NBS MISC. PUBL. 260

1967 Edition

Standard Reference Materials:

CATALOG AND PRICE LIST OF STANDARD MATERIALS ISSUED BY THE NATIONAL BUREAU OF STANDARDS

U.S. Department of Commerce

National Bureau of Standards

THE NATIONAL BUREAU OF STANDARDS

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[1] Headquarters and Laboratories at Gaithersburg, Md., unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Located at Boulder, Colo. 80302.
[3] Located at 5285 Port Royal Road, Springfield, Va. 22151.

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Orders will be processed more expeditiously if they are addressed to:

Office of Standard Reference Materials
National Bureau of Standards
Washington, D. C. 20234

Attention: Standard Reference Materials Unit

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

April 1, 1967

QUARTERLY INSERT SHEETS FOR NBS MISCELLANEOUS PUBLICATION 260-STANDARD REFERENCE MATERIALS

Catalog and Price List of Standard Materials Issued by the National Bureau of Standards

New and renewal Standard Reference Materials continuously are being prepared while the supply of others may be exhausted. This Quarterly Addendum is issued to bring the Catalog and Price List up-to-date as of April 1, 1967. This supersedes the Insert Sheets dated January 1, 1967, which should now be discarded.

3. Standards of Certified Chemical Composition

3.1. Steels (Chip Form) (New Standard Reference Materials)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
348	Ni26-Cr15 (A286)	$15.00			

ANALYSES

Sample Nos.	Kind	C	Mn	P	S		Si	Cu	Ni
					Grav.	Comb.			
348	Ni26-Cr15 (A286)	0.044	1.48	0.015	-------	0.002	0.54	0.22	25.8

ANALYSES—Continued

Sample Nos.	Cr	V	Mo	W	Co	Ti	As	Sn	Al (total)	N	Nb	Ta	B	Se	Fe
348	14.54	0.25	1.3	-------	------	2.24	------	------	0.23	------	------	------	0.0031	------	53.3

Steels (Chip Form) Carbon Only

Sample Nos.	Kind	Carbon	Price
335	Basic Open Hearth, 0.1 C (carbon only)	0.092	$5.00
337	Basic Open Hearth, 1.1 C (carbon only)	1.07	5.00

3.1. Steels (Chip Form) (Renewals of Earlier Materials)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
15g	Basic Open Hearth, 0.1C	$12.00	13g	Basic Open Hearth, 0.6C	12.00
11h	Basic Open Hearth, 0.2C	12.00	16e	Basic Open Hearth, 1.1C	12.00
12h	Basic Open Hearth, 0.4C	12.00	73c	Stainless (Cr13) (SAE 420)	15.00
152a	Basic Open Hearth, 0.5C, 0.03 Sn	12.00	30f	Cr-V (SAE 6150)	12.00

ANALYSES

Sample Nos.	Kind	C	Mn	P	S		Si	Cu	Ni
					Grav.	Comb.			
15g	Basic Open Hearth, 0.1C	0.097	0.485	0.005		0.026	0.095		
11h	Basic Open Hearth, 0.2C	.200	.510	.010		.026	.211		
12h	Basic Open Hearth, 0.4C	.41	.84	.018		.027	.237	0.073	0.033
152a	Basic Open Hearth, 0.5C, 0.03 Sn	.486	.717	.012		.030	.202	.023	.056
13g	Basic Open Hearth, 0.6C	.61	.85	.006		.030	.355		
16e	Basic Open Hearth, 1.1C	1.09	.381	.021		.029	.20		
73c	Stainless (Cr13) (SAE 420)	0.310	.330	.018		.036	.181	.080	.246
30f	Cr-V (SAE 6150)	.49	.79	.010		.010	.28	.076	.071

ANALYSES—Continued

Sample Nos.	Cr	V	Mo	W	Co	Ti	As	Sn	Al (total)	N	Nb	Ta	B	Se
15g														
11h														
12h	0.074	0.003	0.006							0.006				
152a	.046	.001	.036					0.032						
13g														
16e														
73c	12.82	.030	.091							.037				
30f	0.95	.18												

3.1. Steels (Chip Form) (Materials Temporarily Out of Stock)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
36a	Cr2-Mo 1 (Renewal planned but date indefinite)		125a	High-silicon, 3 Si (Renewal planned but date indefinite)	

3.1. Steels (Chip Form) (Materials Out of Stock—Discontinued)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
151	Boron-bearing, 0.003B		123b	Cr-Ni-Nb 0.7-Ta 0.2 (SAE 347)	
	(A possible replacement for this is 827—solid form material from which chips can be obtained)		131a	Low-carbon, silicon (C only) (Planning 4 high-silicon steels in solid form. Carbon to be certified with others.)	
159	Crl-Mo 0.4-Ag 0.1				

3.1. Steels (Chip Form) (Price Changes)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
339	Cr17-Ni 9–0.2 Se (SAE 303Se)	$20.00			
346	Valve (Cr22-Ni4-Mn9)	20.00			

(Correction—The catalog and price list of Standard Reference Materials issued by the National Bureau of Standards (NBS Misc. Publ. 260) gives .889 for Ni in the analysis of Sample No. 339. The correct value is 8.89.)

3.2. Steels (Solid Form) (New Standard Reference Materials)

Special Ingot Irons and Low-Alloy Steels

Sample Nos.	Kind	Price	
		400 series	1100 series
1170	Selenium steel (0.3% Se)		$35.00

Analyses

Sample Nos.	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	W	Co	Ti	As
1170	0.089	0.79	0.109	0.207	0.163									

Analyses—Continued

Sample Nos.	Sn	Al (total)	Nb	Ta	B	Pb	Zr	Ag	Ge	O	N	Se
1170												0.293

Specialty Steels

Maraging Steels: These alloys derive their name from the formation of martensite on age hardening. They attain remarkable metallurgical properties by a simple heat treatment. Extensive use of these alloys is expected, particularly in submarines, missiles and aircraft. The Maraging Steel Standard Reference Material NBS 1156 is of the 19 percent nickel type and is designed primarily for optical emission and x-ray spectrochemical analysis.

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
1156	Maraging steel	$35.00			

Analyses

Sample Nos.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
1156	0.023	0.21	0.011	0.012	0.184	0.025	19.0	0.20	3.1

Analyses—Continued

Sample Nos.	Ti	Co	Zr	B	Al	Ca
1156	0.21	7.3	0.004	0.003	0.047	<0.001

Ferrous Materials (For Oxygen)

This group of standards is intended to provide material of known composition primarily for the determination of oxygen by vacuum fusion or inert gas fusion. The materials are supplied in rods 4 in. long. Standards 1090 and 1092 are ¼ in. in diameter while Standard 1091 is 5/16 in. in diameter. (Note that two titanium-base standards, Nos. 355 and 356 are available for the determination of oxygen.)

Sample Nos.	Kind	Oxygen, ppm	Price
1090	Ingot iron	484	$20.00
1091	Stainless steel (AISI 431)	131	20.00
1092	Vacuum-melted steel	28	20.00

3.2. Steels (Solid Form) (Materials Out of Stock—Discontinued)

Ingot Iron and Low-Alloy Steels

Sample Nos.	Kind	Price		Sample Nos.	Kind	Price	
		400 & 800 series	D800 series			400 & 800 series	D800 series
811a	Cr-Mo (SAE X4130)			421	Cr-W, 0.9C		
812a	Cr-Ni-Mo (NE8637)						
818a	Cr-Mo (SAE X4130)						

Stainless Steels

Sample Nos.	Kind (Group 3)	Price
1151	Stainless Steel, A	
1153	Stainless Steel, C	

Carbon Steels (Certified for Oxygen and Nitrogen Only)

Sample Nos.	Kind	O	N	Price
1042	Bessemer, rimming			
1044	Low-carbon, Si-killed			
1045	Medium-carbon, Si-killed			

3.3. Cast Iron (Chip Form) (Renewals of Earlier Materials)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
3b	White iron (approx. wt. 110 g)	$15.00			
4j	Cast iron	15.00			
82b	Nickel-chromium cast iron	15.00			

Analyses

Sample Nos.	C		Mn	P	S		Si	Cu	Ni	Cr	V	Mo
	Total	Graphitic			Grav.	Comb.						
3b	2.44		0.351	0.085		0.090	1.04	0.050	0.013	0.052	0.006	0.002
4j	2.99	2.38	.79	.17		.062	1.31	.24	.068	.09	.03	.080
82b	2.85	2.37	.75	.025		.007	2.11	.036	1.22	.34	.027	.003

Analyses—Continued

Sample Nos.	Co	Ti	As	Sn	Al (Total)	Mg	N
3b							
4j		0.05	0.03				
82b		.026					

3.4. White Cast Iron (Solid Form) (New Standard Reference Materials)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
1174	White cast iron (special 1) ~1¼ in. sq × ¾ in. thick	$35.00			
1175	White cast iron (special 2) ~1¼ in. sq × ¾ in. thick	35.00			

ANALYSES

Sample Nos.	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	Ti
1174	3.48	0.175	0.170	0.168	0.286	0.171	0.035	0.018	0.008	0.008	0.012
1175	1.97	1.64	.652	.017	3.48	1.50	2.98	2.43	.221	1.51	.35

ANALYSES—Continued

Sample Nos.	As	Sb	Sn	Co	Te	B	Bi	Zr	Pb	Al
1174	0.026	0.19	0.23	0.009	0.073	0.040	(0.008)	(0.01)	(0.01)	(0.001)
1175	.22	.020	.025	.11	.009	.005	(.017)	(.04)	.003	(.03)

3.4. White Cast Iron (Solid Form) (Materials Out of Stock—Discontinued)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
1176	White cast iron A—piston ring (Replaced by 1174 and 1175—now available)		1180	White cast iron E, Mold (Replaced by 1174 and 1175—now available)	
1177	White cast iron B—wear plate (Replaced by 1174 and 1175—now available)		1181	White cast iron F (Replaced by 1174 and 1175—now available)	
1178	White cast iron C—die (Replaced by 1174 and 1175—now available)		1182	White cast iron G (Replaced by 1174 and 1175—now available)	
1179	White cast iron D—brake drum (Replaced by 1174 and 1175—now available)		1183	White cast iron H (Replaced by 1174 and 1175—now available)	

3.5. Steel-Making Alloys (Materials Temporarily Out of Stock)

Sample Nos.	Kind	Approx. wt. in grams	Price
61a	Ferrovanadium (Renewal planned but date indefinite)		

3.6. Nonferrous Alloys (Chip Form) (Materials Temporarily Out of Stock)

Sample Nos.	Kind	Approx. wt. in grams	Price	Sample Nos.	Kind	Approx. wt. in grams	Price
127a	Solder (Pb70-Sn30) (Renewal planned as Pb60-Sn40)						

3.6. Nonferrous Alloys (Chip Form) (Materials Out of Stock—Discontinued)

Sample Nos.	Kind	Approx. wt. in grams	Price	Sample Nos.	Kind	Approx. wt. in grams	Price
53d	Bearing metal, lead-base			167	Co43-Mo4-Nb3-W4		
62d	Bronze, manganese			161	Nickel-base casting alloy		

3.7. Copper-Base Alloys (Solid Form) (Revision of Text)

Several groups of copper-base alloy standards have been prepared to provide for analytical control by rapid instrumental methods in the copper industry. These standards are intended primarily for calibration of optical emission and x-ray spectroscopic equipment, and have been prepared in chill-cast form for the producer, and wrought form for the consumer—both forms having identical (or nearly identical) composition. Seven principal copper-base alloys are covered by a "nominal-composition" together with a low- and a high-composition standard. To make the standards more widely applicable, a number of trace elements were purposely added to the cartridge brass series, and these have been certified. Three beryllium copper standards have been prepared to be representative of the nominal composition for CABRA alloys 165–170, 25–172, and 10–175, respectively.

