds and radioactive standards) intended for the United States, Mexico, Canada, and Cuba are normally shipped prepaid parcel post unless the purchaser requests a different mode of shipment, in which case the shipment will be sent collect. Hydrocarbons, organic sulfur compounds, rubber compounding materials, viscometer calibrating oils, and radioactive standards are shipped express collect. (See pages 12, 13, and 14.) No discounts are given on NBS Standard Materials.

2.3.2. Foreign Shipments

Small shipments will be forwarded as a United States Government shipment via International Parcel Post (providing that the parcel does not exceed the weight limits as prescribed by Postal Laws and Regulations to foreign countries). Shipments exceeding the parcel post weight limit must be handled through an agent (shipping or brokerage firm) located in the United States as designated by the purchaser. Parcels will be packed for overseas shipment and forwarded via express collect to the United States firm designated as agent.

2.3.3. Payment for Foreign Orders

Remittances in payment of foreign orders must be made payable to the National Bureau of Standards, and are *required in advance*. These remittances must be drawn on a bank in the United States and payable at the standard rate of United States currency.

3. Descriptive List of Standard Materials With Weights and Fees

3.1. Standards of Certified Chemical Composition

[For detailed information on compositions and properties certified, see p. 18 to 27, as indicated in the table of contents, p. III. *(See mimeographed insert for standards out of stock, renewals, and new standards.)*]

3.1.1. Chemical Standards

Sample No.	Name	Approximate weight of sample in grams	Price per sample	Sample No.	Name	Approximate weight of sample in grams	Price per sample
	STEELS						
8i	Bessemer, 0.1 C	150	$4. 50	72f	Cr-Mo (SAE X4130)	150	$4. 50
10g	Bessemer, 0.3 C	150	4. 50	111b	Ni-Mo (SAE 4620)	150	4. 50
170a	B. O. H., 0.03 C, 0.2 Ti	150	4. 50	36a	Cr2-Mo1	150	4. 50
15f	B. O. H., 0.1 C	150	4. 50	106a	Cr-Mo-Al (Nitralloy G)	150	4. 50
11g	B. O. H., 0.2 C	150	4. 50	139	Cr-Ni-Mo (AISI 8637)	150	4. 50
12f	B. O. H., 0.4 C	150	4. 50	156	Cr-Ni-Mo (NE 9450)	150	4. 50
152	B. O. H., 0.5 C, 0.04 Sn	150	4. 50	159	Cr1-Mo0.4-Ag0.1	150	4. 50
13f	B. O. H., 0.6 C	150	4. 50				
14d	B. O. H., 0.8 C	150	4. 50	50c	W18-Cr4-V1	150	4. 75
16d	B. O. H., 1.0 C	150	4. 50	132a	Mo5-W6-Cr4-V2	150	5. 00
				134a	Mo8-W2-Cr4-V1	150	4. 75
19f	A. O. H., 0.2 C	150	4. 50	153a	Mo8-W1.7-Cr4-V2-Co8	150	5. 00
20f	A. O. H., 0.4 C	150	4. 50	155	Cr0.5-W0.5	150	4. 75
				167	Co43-Mo4-Nb3-W4 (S-816)	150	5. 75
51b	Electric furnace, 1.2 C	150	4. 50	168	Co41-Mo4-Nb3-Ta1-W4 (S-816)	150	5. 75
65d	Basic electric, 0.3 C	150	4. 50	73b	Stainless (Cr12)	150	5. 00
100b	Manganese (SAE T1340)	150	4. 50	133a	Stainless (Cr13-Mo0.3-S0.3)	150	4. 75
105	High-sulfur, 0.2 C (carbon only)	150	2. 00	101d	Cr18-Ni9 (SAE 30905)	150	4. 75
125a	High-silicon, 3 Si	150	4. 50				
129b	High-sulfur (SAE X1112)	150	4. 50	121c	Cr18-Ni10 (Ti-bearing)	150	4. 75
130a	Lead-bearing, 0.2 Pb	150	5. 00	123b	Cr-Ni-Nb 0.7-Ta 0.2	150	5. 00
151	Boron-bearing, 0.003 B	150	3. 00	160a	Cr19-Ni9-Mo3	150	5. 00
				166a	Cr19-Ni9 (carbon only)	150	4. 50
30e	Cr-V (SAE 6150)	150	4. 50				
32e	Cr-Ni (SAE 3140)	150	4. 50	126b	High-nickel (Ni36)	150	5. 00
33d	Ni-Mo (SAE 4820)	150	4. 50	161	Casting alloy (Ni64-Cr17-Fe15)	150	4. 75
	IRONS						
3	White iron	125	$4. 25	82a	Nickel-chromium cast iron	150	$4. 75
4i	Cast iron	150	4. 75	107a	Nickel-chromium-molybdenum cast iron	150	4. 75
5k	Cast iron	150	4. 75				
6f	Cast iron	150	4. 75				
7g	Cast iron	150	4. 75	122d	Cast iron (car wheel)	150	4. 75
55d	Ingot iron	150	4. 75				
	STEEL-MAKING ALLOYS						
57	Refined silicon	60	$4. 00	66a	Spiegeleisen	100	$4. 00
58	Ferrosilicon (Si 75%)	75	4. 00	68b	Ferromanganese	100	4. 00
61a	Ferrovanadium (high carbon)	100	4. 00	71	Calcium molybdate	60	4. 00
64b	Ferrochromium (high carbon)	100	4. 00	90	Ferrophosphorus	75	4. 00
				172	Ferroboron	100	4. 00

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.1. Standards of Certified Chemical Composition—Continued

3.1.1. Chemical Standards—Continued

Sample No.	Name	Approximate weight of sample in grams	Price per sample	Sample No.	Name	Approximate weight of sample in grams	Price per sample
	NONFERROUS ALLOYS						
85b	Aluminum alloy, wrought	75	$4. 50	124c	Bronze (Cu85–Pb5–Sn5–Zn5)	150	$5. 75
86c	Aluminum-base casting alloy	75	4. 50	158	Bronze, silicon	150	5. 75
87a	Aluminum-silicon alloy	75	4. 50	167	Co43–Mo4–Nb3–W4	150	5. 75
53d	Bearing metal, lead-base	170	6. 00	168	Co41–Mo4–Nb3–Ta1–W4	150	5. 75
54d	Bearing metal, tin-base	170	6. 00	157a	Nickel silver (Cu58–Ni12–Zn29)	135	5. 75
37e	Brass, sheet	150	5. 75	161	Nickel-base casting alloy	150	4. 75
52c	Bronze, cast	150	5. 75	162a	Monel-type (Ni64–Cu31)	150	6. 00
184	Bronze, leaded-tin	150	5. 75	169	Ni77–Cr20 alloy	150	5. 75
62c	Bronze, manganese	150	5. 75	171	Magnesium-base alloy	100	4. 00
164a	Bronze, aluminum	150	5. 75	127a	Solder (Pb70–Sn30)	170	5. 75
63c	Bronze, phosphorus	150	5. 75	94b	Zinc-base die-casting alloy	150	4. 50
	TITANIUM-BASE ALLOYS						
173	Al6–V4	100	$7. 00	174	Al4–Mn4	100	$7. 00
	ORES						
69a	Bauxite	60	$4. 00	183	Lithium Ore (Lepidolite)	45	$4. 00
27c	Iron ore, Mesabi	125	4. 00	197	Zircon ore (In preparation)		
28a	Iron ore, Norrie	50	2. 00	56b	Phosphate rock (Tennessee)	45	4. 00
25c	Manganese ore	100	4. 00	137	Tin ore (Bolivian concentrate)	50	4. 00
181	Lithium Ore (Spodumene)	45	4. 00	138	Tin ore (N. E. I. concentrate)	50	4. 00
182	Lithium Ore (Petalite)	45	4. 00	113	Zinc ore (Tri-State concentrate)	50	4. 00
	CERAMIC MATERIALS						
76	Burned refractory (40% Al_2O_3)	60	$4. 00	92	Glass, low boron	45	$4. 00
77	Burned refractory (60% Al_2O_3)	60	4. 00	93	Glass, high boron	45	4. 00
78	Burned refractory (70% Al_2O_3)	60	4. 00	81	Glass sand	60	4. 00
198	Silica refractory (0.2% Al_2O_3)	45	4. 00	165	Glass sand (low iron)	60	4. 00
199	Silica refractory (0.5% Al_2O_3)	45	4. 00	1a	Limestone, argillaceous	50	4. 00
177	Cement, portland	15	4. 25	102	Silica brick	60	4. 00
98	Clay, plastic	60	4. 00	104	Burned magnesite	60	4. 00
99	Feldspar, soda	40	4. 00	112	Silicon carbide	85	4. 00
89	Glass, lead-barium	45	4. 00	154a	Titanium dioxide	40	3. 75
91	Glass, opal	45	4. 00				

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.1. Standards of Certified Chemical Composition—Continued

3.1.2. Spectroscopic Standards

Sample Nos.[1]		Name	Price per sample[2]	Sample Nos.[1]		Name	Price per sample[2]
INGOT IRON AND LOW-ALLOY STEELS							
401	(3)	B. O. H., 0.4C	$6.00	414	(3)	Cr-Mo (SAE 4140)	$6.00
402	802	B. O. H., 0.8C	6.00	415a	815a	Bessemer, 0.5C	6.00
403a	803a	A. O. H., 0.6C	6.00	416a	(3)	Nitralloy G	6.00
404a	804a	Basic electric	6.00				
405a	805a	Medium manganese	6.00	417	(3)	A. O. H., 0.4C	6.00
				417a	817a	B. O. H., 0.4C	6.00
407a	807a	Chromium-vanadium	6.00	418	(3)	Cr-Mo (SAE X4130)	6.00
408a	808a	Chromium-nickel	6.00	418a	818a	Cr-Mo (SAE X4130)	6.00
409b	809b	Nickel	6.00				
410a	810a	Cr2-Mo1	6.00	420a	820a	Ingot iron	6.00
				421	821	Cr-W, 0.9C	6.00
411a	811a	Cr-Mo (SAE X4130)	6.00	425	(3)	Mn-Ni-Cr (NE 9450) (boron only)	6.00
				427	827	Cr-Mo (SAE 4150) (boron only)	6.00
412a	812a	Cr-Ni-Mo (NE 8637)	6.00				
413	(3)	A. O. H., 0.4C	6.00	(3)	830	Ni-Cr-B (boron only)	6.00

[1] Sizes: 400 series, rods 7/32 in. in diameter, 4 in. long (20 g); 800 series, rods ½ in. in diameter, 2 in. long (50 g).
[2] For each sample in the 400 and 800 series.
[3] This standard is available in only one size.

Sample Nos.[1]		Name	Price per sample	
			400 series	1100 series
INGOT IRONS AND SPECIAL LOW-ALLOY STEELS[2]				
461	[3] 1161	Low-alloy steel A (modified TS46B12)	$8.00	$12.00
462	1162	Low-alloy steel B (modified TS86B45)	8.00	12.00
463	1163	Low-alloy steel C (modified TS94B17)	8.00	12.00
464	1164	Low-alloy steel D (modified 14B52)	8.00	12.00
465	1165	Ingot iron E	8.00	12.00
466	1166	Ingot iron F	8.00	12.00
467	1167	Low-alloy steel G (modified C1010)	8.00	12.00
468	1168	Low-alloy steel H (modified TS4720)	8.00	12.00

[1] Sizes: 400 series, rods 7/32 in. in diameter, 4 in. long (20 g); 1100 series, disks 1¼ in. in diameter, ¾ in. thick (120 g).
[2] The series of 8 standards provides a graded composition for the minor constituents.
[3] This size is suitable for X-ray analysis.

Sample Nos.[1]		Name	Price per sample[2]	Sample Nos.[1]		Name	Price per sample[2]
STAINLESS STEELS							
		Group I				Group II	
442	(3)	Cr16-Ni10	$10.00	445	845	Cr13-Mo0.9 (Modified AISI 410)	$10.00
443	(3)	Cr18.5-Ni9.5	10.00	446	846	Cr18-Ni9 (Modified AISI 321)	10.00
444	(3)	Cr20.5-Ni10	10.00	447	847	Cr24-Ni13 (Modified AISI 309)	10.00
				448	848	Cr9-Mo0.3 (Modified AISI 403)	10.00
				449	849	Cr5.5-Ni6.5	10.00
				450	850	Cr3-Ni25	10.00
TOOL STEELS							
436	836	Special (Cr6-Mo3-W10)	$10.00	439	839	Mo High Speed (AISI-SAE M36)	$10.00
437	837	Special (Cr8-Mo2-W3-Co3)	10.00	440	840	Special W High Speed (Cr2-W13-Co12)	10.00
438	838	Mo High Speed (AISI-SAE M30)	10.00	441	841	W High Speed (AISI-SAE T1)	10.00

[1] Sizes: 400 series, rods 7/32 in. in diameter, 4 in. long (20 g); 800 series, rods ½ in. in diameter, 2 in. long (50 g).
[2] For each sample in the 400 and 800 series.
[3] This standard is available in only one size.