The materials are furnished in two basic forms: (1) unidirectional chill-cast samples (C1100 series) in the form of solid sections 1¼ inches square, ¾ inch thick, and (2) wrought material (either forged or hot-extruded) in the form of disks 1¼ inches in diameter, ¾ inch thick (1100 series). Details on the preparation and use of the seven principal copper-base alloys can be found in National Bureau of Standards Misc. Publ. 260-2, Preparation of NBS Copper-Base Spectrochemical Standards by R. E. Michaelis, LeRoy L. Wyman, and Richard Flitsch. Methods of chemical analyses employed at NBS for these alloys are described in NBS Misc. Publ. 260-7 by R. K. Bell. The beryllium copper standards were prepared similar to the other copper-base alloys. Further details on the analysis, where different, will appear in a subsequent 260 series publication.

(Values in parentheses are not certified, but are given for additional information on the composition.)

3.7. Copper-Base Alloys (Solid Form) (Price Changes)

Sample Nos.		Kind	Price	Sample Nos.		Kind	Price
------	C1100	Cartridge Brass A	$35.00	1112	C1112	Gilding Metal A	$35.00
1101	C1101	Cartridge Brass B	35.00	1113	C1113	Gilding Metal B	35.00
1102	C1102	Cartridge Brass C	35.00	1114	C1114	Gilding Metal C	35.00
1103	C1103	Free-Cutting Brass A	35.00	1115	C1115	Commercial Bronze A	35.00
1104	C1104	Free-Cutting Brass B	35.00	1116	C1116	Commercial Bronze B	35.00
1105	C1105	Free-Cutting Brass C	35.00	1117	C1117	Commercial Bronze C	35.00
1106	C1106	Naval Brass A	35.00	1118	C1118	Aluminum Brass A	35.00
1107	C1107	Naval Brass B	35.00	1119	C1119	Aluminum Brass B	35.00
1108	C1108	Naval Brass C	35.00	1120	C1120	Aluminum Brass C	35.00
1109	C1109	Red Brass A	35.00				
1110	C1110	Red Brass B	35.00				
1111	C1111	Red Brass C	35.00				

3.7. Copper-Base Alloys (Solid Form) (New Standard Reference Materials)

Sample Nos.		Kind	Price	Sample Nos.		Kind	Price
1121	C1121	Beryllium Copper Cabra alloy 165–170	$45.00				
1122	C1122	Beryllium Copper Cabra alloy 25–172	45.00				
1123	C1123	Beryllium Copper Cabra alloy 10–175	45.00				

ANALYSES

Sample Nos.		Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb	As
1121	------	97.49	(0.01)	(0.002)	0.085	0.01	0.012	0.07	------	------
	C1121	97.46	(.01)	(.002)	.085	.01	.012	.07	------	------
1122	C1122	97.45	(.01)	(.003)	.16	(.01)	(.01)	.17	------	------
1123	C1123	97.10	.01	(.001)	.04	(.01)	(.01)	.01	------	------

ANALYSES

Sample Nos.		Be	Bi	Cd	Mn	P	Si	Ag	Te	Co	Cr
1121	------	1.89	------	------	(0.004)	(0.005)	0.11	(0.005)	------	0.295	(0.002)
	C1121	1.92	------	------	(.004)	(.005)	.11	(.005)	------	.295	(.002)
1122	C1122	1.75	------	------	(.004)	(.004)	.17	(.005)	------	.220	(.002)
1123	C1123	0.46	------	------	(.002)	(.002)	.03	(.009)	------	2.35	(.001)

3.8. High Temperature Alloys (Solid Form) (Materials Out of Stock—Discontinued)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
1189	Nimonic 80a				

3.8. High Temperature Alloys (Solid Form) (New Standard Reference Materials)

Sample Nos.[1]	Kind[2]	Price	Sample Nos.	Kind	Price
1193	W 545	$35.00			
1194	A 286	35.00			
1195	Discaloy 24	35.00			

[1] Size: Solid sections, 1¼ in. in diameter and ¾ in. thick.
[2] Issued in the wrought condition.

ANALYSES

Sample Nos.	C	Mn	Si	Cr	Ni	Co	Mo	W	Nb
1193	0.004	0.65	0.110	11.95	28.35	----------	1.47	----------	----------
1194	.081	.67	.71	16.35	24.06	2.7	1.27	----------	----------
1195	.006	.38	1.11	13.83	26.07	----------	2.97	----------	----------

ANALYSES—Continued

Sample Nos.	Ti	Al	Fe	P	S	Cu	Ta	Zr	V	B
1193	3.0	0.21	54.2	0.003	0.030	0.103	----------	0.006	0.051	0.0023
1194	1.45	.39	51.3	.011	.008	.047	----------	.026	.32	.0090
1195	1.28	.074	54.0	.016	.008	.016	----------	.004	.45	.0043

3.10. Tin Metal (Solid Form) (Materials Out of Stock—Discontinued)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
431	Tin A		832	Tin B	
433	Tin C		833	Tin C	
434	Tin D		834	Tin D	
435	Tin E				

3.11. Titanium-Base Alloys (New Standard Reference Materials)

TITANIUM-BASE MATERIALS (FOR OXYGEN)

These standards are intended to provide material of known composition primarily for the determination of oxygen by vacuum fusion or inert gas fusion. The materials are supplied in rods approximately ½ in. in diameter and 2 in. long. (Note that a group of ferrous materials, NBS standards 1090, 1091, and 1092 also is available for the determination of oxygen.)

Sample Nos.	Kind	Oxygen ppm	Price
355	Unalloyed	3031	$20.00
356	Alloy, 6Al-4V	1332	20.00

3.12. Zirconium-Base Alloys (Renewals of Earlier Materials)

Sample Nos.	Kind	Price
360a	Zircaloy-2	$30.00

ANALYSES

Sample Nos.	Sn	Fe	Cr	Ni	Cu	Mn	U	Ti	Si	C	N
	%	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*
360a	1.42	1441	1060	554	140	3	0.15	27	51	136	43

3.12. Zirconium-Base Alloys (Materials Temporarily Out of Stock)

Sample Nos.	Kind	Price	Sample Nos.	Kind	Price
1213	Zircaloy-2 D				

3.16. Ceramic Materials (Renewals of Earlier Materials)

Sample Nos.	Kind	Approximate weight	Price	Sample Nos.	Kind	Approximate weight	Price
70a	Feldspar, potash	40 g	$10.00	1b	Limestone, argillaceous	50 g	$12.00
99a	Feldspar, soda	40 g	10.00	88a	Limestone, dolomitic	50 g	12.00

ANALYSES

Sample Nos.	Kind	SiO_2	Al_2O_3	Fe_2O_3	FeO	TiO_2	ZrO_2	MnO	P_2O_5
70a	Feldspar, potash	67.1	17.9	0.075		0.01			
99a	Feldspar, soda	65.2	20.5	.065		.007			
1b	Limestone, argillaceous	4.92	1.12	.75		.046		0.20	0.08
88a	Limestone, dolomitic	1.20	0.19	.28		.02		.03	.01

ANALYSES—Continued

Sample Nos.	Kind	V_2O_5	Cr_2O_3	CaO	MgO	Li_2O	Na_2O	K_2O	Loss on ignition	BaO	Rb_2O	SrO	CO_2
70a	Feldspar, potash			0.11			2.55	11.8	0.40	0.02	0.06		
99a	Feldspar, soda			2.14			6.2	5.2	.26	.26	.02		
1b	Limestone, argillaceous			5.09	0.36		0.04	0.25	41.1			0.14	40.4
88a	Limestone, dolomitic			30.15	21.3		.01	.12	46.7			.01	46.6

3.16. Ceramic Materials (Materials Temporarily Out of Stock)

Sample Nos.	Kind	Approximate weight	Price	Sample Nos.	Kind	Approximate weight	Price
76	Burned Refractory (40% Al_2O_3) (Renewal indefinite at present)						

3.18. Metallo-Organic Compounds (Renewals of Earlier Materials)

Sample Nos.	Kind (approximate wt. 5 grams)	Constituents determined	%	Price
1074a	Calcium 2-ethylhexanoate	Ca	12.5	$15.00
1079a	Tris(1-phenyl-1,3-butanediono)iron(III)	Fe	10.3	15.00

3.18. Metallo-Organic Compounds (Materials Out of Stock—Discontinued)

Sample Nos.	Kind (approximate wt. 5 grams)	Constituents determined	%	Price
1056a	Cupric cyclohexanebutyrate			

3.19. Microchemical Standards (Renewals of Earlier Materials)

Sample Nos.	Kind	Constituents determined or intended use	Approximate weight of sample in grams	Price
141b	Acetanilide	N, C, H	2	$9.00

3.19. Microchemical Standards (Materials Out of Stock—Discontinued)

Sample Nos.	Kind	Constituents determined or intended use	Approximate weight of sample in grams	Price
145	2-Iodobenzoic acid			

3.19. Microchemical Standards (Price Changes)

Sample Nos.	Kind	Constituents determined or intended use	Approximate weight of sample in grams	Price
143b	Cystine	S, C, H, N	2	$11.00

3.20. Chemicals (Renewals of Earlier Materials)

(a) Primary Chemicals

Sample Nos.	Kind		Approx. wt. in grams	Price
84h	Acid potassium phthalate	Acidimetric value	60	$6.50

3.20. Chemicals (New Standard Reference Materials)

(b) Intermediate purity chemicals. This group of materials is intended to bridge the gap between commercial materials available in bulk and materials available in primary or purer grades. They should prove useful to the samll research laboratory or individual workers engaged in purification, as a characterized starting material. Such materials are also useful in analytical procedures when a higher-purity primary grade is neither necessary nor available.