3.1. Standards of Certified Chemical Composition—Continued

3.1.2. Spectroscopic Standards—Continued

Sample Nos.[1]	Name	Price per sample	Sample Nos.[1]	Name	Price per sample
STAINLESS STEELS[2]			**TOOL STEELS[2]**		
D845	Cr13-Mo0.9 (Modified AISI 410)	$12.00	D836	Special (Cr6-Mo3-W10)	$12.00
D846	Cr18-Ni9 (Modified AISI 321)	12.00	D837	Special (Cr8-Mo2-W3-Co3)	12.00
D847	Cr24-Ni13 (Modified AISI 309)	12.00	D838	Mo High Speed (AISI-SAE M30)	12.00
D848	Cr9-Mo0.3 (Modified AISI 403)	12.00	D839	Mo High Speed (AISI-SAE M36)	12.00
D849	Cr5.5-Ni6.5	12.00	D840	Special W High Speed (Cr2-W13-Co12)	12.00
D850	Cr3-Ni25	12.00	D841	W High Speed (AISI-SAE T1)	12.00

[1] Size: Disks 1¼ in. in diameter, ¼ in. thick (45g).
[2] The disk samples are for use only in X-ray analysis and were prepared from the rods ½ in. in diameter by upset forging.

Sample No.	Name	Approximate weight of sample in grams	Price per sample	Sample No.	Name	Approximate weight of sample in grams	Price per sample
ALUMINUM ALLOY							
604[1]	Aluminum-base casting alloy (142).	160	$8.00				

[1] Size: Disks 2½ in. in diameter, ¾ in. thick.

TIN METAL							
431[1]	Tin A	25	$8.00	831[1]	Tin A	45	$14.00
432	Tin B	25	8.00	832	Tin B	45	14.00
433	Tin C	25	8.00	833	Tin C	45	14.00
434	Tin D	25	8.00	834	Tin D	45	14.00
435	Tin E	25	8.00	835	Tin E	45	14.00

[1] Sizes: 400 series, rods ¼ in. in diameter, 4 in. long; 800 series, rods, ½ in. in diameter, 2 in. long.

ZINC-BASE, DIE-CASTING ALLOYS AND ZINC SPELTER							
625[1]	Zinc-base A[2]	250	$15.00	628	Zinc-base D	250	$15.00
626	Zinc-base B	250	15.00	629	Zinc-base E	250	15.00
627	Zinc-base C	250	15.00	630	Zinc-base F	250	15.00
				631	Zinc spelter (modified)[3]	250	15.00

[1] Size: Bar segments, 1¾ in. square and ¾ in. thick.
[2] NBS Nos. 625, 626, and 627 correspond to ASTM Alloy AG40A; NBS Nos. 628, 629, and 630 correspond to ASTM Alloy AC41A.
[3] Modified by addition of 0.5 percent Al.

NICKEL OXIDES							
671[1]	Nickel oxide 1	25	$8.00	673	Nickel oxide 3	25	$8.00
672	Nickel oxide 2	25	8.00				

[1] Each sample consists of 25 g of powder.

HIGH-TEMPERATURE ALLOYS					
1184[1]	19–9DL[2]	$18.00	1187	AMS 5376A, Multimet (N–155)	$18.00
1185	AMS 5360A, AISI 316	18.00	1189	Nimonic 80a	18.00

[1] Size: Disks 1¼ in. in diameter, ¾ in. thick.
[2] For optical emission and X-ray analysis.

TITANIUM-BASE ALLOYS					
653[1]	6 Al–4V (A)	$20.00	655	6 Al–4V (C)	$20.00
654	6 Al–4V (B)	20.00			

[1] Size: Disks 1¼ in. in diameter, ¾ in. thick.

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.2. Standards of Certified Properties or Purity

3.2.1. Microchemical Standards

Sample No.	Name	Constituents determined or intended use	Approximate weight of sample in grams	Price per sample
140a	Benzoic acid	C, H	2	$4.00
141	Acetanilide	N, C, H	2	4.00
142	Anisic acid	Methoxyl	2	4.00
143a	Cystine	S, C, H, N	2	4.00
145	2-iodobenzoic acid	I	2	4.00

3.2.2. Chemicals

84f	Acid potassium phthalate	Acidimetric value	60	$3.75
39h	Benzoic acid	Calorimetric value	30	3.75
350	Benzoic acid	Acidimetric value	30	3.75
40g	Sodium oxalate	Oxidimetric value	60	3.75
83b	Arsenic trioxide	Oxidimetric value	75	3.75
136a	Potassium dichromate	Oxidimetric value	75	3.75
17	Sucrose (cane-sugar)	Saccharimetric value	60	3.75
41	Dextrose (glucose)	Reducing value	70	3.75
950	Uranium Oxide (U_3O_8)	Uranium standard	25	5.00

3.2.3. *p*H Standards

185c	Acid potassium phthalate	*p*H (approx.) 4.0	60	$2.50
186Ib	Potassium dihydrogen phosphate	*p*H (approx.) 6.8 [1]	[2] 60	5.00
186IIb	Disodium hydrogen phosphate			
187a	Borax	*p*H (approx.) 9.2	30	2.50
188	Potassium hydrogen tartrate	*p*H (approx.) 3.6	60	2.50
189	Potassium tetroxalate	*p*H (approx.) 1.7	65	2.50

[1] 2 phosphates are to be used together in equal molar proportions.
[2] 30 g of each phosphate are furnished.

3.2.4. Freezing-Point Standards

44e	Aluminum	660.0° C	200	$4.00
45c	Copper	1083.3° C	450	5.00
49d	Lead	327.40° C	600	5.00
42f	Tin	231.88° C	350	5.00
43g	Zinc	419.50° C	350	5.00

3.2.5. Carbon Steels and Iron (certified for oxygen and nitrogen only) [1]

Sample No.	Type	O	N	Size of sample	Price per sample
1040	Low-carbon, rimming	0.018	0.003	3 in. by 1 in.	$10.00
1041	Medium-carbon	.017	.004	3 in. by 1 in.	10.00
1042	Bessemer, rimming	.017	.014	3 in. by 1 in.	10.00
1043	Low-carbon, Al-killed	.002	.005	3 in. by 1 in.	10.00
1044	Low-carbon, Si-killed	.009	.004	3 in. by 1 in.	10.00
1045	Medium-carbon, Si-killed	.007	.004	3 in. by 1 in.	10.00
1047	Low-carbon	.017	.004	3 in. by 1 in.	10.00

[1] These materials are not certified for use as spectroscopic standards.

3.2.6. Uranium Isotopic Standards

Thirteen uranium isotopic standards are now available from NBS. They represent the following weight percent U–235: 0.5, 1, 1.5, 2, 3, 5, 20, 85, 90, and 93. Each isotopic standard issue unit contains a quantity of uranium oxide (U_3O_8) equivalent to 1 g of uranium. Charges vary from $20 to $38 per unit, depending on the enrichment level. These standards are available only to the U.S. Atomic Energy Commission's contractors and licensees. Order forms and further information may be obtained from the National Bureau of Standards, Washington 25, D.C.

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.2. Standards of Certified Properties or Purity—Continued

3.2.7. Hydrocarbons and Organic Sulfur Compounds

Sample No.[1]	Compound		Amount of impurity [2]	Volume per sample [3]	Price per sample
	Formula	Name			
		PARAFFINS			
			Mole percent	*ml*	
201a–5	C_5H_{12}	*n*-Pentane	0.15±0.07	5	$10
201a–8S	C_5H_{12}	*n*-Pentane	.15±0.07	8	18
201a–25	C_5H_{12}	*n*-Pentane	.15±0.07	25	35
202a–8S	C_5H_{12}	2-Methylbutane (isopentane)	.09±0.06	8	18
299–5S	C_5H_{12}	2,2-Dimethylpropane (neopentane)	.04±0.02	5	25
203b–5	C_6H_{14}	*n*-Hexane	.020±0.010	5	10
203a–8S	C_6H_{14}	*n*-Hexane	.10±0.05	8	18
203b–25	C_6H_{14}	*n*-Hexane	.020±0.010	25	35
204a–8S	C_6H_{14}	2-Methylpentane	.16±0.08	8	18
205a–8S	C_6H_{14}	3-Methylpentane	[4].20±0.15	8	18
206a–8S	C_6H_{14}	2,2-Dimethylbutane	.10±0.04	8	18
207a–8S	C_6H_{14}	2,3-Dimethylbutane	.11±0.06	8	18
216a–5	C_7H_{16}	*n*-Heptane	0.01±0.01	5	10
216a–8S	C_7H_{16}	*n*-Heptane	.01±0.01	8	18
216a–25	C_7H_{16}	*n*-Heptane	.01±0.01	25	35
223–5S	C_7H_{16}	2-Methylhexane	.23±0.07	5	18
224–5S	C_7H_{16}	3-Methylhexane	[4].25±0.15	5	18
225–5S	C_7H_{16}	3-Ethylpentane	.13±0.03	5	18
226–5S	C_7H_{16}	2,2-Dimethylpentane	.21±0.06	5	18
227–5S	C_7H_{16}	2,3-Dimethylpentane	[4].25±0.15	5	18
228–5S	C_7H_{16}	2,4-Dimethylpentane	.17±0.05	5	18
229–5S	C_7H_{16}	3,3-Dimethylpentane	.20±0.15	5	18
222–5S	C_7H_{16}	2,2,3-Trimethylbutane	.06±0.03	5	18
230–5S	C_8H_{18}	*n*-Octane	.06±0.04	5	25
231–5S	C_8H_{18}	2-Methylheptane	.41±0.18	5	25
232–5S	C_8H_{18}	3-Methylheptane	.50±0.23	5	25
233–5S	C_8H_{18}	4-Methylheptane	.12±0.07	5	25
234–5S	C_8H_{18}	3-Ethylhexane	[4].30±0.20	5	25
235–5S	C_8H_{18}	2,2-Dimethylhexane	.29±0.11	5	25
236–5S	C_8H_{18}	2,3-Dimethylhexane	[4].30±0.20	5	25
237–5S	C_8H_{18}	2,4-Dimethylhexane	[4].30±0.20	5	25
238–5S	C_8H_{18}	2,5-Dimethylhexane	.30±0.09	5	25
239–5S	C_8H_{18}	3,3-Dimethylhexane	[4].30±0.20	5	25
240–5S	C_8H_{18}	3,4-Dimethylhexane	[4].30±0.20	5	25
241–5S	C_8H_{18}	2-Methyl-3-ethylpentane	.23±0.11	5	25
242–5S	C_8H_{18}	3-Methyl-3-ethylpentane	.08±0.04	5	25
243–5S	C_8H_{18}	2,2,3-Trimethylpentane	.42±0.20	5	25
217b–5	C_8H_{18}	2,2,4-Trimethylpentane [5,6]		5	10
217b–8S	C_8H_{18}	2,2,4-Trimethylpentane [5,6]		8	18
217b–25	C_8H_{18}	2,2,4-Trimethylpentane [5,6]		25	35
244–5S	C_8H_{18}	2,3,3-Trimethylpentane	.40±0.08	5	25
245–5S	C_8H_{18}	2,3,4-Trimethylpentane	.19±0.06	5	25
252–5S	C_9H_{20}	*n*-Nonane	.08±0.06	5	35
541–5S	C_9H_{20}	2,2,3-Trimethylhexane	[4].30±0.20	5	35
253–5S	C_9H_{20}	2,2,4-Trimethylhexane	.30±0.20	5	35
254–5S	C_9H_{20}	2,2,5-Trimethylhexane	.20±0.04	5	35
542–5S	C_9H_{20}	2,3,3-Trimethylhexane	.13±0.06	5	35
255–5S	C_9H_{20}	2,3,5-Trimethylhexane	[4].30±0.20	5	35
256–5S	C_9H_{20}	2,4,4-Trimethylhexane	.29±0.11	5	35
544–5S	C_9H_{20}	3,3,4-Trimethylhexane	.23±0.10	5	35
289–5S	C_9H_{20}	3,3-Diethylpentane	.018±0.011	5	35
296–5S	C_9H_{20}	2,2,3,3-Tetramethylpentane	.064±0.020	5	35
297–5S	C_9H_{20}	2,2,3,4-Tetramethylpentane	.035±0.014	5	35
257–5S	C_9H_{20}	2,2,4,4-Tetramethylpentane	.16±0.08	5	35
298–5S	C_9H_{20}	2,3,3,4-Tetramethylpentane	.051±0.037	5	35
505–5S	$C_{10}H_{22}$	*n*-Decane	.04±0.02	5	35
562–5S	$C_{11}H_{24}$	*n*-Undecane	.04±0.03	5	35
559–5S	$C_{12}H_{26}$	*n*-Dodecane	.031±0.025	5	35
554–5S	$C_{12}H_{26}$	2,2,4,6,6-Pentamethylheptane	.06±0.04	5	35
573–5S	$C_{13}H_{28}$	*n*-Tridecane	.09±0.06	5	35
580–5S	$C_{14}H_{30}$	*n*-Tetradecane	.07±0.06	5	35
581–5S	$C_{15}H_{32}$	*n*-Pentadecane	.07±0.05	5	35
568–5S	$C_{16}H_{34}$	*n*-Hexadecane	.06±0.04	5	35

See footnotes at end of tables.

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.2. Standards of Certified Properties or Purity—Continued

3.2.7. Hydrocarbons and Organic Sulfur Compounds—Continued

Sample No.[1]	Compound		Amount of impurity [2]	Volume per sample [3]	Price per sample
	Formula	Name			
		ALKYL CYCLOPENTANES			
			Mole percent	*ml*	
219–5S	C_5H_{10}	Cyclopentane	0.05±0.02	5	$18
208a–5	C_6H_{12}	Methylcyclopentane	.11±0.06	5	10
208a–8S	C_6H_{12}	Methylcyclopentane	.11±0.06	8	18
208a–25	C_6H_{12}	Methylcyclopentane	.11±0.06	25	35
266–5S	C_7H_{14}	Ethylcyclopentane	.06±0.03	5	25
267–5S	C_7H_{14}	1,1-Dimethylcyclopentane	.03±0.02	5	35
268–5S	C_7H_{14}	1,*cis*-2-Dimethylcyclopentane	.031±0.016	5	35
269–5S	C_7H_{14}	1,*trans*-2-Dimethylcyclopentane	.19±0.10	5	35
270–5S	C_7H_{14}	1,*cis*-3-Dimethylcyclopentane	.65±0.23	5	35
271–5S	C_7H_{14}	1,*trans*-3-Dimethylcyclopentane	.39±0.09	5	35
272–5S	C_8H_{16}	*n*-Propycyclopentane	.20±0.10	5	25
273–5S	C_8H_{16}	Isopropylcyclopentane	.20±0.07	5	25
274–5S	C_8H_{16}	1-Methyl-1-ethylcyclopentane	.13±0.08	5	50
275–5S	C_8H_{16}	1-Methyl-*cis*-2-ethylcyclopentane	.48±0.24	5	50
279–5S	C_8H_{16}	1,1,2-Trimethylcyclopentane	.015±0.009	5	50
280–5S	C_8H_{16}	1,1,3-Trimethylcyclopentane	.48±0.32	5	50
290–5S	C_8H_{16}	1,*cis*-2,*cis*-3-Trimethylcyclopentane	.10±0.06	5	50
292a–5S	C_8H_{16}	1,*trans*-2,*cis*-3-Trimethylcyclopentane	.14±0.04	5	50
294–5S	C_8H_{16}	1,*cis*-2,*trans*-4-Trimethylcyclopentane	.42±0.23	5	50
295–5S	C_8H_{16}	1,*trans*-2,*cis*-4-Trimethylcyclopentane	.24±0.10	5	50
517–5S	C_9H_{18}	*n*-Butylcyclopentane	.034±0.025	5	35
518–5S	C_9H_{18}	Isobutycyclopentane	.16±0.08	5	35
583–5S	$C_{10}H_{18}$	Cyclopentylcyclopentane	.05±0.03	5	35
588–5S	$C_{15}H_{30}$	*n*-Decylcyclopentane	.20±0.18	5	35
		ALKYL CYCLOHEXANES			
209a–5	C_6H_{12}	Cyclohexane	0.010±0.006	5	$10
209a–8S	C_6H_{12}	Cyclohexane	.010±0.006	8	18
209a–25	C_6H_{12}	Cyclohexane	.010±0.006	25	35
218a–5	C_7H_{14}	Methylcyclohexane [5]	.03±0.02	5	10
218a–8S	C_7H_{14}	Methylcyclohexane [5]	.03±0.02	8	18
218a–25	C_7H_{14}	Methylcyclohexane [5]	.03±0.02	25	35
258–5S	C_8H_{16}	Ethylcyclohexane	.13±0.08	5	25
259–5S	C_8H_{16}	1,1-Dimethylcyclohexane	.19±0.03	5	35
260–5S	C_8H_{16}	1-*cis*-2-Dimethylcyclohexane	.024±0.015	5	35
261–5S	C_8H_{16}	1,*trans*-2-Dimethylcyclohexane	.08±0.07	5	35
263–5S	C_8H_{16}	1,*cis*-3-Dimethylcyclohexane [7]	.09±0.05	5	35
262–5S	C_8H_{16}	1,*trans*-3-Dimethylcyclohexane [8]	.16±0.07	5	35
264–5S	C_8H_{16}	1,*cis*-4-Dimethylcyclohexane	.06±0.04	5	35
265–5S	C_8H_{16}	1,*trans*-4-Dimethylcyclohexane	.14±0.08	5	35
506–5S	C_9H_{18}	*n*-Propylcyclohexane	.08±0.05	5	25
507–5S	C_9H_{18}	Isopropylcyclohexane	.16±0.07	5	25
516–5S	C_9H_{18}	1,1,3-Trimethylcyclohexane	.21±0.05	5	50
508–5S	$C_{10}H_{20}$	*n*-Butylcyclohexane	.08±0.04	5	35
509–5S	$C_{10}H_{20}$	Isobutylcyclohexane	.17±0.09	5	35
510–5S	$C_{10}H_{20}$	*sec*-Butylcyclohexane	[4].30±0.20	5	35
511–5S	$C_{10}H_{20}$	*tert*-Butylcyclohexane	.05±0.03	5	35
591–5S	$C_{16}H_{32}$	*n*-Decylcyclohexane	.14±0.11	5	35

See footnotes at end of tables.

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.2. Standards of Certified Properties or Purity—Continued

3.2.7. Hydrocarbons and Organic Sulfur Compounds—Continued

Sample No.[1]	Compound		Amount of impurity [2]	Volume per sample [3]	Price per sample
	Formula	Name			
		MONOOLEFINS			
			Mole percent	*ml*	
281–5S	C_5H_{10}	1-Pentene	0. 66±0. 40	5	$25
283–5S	C_5H_{10}	*trans*-2-Pentene	. 09±0. 05	5	25
284–5S	C_5H_{10}	2-Methyl-1-butene	. 14±0. 08	5	25
286–5S	C_5H_{10}	2-Methyl-2-butene	. 06±0. 04	5	25
519–5S	C_6H_{12}	1-Hexene	. 14±0. 08	5	35
526–5S	C_6H_{12}	*cis*-2-Hexene	. 30±0. 10	5	35
527–5S	C_6H_{12}	*trans*-2-Hexene	. 17±0. 11	5	35
528–5S	C_6H_{12}	*cis*-3-Hexene	. 13±0. 08	5	35
529–5S	C_6H_{12}	*trans*-3-Hexene	. 06±0. 03	5	35
530–5S	C_6H_{12}	2-Methyl-1-pentene	. 19±0. 09	5	35
531–5S	C_6H_{12}	3-Methyl-1-pentene	. 30±0. 20	5	35
532–5S	C_6H_{12}	4-Methyl-1-pentene	. 18±0. 12	5	35
533–5S	C_6H_{12}	2-Methyl-2-pentene	. 09±0. 05	5	35
534–5S	C_6H_{12}	3-Methyl-*cis*-2-pentene	. 15±0. 08	5	35
535–5S	C_6H_{12}	3-Methyl-*trans*-2-pentene	. 14±0. 09	5	35
537–5S	C_6H_{12}	4-Methyl-*cis*-2-pentene	. 08±0. 07	5	35
536–5S	C_6H_{12}	4-Methyl-*trans*-2-pentene	. 25±0. 07	5	35
538–5S	C_6H_{12}	2-Ethyl-1-butene	. 10±0. 04	5	35
539–5S	C_6H_{12}	2,3-Dimethyl-1-butene	. 14±0. 13	5	35
287–5S	C_6H_{12}	3,3-Dimethyl-1-butene	. 09±0. 06	5	35
540–5S	C_6H_{12}	2,3-Dimethyl-2-butene	. 10±0. 05	5	35
520–5S	C_7H_{14}	1-Heptene	. 20±0. 10	5	35
589–5S	C_7H_{14}	4-Methyl-1-hexene	. 22±0. 16	5	35
547–5S	C_7H_{14}	4,4-Dimethyl-1-pentene	. 15±0. 08	5	35
582–5S	C_7H_{14}	4,4-Dimethyl-*cis*-2-pentene	. 21±0. 11	5	35
574–5S	C_7H_{14}	4,4-Dimethyl-*trans*-2-pentene	. 09±0. 03	5	35
550–5S	C_7H_{14}	2,3,3-Trimethyl-1-butene	. 06±0. 04	5	35
521–5S	C_8H_{16}	1-Octene	. 24±0. 13	5	35
548–5S	C_8H_{16}	*trans*-4-Octene	. 16±0. 11	5	35
545–5S	C_8H_{16}	2,4,4-Trimethyl-1-pentene	. 09±0. 03	5	35
546–5S	C_8H_{16}	2,4,4-Trimethyl-2-pentene	. 08±0. 05	5	35
551–5S	C_9H_{18}	1-Nonene	. 24±0. 18	5	35
552–5S	$C_{10}H_{20}$	1-Decene	. 11±0. 07	5	35
555–5S	$C_{11}H_{22}$	1-Undecene	. 09±0. 08	5	35
584–5S	$C_{12}H_{24}$	1-Dodecene	. 13±0. 07	5	35
590–5S	$C_{16}H_{32}$	1-Hexadecene	. 16±0. 07	5	35
		DIOLEFINS			
513–5S	C_4H_6	1,3-Butadiene	[9]. 08±0. 04	5	$25
565–5S	C_5H_8	1,4-Pentadiene	[9]. 07±0. 05	5	35
558–5S	C_5H_8	2,3-Pentadiene	[9]. 15±0. 07	5	35
553–5S	C_6H_{10}	1,5-Hexadiene	[9]. 11±0. 08	5	35
		CYCLOMONOOLEFINS			
			Mole percent	*ml*	
288–5S	C_5H_8	Cyclopentene	0. 034±0. 021	5	$25
522–5S	C_6H_{10}	Cyclohexene	. 023±0. 020	5	35
557–5S	C_8H_{12}	4-Ethenyl-1-cyclohexene (4-vinyl-1-cyclohexene)	[9]. 10±0. 07	5	35

See footnotes at end of tables.

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.2. Standards of Certified Properties or Purity—Continued

3.2.7. Hydrocarbons and Organic Sulfur Compounds—Continued

Sample No.[1]	Compound		Amount of impurity [2]	Volume per sample [3]	Price per sample
	Formula	Name			
		ACETYLENES			
				ml	
514–5S	C_4H_6	1-Butyne	0.13±0.07	5	$25
515–5S	C_4H_6	2-Butyne	.069±0.038	5	25
		ALKYL BENZENES			
210b–5	C_6H_6	Benzene	0.023±0.015	5	$10
210a–8S	C_6H_6	Benzene	.03±0.02	8	18
211b–5	C_7H_8	Methylbenzene (toluene)[5]	.03±0.02	5	10
211a–8S	C_7H_8	Methylbenzene (toluene)[5]	.04±0.02	8	18
212a–8S	C_8H_{10}	Ethylbenzene	.04±0.02	8	18
212a–25	C_8H_{10}	Ethylbenzene	.04±0.02	25	35
213b–5	C_8H_{10}	1,2-Dimethylbenzene (*o*-xylene)	.005±0.004	5	10
213a–8S	C_8H_{10}	1,2-Dimethylbenzene (*o*-xylene)	.010±0.007	8	18
213a–25	C_8H_{10}	1,2-Dimethylbenzene (*o*-xylene)	.010±0.007	25	35
214c–5S	C_8H_{10}	1,3-Dimethylbenzene (*m*-xylene)		5	10
215d–5	C_8H_{10}	1,4-Dimethylbenzene (*p*-xylene)	.05±0.03	5	10
215b–8S	C_8H_{10}	1,4-Dimethylbenzene (*p*-xylene)	.06±0.03	8	18
215b–25	C_8H_{10}	1,4-Dimethylbenzene (*p*-xylene)	.06±0.03	25	35
221–5S	C_9H_{12}	*n*-Propylbenzene	.25±0.08	5	25
220–5	C_9H_{12}	Isopropylbenzene	.07±0.03	5	10
220–8S	C_9H_{12}	Isopropylbenzene	.07±0.03	8	18
220–25	C_9H_{12}	Isopropylbenzene	.07±0.03	25	35
246–5S	C_9H_{12}	1-Methyl-2-ethylbenzene	.27±0.07	5	35
247–5S	C_9H_{12}	1-Methyl-3-ethylbenzene	.43±0.15	5	35
248–5S	C_9H_{12}	1-Methyl-4-ethylbenzene	.13±0.03	5	35
249–5S	C_9H_{12}	1,2,3-Trimethylbenzene	.018±0.012	5	35
250–5S	C_9H_{12}	1,2,4-Trimethylbenzene	.33±0.20	5	35
251–5S	C_9H_{12}	1,3,5-Trimethylbenzene	.05±0.02	5	35
501–5S	$C_{10}H_{14}$	*n*-Butylbenzene	.12±0.08	5	35
502–5S	$C_{10}H_{14}$	Isobutylbenzene	.13±0.09	5	35
503–5S	$C_{10}H_{14}$	*sec*-Butylbenzene	.12±0.06	5	35
504–5S	$C_{10}H_{14}$	*tert*-Butylbenzene	.06±0.03	5	35
560–5S	$C_{10}H_{14}$	1-Methyl-3-isopropylbenzene	.064±0.038	5	35
571–5S	$C_{10}H_{14}$	1-Methyl-4-isopropylbenzene	.05±0.03	5	35
523–5S	$C_{10}H_{14}$	1,2-Diethylbenzene	.05±0.03	5	35
524–5S	$C_{10}H_{14}$	1,3-Diethylbenzene	.07±0.04	5	35
525–5S	$C_{10}H_{14}$	1,4-Diethylbenzene	.07±0.02	5	35
566–5S	$C_{10}H_{14}$	1,3-Dimethyl-5-ethylbenzene	.11±0.06	5	35
575–5S	$C_{10}H_{14}$	1,2,3,5-Tetramethylbenzene	.08±0.02	5	35
585–5S	$C_{10}H_{14}$	1,2,4,5-Tetramethylbenzene	.14±0.04	5	35
572–5S	$C_{11}H_{16}$	1-Methyl-3-*tert*-butylbenzene	.08±0.05	5	35
576–5S	$C_{11}H_{16}$	1-Methyl-4-*tert*-butylbenzene	.05±0.03	5	35
586–5S	$C_{16}H_{26}$	*n*-Decylbenzene	.20±0.16	5	35
		NAPHTHALENES			
			Mole percent	*ml*	
577–5S	$C_{10}H_8$	Naphthalene	0.04±0.03	5	$35
587–5S	$C_{10}H_{12}$	1,2,3,4-Tetrahydronaphthalene	.14±0.06	5	35
578–5S	$C_{11}H_{14}$	1-Methylnaphthalene	.08±0.03	5	35
579–5S	$C_{11}H_{14}$	2-Methylnaphthalene	.09±0.06	5	35

See footnotes at end of tables.