Sample Nos.	Kind	Constituents determined or intended use	Approximate weight	Price
726	Selenium	Limits for Al, As, B, Ca, Cr, Cu, halogens, Fe, Pb, Mg, Mn, Mo, Ni, Ag, S, Te, Tl, Sn, Be, Bi, Cd, Co, In, and V.	1 lb.	$40.00
727	Rubidium chloride	Isotopic ratio, assay	1.0 g	20.00

3.21. Special Nuclear Materials (Renewals of Earlier Materials)

Sample Nos.	Kind	Certified for	Unit	Price
949b	Plutonium metal	*Plutonium content* 99.99%	*Pu* 0.5 g	$88.00

3.22. Isotopic Reference Standards (New Standard Reference Materials)

Sample Nos.	Kind	Element	Price
979	Chromium Nitrate	Chromium	$20.00
980	Magnesium Metal	Magnesium	20.00

4. Standards of Certified Properties and Purity

4.1. *p*H Standards (Renewals of Earlier Materials)

The standard 186Ic and 186IIb are certified for use in admixture only. At an equimolar (0.025 molal) mixture of the two salts a *p*H(S) of 6.862 at 25 °C is obtained. Directions are also furnished for the preparation of a physiological reference solution having a *p*H(S) of 7.410 at 25 °C.

Sample Nos.	Kind	*p*H (S) (at 25 °C)	Approx. wt. in grams	Price
186Ic	Potassium dihydrogen phosphate	See above	30	$7.00

4.1. *p*H Standards (Price Changes)

Sample Nos.	Kind	*p*H (S) (at 25 °C)	Approx. wt. in grams	Price
185d	Acid potassium phthalate	4.004	60	$7.50

4.2. Freezing-Point Standards (New Standard Reference Materials and Revision of Section)

(a) Defining fixed points—International Practical Temperature Scale.
The purity of these materials is such that they are suitable for realizing the defining fixed points on the International Practical Temperature Scale of 1948.

Sample Nos.	Kind	Value assigned to defining fixed point °C (Int. 1948)	Approximate weight in grams	Price
740	Zinc	419.505	350	$65.00

(b) Secondary reference points.
These are intended for the calibration of resistance thermometers and thermocouples.

Sample Nos.	Kind	Determined freezing point °C (Int. 1948)	Approximate weight in grams	Price
44e	Aluminum	660.0	200	$12.00
45d	Copper	1083.3	450	12.00
49e	Lead	327.417	600	12.00
42f	Tin	231.88	350	12.00

4.3. Thermometric Cells (Materials Out of Stock—Discontinued)

Sample Nos.	Kind	Price
940	Phenol thermometric cell near 40.8 °C	
941	Naphthalene thermometric cell near 80.2 °C	
942	Phthalic anhydride thermometric cell near 131.1 °C	

4.5. Radioactivity Standards

4.5.1. Alpha-Ray Standards (Renewals of Earlier Materials)

Sample Nos.	Radionuclide	Approximate α-particle emission rate in 2π geometry	Price
4904-B	Americium-241	20 αps	$77.00

4.5.3. Beta-Ray, Gamma-Ray and Electron-Capture Solution Standards (New Standard Reference Materials)

Sample Nos.	Radionuclide	Calibration radiation	Approximate activity or emission rate at time of calibration (month, year)	Approximate weight of solution	Price
4948	Ce-Pr-144	β^-	1.5×10^5 dps/g (12–65)	3.3 g	$80.00

4.5.3. Beta-Ray, Gamma-Ray and Electron-Capture Solution Standards (Renewals of Earlier Materials)

Sample Nos.	Radionuclide	Calibration radiation	Approximate activity or emission rate at time of calibration (month, year)	Approximate weight of solution	Price
4932-D	Mercury-203	γ	2.1×10^6 dps/g (1–66)	5.1 g	$50.00
4937-C	Niobium-95	β^-	2.6×10^5 dps/g (7–66)	5.2 g	56.00
4944-D	Iodine-125	x-ray	1.1×10^5 dps/g (12/66)	5 g	66.00

4.5.3. Beta-Ray, Gamma-Ray and Electron-Capture Solution Standards (Materials Temporarily Out of Stock)

Sample Nos.	Radionuclide	Calibration radiation	Approximate activity or emission rate at time of calibration (month, year)	Approximate weight of solution	Price
4946-B	Cerium-141				

4.5.3. Beta-Ray, Gamma-Ray and Electron-Capture Solution Standards (Materials Out of Stock—Discontinued)

Sample Nos.	Radionuclide	Calibration radiation	Approximate activity or emission rate at time of calibration (month, year)	Approximate weight of solution	Price
4941-B	Cobalt-57				
4945-B	Strontium-89				

4.5.5. Point-Source Gamma-Ray Standards (New Standard Reference Materials)

Sample Nos.	Radionuclide	Approximate emission rate at time of calibration (month, year)	Price per sample
4201	Niobium-94	1×10^4 γps (7/65)	$55.00

4.5.5. Point-Source Gamma-Ray Standards (Materials Temporarily Out of Stock)

Sample Nos.	Radionuclide	Approximate emission rate at time of calibration (month, year)	Price per sample
4993-B	Niobium-95	1.4×10^5 γps (7/66)	$56.00
4995-B	Mercury-203	$\sim 8 \times 10^4$ γps (3/66)	63.00
4999-C	Cerium-139	1×10^5 γps (9/65)	58.00

4.5.5. Point-Source Gamma-Ray Standards (Renewals of Earlier Materials)

Sample Nos.	Radionuclide	Approximate emission rate at time of calibration (month, year)	Price per sample
4991-B	Sodium-22	6×10^4 γps (1/65)	$57.00
4992-C	Zinc-65	5×10^4 γps (1/65)	50.00
4997-D	Manganese-54	6×10^4 γps (6/66)	53.00
4998-D	Yttrium-88	1×10^4 γps (3/65)	53.00
4203-A	Cobalt-60	3×10^5 γps (8/66)	65.00
4203-B	Cobalt-60	7×10^5 γps (8/66)	65.00

4.5.6. Radium Rock Samples (Materials Out of Stock—Discontinued)

Sample Nos.	Rock	Average radium content (picogram of radium per gram of rock)	Price
4978	Columbia River Basalt		

4.5.8. Radium Gamma-Ray Solution Standards (Renewals of Earlier Materials)

Sample Nos.	Radium content (in micrograms) as of 1965	Approximate weight	Price per sample
4964B	100	5 g	$43.00

4.5.8. Radium Gamma-Ray Solution Standards (Price Changes)

Sample Nos.	Radium content (in micrograms) as of 1947	Approximate weight	Price per sample
4955	0.1	5 g	$34.00
4956	0.2	5 g	34.00
4957	0.5	5 g	34.00
4958	1.0	5 g	34.00
4959	2.0	5 g	34.00
4960	5.0	5 g	34.00
4961	10.0	5 g	34.00
4962	20.0	5 g	34.00
4963	50.0	5 g	34.00

4.5.9. Contemporary Standard for Carbon-14 Dating Laboratories (Renewals of Earlier Materials)

Sample Nos.	Kind	Price
4990-B	Carbon-14 dating standard	$6.00

4.6. Standard Rubbers and Rubber Compounding Materials

4.6.1. Standard Rubbers (New Standard Reference Materials)

Sample Nos.	Kind	Approx. wt. in grams	Price
389	Styrene-butadiene, type 1503	34,000	$49.00

4.6.1. Standard Rubbers (Renewals of Earlier Materials)

Sample Nos.	Kind	Approx. wt. in grams	Price
386f	Styrene-butadiene, type 1500	34,000	$45.00

4.6.1. Standard Rubbers (Materials Temporarily Out of Stock)

Sample Nos.	Kind	Approx. wt. in grams	Price
385b	Natural rubber (Renewal possibly about middle of 1967)		

4.6.2. Rubber Compounding Materials (New Standard Reference Materials)

Sample Nos.	Kind	Approx. wt. in grams	Price	Sample Nos.	Kind	Approx. wt. in grams	Price
384	N-tertiary-Butyl-2-benzothiazolosulfenamide	800	$5.00				

4.6.2. Rubber Compounding Materials (Renewals of Earlier Materials)

Sample Nos.	Kind	Approx. wt. in grams	Price	Sample Nos.	Kind	Approx. wt. in grams	Price
371e	Sulfur	1,400	$4.50				
375f	Channel Black	7,000	16.00				

4.8. Viscometer Calibrating Liquids

4.8.1. CGS Units (Price Changes)

Oil	Viscosity, in poises, at—					Kinematic viscosity, in stokes, at—					Price 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		$20.00
I	.12	.10	.066	.017		.14	.12	.081	.022		22.50
K	.41	.32	.18	.032		.48	.38	.22	.040		22.50
L	1.0	.74	.37	.049		1.1	.84	.43	.060		22.50
M	3.0	2.1	1.0	.099		3.4	2.4	1.1	.12		20.00
N	14.0	9.6	4.0	.25		16.0	11.0	4.6	.30		25.00
	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		37.50
P			450	200	95			510	220	100	36.00

4.8.2. Saybolt Units (Price Changes)

Oil	Temperature °F	Viscosity	Price F.O.B. Washington, D.C.
SB	100	300 seconds, Saybolt Universal	$8.00
SF	122	110 seconds, Saybolt Furol	8.00

4.9. Glass Viscosity Standards (New Standard Reference Materials)

Sample Nos.	Kind	Unit of issue	Price
712	Mixed alkali lead silicate glass, ¼ in. patties (6 pcs.)	0.5 lb	$25.00
713	Dense barium crown 620/603 glass .. 1⅜ in. diam × ⅝ in. thick gobs (4 pcs.)	.5 lb	25.00
714	Alkaline earth alumina silicate glass .. ¼ in. diam cane (16 pcs.—6 in. long)	.5 lb	25.00
715	Alkali-free aluminosilicate glass, ¼ in. diam cane (13 pcs.—6 in. long)	200 g	25.00
716	Neutral (borosilicate) glass ½ in. diam cane (6 pcs.—6 in. long)	250 g	25.00

Certified Properties

Viscosity poises	Temperature °C standard 712	Temperature °C standard 713	Temperature °C standard 714	Temperature °C standard 715	Temperature °C standard 716
10^2					
10^3					
10^4					
10^5					
10^6					
10^7					
10^8					
10^9					
10^{10}					
10^{11}					
10^{12}					
Softening point	528	738	908	961	794
Annealing point	386	631	710	764	574
Strain point	352	599	662	714	530

4.11. The ISCC-NBS Centroid Color Charts (Price Changes)

Sample Nos.	Kind	Price per set
2106	Centroid color charts	$5.00

4.16. Internal Tearing Resistance Standard Paper (Renewals of Earlier Materials)

Sample Nos.	Kind	Price
704a	Internal tearing resistance of paper	$7.00 per package

4.17. Microcopy Resolution Test Chart (Price Changes)

Sample Nos.	Kind	Unit of issue	Price per chart
1010	Resolution chart for testing the resolving power of microcopying cameras (add $2.00 per order for handling)	5 (minimum)	$0.60

4.18. Glass Spheres for Sieve Calibration (New Standard Reference Materials)

Sample Nos.	Kind	Weight in grams	Price
1003	Calibrated glass spheres (5–30 micron)	40–45	$15.00

4.18. Glass Spheres for Sieve Calibration (Materials Temporarily Out of Stock)

Sample Nos.	Kind	Weight in grams	Price
1017	Calibrated glass spheres (for calibrating sieves No. 70–270)		

4.21. Coating Thickness (New Standard Reference Materials)

Nominal thickness only is given below. The certified thickness appears on the cards accompanying the samples.

Sample Nos.	Prev. Desig.	Nominal Thickness (inch)	Coating	Substrate	Price
	Type I	0–0.08	Nonmagnetic	Magnetic	
1301		0.00010	copper+chromium	steel	$7.50
1302	AA	.00025	do	do	7.50
1303	AB	.00050	do	do	7.50
1304	AM	.00075	do	do	7.50
1305	AC	.0010	do	do	7.50
1306	CA	.0015	do	do	7.50
1307	AD	.0020	do	do	7.50
1308		.0025	do	do	7.50
1309	CM	.0027	do	do	7.50
1310	CB	.0032	do	do	7.50
1311	CC	.0055	do	do	7.50
1312	CD	.0080	do	do	7.50
1313	DA	.010	do	do	7.50
1314	DB	.015	do	do	7.50
1315	DC	.020	do	do	7.50
1316	DD	.025	do	do	7.50
1317	HA	.03	do	do	7.50
1318	HB	.04	do	do	7.50
1319	HC	.06	do	do	7.50
1320	HD	.08	do	do	7.50
	Type II	0–0.0025	Magnetic	Magnetic	
1331	BA	0.00012	nickel	steel	$7.50
1332	BB	.00035	do	do	7.50
1333	BC	.00055	do	do	7.50
1334	BD	.00075	do	do	7.50
1335	EA	.0010	do	do	7.50
1336	EB	.0013	do	do	7.50
1337	EC	.0016	do	do	7.50
1338	ED	.0020	do	do	7.50
1339	EE	.0025	do	do	7.50
	Type III	0–0.002	Magnetic	Nonmagnetic	
1341	FA	0.00012	nickel/chromium	brass	$7.50
1342	FB	.00035	do	do	7.50
1343	FC	.00065	do	do	7.50
1344	FD	.0010	do	do	7.50
1345	FE	.0015	do	do	7.50
1346	FF	.0020	do	do	7.50

4.22. Thermal Emittance Standards (New Standard Reference Materials)

Standards of normal spectral emittance are available in three materials, platinum-13 percent rhodium alloy having low emittance, sandblasted and oxidized Kanthal (an iron-chromium-aluminum alloy) having intermediate emittance, and sandblasted and oxidized Inconel (a nickel-chromium-iron alloy) having high emittance. Standards of all three materials have been calibrated for normal spectral emittance at 800 and 1100 °K, the Kanthal and Inconel standards at 1300 °K and the platinum-13 percent rhodium at 1400 and 1600 °K. Normal spectral emittance data is supplied at 156 wavelengths in the one to fifteen micron range for all the combinations listed above. In addition, data for the platinum-13 percent rhodium standards is supplied in the fifteen to thirty-five micron range at 1100 °K.

Sample Nos.	Kind	Price
1402	Emittance standards, ½ in. disks Pt-13% Rh	$175.00
1403	Emittance standards, ⅞ in. disks Pt-13% Rh	185.00
1404	Emittance standards, 1 in. disks Pt-13% Rh	200.00
1405	Emittance standards, 1⅛ in. disks Pt-13% Rh	235.00
1406	Emittance standards, 1¼ in. disks Pt-13% Rh	250.00
1407	Emittance standards, 2 in. × 2 in. squares Pt-13% Rh	385.00
1408	Emittance standards, 1 in. × 10 in. strips Pt-13% Rh	750.00
1409	Emittance standards, ¾ in. × 10 in. strips Pt-13% Rh	600.00
1420	Emittance standards, ½ in. disks Kanthal	175.00
1421	Emittance standards, ⅞ in. disks Kanthal	175.00
1422	Emittance standards, 1 in. disks Kanthal	175.00
1423	Emittance standards, 1⅛ in. disks Kanthal	175.00
1424	Emittance standards, 1¼ in. disks Kanthal	175.00
1425	Emittance standards, 2 in. × 2 in. squares Kanthal	175.00
1427	Emittance standards, ¾ in. × 10 in. strips Kanthal	175.00
1428	Emittance standards, ¼ in. × 8 in. strips Kanthal	175.00
1440	Emittance standards, ½ in. disks Inconel	175.00
1441	Emittance standards, ⅞ in. disks Inconel	175.00
1442	Emittance standards, 1 in. disks Inconel	175.00
1443	Emittance standards, 1⅛ in. disks Inconel	175.00
1444	Emittance standards, 1¼ in. disks Inconel	175.00
1445	Emittance standards, 2 in. × 2 in. squares Inconel	175.00
1447	Emittance standards, ¾ in. × 10 in. strips Inconel	175.00

4.22. Thermal Emittance Standards (Materials Out of Stock—Discontinued)

Sample Nos.	Kind	Price
1426	Emittance standards, 1 in. × 10 in. strips Kanthal	
1446	Emittance standards, 1 in. × 10 in. strips Inconel	

4.23. Permittivity Standards (New Standard Reference Materials)

These standards are furnished in three different shapes and are certified for relative permittivity (approximately 6.3 in the case of the 1723 glass and 3.83 in the case of the 7940 fused silica) in the frequency range 10^3 to 10^{10} hertz. These standards are intended for use in checking and improving measurement systems for complex permittivity.

Sample Nos.	Kind	Price
1501	1723 glass, 2¼ in. × 2¼ in. × 3/16 in. rough cut blank for making 2 in. disk for low-frequency, capacity-type holder	$87.50
1502	1723 glass, 1 in. × ½ in. × ½ in. rough-cut blank for X-band waveguide	87.50
1503	1723 glass, 1¼ in. × 1¼ in. × ⅜ in. rough-cut blank for making nominal 1 in. cylindrical waveguide for dielectrometer	87.50
1504	7940 fused silica, 2¼ in. × 2¼ in. × ¼ in. for making 2 in. disk for low-frequency, capacity-type holder	87.50
1505	7940 fused silica, 1 in. × ½ in. × ½ in. rough-cut blank for X-band waveguide	87.50
1506	7940 fused silica, 1¼ in. × 1¼ in. × ⅜ in. rough-cut blank for making 1 in. cylindrical waveguide for dielectrometer	87.50

4.24. Mössbauer Differential Chemical Shift for Iron-57 (New Standard Reference Materials)

This standard reference material is intended to furnish a base (zero) point for Mössbauer spectrometry. It is furnished as a platelet 1 cm x 1 cm x 0.0775 cm cut from a single crystal of sodium nitroprusside along the 100 crystal plane. The natural iron concentration is 25.0 mg/cm^2 ± 4 percent. This standard reference material has an average value for the chemical shift of 0.0000 ±0.0002 cm/sec, and an average value for the electric quadrupole splitting of 0.1726 ±0.0002 cm/sec at 25 °C.

Sample Nos.	Kind	Price
725	Mössbauer Differential Chemical Shift for Iron-57 (Sodium Nitroprusside)	$150.00

4.25. Carbon-14 and Hydrogen-3 Labeled Sugars (New Standard Reference Materials)

4.25.1. Terminal Carbon-14 Sugars

Sample Nos.	Kind	Amount of Activity	Price
1525 series	Carbon-14 labeled sugars and related products, Type 1 (carbohydrates labeled at carbon 1)	10 micro-curies	$12.50

4.25.2. Interior Carbon-14 Sugars

Sample Nos.	Kind	Amount of Activity	Price
1550 series	Carbon-14 labeled sugars and related products, Type 2 (carbohydrates labeled in positions other than carbon 1)	10 micro-curies	$17.50

4.25.3. Tritium Labeled Sugars

Sample Nos.	Kind	Amount of Activity	Price
1575 series	Tritium-labeled carbohydrates (carbohydrates labeled without extensive alteration of the carbon skeleton)	10 micro-curies	$12.50

4.26. Light-Sensitive Plastic Chips (New Standard Reference Materials)

Standard light-sensitive plastic chips are available for use in calibration and standardization of artificial weathering and fading apparatus. These chips are distributed in two thicknesses (0.060 and 0.124 inch) in units of five plates 2 inches by 4⅛ inches, and have been standardized by the measurement of the change of transmittance as a function of exposure (in standard fading hours) to the NBS master lamps.

Sample Nos.	Kind	Unit of Issue	Price
702	Light-sensitive plastic chips (0.124 inch)	Package of 5 chips	$15.50
703	Light-sensitive plastic chips (0.060 inch)	Package of 5 chips	15.50

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UNITED STATES DEPARTMENT OF COMMERCE • Alexander B. Trowbridge, *Secretary*
NATIONAL BUREAU OF STANDARDS • A. V. Astin, *Director*

Standard Reference Materials:

Catalog and Price List of Standard Materials Issued by The National Bureau of Standards

Office of Standard Reference Materials
National Bureau of Standards
Washington, D.C. 20234

CAUTION: The values given in the following sections are listed primarily as a guide to purchaser. In some cases, the values shown are provisional and may differ from those shown on the certificates. Space limitations have required that some values be omitted. For these reasons, the certificates issued with the standards should always be consulted to obtain the certified values.