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.2. Standards of Certified Properties or Purity—Continued

3.2.7. Hydrocarbons and Organic Sulfur Compounds—Continued

Sample No.[1]	Compound		Amount of impurity [2]	Volume per sample [3]	Price per sample
	Formula	Name			
		POLYCYCLIC AROMATIC HYDROCARBONS			
				ml	
556–5S	C_9H_{10}	2,3-Dihydroindene (Indan)	0.06±0.02	5	$35
567–5S	$C_{10}H_{18}$	*cis*-Decahydronaphthalene (*cis*-Bicyclo [4.4.0] decane)	.11±0.05	5	35
561–5S	$C_{10}H_{18}$	*trans*-Decahydronaphthalene (*trans*-Bicyclo [4.4.0] decane)	.04±0.03	5	35
		ORGANIC SULFUR COMPOUNDS [10]			
904–5S	C_2H_6S	Ethanethiol (ethyl mercaptan)	0.05±0.04	5	$35
907–5S	$C_2H_6S_2$	Methyldithiomethane (dimethyl disulfide) [11]	.03±0.02	5	35
902–5S	C_2H_8S	Methylthioethane (methyl ethyl sulfide) [11]	.04±0.04	5	35
901–5S	C_4H_4S	Thiophene	.013±0.011	5	35
903–5S	$C_4H_{10}S$	Ethylthioethane (diethyl sulfide) [11]	.06±0.04	5	35
905–5S	$C_4H_{10}S$	2-Methyl-2-propanethiol (*tert*-butyl mercaptan)	.08±0.04	5	35
908–5S	$C_4H_{10}S_2$	Ethyldithiodisulfide (diethyl disulfide) [11]	.10±0.08	5	35
906–5S	$C_5H_{10}S$	1-Pentanethiol (*n*-pentyl mercaptan)	.08±0.05	5	35

[1] The designations following the sample numbers indicate the following: "-5S" or "8S", a sample of 5 ml or 8 ml sealed "in vacuum" in a special Pyrex-glass ampoule with internal "break-off" tip: "-5", "-25", or "-50", a sample of 5, 25, or 50 ml sealed "in vacuum" in a plain-glass ampoule. Although, with a few exceptions, each of the samples originally distributed by the NBS and the API was from a single preparation, this will not continue to be true when the original preparations are exhausted and replacements are made. Such new preparations will be indicated by differences in the sample number. For example, in this list isopropylbenzene 220–5 and 220–25 are from one preparation and 220a-8S is from another.

[2] Unless otherwise indicated, the purity has been evaluated from measurements of freezing points. See J. Research NBS **35,** 355 (1945) RP1676.

[3] Tolerance approximately ±10 percent. All volumes have been estimated in the liquid state, including those of compounds normally solid.

[4] Estimated by analogy with isomers subjected to similar purification.

[5] Certified with regard to density and refractive index.

[6] Certified with regard to calorimetric heat of combustion.

[7] This isomer, formerly known as "*trans*", see Science **105,** 647 (1947), has the following properties: Boiling point at one atmosphere, 120.09° C; refractive index, n_D at 25° C, 1.4206; density at 25° C, 0.7620 g/ml. See NBS Circular 461, p. 45 (1947).

[8] This isomer, formerly known as "*cis*", see Science **105,** 647 (1947), has the following properties: Boiling point at one atmosphere, 124.45° C; refractive index, n_D at 25° C, 1.4284; density at 25° C, 0.7806 g/ml. See NBS Circular 461, p. 45 (1947).

[9] When sealed. Polymer formed may be removed as residue by simple vaporization of the sample "in vacuum" at an appropriate temperature.

[10] In the determination of the purity of these compounds, an apparatus providing no connection with the atmosphere was employed. See Anal. Chem. **22,** 1521 (1950).

[11] These compounds are here named in accordance with the recommendations of the International Union of Pure and Applied Chemistry. The samples themselves bear labels in accordance with recommendations made for the naming of sulfur compounds in petroleum. See Chem. and Eng. News **24,** 2765 (1946). The samples are labeled as follows: 907-5S, 2,3-dithiabutane; 902-5S, 2-thiabutane; 903-5S, 3-thiapentane; and 908-5S, 3,4-dithiahexane.

STANDARDS CERTIFIED FOR DENSITY AND REFRACTIVE INDEX

The following three compounds of the original NBS list are certified with respect to values of density, for air-saturated material at 1 atm, at 20°, 25°, and 30° C, to ±0.00002 g/ml, and also with respect to values of refractive index, for each of seven wavelengths (helium 668 and 502, hydrogen 656 (C) and 486 (F), mercury 546 (e) and 436 (g), and sodium 589 (D_1, D_2) at 20°, 25°, and 30° C to ±0.00002):

No. 217b———— 2,2,4-Trimethylpentane.
No. 218a———— Methylcyclohexane.
No. 211a, 211b—— Toluene.

These standards may be used to calibrate refractometers, picnometers, and density balances, as well as spectrometers. A certificate is supplied with each of these samples.

STANDARDS CERTIFIED FOR CALORIMETRIC HEAT OF COMBUSTION

Standard Sample 217b, 2,2,4-Trimethylpentane, is also certified with regard to the value for calorimetric heat of combustion, primarily for calibrating apparatus for determining the heating value of gasoline and other liquid fuels.

INSTRUCTIONS AND CONNECTING TUBES

A set of instructions for transferring standard samples of hydrocarbons "in vacuum" may be obtained on request.

The unsaturated hydrocarbons are usually sealed in ampoules of Pyrex Red glass. In order to facilitate the handling of these ampoules, each laboratory obtaining one or more samples in such ampoules will be supplied gratis one special graded glass connecting tube of appropriate diameter, consisting of Pyrex Red to Pyrex Uranium to Pyrex Clear glass.

ORDERS

The standard samples of hydrocarbons listed herein were prepared through a cooperative undertaking between the American Petroleum Institute and the National Bureau of Standards. The preparation of the organic sulfur compounds involved, in addition, the cooperation of the U. S. Bureau of Mines at Laramie, Wyo. By agreement with the American Petroleum Institute, distribution of these two groups of standards by the National Bureau of Standards is limited to laboratories not directly associated with the petroleum industry. Orders from such laboratories should be sent to the National Bureau of Standards, Washington 25, D.C. Orders from laboratories that are associated with the petroleum industry should be sent, in duplicate, with payment in advance, to the American Petroleum Institute, Carnegie Institute of Technology, Pittsburgh, Pa.

In all cases, compounds should be specified by both name and sample number.

SHIPMENTS

All orders for hydrocarbons or organic sulfur compounds are shipped express collect

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.2. Standards of Certified Properties or Purity—Continued

3.2.8. Viscometer Calibrating Liquids

These oils are not intended for use as permanent viscosity standards. They are not suitable for stockroom items and should be ordered only for immediate use. They are available only in containers of nominal 1-pint capacity. This quantity is sufficient for the calibration of most viscometers. In cases where a larger quantity (e. g., duplicate samples) is required, a satisfactory explanation of the need for the larger quantity must be given in the order or accompanying letter. All available liquids are hydrocarbon oils and are listed in the tables below.

(A) Oils for use with viscometers calibrated in units of absolute or kinematic viscosity. Price covers the sample and a report containing accurate values at the time of shipment, for absolute viscosity, kinematic viscosity, and density at the following temperatures:

Oils D through N---------- 20° C, 25° C, 100° F, and 210° F
Oil OB---------- 20° C, 25° C, and 40° C
Oil P---------- 30° C, 40° C, and 50° C

Viscosity values at other temperatures in the range 20° to 100° C (30° to 100° C for oil P) are supplied as a special service. For oils D through N, the charge for this special service is $15.00 per sample per temperature. For oils OB and P, the charge is $32.00 per sample per temperature. These special service charges are in addition to the charge for the sample and usual report.

The approximate viscosities and the prices of the calibrating oils are as follows:

Oil	Absolute viscosity, in poises, at—				Kinematic viscosity, in stokes, at—				Price [1] per sample F.O.B. Washington, D.C.
	20° C	25° C	100° F	210° F	20° C	25° C	100° F	210° F	
D	0. 020	0. 018	0. 014	0. 006	0. 026	0. 023	0. 019	0. 008	$15. 00
H	. 074	. 063	. 044	. 013	. 091	. 078	. 055	. 017	15. 00
I	. 12	. 10	. 066	. 017	. 14	. 12	. 081	. 022	15. 00
J	. 21	. 17	. 11	. 023	. 25	. 21	. 13	. 028	15. 00
K	. 41	. 32	. 18	. 032	. 48	. 38	. 22	. 040	15. 00
L	1. 0	. 74	. 37	. 049	1. 1	. 84	. 43	. 060	15. 00
M	3. 0	2. 1	1. 0	. 099	3. 4	2. 4	1. 1	. 12	15. 00
N	14	9. 6	4. 0	. 25	16	11	4. 6	. 30	15. 00
	20° C	25° C	30° C	40° C	50° C	20° C	25° C	30° C	40° C	50° C	
OB	300	200	---	55	---	350	210	---	60	---	32. 00
P	---	---	450	200	95	---	---	510	220	100	32. 00

(B) Oils for use with Saybolt viscometers. Price covers the sample and a report containing an accurate value at the time of shipment, for viscosity at the indicated temperature. Viscosity values at other temperatures or in other units are not supplied. Saybolt viscosity values are based on determined values for kinematic viscosity and the standard conversion tables published by the American Society for Testing Materials.

The approximate viscosities and the prices of the Saybolt calibrating oils are as follows:

Oil	Temperature ° F	Viscosity	Price [1] per sample F.O.B. Washington, D.C.
SB	100	300 seconds, Saybolt Universal	$6. 50
SF	122	110 seconds, Saybolt Furol	6. 50

[1] Because of the nature of the material, samples of oils for use as viscometer calibrating liquids will be shipped via railway express, express charges collect.

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.2. Standards of Certified Properties or Purity—Continued

3.2.9. Radioactivity Standards*

ALPHA, BETA, GAMMA STANDARDS

Sample No.	Radiation	Nuclide	Nominal activity [a]	Volume	Price per sample
4900	α	Polonium-210 [b]	200 dps	[c]	$27.00
4901	α	Polonium-210 [b]	500 dps	[c]	27.00
4902	α	Polonium-210 [b]	1000 dps	[c]	27.00
4903	α	U_3O_8 [d]	15 dps	[c]	27.00
4921	β (γ)	Sodium-22	10^4 dps/ml [e]	[f]	27.00
4922	γ (β)	Sodium-22	10^6 dps [g]	5.0 ml	27.00
4924	β	Carbon-14	10^3 dps/ml [e]	25.0 ml	27.00
4925	β	Carbon-14	10^4 dps/ml [e]	[h]	27.00
4926	β	Hydrogen-3	10^4 dps/ml [e]	25.0 ml	27.00
4927	β	Hydrogen-3	10^6 dps/ml [e]	[f]	27.00
4929	K	Iron-55	10^5 dps/ml [e]	In preparation	
4930	K (γ)	Zinc-65	10^5 dps/ml [e]	[f]	27.00
4932	γ (β)	Mercury-203	10^6 dps [g]	5.0 ml	27.00
4935	γ (β)	Krypton-85	10^7 dps/g.mol [e]	[i]	27.00

Discontinued NBS radioactive standards.—The National Bureau of Standards has discontinued distribution of the, following radioactivity standards, Nos. 4910, 4911, 4912, 4913, 4914, 4915, 4916, 4917, 4918, 4919, 4920, 4923, 4928, 4931 4933, 4934, 4936. Standardized samples of these nuclides may now be obtained commercially.

*Radioactivity standards are shipped express collect only to destinations in Canada and the United States. In the case of shipments to other countries consignee should appoint an agent to handle shipment abroad, apply to the National Bureau of Standards for pro forma invoices, and establish a credit for the cost of the standards at any bank in the United States.

[a] The disintegration rate as of the reference date is given on a certificate accompanying the standard.

[b] Samples consist of a practically weightless deposit of polonium-210 on a silver disk 1 inch in diameter, 1/16-inch thick and faced with 0.002 inch of palladium. Please note that standards Nos. 4900, 4901, and 4902 are now polonium-210. This change makes possible the preparation of small diameter weightless source with little self-absorption and no beta emission. Corrections for decay may be made accurately. If uncalibrated strong alpha sources with a longer half-life are desired and the above characteristics are not required, the beta sources Nos. 4911, and 4912 may be used. Two years after plating, the alpha emission rate in the forward direction is approximately one-half the given disintegration rate and decays with approximately the half-life of radium D.

[c] Deposited source.

[d] Samples consist of U_3O_8 deposited on a 0.1-mm platinum foil and mounted on an aluminum disk, 1¼ inch in diameter and 1/32-inch thick. The alpha-ray disintegration rate as of the date of calibration is indicated on the certificate accompanying the standard.

[e] Total activity of these standards is such that they may be ordered singly under the general licensing provisions of the Atomic Energy Act of 1954 (please refer to Federal Register, Volume 21, page 213, January 11, 1956).

[f] Approximately 3 ml of low-solids carrier solution containing the active nuclide in a flame-sealed ampoule.

[g] This standard can be issued only under the special licensing provisions of the Atomic Energy Act of 1954, and it is therefore required that a copy of the purchaser's current AEC By-Product Material license be on file at the National Bureau of Standards.

[h] Benzoic acid (7C-14) in about 3 ml of toluene in a flame-sealed glass ampoule.

[i] Approximately 10 ml of Kr^{85} in inert krypton at a pressure of approximately one atmosphere in a break-seal glass ampoule.

RADIUM STANDARDS (FOR RADON ANALYSIS)

Sample No.	Radium content (grams)	Volume [m] (milliliters)	Price per sample
4950	10^{-9}	100	$27.00
4951	10^{-11}	100	27.00
4952	Blank solution	100	5.00

[m] Samples are sealed in flame-sealed glass ampoules.

RADIUM GAMMA-RAY STANDARDS

Sample No.	Radium content (micrograms)	Volume [n] (milliliters)	Price per sample	Sample No.	Radium content (micrograms)	Volume [n] (milliliters)	Price per sample
4955	0.1	5	$27.00	4960	5.0	5	$27.00
4956	.2	5	27.00	4961	10	5	27.00
4957	.5	5	27.00	4962	20	5	27.00
4958	1.0	5	27.00	4963	50	5	27.00
4959	2.0	5	27.00	4964	100	5	27.00

[n] Samples are contained in flame-sealed glass ampoules.

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.2. Standards of Certified Properties or Purity—Continued

3.2.9. Radioactivity Standards—Continued

ROCK STANDARDS

Radium Rock Samples [p]

Sample No.	Rock	Average radium content micromicrograms of radium per gram of rock	Price per sample
4975	Dunite	0.009 ± 0.004	$3. 00
4976	Carthage limestone	.15 ± .03	3. 00
4977	Berea sandstone	.24 ± .02	3. 00
4978	Columbia River basalt	.33 ± .03	3. 00
4979	Chelmsford granite	2.96 ± .08	3. 00
4980	Quartzite	0.06 ± .01	3. 00
4981	Graniteville granite	3.3 ± .2	3. 00
4982	Gabbro-diorite	0.18 ± .02	3. 00
4983	Milford granite	.23 ± .02	3. 00
4984	Triassic diabase	.18 ± .03	3. 00
4985	Deccan trap	.21 ± .04	3. 00
4986	Kimberlite	.59 ± .04	3. 00

[p] Each sample consists of 100 g of pulverized rock taken from bulk material analyzed for radium content. Petrographic data of each rock and approximate chemical analysis of a representative sample of all except 4976, 4977, and 4980 is also given in a certificate accompanying each standard.

4990 Contemporary Standard for Carbon-14-Dating Laboratories (sample consists of 5 lb of oxalic acid) $5. 00

3.3. Standard Rubbers and Rubber Compounding Materials

3.3.1. Rubbers [1]

Sample No.	Name	Approximate weight of sample in grams	Price per sample	Sample No.	Name	Approximate weight of sample in grams	Price per sample
385	Natural	31, 500	$44. 00	387a	Styrene-butadiene, type 1000	34, 000	$30. 00
386a	Styrene-butadiene, type 1500	34, 000	38. 00				

[1] Normally, samples are shipped railway express, express charges collect.

3.3.2. Rubber Compounding Materials [1]

370a	Zinc oxide	2, 000	$2. 15	377	Phenyl-beta-naphthylamine	600	$4. 00
371c	Sulfur	1, 400	2. 25	378	Oil furnace black	7, 000	3. 50
372b	Stearic acid	600	1. 90	379	Conducting black	5, 500	3. 50
373b	Benzothiazyl-disulfide	500	1. 75	380	Calcium carbonate	6, 000	2. 50
374a	Tetramethylthiuram-disulfide	500	3. 50	381	Calcium silicate	4, 000	2. 50
375d	Channel black	7, 500	4. 50	382	Gas furnace black	7, 500	3. 50
376a	Light magnesia	450	2. 40	383	Mercaptobenzothiazole	800	2. 75

[1] Normally, samples are shipped railway express, express charges collect.

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.4. Miscellaneous Standard Materials—Continued

3.4. Miscellaneous Standard Materials

3.4.1. Phosphors

Sample No.	Name	Approximate weight of sample in in grams	Price	Sample No.	Name	Approximate weight of aample in grams	Price
1020	Zinc sulfide phosphor	14	$3. 00	1026	Calcium tungstate phosphor	28	$3. 00
1021	Zinc silicate phosphor	28	3. 00	1027	Magnesium tungstate phosphor	28	3. 00
1022	Zinc sulfide phosphor	14	3. 00	1028	Zinc silicate phosphor	28	3. 00
1023	Zinc-cadmium sulfide phosphor (Ag activator)	14	3. 00	1029	Calcium silicate phosphor	14	3. 00
				1030	Magnesium arsenate phosphor	28	3. 00
1024	Zinc-cadmium sulfide phosphor (Cu activator)	14	3. 00	1031	Calcium halophosphate phosphor	28	3. 00
				1032	Barium silicate phosphor	28	3. 00
1025	Zinc phosphate phosphor	28	3. 00	1033	Calcium phosphate phosphor	28	3. 00

3.4.2. Turbidimetric and Fineness Standard

Sample No.	Name	Constituents determined or intended use	Approximate weight of sample in grams	Price per sample
114i	Cement	No. 325 sieve residue, 8.1% Surface area, 1,870 cm^2/g Air permeability, 3,100 cm^2/g	20	$2. 50

3.4.3. Paint-Pigment Standards for Color and Tinting Strength Only

Sample No.	Name	Approximate weight of sample in grams	Price per sample	Sample No.	Name	Approximate weight of sample in grams	Price per sample
300	Toluidine red toner	40	$3. 00	314	Yellow iron oxide, light lemon	20	$3. 00
301	Yellow ocher	45	3. 00	315	Yellow iron oxide, lemon	20	3. 00
302	Raw sienna	45	3. 00	316	Yellow iron oxide, orange	25	3. 00
303	Burnt sienna	50	3. 00	317	Yellow iron oxide, dark orange	40	3. 00
304	Raw umber	45	3. 00	318	Lampblack	15	3. 00
305	Burnt umber	50	3. 00	319	Primrose chrome yellow	65	3. 00
306	Venetian red	60	3. 00	320	Lemon chrome yellow	60	3. 00
				321	Medium chrome yellow	65	3. 00
307	Metallic brown	60	3. 00				
308	Indian red	50	3. 00	322	Light chrome orange	100	3. 00
309	Mineral red	65	3. 00	323	Dark chrome orange	100	3. 00
310	Bright red oxide	50	3. 00	324	Ultramarine blue	37	3. 00
311	Carbon black (high color)	10	3. 00	325	Iron blue	25	3. 00
312	Carbon black (all-purpose)	20	3. 00	326	Light chrome green	60	3. 00
313	Black iron oxide	42	3. 00	327	Medium chrome green	50	3. 00
				328	Dark chrome green	45	3. 00

3. Descriptive List of Standard Materials With Weights and Fees—Continued

3.4 Miscellaneous Standard Materials—Continued

3.4.4. Light-Sensitive Papers

Sample No.	Item	Unit of issue	Price per set
1015	Light-sensitive paper for calibration of carbon-arc fading lamps for color-fastness tests of textiles. See current NBS Letter Circular 1024 on this subject for directions for use.	Package of 100 pieces.	$3. 00
1016	Booklet of standard faded strips of light-sensitive paper for use with above sample. See the current NBS Letter Circular for directions for use.	Booklet	26. 00

3.4.5. Standard Colors for Kitchen and Bathroom Accessories[1]

Sample No.	Item	Unit of issue	Price per set
1000	Enameled iron plaques, 3 by 5 inches, in accordance with Commercial Standards CS62–38 and CS63–38.	Set of 10	$10. 00

[1] Calibration of these standards for use with three-filter reflectometers may be obtained by applying to the Bureau.

3.4.6. Limestone Slabs for Calking Compound Test

Sample No.	Description	Unit of issue	Price per set
1005	Limestone slabs, as required by Federal Specification TT–C–598, "Compound, Calking; Plastic".	Set of 12 slabs	$25. 00

3.4.7. Microcopy Resolution Test Chart

Sample No.	Description[1]	Unit of issue (minimum)	Price per chart
1010	Resolution chart for testing the resolving power of micro copying cameras	5 charts	$0. 20

[1] These charts are made photographically, and consist of line patterns, the lines and spaces being of equal width. Each pattern contains two sets of lines, one set at right angles to the other. The patterns range from 1 to 10 lines per millimeter. Instructions for the use of these charts are furnished with each order.

4. Summary of Analyses

The values given in the following sections are listed primarily as a guide to purchasers. In some cases provisional values are given which may differ slightly from those given on the certificates. For this reason *the certificates issued with the standards should always be consulted to obtain the proper values.*

4.1. Averaged Analyses

ALUMINUM-BASE ALLOYS (CHEMICAL STANDARDS)

Sample No.	Cu	Mn	Si	Mg	Fe	Ti	Zn	Pb	V	Ga	Ni	Cr
85b	3. 99	0. 61	0. 18	1. 49	0. 24	0. 022	0. 030	0. 021	0. 006	0. 019	0. 084	0. 211
86c	7. 92	. 041	. 68	0. 002	. 90	. 035	1. 50	. 031	----	----	. 030	. 029
87a	----	----	----	----	----	----	----	----	----	----	----	----

COBALT-BASE ALLOYS

Sample No.	Kind	Co	Ni	Cr	Mo	W	Nb	Ta	Fe	Mn	C	P	S	Si	Cu	V	Ti
167	Heat-resisting alloy (S816)	42. 90	20. 65	20. 00	3. 90	4. 50	3. 15	0. 08	2. 13	1. 64	0. 38	0. 010	0. 007	0. 44	0. 03	0. 01	----
168	Heat-resisting alloy (S816)	41. 20	20. 25	20. 33	3. 95	3. 95	2. 95	. 95	3. 43	1. 50	. 37	. 008	. 005	. 80	. 035	. 03	0. 06

COPPER-BASE ALLOYS

Sample No.	Kind	Cu	Zn	Sn	Pb	Ni	Fe	Al	Mn
37e	Sheet brass	69. 61	27. 85	1. 00	1. 00	0. 53	0. 004	----	----
52c	Cast bronze	89. 25	2. 12	7. 85	0. 011	. 76	. 004	----	----
62c	Manganese bronze	59. 16	37. 24	0. 39	. 24	. 28	. 74	1. 22	0. 66
63c	Phosphor bronze	80. 48	0. 093	9. 03	9. 35	. 32	. 0013	----	----
124c	Ounce metal	84. 22	4. 93	5. 13	4. 74	. 60	. 107	----	----
158	Silicon bronze	90. 86	2. 07	0. 97	0. 004	. 006	1. 48	0. 54	1. 31
164a	Aluminum bronze	82. 25	0. 07	. 04	. 04	3. 72	4. 05	9. 59	0. 22
184	Leaded-tin bronze	88. 96	2. 69	6. 38	1. 44	0. 50	0. 005	----	----
157a	Nickel silver	58. 61	29. 09	0. 02	0. 03	11. 82	. 17	----	. 18

Sample No.	Kind	Sb	As	Ag	Si	S	P	Co
52c	Cast bronze	----	----	----	----	0. 002	0. 001	----
62c	Manganese bronze	----	----	----	0. 068	----	----	----
63c	Phosphor bronze	0. 52	0. 023	----	----	. 060	. 145	----
124c	Ounce metal	. 20	----	----	. 002	. 048	. 024	----
158	Silicon bronze	----	----	----	2. 72	----	----	----
164a	Aluminum bronze	----	----	----	0. 03	----	----	0. 01
184	Leaded-tin bronze	----	----	----	----	----	. 009	----
157a	Nickel silver	----	----	----	----	----	. 01	. 02

LEAD- AND TIN-BASE ALLOYS

Sample No.	Kind	Pb	Sn	Sb	Bi	Cu	Fe	As	Ag	Ni	Al
53d	Lead-base	----	4. 94	9. 92	0. 13	0. 27	----	0. 045	----	0. 002	----
127a	Solder	----	30. 03	0. 79	. 036	. 004	----	. 129	0. 004	. 002	----
54d	Tin-base	0. 62	88. 57	7. 04	. 04	3. 62	0. 03	. 09	. 003	. 003	----