National Bureau of Standards Miscellaneous Publication 260

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Preface

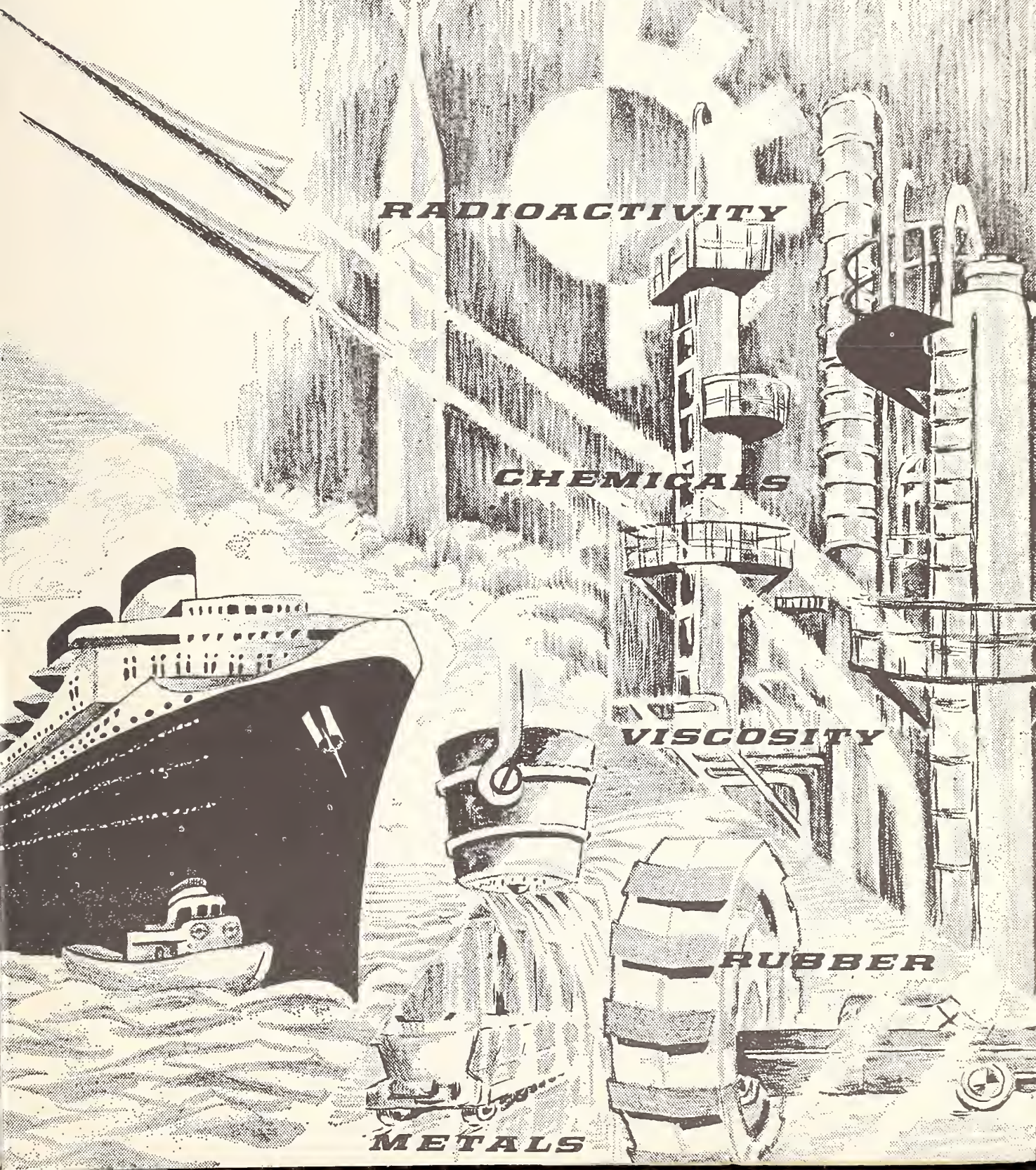
Within the framework of the NBS Institute for Materials Research the area of standard reference materials is a broad and important one, including the preparation, characterization, and distribution of a wide variety of materials in such diverse fields as metallurgy, polymers, and inorganic materials. In carrying out such a program there is much interaction with representatives of industry and science, beginning with discussions as to which primary standard materials will do most to advance technology, the furnishing of materials and fabrication of samples, and the characterization and certification of the materials by cooperative efforts. The many groups participating in a standards program are very interested in detailed information on specific aspects of the program—but to date there has been no publication outlet for such written discussions.

To meet this need, the NBS Miscellaneous Publication 260 Series has been reserved for papers in the general area of "standard reference materials." This series begins with a descriptive price list of standard materials available. Succeeding publications present the results of studies and investigations undertaken within the Institute for Materials Research with emphasis on the preparation and characterization of standard reference materials. This subject-oriented series provides a means for rapid dissemination of this detailed information and we hope will stimulate the use of standard reference materials in science and industry.

W. Wayne Meinke, Chief
Office of Standard Reference Materials

STANDARD MATERIALS

PROMOTE THE ADVANCE OF THE NATION'S RESEARCH AND TECHNOLOGY



Contents

Standard Reference Materials

Issued by the National Bureau of Standards

This catalog describes the various Standard Reference Materials issued by the National Bureau of Standards. These materials are used to calibrate measurement systems and provide scientific information that can be referred to a common base. A schedule of prices and quantities is included for each material, as well as directions for ordering. Listed are the types and compositions of those chemical standards that are presently available. Announcements of new standard reference materials are made in the Federal Register, in scientific and trade journals, and in the Technical News Bulletin of the National Bureau of Standards. Changes affecting the current status of the various standards will be indicated by an insert sheet available quarterly from the Bureau.

Key words: Analysis, catalog, certificate, characterization, composition, price list, property of material, purity of material, standard reference materials, standards.

1. General Information

1.1. Introduction

The standard reference materials issued by the National Bureau of Standards, their prices and directions for ordering, are given in this publication. All types of well-characterized materials are available for calibrating measurement systems, and providing scientific information that can be referred to a common base.

Other uses include calibration and standardization of spectrometers, spectrographs, colorimeters, *p*H meters, Geiger counters, scintillators, ionization chambers, pyrometers, polarimeters, refractometers, viscometers, and other laboratory and plant instruments; checking methods of analysis and analytical techniques; standardization of solutions for volumetric analysis and the development of new or improved methods of analysis, and the evaluation of the accuracy of analytical methods.

The first standard materials issued by the 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. More recently, the term "Standard Sample" has been replaced with the more apt description "Standard Reference Material."

In this publication 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 600 different standards of metals, ores, ceramics, chemicals, and hydrocarbons are now available for distribution. About 400 of these are certified for chemical composition. Almost half 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. Each standard material is accompanied by a certificate of characterization. An example of such a certificate is shown in appendix I.

1.2. Standards Out of Stock

The preparation of "renewals" is intended to be completed at the time each kind of material 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 standard reference materials that are out of stock, notice will be mailed to that effect. The composition of a "renewal" 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, and generally the "renewal" can be used in place of its predecessor.

1.3. New Standards

When new standard reference materials or renewals of old ones are issued, announcement will be made in scientific and trade journals, in the Standard Materials column of National Bureau of Standards Technical News Bulletin, and in the Federal Register. This information will also be given in the Quarterly *insert sheet* for this catalog (NBS Misc. Publ. 260) available from the Bureau.

If you wish to be placed on a mailing list to receive these inserts as they are issued, please complete the post card included at the end of this catalog, detach it, and mail to the National Bureau of Standards.

The Office of Standard Reference Materials welcomes suggestions for new standard materials. While it is not possible to produce all of the materials that will be requested by science and industry throughout the country, we will try to make those for which there is the greatest demonstrated need. Thus we have prepared a "Guide for the Submission of Requests for the Development of New or Renewal Standard Reference Materials" which delineates Bureau policy in this area and establishes a standard format for such requests. This "Guide" is reproduced for your information in appendix II (page 40) of this publication.

NBS calibrating and testing services for a wide variety of standards and instruments are given in a separate publication; NBS Misc. Publ. 250, Calibrating and Testing Services, price $1.00.

2. Purchase Procedure

2.1. Identification of Standards

The standards are listed by groups; the numbers represent the issuance of the first representative sample of each kind. Renewals are indicated by the original number with an added letter to denote the relation. Thus, 11a is the first, 11b the second, 11c is the third renewal of No. 11 Basic Open-Hearth Steel, 0.2 percent carbon. In this way, a particular number always represents a material of fixed or approximately fixed composition. Although renewals are not identical with their predecessors, they generally can be used in place of them.

2.2. Ordering

Orders should be addressed to the Office of Standard Reference Materials, National Bureau of Standards, Washington, D.C. 20234, and should give the amount, catalog number and name of the standards requested. For example: 150 g of No. 11h Basic Open-Hearth Steel, 0.2 percent C. The list of standard materials, their numbers, prices and composition or intended use are given on the pages which follow. These materials are distributed only in the units listed. Acceptance of orders does not imply acceptance of any provision set forth in this order contrary to the policy, practice or regulations of the National Bureau of Standards in the U.S. Government. Prices as listed in this catalog are subject to change without notice. Price changes, when made are first announced in the Federal Register. Prices in effect at time of shipment will be billed to the purchaser.

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, and Canada are normally shipped prepaid parcel post (providing that the parcel does not exceed the weight limits as prescribed by Postal Laws and Regulations) unless the purchaser requests a different mode of shipment, in which case the shipment will be sent collect. It is impractical for the Bureau to prepay shipping charges and add this cost to the billing invoice. Hydrocarbons, organic sulfur compounds, rubber compounding materials, viscometer calibrating oils, and radioactive standards are shipped express collect. No discounts are given on NBS Standard Reference Materials.

2.3.2. Foreign Shipments

Small shipments will be forwarded as a U.S. 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 U.S. 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 U.S. currency.

3. Standards of Certified Chemical Composition

3.1. Steels (Chip Form)

This group of standard reference materials has been prepared for the steel industry primarily for use in checking chemical methods of analysis both for production control, and for customer acceptance. The group consists of nominal composition steel alloys and is selected to provide a wide range of analytical values for the various elements which are of vital concern to the chemist. They are furnished in 150 g units of chips, usually sized between 16- and 40-mesh sieves, prepared from selected portions of commercial ingots.

Certificates of analyses, provided with these standards, give the composition as determined at the National Bureau of Standards, and most also include values obtained by industrial and other outside laboratories cooperating in the certification of the standards.