MAGNESIUM-BASE ALLOY

Sample No.	Al	Zn	Mn	Si	Cu	Pb	Fe	Ni
171	2. 98	1. 05	0. 45	0. 012	0. 011	0. 0033	0. 0018	0. 0009

4. Summary of Analyses—Continued

4.1. Averaged Analyses—Continued

NICKEL-BASE ALLOYS (CHEMICAL STANDARDS)

Sample No.	Kind	Ni	Cu	Mn	Si	Co	Fe	Cr	Al	Ti	C	S	P	Zr	V	Ca	N
161	Ni-base casting	64. 29	0. 045	1. 28	1. 56	0. 47	15. 01	16. 88			0. 342	0. 006	0. 012		0. 029		0. 027
169	Ni-Cr	77. 26	. 015	0. 073	1. 42	. 19	0. 54	20. 26	0. 095	0. 006	. 043	. 002		0. 042	. 018	0. 015	. 031
162a	Monel type	63. 95	30. 61	1. 60	0. 93	. 076	2. 19	0. 042	. 50	. 006	. 078	. 006					

TITANIUM-BASE ALLOYS (CHEMICAL STANDARDS)

Sample No.	Kind	Al	V	Mn	Fe	Cr	Si	Mo	C	N			
173	Al6–V4	5. 42	4. 09		0. 16		0. 045			0. 018			
174	Al4–Mn4	4. 27		4. 57	. 18		. 015			. 012			

ZINC-BASE DIE-CASTING ALLOY (CHEMICAL STANDARD)

Sample No.	Al	Cu	Mg	Fe	Mn	Pb	Ni	Sn	Cd
94b	4. 07	1. 01	0. 042	0. 018	0. 014	0. 006	0. 006	0. 006	0. 002

STEEL-MAKING ALLOYS

Sample No.	Kind	C	Mn	P	S	Si	V	Ti	Al	Ca	Fe	Cr
57	Refined silicon	0. 087	0. 034	0. 008	0. 005	96. 8		0. 10	0. 67	0. 73	0. 65	0. 025
58	Ferrosilicon (75% Si)	. 033	. 165	. 016	. 01	75. 6	0. 004	. 085	. 77	. 45	22. 5	. 07

Sample No.	Kind	C	Mn	P	S	Si	B	Cr	V	Al	
61a	Ferrovanadium	1. 06	1. 78	0. 119	0. 005	5. 12		0. 68	50. 19	0. 02	
64b	Ferrochromium										
66a	Spiegeleisen	4. 39	19. 77	. 049	. 021	2. 26					
68b	Ferromanganese	6. 77	79. 97	. 293	. 006	0. 44					
90	Ferrophosphorus			26. 2							
172	Ferroboron	0. 23				3. 6	13. 7			. 05	
71	Calcium molybdate	Mo=35.3; Fe=1.92; Ti=0.06.									

4. Summary of Analyses—Continued

4.1. Averaged Analyses—Continued

IRONS (CHEMICAL STANDARDS)

Sample No.	Kind	C		Mn	P	S		Si	Cu	Ni
		Total	Graphitic			By oxidation	Evolved as H_2S			
3	White	2.27	<0.01	0.350	0.123	0.089	-------	0.99	0.126	0.019
4i	Cast	3.26	2.64	.793	.130	.054	0.054	1.45	.253	.062
5k	Cast	2.71	1.99	.536	.263	.100	.096	2.08	1.50	.051
6f	Cast	2.91	2.19	.499	.530	.106	.103	1.85	0.252	.060
7g	Cast	2.69	2.58	.61	.80	.061	.060	2.41	.13	.12
55d	Ingot	0.011	-------	.030	.005	.014	.015	<0.001	.056	.010
82a	Ni-Cr	2.24	1.71	.649	.053	.102	.094	2.07	.076	1.07
107a	Ni-Cr-Mo	2.72	1.84	.582	.278	.095	-------	1.35	.103	0.968
122d	Cast (car-wheel)	3.28	2.49	.504	.280	.092	.092	0.624	.054	.029

STEELS (CHEMICAL STANDARDS)

8i	Bessemer	0.076	-------	0.51	0.081	0.064	0.065	0.021	0.015	0.009
10g	Bessemer	.240	-------	.850	.086	.109	.110	.020	.008	.500
170a	B.O.H. (Ti-bearing)	.053	-------	.325	.005	.021	-------	.034	.060	.026
15f	B.O.H	.084	-------	.390	.006	.032	.033	.042	.085	.029
11g	B.O.H	.191	-------	.513	.008	.026	.026	.203	.046	.020
12g	B.O.H	.389	-------	.716	.014	.030	.030	.187	.125	.060
152	B.O.H. (Tin-bearing)	.466	-------	.782	.019	.027	.027	.244	.127	.062
13f	B.O.H	.629	-------	.889	.020	.016	.016	.236	.103	.113
14d	B.O.H	.841	-------	.399	.014	.027	.027	.126	.084	.041
16d	B.O.H	1.01	-------	.439	.014	.033	.034	.188	.052	.022
19f	A.O.H	0.193	-------	.497	.029	.043	.041	.204	.151	.317
20f	A.O.H	.380	-------	.754	.028	.034	.032	.299	.238	.243
51b	Electric	1.21	-------	.573	.013	.014	.015	.246	.071	.053
65d	Basic electric	0.264	-------	.730	.015	.010	.010	.370	.051	.060
100b	Manganese (SAE T1340)	.39	-------	1.88	.023	.029	-------	.21	.061	.030
105	High-sulfur	.193	-------	-------	-------	-------	-------	-------	-------	-------
125a	High-silicon	.032	-------	0.052	.006	.013	-------	3.32	.084	.053
129b	High-sulfur (SAE X1112)	.094	-------	.763	.085	.221	-------	0.021	.015	.013
130a	Lead-bearing	.182	-------	.753	.016	.019	.019	.173	.027	.010
151	Boron	-------	-------	-------	-------	-------	-------	-------	-------	-------
30e	Cr-V steel (SAE 6150)	.505	-------	.786	.026	.035	.036	.269	.094	.027
32e	Cr-Ni steel (SAE 3140)	.409	-------	.798	.008	.022	.021	.278	.127	1.19
33d	Ni-Mo steel (SAE 4820)	.173	-------	.537	.006	.010	.010	.253	.123	3.58
72f	Cr-Mo steel (SAE X4130)	.301	-------	.545	.014	.024	-------	.256	.062	0.055
111b	Ni-Mo steel (SAE 4620)	.193	-------	.706	.012	.015	.013	.302	.028	1.81
36a	Cr2-Mo1	.120	-------	.432	.014	.016	-------	.356	.114	0.243
106a	Cr-Mo-Al	.355	-------	.546	.016	.018	.017	.254	.156	.277
139	Cr-Ni-Mo (AISI 8637)	.394	-------	.867	.019	.024	.024	.292	.089	.563
156	Cr-Ni-Mo (NE 9450)	.515	-------	1.40	.032	.017	.017	.226	.053	.475
159	Cr1-Mo0.4-Ag0.1	.521	-------	0.807	.036	.027	.026	.258	.181	.137
50c	W18-Cr4-V1	.719	-------	.342	.022	.010	-------	.311	.079	.069
132a	W6-Mo5	.825	-------	.268	.029	.005	-------	.190	.120	.137
134a	W2-Mo8-Cr4-V1	.808	-------	.218	.018	.007	-------	.323	.101	.088
153a	W1.5-Mo8-Cr4-V2-Co8	.90	-------	.18	.023	.006	-------	.27	.095	.16
155	W0.5-Cr0.5	.905	-------	1.24	.015	.010	-------	.322	.083	.100
73b	Cr12	.355	-------	0.361	.019	.006	-------	.437	.125	.197
133a	Cr13-Mo0.3-S0.3	.120	-------	1.03	.026	.326	-------	.412	.118	.241
101d	Cr18-Ni9 (SAE 30905)	.056	-------	0.739	.020	.017	-------	.471	.184	9.05
121c	Cr18-Ni11-Ti0.4	.038	-------	1.31	.028	.009	-------	.64	.14	10.51
123b	Cr-Ni-Nb-Ta	-------	-------	-------	.024	-------	-------	.52	-------	-------
160a	Cr-Ni-Mo	.062	-------	1.62	.027	.015	-------	.605	.174	14.13
166a	Cr-Ni	.027	-------	-------	-------	-------	-------	-------	-------	-------
126b	Ni36	.090	-------	0.380	-------	-------	-------	.200	.082	35.99

4. Summary of Analyses—Continued

4.1. Averaged Analyses—Continued

IRONS (CHEMICAL STANDARD)—Continued

Sample No.	Cr	V	Mo	W	Co	Ti	As	Sn	Al (total)	Al_2O_3	N	Nb	Ta	B
3	0.051	0.008	0.005	-------	-------	0.010	-------	-------	-------	-------	0.010	-------	-------	0.0007
4i	.104	.013	.003	-------	-------	.026	0.018	-------	-------	-------	.006	-------	-------	-------
5k	.109	.014	.007	-------	-------	.028	.027	-------	-------	-------	.009	-------	-------	-------
6f	.442	.032	.009	-------	-------	.063	.032	-------	-------	-------	.005	-------	-------	-------
7g	.048	.011	.012	-------	-------	.044	-------	-------	-------	-------	.004	-------	-------	-------
55d	.005	<0.001	.001	-------	0.007	-------	.009	0.005	0.002	-------	.004	-------	-------	-------
82a	.323	.019	.008	-------	-------	.065	-------	-------	-------	-------	-------	-------	-------	-------
107a	.479	.028	.771	-------	-------	.035	-------	-------	-------	-------	-------	-------	-------	-------
122d	.032	.011	.004	-------	-------	.007	.021	-------	-------	-------	.004	-------	-------	-------

STEELS (CHEMICAL STANDARDS)—Continued

8i	0.008	0.013	0.004	-------	-------	-------	-------	-------	-------	-------	0.018	-------	-------	-------
10g	.008	.007	.002	-------	-------	-------	-------	-------	-------	-------	.015	-------	-------	-------
170a	.015	.009	.006	Zirconium 0.038	-------	.29	-------	-------	.041	-------	-------	-------	-------	-------
15f	.009	.001	.006	-------	-------	-------	-------	-------	-------	-------	.005	-------	-------	-------
11g	.015	.001	.005	-------	-------	-------	-------	.004	-------	-------	.006	-------	-------	-------
12g	.046	.002	.010	-------	-------	-------	-------	-------	-------	-------	.003	-------	-------	-------
152	.050	.001	.013	-------	-------	-------	-------	.036	-------	-------	.004	-------	-------	-------
13f	.129	.002	.033	-------	-------	-------	-------	-------	-------	-------	.004	-------	-------	-------
14d	.065	.002	.007	-------	-------	-------	-------	-------	-------	-------	.004	-------	-------	-------
16d	.042	.002	.006	-------	-------	-------	-------	-------	-------	-------	.003	-------	-------	-------
19f	.053	.007	.058	-------	-------	-------	-------	.022	-------	-------	-------	-------	-------	-------
20f	.097	.007	.058	-------	-------	-------	-------	.021	-------	-------	.005	-------	-------	-------
51b	.455	.002	.014	-------	-------	-------	-------	.008	-------	-------	.011	-------	-------	-------
65d	.049	.002	.025	-------	-------	-------	-------	.004	.059	0.009	.013	-------	-------	-------
100b	.063	.003	.24	-------	-------	-------	-------	-------	-------	-------	.004	-------	-------	-------
105	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
125a	.023	.001	.007	-------	-------	<0.01	-------	.007	<0.01	-------	.002	-------	-------	<0.001
129b	.016	.004	.003	-------	-------	-------	-------	-------	-------	-------	.014	-------	-------	-------
130a	.012	.001	.004	-------	Lead 0.228	-------	-------	-------	-------	-------	.008	-------	-------	-------
151	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	.0027
30e	.934	.149	.007	-------	-------	-------	-------	-------	-------	-------	.007	-------	-------	-------
32e	.678	.002	.023	-------	-------	-------	-------	.011	-------	-------	.009	-------	-------	-------
33d	.143	.002	.246	-------	-------	-------	-------	-------	-------	-------	.011	-------	-------	-------
72f	.891	.005	.184	-------	-------	-------	-------	-------	-------	-------	.009	-------	-------	-------
111b	.070	.003	.255	-------	-------	-------	-------	-------	.043	-------	-------	-------	-------	-------
36a	2.41	.006	.920	-------	-------	-------	-------	.011	-------	-------	-------	-------	-------	-------
106a	1.15	.002	.203	-------	-------	-------	-------	-------	1.08	.011	-------	-------	-------	-------
139	0.549	.002	.178	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
156	.429	.002	.138	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
159	1.00	.054	.414	-------	-------	-------	-------	-------	Silver 0.090	-------	-------	-------	-------	-------
50c	4.13	1.16	.082	18.44	-------	-------	.022	.018	-------	-------	.012	-------	-------	-------
132a	4.21	1.94	4.51	6.20	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
134a	3.67	1.25	8.35	2.00	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
153a	3.73	2.06	8.85	1.76	8.46	-------	-------	-------	-------	-------	.024	-------	-------	-------
155	0.485	0.014	0.039	0.517	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
73b	12.82	.032	.014	-------	-------	-------	-------	-------	-------	-------	.052	-------	-------	-------
133a	12.89	.026	.294	-------	-------	-------	-------	-------	-------	-------	.032	-------	-------	-------
101d	18.68	.049	.110	-------	0.058	-------	-------	.009	-------	-------	.024	-------	-------	-------
121c	17.58	.048	.16	-------	-------	.42	-------	-------	-------	-------	-------	-------	-------	-------
123b	-------	.05	.17	.18	-------	.006	-------	-------	-------	-------	-------	0.75	0.20	-------
160a	18.74	.051	2.83	-------	.071	-------	-------	.013	-------	-------	.051	-------	-------	-------
166a	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
126b	0.066	.001	0.006	-------	.032	-------	-------	-------	-------	-------	-------	-------	-------	-------