SRM Nos.	Kind	Price	SRM Nos.	Kind	Price
8i	Bessemer, 0.1 C	$12.00	111b	Ni-Mo (SAE 4620)	$12.00
10g	Bessemer, 0.2 C	12.00	106b	Cr-Mo-Al (Nitralloy G)	12.00
170a	Basic Open Hearth, 0.05 C, 0.3 Ti	12.00	139a	Cr-Ni-Mo (AISI 8640)	12.00
15g	Basic Open Hearth, 0.1 C	12.00	156	Cr-Ni-Mo (NE 9450)	12.00
335	Basic Open Hearth, 0.1 C (carbon only)	5.00	50c	W18-Cr4-V1	15.00
11h	Basic Open Hearth, 0.2 C	12.00	132a	Mo5-W6-Cr4-V2	15.00
12h	Basic Open Hearth, 0.4 C	12.00	134a	Mo8-W2-Cr4-V1	15.00
152a	Basic Open Hearth, 0.5 C, 0.03 Sn	12.00	153a	Co8-Mo9-W2-Cr4-V2	15.00
13g	Basic Open Hearth, 0.6 C	12.00	155	Cr 0.5-W 0.5	15.00
14e	Basic Open Hearth, 0.8 C	12.00	73c	Stainless (Cr13) (SAE 420)	15.00
16e	Basic Open Hearth, 1.1 C	12.00	133a	Stainless (Cr13-Mo0.3-S0.3)	15.00
337	Basic Open Hearth, 1.1 C (carbon only)	5.00	101e	Cr18-Ni9 (SAE 304)	20.00
19g	Acid Open Hearth, 0.2 C	12.00	121c	Cr18-Ni10 (Ti-bearing) (SAE 321)	15.00
20f	Acid Open Hearth, 0.4 C	12.00	160a	Cr19-Ni14-Mo3 (SAE 316)	15.00
51b	Electric furnace, 1.2 C	12.00	166b	Cr19-Ni9 (carbon only)	15.00
65d	Basic electric, 0.3 C	12.00	339	Cr17-Ni9-0.2Se (SAE 303Se)	20.00
100b	Manganese (SAE T1340)	12.00	343	Cr16-Ni2 (SAE 431)	15.00
105	High-sulfur, 0.2 C (carbon only)	6.00	344	Cr15-Ni7-Mo2-Al 1	15.00
129b	High-sulfur, (SAE X1112)	12.00	345	Cr16-Ni4-Cu3	15.00
30f	Cr-V (SAE 6150)	12.00	346	Valve (Cr22-Ni4-Mn9)	20.00
32e	Ni-Cr (SAE 3140)	12.00	348	Ni26-Cr15 (A286)	15.00
33d	Ni-Mo (SAE 4820)	12.00	126b	Ni36 (High nickel)	15.00
72f	Cr-Mo (SAE X4130)	12.00			

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3.1. Steels (Chip Form)—Continued

ANALYSES

SRM Nos.	Kind	C	Mn	P	S		Si	Cu	Ni
					Grav.	Comb.			
8i	Bessemer	0. 077	0. 511	0. 080	0. 063	0. 063	0. 020	0. 016	0. 009
10g	Bessemer	. 240	. 850	. 086	. 109	. 109	. 020	. 008	005
170a	B.O.H. (Ti-bearing)	. 052	. 325	. 005	. 021	. 021	. 036	. 059	. 026
15g	B.O.H. 0.1C	. 097	. 485	. 005	-------	. 026	. 095	-------	-------
335	B.O.H. 0.1C	. 092	-------	-------	-------	-------	-------	-------	-------
11h	B.O.H. 0.2C	. 200	. 510	. 010	-------	. 026	. 211	-------	-------
12h	B.O.H. 0.4C	. 41	. 84	. 018	-------	. 027	. 237	. 073	. 033
152a	B.O.H. 0.5C, 0.03 Sn	. 486	. 717	. 012	-------	. 030	. 202	. 023	. 056
13g	B.O.H. 0.6C	. 61	. 85	. 006	-------	. 030	. 355	-------	-------
14e	B.O.H. 0.8C	. 751	. 404	. 008	. 039	. 039	. 177	. 072	. 052
16e	B.O.H. 1.1C	1. 09	. 381	. 021	-------	. 029	. 20	-------	-------
337	B.O.H. 1.1C	1. 07	-------	-------	-------	-------	-------	-------	-------
19g	A.O.H. 0.2C	0. 223	. 554	. 046	. 032	. 033	. 186	. 093	. 066
20f	A.O.H. 0.4C	. 380	. 754	. 028	. 034	. 034	. 299	. 238	. 243
51b	Electric furnace	1. 21	. 573	. 013	. 014	. 014	. 246	. 071	. 053
65d	Basic electric	0. 264	. 730	. 015	. 010	. 010	. 370	. 051	. 060
100b	Manganese (SAE T1340)	. 397	1. 89	. 023	. 029	. 028	. 210	. 064	. 030
105	High-sulfur (Carbon only)	. 193	-------	-------	-------	-------	-------	-------	-------
129b	High-sulfur (SAE X1112)	. 094	0. 763	. 085	. 221	. 226	. 021	. 015	. 013
30f	Cr-V steel (SAE 6150)	. 49	. 79	. 010	-------	. 010	. 28	. 076	. 071
32e	Ni-Cr steel (SAE 3140)	. 409	. 798	. 008	. 022	. 021	. 278	. 127	1. 19
33d	Ni-Mo steel (SAE 4820)	. 173	. 537	. 006	. 010	. 011	. 253	. 123	3. 58
72f	Cr-Mo steel (SAE X4130)	. 301	. 545	. 014	. 024	. 024	. 256	. 062	0. 055
111b	Ni-Mo Steel (SAE 4620)	. 193	. 706	. 012	. 015	. 015	. 302	. 028	1. 81
106b	Cr-Mo-Al (Nitralloy G)	. 326	. 506	. 008	. 016	. 017	. 274	. 117	0. 217
139a	Cr-Ni-Mo (AISI 8640)	. 404	. 780	. 013	. 019	. 019	. 241	. 096	. 510
156	Cr-Ni-Mo (NE 9450)	. 515	1. 40	. 032	. 017	. 018	. 226	. 053	. 475
50c	W18-Cr4-V1	. 719	. 342	. 022	. 010	. 009	. 311	. 079	. 069
132a	Mo5-W6-Cr4-V2	. 825	. 268	. 029	. 005	. 006	. 190	. 120	. 137
134a	Mo8-W2-Cr4-V1	. 808	. 218	. 018	. 007	. 007	. 323	. 101	. 088
153a	Co8-Mo9-W2-Cr4-V2	. 902	. 192	. 023	. 007	. 007	. 270	. 094	. 168
155	Cr 0.5-W 0.5	. 905	1. 24	. 015	. 010	. 011	. 322	. 083	. 100
73c	Cr13 (SAE 420)	. 310	0. 330	. 018	-------	. 036	. 181	. 080	. 246
133a	Cr13-Mo 0.3-S 0.3	. 120	1. 03	. 026	. 326	. 330	. 412	. 118	. 241
101e	Cr18-Ni9 (SAE 304)	. 054	1. 77	. 025	. 010	. 010	. 43	. 359	9. 48
121c	Cr18-Ni10-Ti 0.4 (SAE 321)	. 038	1. 31	. 028	-------	. 009	. 64	. 14	10. 51
160a	Cr19-Ni14-Mo3 (SAE 316)	. 062	1. 62	. 027	. 015	. 016	. 605	. 174	14. 13
166b	Cr19-Ni9 (Carbon only)	. 0191	-------	-------	-------	-------	-------	-------	-------
339	Cr17-Ni9-Se (SAE 303Se)	. 052	0. 738	. 129	-------	. 013	. 654	. 199	8. 89
343	Cr16-Ni2 (SAE 431)	. 150	-------	-------	-------	-------	-------	-------	2. 14
344	Cr15-Ni7-Mo2-Al 1	. 069	. 57	. 018	-------	. 019	. 395	. 106	7. 28
345	Cr16-Ni4-Cu3	. 048	. 224	. 018	. 012	. 012	. 610	3. 44	4. 24
346	Valve (Cr22-Ni4-Mn9)	. 541	9. 15	. 018	-------	. 063	. 234	-------	3. 94
348	Ni26-Cr15 (A286)	. 044	1. 48	. 015	-------	. 002	. 54	0. 22	25. 8
126b	Ni36	. 090	0. 380	-------	-------	-------	. 200	. 082	35. 99

3.1. Steels (Chip Form)—Continued

ANALYSES—Continued

SRM Nos.	Cr	V	Mo	W	Co	Ti	As	Sn	Al (total)	N	Nb	Ta	B	Se	Fe
8i	0. 009	0. 012	0. 003							0. 018					
10g	. 008	. 007	. 002							. 015					
170a	. 014	. 009	. 005	{Zirconium 0. 037}		0. 281		0. 006	0. 046	. 005					
15g															
11h															
12h	. 074	. 003	. 006							. 006					
152a	. 046	. 001	. 036					. 032							
13g															
14e	. 072	. 002	. 013						. 059						
16e															
19g	. 374	. 012	. 013		0. 012	0. 27		. 008	. 031		0. 026				
20f	. 097	. 007	. 058					. 021		. 005					
51b	. 455	. 002	. 014					. 008		. 011	{Acid-insoluble Al as Al_2O_3 0.009}				
65d	. 049	. 002	. 025					. 004	. 059	. 013					
100b	. 063	. 003	. 237							. 004					
105															
129b	. 016	. 004	. 003							. 014					
30f	. 95	. 18													
32e	. 678	. 002	. 023					. 011		. 009					
33d	. 143	. 002	. 246							. 011					
72f	. 891	. 005	. 184							. 009					
111b	. 070	. 003	. 255						. 043						
106b	1. 18	. 003	. 199						1. 07						
139a	0. 486	. 003	. 183							. 008					
156	. 429	. 002	. 138												
50c	4. 13	1. 16	. 082	18. 44			0. 022	. 018		. 012					
132a	4. 21	1. 94	4. 51	6. 20											
134a	3. 67	1. 25	8. 35	2. 00											
153a	3. 72	2. 06	8. 85	1. 76	8. 47					. 024					
155	0. 485	0. 014	0. 039	0. 517											
73c	12. 82	. 030	. 091							. 037					
133a	12. 89	. 026	. 294							. 032					
101e	17. 98	. 043	. 426	. 056	0. 18			. 020		. 039	. 013				
121c	17. 58	. 048	. 16			. 42									
160a	18. 74	. 051	2. 83		. 071			. 013		. 051	(Lead 0.001)				
166b															
339	17. 42	. 058	0. 248		. 096									0. 247	
343	15. 76	. 036								. 074					
344	14. 95	. 040	2. 40			. 076			1. 16						
345	16. 04	. 041	0. 122		. 089						. 231	. 002			
346	21. 61	. 058								. 441					
348	14. 54	. 25	1. 3			2. 24			0. 23				0. 0031		53. 3
126b	0. 066	. 001	0. 006		. 032										

3.2. Steels (Solid Form)

Several groups of standards have been prepared and designed to meet the basic needs of the steel industry for analytical control primarily by optical emission and x-ray spectroscopic methods of analysis. Both nominal composition and analytical range standards are provided for ingot iron, low-alloy steel, stainless steel, and tool steel.