4. Summary of Analyses—Continued

4.1. Averaged Analyses—Continued

IRONS AND STEELS (SPECTROSCOPIC STANDARDS)

Sample Nos.[1]		Kind	C	Mn	P	Si	Cu	Ni	Cr	V
INGOT IRON AND LOW-ALLOY STEELS										
401	[2]	B.O.H., 0.4 C	[3]	0. 34		0. 015	0. 015	0. 005	0. 015	
402	802	B.O.H., 0.8 C		. 46		. 060	. 025	. 010	. 025	
403a	803a	A.O.H., 0.6 C		1. 04		. 34	. 096	. 190	. 101	0. 005
404a	804a	Basic electric		0. 88		. 44	. 050	. 040	. 025	. 002
405a	805a	Medium manganese		1. 90		. 27	. 032	. 065	. 037	
407a	807a	Chromium-vanadium		0. 76		. 29	. 132	. 169	. 92	. 146
408a	808a	Chromium-nickel		. 76		. 28	. 10	1. 20	. 655	. 002
409b	809b	Nickel		. 46		. 27	. 104	3. 29	. 072	. 002
410a	810a	Cr2–Mo1				. 36	. 11	0. 24	2. 39	
411a	811a	Cr–Mo (SAE X4130)				. 29	. 105	. 24	0. 93	. 002
412a	812a	Cr–Ni–Mo (NE 8637)		. 87		. 30	. 090	. 56	. 55	
413	[2]	A.O.H., 0.4 C		. 67		. 22	. 25	. 18	. 055	. 007
414	[2]	Cr–Mo (SAE 4140)		. 67		. 26	. 11	. 080	. 99	. 003
415a	815a	Bessemer, 0.5 C				. 10	. 012	. 006	. 008	. 006
416a	[2]	Nitralloy G		. 54		. 25	. 15	. 28	1. 14	
417	[2]	A.O.H., 0.4 C		. 64		. 18		. 105	0. 028	. 004
417a	817a	B.O.H., 0.4 C		. 78			. 13	. 062	. 050	
418	[2]	Cr–Mo (SAE X4130)		. 52		. 28		. 11	. 96	
418a	818a	Cr–Mo (SAE X4130)		. 52		. 27	. 040	. 125	1. 02	
420a	820a	Ingot Iron		. 017			. 027	. 0092	0. 0032	
421	821	Cr–W, 0.9 C		1. 24			. 080	. 10	. 49	. 012
425	[2]	Mn–Ni–Cr (NE 9450) (B only)								
427	827	Cr–Mo (SAE 4150) (B only)								
[2]	830	Ni–Cr–B (B only)								
INGOT IRONS AND SPECIAL LOW-ALLOY STEELS										
461	1161	Low-Alloy Steel A	0. 15	0. 36	0. 053	0. 047	0. 34	1. 73	0. 13	0. 024
462	1162	Low-Alloy Steel B	. 40	. 94	. 045	. 28	. 20	0. 70	. 74	. 058
463	1163	Low-Alloy Steel C	. 19	1. 15	. 031	. 41	. 47	. 39	. 26	. 10
464	1164	Low-Alloy Steel D	. 54	1. 32	. 017	. 48	. 094	. 135	. 078	. 295
465	1165	Ingot Iron E	. 037	0. 032	. 008	. 029	. 019	. 026	. 004	. 002
466	1166	Ingot Iron F	. 065	. 113	. 012	. 025	. 033	. 051	. 011	. 007
467	1167	Low-Alloy Steel G	. 11	. 275	. 033	. 26	. 067	. 088	. 036	. 041
468	1168	Low-Alloy Steel H	. 26	. 47	. 023	. 075	. 26	1. 03	. 54	. 17
STAINLESS STEELS[4] GROUP I										
442	[2]	Cr16–Ni10		2. 88		[5](0. 09)	0. 11	9. 9	16. 1	0. 032
443	[2]	Cr18.5–Ni9.5		3. 38		(. 15)	. 14	9. 4	18. 5	. 064
444	[2]	Cr20.5–Ni10		4. 62		(. 65)	. 24	10. 1	20. 5	. 12
STAINLESS STEELS[6] GROUP II										
445	845	D845 Cr13–Mo0.9 (Modified AISI 410)		0. 77		0. 52	0. 065	0. 28	13. 31	(0. 05)
446	846	D846 Cr18–Ni9 (Modified AISI 321)		. 53		1. 19	. 19	9. 11	18. 35	(. 03)
447	847	D847 Cr24–Ni13 (Modified AISI 309)		. 23		0. 37	. 19	13. 26	23. 72	(. 03)
448	848	D848 Cr9–Mo0.3 (Modified AISI 403)		2. 13		1. 25	. 16	0. 52	9. 09	(. 02)
449	849	D849 Cr5.5–Ni6.5		1. 63		0. 68	. 21	6. 62	5. 48	(. 01)
450	850	D850 Cr3–Ni25				. 12	. 36	24. 8	2. 99	(. 006)

[1] Sizes: 400 series, rods 7/32 in. in diameter, 4 in. long; 800 series, rods 1/2 in. in diameter, 2 in. long; 1100 series, disks 1¼ in. in diameter, ¾ in. thick (suitable for optical and X-ray analysis); D800 series, 1¼ in. in diameter, ¼ in. thick (suitable only for X-ray analysis—prepared from the rods ½ in. in diameter by upset forging).

[2] The standard is available in only one size.

[3] The carbon contents of this group of steel standards are between 0.1 and 0.9 percent.

4. Summary of Analyses—Continued

4.1. Averaged Analyses—Continued

IRONS AND STEELS (SPECTROSCOPIC STANDARDS)—Continued

Sample Nos.[1]		Mo	W	Co	Ti	As	Sn	Al (total)	Nb	Ta	B	Pb	Zr	Zn
INGOT IRON AND LOW-ALLOY STEELS														
401	(2)													
402	802													
403a	803a	0. 033												
404a	804a	. 007												
405a	805a	. 005						0. 056						
407a	807a													
408a	808a	. 065												
409b	809b	. 009		0. 025			0. 012							
410a	810a	. 91												
411a	811a	. 22												
412a	812a	. 18												
413	(2)	. 006												
414	(2)	. 32					. 014	. 020						
415a	815a							. 11						
416a	(2)	. 20					. 011	1. 08						
417	(2)						. 020	0. 013						
417a	817a	. 013					. 036							
418	(2)	. 22												
418a	818a	. 21												
420a	820a	. 0013		. 006			. 0017	. 003						
421	821	. 040	0. 52											
425	(2)										0. 0006			
427	827										. 0027			
(2)	830										. 019			
INGOT IRONS AND SPECIAL LOW-ALLOY STEELS														
461	1161	0. 30	0. 012				0. 022		0. 011	0. 002	0. 0002			
462	1162	. 080	. 053		0. 037	0. 046	. 066		. 096	. 036	0. 0005		0. 063	
463	1163	. 12	. 105		. 010	. 10	. 013		. 195	. 15	0. 0012			
464	1164	. 029	. 022		. 004	. 018	. 043		. 037				0. 010	
465	1165	. 005			. 20	. 010	. 001			. 001	0. 0001			
466	1166	. 011			. 057	. 014	. 005							
467	1167	. 021	. 20		. 26		. 10		. 29	. 23			0. 094	
468	1168		. 077		. 011	. 008	. 009							
STAINLESS STEELS[4] GROUP I														
442	(2)	0. 12	[5](0. 08)	0. 13	0. 002		0. 0035		0. 032	(0. 0006)	0. 0005	0. 0017	(0. 004)	(0. 003)
443	(2)	. 12	(. 09)	. 12	. 003		. 006		. 056	(. 0008)	. 0012	. 0025		(. 005)
444	(2)	. 23	(. 17)	. 22	. 019		. 014		. 20	(. 004)	. 0033	. 0037	(. 011)	(. 004)
STAINLESS STEEL[6] GROUP II														
445	845	D845	0. 92	(0. 42)		(0. 03)				0. 11	(0. 002)			
446	846	D846	. 43	(. 04)		(. 34)		(0. 02)		. 60	(. 030)			
447	847	D847	. 059	(. 06)		(. 02)				. 03	(. 002)			
448	848	D848	. 33	(. 14)		(. 23)		(. 05)		. 49	(. 026)			
449	849	D849	. 15	(. 19)		(. 11)		(. 07)		. 31	(. 021)			
450	850	D850		(. 21)		(. 05)		(. 09)		. 05	(. 002)			

[4] By difference, the approximate iron contents of the standards are: 442–70.5%; 443–68.1%; 444–62.9%.

[5] Values in parentheses are *not* certified, but are given for additional information on the composition.

[6] The carbon contents of this group of standards are between 0.06 and 0.1 percent; phosphorus 0.02 and 0.03 percent; and sulfur 0.01 and 0.02 percent. By difference, the approximate iron contents are: 445, 845, and D845–83.2%; 446, 846, and D846–68.8%; 447, 847, and D847–61.8%; 448, 848, and D848–85.3%; 449, 849, and D849–84.2%; 450, 850, and D850–70.8%.

4. Summary of Analyses—Continued

4.1. Averaged Analyses—Continued

TOOL STEELS (SPECTROSCOPIC STANDARDS)

Sample Nos.[1]			Kind	Mn	Si	Cu	Cr	V	Mo	W	Co
436	836	D836	Special (Cr6–Mo3–W10)[2]	0. 21	0. 32	0. 075	6. 02	0. 63	2. 80	9. 7	------
437	837	D837	Special (Cr8–Mo2–W3–Co3)	. 48	. 53	------	7. 82	3. 04	1. 50	2. 8	2. 9
438	838	D838	Mo High Speed (AISI–SAE M30)	. 20	. 17	. 17	4. 66	1. 17	8. 26	1. 7	4. 9
439	839	D839	Mo High Speed (AISI–SAE M36)	. 18	. 21	. 12	2. 72	1. 50	4. 61	5. 7	7. 8
440	840	D840	Special W High Speed (Cr2–W13–Co12)	. 15	. 14	. 059	2. 12	2. 11	0. 070	13. 0	11. 8
441	841	D841	W High Speed (AISI–SAE T1)	. 27	. 16	. 072	4. 20	1. 13	. 84	18. 5	------

[1] Sizes: 400 series, rods 7/32 in. in diameter, 4 in. long; 800 series, rods ½ in. in diameter, 2 in. long; D800 series, 1¼ in. in diameter, ¼ in. thick (suitable only for X-ray analysis—prepared from the rods ½ in. in diameter by upset forging).

[2] The carbon contents of this group of standards are between 0.7 and 0.8%. By difference, the approximate iron contents are: 436, 836, and D836—79.2%; 437, 837, and D837—79.7%; 438, 838, and D838—77.6%; 439, 839, and D839—76.0%; 440, 840, and D840—69.1%; 441, 841, and D841—73.6%.

ALUMINUM ALLOY (SPECTROSCOPIC STANDARD)

Sample No.[1]	Kind	Cu	Mg	Si	Fe	Ni	Ti	Zn
604	Aluminum-base casting alloy (142)	3. 98	1. 56	0. 27	0. 45	2. 00	0. 100	0. 029

[1] Size: Disks 2½ in. in diameter, ¾ in. thick.

TIN METAL (SPECTROSCOPIC STANDARDS)

Sample Nos.[1]		Cu	Pb	As	Sb	Ni	Zn	Ag	Bi	Cd	Co
431	831	0. 19	0. 19	0. 16	0. 19	0. 038	0. 041	0. 015	0. 020	0. 020	0. 021
432	832	. 097	. 094	. 075	. 095	. 020	. 020	. 0095	. 0098	. 0095	. 011
433	833	. 055	. 055	. 047	. 050	. 0095	. 0095	. 0055	. 0052	. 0053	. 0045
434	834	. 019	. 022	. 019	. 019	. 0044	. 0046	. 0018	. 0020	. 0020	. 0020
435	835	. 0077	. 015	. 0090	. 010	. 0024	. 0020	. 0010	. 0011	. 0011	. 0011

[1] Sizes: 400 series, rods ¼ in. in diameter, 4 in. long; 800 series, rods ½ in. in diameter, 2 in. long.