These standard reference materials are furnished in three basic forms: (1) rods $\frac{7}{32}$ in in diameter, 4 in long (400 series); (2) rods ½ in in diameter, 2 in long (800 series); and (3) disks 1¼ in in diameter and either ¾ in or ¼ in thick (1100 series or D 800 series). The 400 series is intended for optical emission spectroscopic methods of analysis utilizing the "point-to-point" technique. The 800 and 1100 series are intended for "point-to-plane" optical emission spectroscopic methods of analysis. The D 800 series, and the 1100 series also, are intended for x-ray spectroscopic methods of analysis.

Because of the special homogeneity requirements, most of these materials have been prepared by using the most modern techniques of melting, casting, fabrication, and heat treatment to insure adequate uniformity of composition. The standards are furnished with Certificates of Analyses which give the composition as determined at the National Bureau of Standards; some also include values by outside laboratories cooperating in the certification of the standards. (Values in parentheses are not certified, but are given for additional information on the composition.)

3.2.1. Ingot Iron and Low-Alloy Steels

SRM Nos.			Kind	Price	
				400 & 800 series	D800 series
----------	802	----------	B.O.H., 0.8C	$10. 00	----------
----------	803a	D803a	A.O.H., 0.6C	10. 00	$15. 00
404a	804a	----------	Basic electric	10. 00	----------
405a	805a	D805a	Medium manganese	10. 00	15. 00
407a	807a	D807a	Chromium-vanadium	10. 00	15. 00
408a	808a	----------	Chromium-nickel	10. 00	----------
409b	809b	D809b	Nickel	10. 00	15. 00
410a	810a	----------	Cr2-Mol	10. 00	----------
413	----------	----------	A.O.H., 0.4C	10. 00	----------
414	----------	----------	Cr-Mo (SAE 4140)	10. 00	----------
417a	817a	----------	B.O.H., 0.4C	10. 00	----------
418	----------	----------	Cr-Mo (SAE X4130)	10. 00	----------
418a	----------	----------	Cr-Mo (SAE X4130)	10. 00	----------
420a	820a	D820a	Ingot iron	10. 00	15. 00
----------	821	----------	Cr-W, 0.9C	10. 00	----------
427	827	----------	Cr-Mo (SAE 4150) (boron only)	10. 00	----------

ANALYSES

SRM Nos.			Mn	Si	Cu	Ni	Cr	V	Mo	W	Co	Sn	Al Total	B
------	802	--------	0. 46	0. 060	0. 025	0. 010	0. 025	------	------	------	------	------	------	------
------	803a	D803a	1. 04	. 34	. 096	. 190	. 101	0. 005	0. 033	------	------	------	------	------
404a	804a	--------	0. 88	. 44	. 050	. 040	. 025	. 002	. 007	------	------	------	------	------
405a	805a	D805a	1. 90	. 27	. 032	. 065	. 037	------	. 005	------	------	------	0. 056	------
407a	807a	D807a	0. 76	. 29	. 132	. 169	. 92	. 146	------	------	------	------	------	------
408a	808a	--------	. 76	. 28	. 10	1. 20	. 655	. 002	. 065	------	------	------	------	------
409b	809b	D809b	. 46	. 27	. 104	3. 29	. 072	. 002	. 009	------	0. 025	0. 012	------	------
410a	810a	--------	------	. 36	. 11	0. 24	2. 39	------	. 91	------	------	------	------	------
413	------	--------	. 67	. 22	. 25	. 18	0. 055	. 007	. 006	------	------	------	------	------
414	------	--------	. 67	. 26	. 11	. 080	. 99	. 003	. 32	------	------	. 014	. 020	------
417a	817a	--------	. 78	------	. 13	. 062	. 050	------	. 013	------	------	. 036	------	------
418	------	--------	. 52	. 28	------	. 11	. 96	------	. 22	------	------	------	------	------
418a	------	--------	. 52	. 27	. 040	. 125	1. 02	------	. 21	------	------	------	------	------
420a	820a	D820a	. 017	------	. 027	. 0092	0. 0032	------	. 0013	------	. 006	. 0017	. 003	------
------	821	--------	1. 24	------	. 080	. 10	. 49	. 012	. 040	0. 52	------	------	------	------
427	827	--------	------	------	------	------	------	------	------	------	------	------	------	0. 0027

3.2.2. Special Ingot Irons and Low-Alloy Steels

SRM Nos.		Kind	Price	
			400 series	1100 series
461	1161	Low-alloy steel A (modified TS46B12)	$15. 00	$35. 00
462	1162	Low-alloy steel B (modified TS86B45)	15. 00	35. 00
463	1163	Low-alloy steel C (modified TS94B17)	15. 00	35. 00
464	1164	Low-alloy steel D (modified 14B52)	15. 00	35. 00
465	1165	Ingot iron E	15. 00	35. 00
466	1166	Ingot iron F	15. 00	35. 00
467	1167	Low-alloy steel G (modified C1010)	15. 00	35. 00
468	1168	Low-alloy steel H (modified TS4720)	15. 00	35. 00
----	1169	Leaded steel (0.2% Pb)	----	35. 00
----	1170	Selenium steel (0.3% Se)	----	35. 00

Analyses

SRM Nos.		C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	W	Co	Ti	As
461	1161	0. 15	0. 36	0. 053	(0. 02)	0. 047	0. 34	1. 73	0. 13	0. 024	0. 30	0. 012	0. 26	(0. 01)	0. 028
462	1162	. 40	. 94	. 045	(. 02)	. 28	. 20	0. 70	. 74	. 058	. 080	. 053	. 11	. 037	. 046
463	1163	. 19	1. 15	. 031	(. 02)	. 41	. 47	. 39	. 26	. 10	. 12	. 105	. 013	. 010	. 10
464	1164	. 54	1. 32	. 017	(. 02)	. 48	. 094	. 135	. 078	. 295	. 029	. 022	. 028	. 004	. 018
465	1165	. 037	0. 032	. 008	(. 01)	. 029	. 019	. 026	. 004	. 002	. 005	(. 001)	. 008	. 20	. 010
466	1166	. 065	. 113	. 012	(. 01)	. 025	. 033	. 051	. 011	. 007	. 011	(. 006)	. 046	. 057	. 014
467	1167	. 11	. 275	. 033	(. 01)	. 26	. 067	. 088	. 036	. 041	. 021	. 20	. 074	. 26	. 14
468	1168	. 26	. 47	. 023	(. 02)	. 075	. 26	1. 03	. 54	. 17	. 20	. 077	. 16	. 011	. 008
----	1169	. 077	. 992	. 064	. 318	. 011	. 083	0. 032	. 015	. 001	. 008	----	----	----	----
----	1170	. 089	. 79	. 109	. 207	. 163	----	----	----	----	----	----	----	----	----

SRM Nos.		Sn	Al (total)	Nb	Ta	B	Pb	Zr	Ag	Ge	O	N	Se
461	1161	0. 022	(0. 005)	0. 011	0. 002	0. 0002	(0. 003)	(<0. 005)	(0. 0015)	(0. 0015)	(0. 020)	(0. 006)	----
462	1162	. 066	. 023	. 096	. 036	. 0005	. 006	. 063	(<. 0002)	(. 0030)	(. 006)	(. 008)	----
463	1163	. 013	. 027	. 195	. 15	. 0012	. 012	. 20	(<. 0002)	(. 0025)	(. 007)	(. 006)	----
464	1164	. 043	. 005	. 037	. 069	. 005	. 020	. 010	(. 0030)	(. 0015)	(. 006)	(. 007)	----
465	1165	. 001	. 19	(. 001)	. 001	. 0001	(<. 0005)	(. 002)	(. 00025)	(. 0035)	(. 003)	(. 005)	----
466	1166	. 005	. 015	. 005	. 002	(. 0002)	(. 0013)	(<. 005)	(. 00045)	(. 0030)	(. 005)	(. 006)	----
467	1167	. 10	. 16	. 29	. 23	(. 0002)	. 0006	. 094	(. 0040)	(. 0030)	(. 004)	(. 004)	----
468	1168	. 009	. 042	. 006	. 005	. 009	(<. 0005)	(<. 005)	(<. 0002)	(. 0010)	(. 004)	(. 006)	----
----	1169	----	----	----	----	----	. 227	----	----	----	----	----	----
----	1170	----	----	----	----	----	----	----	----	----	----	----	0.293

SRM Nos.	Kind (Group 1)	Price
442	Cr16–Ni10	$15. 00
443	Cr18.5–Ni9.5	15. 00
444	Cr20.5–Ni10	15. 00

SRM Nos.			Kind (Group 2)	Price		
				400 series	800 series	D800 series
445	845	D845	Cr13- Mo0.9 (Modified AISI 410)	$15. 00	$20. 00	$25. 00
446	846	D846	Cr18–Ni9 (Modified AISI 321)	15. 00	20. 00	25. 00
447	847	D847	Cr24–Ni13 (Modified AISI 309)	15. 00	20. 00	25. 00
448	848	D848	Cr9–Mo0.3 (Modified AISI 403)	15. 00	20. 00	25. 00
449	849	D849	Cr5.5–Ni6.5	15. 00	20. 00	25. 00
450	850	D850	Cr3–Ni25	15. 00	20. 00	25. 00

SRM Nos.	Kind (Group 3)	Price
1152	Stainless Steel, B (Cr18–Ni10)	$35. 00
1154	Stainless Steel, D (Cr19–Ni10)	35. 00

Stainless Steels Group 1—Analyses

SRM Nos.	Mn	Si	Cu	Ni	Cr	V	Mo	W	Co	Ti	Sn	Nb	Ta	B	Pb	Zr	Zn
442	2. 88	(0. 09)	0. 11	9. 9	16. 1	0. 032	0. 12	(0. 08)	0. 13	0. 002	0. 0035	0. 032	(0. 0006)	0. 0005	0. 0017	(0. 004)	(0. 003)
443	3. 38	(. 15)	. 14	9. 4	18. 5	. 064	. 12	(. 09)	. 12	. 003	. 006	. 056	(. 0008)	. 0012	. 0025	-------	(. 005)
444	4. 62	(. 65)	. 24	10. 1	20. 5	. 12	. 23	(. 17)	. 22	. 019	. 014	. 20	(. 004)	. 0033	. 0037	(. 011)	(. 004)