4. Summary of Analyses—Continued

4.1. Averaged Analyses—Continued

ZINC-BASE, DIE-CASTING ALLOYS (SPECTROSCOPIC STANDARDS)

Sample No.[1]	Kind [2]	Cu	Al	Mg	Fe	Pb	Cd	Sn	Cr	Mn	Ni	Si
625	Zinc-base A	0.035	3.06	0.070	0.035	0.0014	0.0006	0.0005	0.013	0.031	0.019	0.018
626	Zinc-base B	.055	3.57	.020	.105	.0021	.0014	.0011	.039	.048	.048	.042
627	Zinc-base C	.135	3.89	.030	.023	.0082	.0049	.0042	.004	.014	.003	.024
628	Zinc-base D	.61	4.61	.009	.066	.0044	.0041	.0017	.009	.009	.030	.009
629	Zinc-base E	1.50	5.16	.094	.016	.013	.015	.012	.0008	.002	.008	.078
630	Zinc-base F	0.98	4.30	.030	.022	.0083	.0048	.0040	.003	.011	.003	.023

[1] Size: Bar segments, 1¾ in. square and ¾ in. thick.
[2] NBS Nos. 625,626, and 627 correspond to ASTM Alloy AG40A; NBS Nos. 628, 629, and 630 correspond to ASTM Alloy AC41A.

ZINC SPELTER (SPECTROSCOPIC STANDARD)

Sample No.[1]	Kind	Al	Fe	In	Cu	Cd	Mn	Cr	Sn
631	Zinc Spelter (modified) [2]	0.50	0.005	0.0023	0.0013	0.0002	0.00015	0.0001	0.0001
		Ga	Si	Pb	Mg	Ca	Ni	Ag	Ge
		[3] (0.002)	(<0.002)	(0.001)	(<0.001)	(<0.001)	(<0.0005)	(<0.0005)	(0.0002)

[1] Size: Bar segments, 1¾ in. square and ¾ in. thick.
[2] Modified by addition of 0.5% Al.
[3] Values in parentheses are *not* certified, but are given for additional information on the composition.

NICKEL OXIDES (SPECTROSCOPIC STANDARDS)

Sample No.[1]	Kind	Co	Cu	Fe	Mg	Mn	Si	Ti	Al	Cr
671	Nickel oxide 1	0.31	0.20	0.39	0.030	0.13	0.047	0.024	0.009	0.025
672	Nickel oxide 2	.55	.018	.079	.020	.095	.11	.009	.004	.003
673	Nickel oxide 3	.016	.002	.029	.003	.0037	.006	.003	.001	.0003

[1] Each sample consists of 25g of powder.

HIGH-TEMPERATURE ALLOYS (SPECTROSCOPIC STANDARDS)

Sample No.[1]	Kind [2]	C	Mn	Si	Cr	Ni	Co	Mo	W
1184	19–9DL	0.25	1.04	0.70	19.44	9.47	[3]	1.46	1.39
1185	AMS 5360A, AISI 316	.11	1.22	.40	17.09	13.18		2.01	
1187	AMS 5376A, Multimet (N–155)	.040	1.28	.94	21.62	20.26	20.80	3.41	2.40
1189	Nimonic 80a	.041	0.81	.92	20.30	72.60	0.06		

Sample No.[1]	Kind [2]	Nb	Ti	Al	Fe	P	S	Cu	Ta
1184	19–9DL	0.49	0.056			0.015	0.012		0.022
1185	AMS 5360A, AISI 316	<.001	<.001			.019	.016	0.067	<.001
1187	AMS 5376A, Multimet (N–155)	1.28	<.001		27.4	.011			.04
1189	Nimonic 80a		2.52	1.21	1.40				

[1] Size: Disks 1¼ in. in diameter, ¾ in. thick.
[2] For optical emission and X-ray analysis.
[3] Dashes indicate elements not certified.

TITANIUM-BASE ALLOYS (SPECTROSCOPIC STANDARDS)

Sample No.[1]	Kind	Al	V	Sample No.[1]	Kind	Al	V
653	6Al–4V (A)	7.25	2.58	655	6Al–4V (C)	4.63	5.38
654	6Al–4V (B)	6.03	3.83				

[1] Size: Disks 1¼ in. in diameter, ¾ in. thick.

4. Summary of Analyses—Continued

4.1. Averaged Analyses—Continued

ORES

Sample No.	Kind	Elements certified
27a	Iron, Mesabi	SiO_2, 2.08; P, 0.028; Fe, 65.0
28a	Iron, Norrie	Mn, 0.435
181	Lithium (Spodumene)	Li_2O, 6.4
182	Lithium (Petalite)	Li_2O, 4.3
183	Lithium (Lepidolite)	Li_2O, 4.1
25c	Manganese	Mn, 55.86; Available O_2, 16.72
137	Tin (Bolivian concentrate)	Sn, 56.6
138	Tin (N. E. I. concentrate)	Sn, 74.8
113	Zinc (Tri-State concentrate)	Zn, 61.1
197	Zircon	In preparation

PHOSPHATE ROCK

Sample No.	Kind	P_2O_5	Fe_2O_3	Al_2O_3	CaO	MgO	F	SiO_2
56b	Tennessee brown	31. 55			44. 06		3. 4	10. 1

ALUMINA AND SILICA REFRACTORIES, BAUXITE, AND CLAYS

Sample No.	Kind	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	ZrO_2	MnO	Mn_2O_3	P_2O_5	V_2O_5	Cr_2O_3
76	Alumina refractory	54. 7	37. 7	2. 4	2. 2	0. 07			0. 07	0. 02	
77	Alumina refractory	32. 4	59. 4	0. 90	2. 9	. 09			. 45	. 03	
78	Alumina refractory	20. 7	70. 0	. 79	3. 4	. 12			. 62	. 05	
198	Silica refractory		0. 16	. 66	0. 02	<0. 01	<0. 01		. 02		
199	Silica refractory		. 48	. 74	. 06	. 01	<0. 01		. 01		
69a	Bauxite	6. 0	55. 0	5. 8	2. 8	. 18	<0. 01		. 08	. 03	0. 05
98	Plastic clay	59. 1	25. 5	2. 05	1. 4	. 04	. 005		. 08	. 025	. 02

Sample No.	Kind	CaO	SrO	BaO	MgO	Li_2O	Na_2O	K_2O	SO_3	Loss on ignition	CuO
76	Alumina refractory	0. 27			0. 58	0. 11	0. 15	1.54		0. 22	
77	Alumina refractory	. 26			. 50	. 35	. 06	2.11		. 21	
78	Alumina refractory	. 38			. 51	. 20	. 06	2.83		. 26	
198	Silica refractory	2. 71			. 07	. 001	. 01	0. 02		. 21	
199	Silica refractory	2. 41			. 13	. 002	. 01	. 09		. 17	
69a	Bauxite	0. 29		0. 01	. 02		<. 01	<. 01	0. 04	29. 55	
98	Plastic clay	. 21		. 06	. 72	. 03	. 26	3. 17	. 07	7. 28	0. 009

FELDSPAR

Sample No.	Kind	K_2O	Na_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	TiO_2	Loss on ignition
99	Soda	0. 41	10. 73	68. 66	19. 06	0. 067	0. 36	0. 053	0. 017	0. 52

GLASS SANDS

Sample No.		Fe_2O_3	Al_2O_3	TiO_2	ZrO_2	CaO	MgO
81		0. 073	0. 265	0. 095	0. 031	0. 029	0. 016
165		. 019					

4. Summary of Analyses—Continued

4.1. Average Analyses—Continued

GLASSES

Sample No.	Kind	SiO_2	PbO	Al_2O_3	Fe_2O_3	ZnO	MnO	TiO_2	ZrO_2	CaO	BaO
89	Lead-barium	65. 35	17. 50	0. 18	0. 049	------	0. 088	0. 01	0. 005	0. 21	1. 40
91	Opal	67. 53	0. 097	6. 01	. 081	0. 08	. 008	. 019	. 01	10. 48	------
92	Low-boron	------	------	------	------	------	------	------	------	------	------
93	High-boron	80. 60	------	1. 94	. 076	------	------	. 027	. 013	[1]	------

Sample No.	Kind	MgO	K_2O	Na_2O	B_2O_3	P_2O_5	As_2O_5	As_2O_3	SO_3	Cl	F	Loss on ignition
89	Lead-barium	0. 03	8. 40	5. 70	------	0. 23	0. 36	0. 03	0. 03	0. 05	------	0. 32
91	Opal	. 008	3. 25	8. 48	------	. 022	. 102	. 091	------	. 014	5. 72	------
92	Low-boron	------	------	------	0. 70	------	------	------	------	------	------	------
93	High-boron	. 026	0. 16	4. 16	12. 76	[1]	. 14	. 085	. 009	. 036	------	------

[1] Not detected.

LIMESTONE, PORTLAND CEMENT, SILICA BRICK, BURNED MAGNESITE, AND TITANIUM DIOXIDE

Sample No.	Kind	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	MnO	CaO	SrO	MgO	Na_2O
1a	Limestone	14. 11	1. 63	4. 16	0. 16	0. 038	41. 32	0. 23	2. 19	0. 39
177	Portland cement	21. 92	2. 39	5. 27	. 26	------	64. 32	0. 05	2. 45	. 14
102	Silica brick [1]	93. 94	. 66	1. 96	. 16	. 005	2. 29	------	. 21	. 015
104	Burned magnesite	2. 54	7. 07	0. 84	. 03	. 43	3. 35	------	85. 67	. 015
154a	Titanium dioxide	------	------	------	99. 6	------	------	------	------	------

Sample No.	Kind	K_2O	SO_3	S	P_2O_5	CO_2	C	Mn_2O_3	Loss on ignition
1a	Limestone	0. 71	0. 04	0. 25	0. 15	33. 53	0. 61	------	34. 55
177	Portland cement	. 57	1. 59	------	. 04	------	------	0. 05	1. 15
102	Silica brick	. 32	------	------	. 025	------	------	------	0. 38
104	Burned magnesite	. 015	------	------	. 057	------	------	------	------

[1] Density 2.33 g/cm³ at 25° C.

SILICON CARBIDE

Sample		Total Si	Total C	Free C	SiC	Fe	Al	Ti	Zr	Ca	Mg
112	------	69. 11	29. 10	0. 09	96. 85	0. 45	0. 23	0. 025	0. 027	0. 03	0. 02

4.2. Chemicals

Sample No.	Name	Purity on basis of titration	Heat of combustion
84f	Acid potassium phthalate	99. 99	
39h	Benzoic acid	99. 98	26.434 absolute kilojoules per gram mass (wt in vacuum).
350	Benzoic acid	99. 98	
40g	Sodium oxalate	99. 95	
83b	Arsenic trioxide	100. 00	
136a	Potassium dichromate	99. 99	
950	Uranium oxide U_3O_8	99. 9₄	

SUGARS

Sample No.	Kind	Moisture	Reducing substances	Ash
17	Sucrose	<0. 003	<0. 002	<0. 003
41	Dextrose	<. 01	------	<. 003

U. S. GOVERNMENT PRINTING OFFICE: 1959

THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards at its headquarters in Washington, D. C., and its major laboratories in Boulder, Colo., is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section carries out specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant publications, appears on the inside front cover.

WASHINGTON, D. C.

Electricity and Electronics. Resistance and Reactance. Electron Devices. Electrical Instruments. Magnetic Measurements. Dielectrics. Engineering Electronics. Electronic Instrumentation. Electrochemistry.

Optics and Metrology. Photometry and Colorimetry. Optical Instruments. Photographic Technology. Length. Engineering Metrology.

Heat. Temperature Physics. Thermodynamics. Cryogenic Physics. Rheology. Engine Fuels. Free Radicals Research.

Atomic and Radiation Physics. Spectroscopy. Radiometry. Mass Spectrometry. Solid State Physics. Electron Physics. Atomic Physics. Neutron Physics. Radiation Theory. Radioactivity. X-rays. High Energy Radiation. Nucleonic Instrumentation. Radiological Equipment.

Chemistry. Organic Coatings. Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Molecular Structure and Properties of Gases. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

Mechanics. Sound. Mechanical Instruments. Fluid Mechanics. Engineering Mechanics. Mass and Scale. Capacity, Density, and Fluid Meters. Combustion Controls.

Organic and Fibrous Materials. Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Plastics. Dental Research.

Metallurgy. Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion. Metal Physics.

Mineral Products. Engineering Ceramics. Glass. Refractories. Enameled Metals. Concreting Materials. Constitution and Microstructure.

Building Technology. Structural Engineering. Fire Protection. Air Conditioning, Heating, and Refrigeration. Floor, Roof, and Wall Coverings. Codes and Safety Standards. Heat Transfer.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics.

Data Processing Systems. SEAC Engineering Group. Components and Techniques. Digital Circuitry. Digital Systems. Analog Systems. Application Engineering.

- Office of Basic Instrumentation
- Office of Weights and Measures

BOULDER, COLORADO

Cryogenic Engineering. Cryogenic Equipment. Cryogenic Processes. Properties of Materials. Gas Liquefaction.

Radio Propagation Physics. Upper Atmosphere Research. Ionospheric Research. Regular Propagation Services. Sun-Earth Relationships. VHF Research. Ionospheric Communication Systems.

Radio Propagation Engineering. Data Reduction Instrumentation. Modulation Systems. Navigation Systems. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Radio Systems Application Engineering. Radio-Meteorology.

Radio Standards. High Frequency Electrical Standards. Radio Broadcast Service. High Frequency Impedance Standards. Electronic Calibration Center. Microwave Physics. Microwave Circuit Standards.