Stainless Steels Group 2—Analyses

SRM Nos.			Mn	Si	Cu	Ni	Cr	V	Mo	W	Ti	Sn	Nb	Ta
445	845	D845	0. 77	0. 52	0. 065	0. 28	13. 31	(0. 05)	0. 92	(0. 42)	(0. 03)	------	0. 11	(0. 002)
446	846	D846	. 53	1. 19	. 19	9. 11	18. 35	(. 03)	. 43	(. 04)	(. 34)	(0. 02)	. 60	(. 030)
447	847	D847	. 23	0. 37	. 19	13. 26	23. 72	(. 03)	. 059	(. 06)	(. 02)	------	. 03	(. 002)
448	848	D848	2. 13	1. 25	. 16	0. 52	9. 09	(. 02)	. 33	(. 14)	(. 23)	(. 05)	. 49	(. 026)
449	849	D849	1. 63	0. 68	. 21	6. 62	5. 48	(. 01)	. 15	(. 19)	(. 11)	(. 07)	. 31	(. 021)
450	850	D850	-----	. 12	. 36	24. 8	2. 99	(. 006)	------	(. 21)	(. 05)	(. 09)	. 05	(. 002)

Stainless Steels Group 3—Analyses

SRM Nos.	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo
1152	0. 163	1. 19	0. 017	0. 017	0. 654	0. 497	10. 21	18. 49	0. 044	0. 366
1154	. 094	1. 74	. 038	. 033	1. 09	. 560	10. 25	19. 58	. 061	. 463

SRM Nos.	Ti	Nb	Ta	Al	Zr	Co	Sn	Pb	As	B
1152	(0. 12)	(0. 20)	(0. 085)	(0. 003)	(0. 03)	(0. 095)	(0. 004)	(0. 001)	(0. 01)	(0. 005)
1154	(. 48)	(. 26)	(. 045)	(. 035)	(. 022)	(. 12)	(. 023)	(. 012)	(. 03)	(. 0006)

3.2.4. Tool Steels

SRM Nos.			Kind	Price		
				400 series	800 series	D800 series
436	836	D836	Special (Cr6–Mo3–W10)	$15. 00	$20 00	$25. 00
437	837	D837	Special (Cr8–Mo2–W3–Co3)	15. 00	20. 00	25. 00
438	838	D838	Mo High Speed (AISI–SAE–M30)	15. 00	20. 00	25. 00
439	839	D839	Mo High Speed (AISI–SAE–M36)	15. 00	20. 00	25. 00
440	840	D840	Special W High Speed (Cr2–W13–Co12)	15. 00	20. 00	25. 00
441	841	D841	W High Speed (AISI–SAE T1)	15. 00	20. 00	25. 00

ANALYSES

SRM Nos.			Mn	Si	Cu	Cr	V	Mo	W	Co
436	836	D836	0. 21	0. 32	0. 075	6. 02	0. 63	2. 80	9. 7	----------
437	837	D837	. 48	. 53	----------	7. 79	3. 04	1. 50	2. 8	2. 9
438	838	D838	. 20	. 17	. 17	4. 66	1. 17	8. 26	1. 7	4. 9
439	839	D839	. 18	. 21	. 12	2. 72	1. 50	4. 61	5. 7	7. 8
440	840	D840	. 15	. 14	. 059	2. 12	2. 11	0. 070	13. 0	11. 8
441	841	D841	. 27	. 16	. 072	4. 20	1. 13	. 84	18. 5	----------

3.2.5. Ferrous Materials (For Oxygen and Nitrogen)

These standards are intended to provide materials for checking analytical methods for determining oxygen and nitrogen only.

SRM No. 1041 is supplied in rods 1 in in diameter and 3 in long weighing approximately 300 g. Because the rods are radially segregated, care must be taken so that the sample used for an analysis represents the entire cross section of the rod.

SRM Nos. 1090 to 1092 are intended primarily to provide standards for determining oxygen by the vacuum fusion or inert gas fusion methods. They are supplied in rods 4 in long. Nos. 1090 and 1092 are ¼ in in diameter and 1091 is $\frac{5}{16}$ in in diameter. (Note that two titanium-base SRMs, Nos. 355 and 356, section 3.11.3, page 18, also are available for the determination of oxygen.)

Details on the preparation and analysis of SRMs 1090, 1091, and 1092 are given in NBS Misc. Publ. 260–14 "Determination of Oxygen in Ferrous Materials SRM 1090, 1091, and 1092" by Oscar Menis and J. T. Sterling. (See inside back cover for ordering instructions.)

SRM Nos.	Kind	O		N	Price
		Percent	ppm		
1041	Medium-carbon	0. 017	----------	0. 004	$20. 00
1090	Ingot iron	----------	434	----------	20. 00
1091	Stainless steel (AISI 431)	----------	131	----------	20. 00
1092	Vacuum-melted steel	----------	28	----------	20. 00

3.2.6. Specialty Steels

Maraging Steels: These alloys derive their name from the formation of martensite on age hardening. They attain remarkable metallurgical properties by a simple heat treatment. Extensive use of these alloys is expected, particularly in submarines, missiles and aircraft. The Maraging Steel Standard Reference Material No. 1156 is of the 19 percent nickel type and is designed primarily for optical emission and x-ray spectrochemical analysis.

SRM No.	Kind	Price
1156	Maraging Steel (Disk form)	$35. 00

ANALYSIS

SRM No.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
1156	0. 023	0. 21	0. 011	0. 012	0. 184	0. 025	19. 0	0. 20	3. 1

SRM No.	Ti	Co	Zr	B	Al	Ca
1156	0. 21	7. 3	0. 004	0. 003	0. 047	<0. 001

3.3. Cast Irons (Chip Form)

This group of standard reference materials is similar to the steels described in 3.1 and has been prepared for use in checking chemical methods in the cast iron industry. These materials, except White Iron No. 3b are furnished as 150 g portions in the form of chips, usually sized between 16- and 25-mesh sieves. They are prepared from thin-wall cylindrical castings specially made for this purpose by lathe cutting the chips with a multiple-tooth cutting tool. Supplied with each material is a Certificate of Analyses listing the composition as determined at the National Bureau of Standards and by outside laboratories.

SRM Nos.	Kind	Price	SRM Nos.	Kind	Price
3b	White iron (approx. wt. 110 g)	$15. 00	107b	Nickel-chromium-molybdenum cast iron	$15. 00
4j	Cast iron	15. 00	115a	Copper-nickel-chromium cast iron	15. 00
5k	Cast iron	15. 00	122d	Cast iron (car-wheel)	15. 00
6f	Cast iron	15. 00	341	Ductile iron	15. 00
7g	Cast iron (high phosphorus)	15. 00	342	Nodular iron	15. 00
55e	Ingot iron	15. 00			
82b	Nickel-chromium cast iron	15. 00			

ANALYSES

SRM Nos.	C		Mn	P	S		Si	Cu	Ni	Cr	V	Mo
	Total	Graphitic			Grav.	Comb.						
3b	2. 44		0. 351	0. 085		0. 090	1. 04	0. 050	0. 013	0. 052	0. 006	0. 002
4j	2. 99	2. 38	. 79	. 17		. 062	1. 31	. 24	. 068	. 09	. 03	. 080
5k	2. 71	1. 99	. 536	. 263	0. 100	. 100	2. 08	1. 50	. 051	. 109	. 014	. 007
6f	2. 91	2. 19	. 499	. 530	. 106	. 106	1. 85	0. 252	. 060	. 442	. 032	. 009
7g	2. 69	2. 59	. 612	. 794	. 061	. 060	2. 41	. 128	. 120	. 048	. 010	. 012
55e	0. 0112		. 035	. 003	. 012	. 011	0. 001	. 065	. 038	. 006	<. 001	. 011
82b	2. 85	2. 37	. 745	. 025		. 007	2. 10	. 038	1. 22	. 333	. 027	. 002
107b	2. 75	1. 87	. 510	. 058	. 067	. 067	1. 35	. 235	2. 12	. 560	. 008	. 750
115a	2. 62	1. 96	1. 00	. 086	. 064	. 065	2. 13	5. 52	14. 49	1. 98	. 014	. 050
122d	3. 28	2. 49	0. 504	. 280	. 092	. 091	0. 624	0. 054	0. 029	0. 032	. 011	. 004
341	1. 81	1. 23	. 92	. 024	. 007	. 007	2. 44	. 152	20. 32	1. 98	. 012	. 010
342	2. 45	2. 14	. 369	. 020	. 014	. 014	2. 85	. 14	0. 023	0. 032	. 005	. 009

SRM Nos.	Co	Ti	As	Sn	Al (Total)	Mg	N
3b							
4j		0. 05	0. 03				
5k		. 028	. 027				0. 009
6f		. 063	. 032				. 005
7g		. 044	. 014				. 004
55e	0. 007		. 007	0. 007	0. 002		. 004
82b		. 027					
107b		. 016					. 008
115a		. 020					
122d		. 007	. 021				. 004
341		. 018				0. 068	
342		. 019				. 053	

3.4. White Cast Irons (Solid Form)

These cast iron SRMs were prepared for use in analytical control by rapid instrumental methods. Although often employed in x-ray spectroscopic analysis, they are particularly useful for calibrating vacuum optical emission spectrometers because they permit the determination of carbon, phosphorus, and sulfur, in addition to the metallic elements.

These materials are furnished as chill-cast sections approximately 1¼ in sq and ½ in thick. Details of the preparation and intended use of the standards are in the NBS Misc. Publ. 260–1, Preparation of NBS White Cast Iron Spectrochemical Standards by R. E. Michaelis and LeRoy L. Wyman. (See inside back cover for ordering instructions.)

(Values in parentheses are not certified, but are given for additional information on the composition.)

SRM Nos.	Kind	Price
1174	White cast iron (special 1)	$35. 00
1175	White cast iron (special 2)	35. 00

Analyses

SRM Nos.	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	Ti
1174	3. 48	0. 175	0. 170	0. 168	0. 286	0. 171	0. 035	0. 018	0. 008	0. 008	0. 012
1175	1. 97	1. 64	. 652	. 017	3. 48	1. 50	2. 98	2. 43	. 221	1. 51	. 35

SRM Nos.	As	Sb	Sn	Co	Te	B	Bi	Zr	Pb	Al
1174	0. 026	0. 19	0. 23	0. 009	0. 073	0. 040	(0. 008)	(0. 01)	(0. 01)	(0. 001)
1175	. 22	. 020	. 025	. 11	. 009	. 005	(. 017)	(. 04)	. 003	(. 03)

3.5. Steel-Making Alloys

These SRMs provide materials of known composition for checking the performance of chemical methods of analysis for the major constituents and for selected minor elements covered by ASTM specifications. They are furnished as fine powders, sized to about 100 mesh or finer. A Certificate of Analyses accompanies each standard.

SRM Nos.	Kind	Approx. wt. in grams	Price
57	Refined silicon	60	$10. 00
64b	Ferrochromium (high carbon)	100	10. 00
66a	Spiegeleisen	100	10. 00
71	Calcium molybdate	60	10. 00
90	Ferrophosphorus	75	10. 00
172	Ferroboron	100	10. 00

Analyses

SRM Nos.	C	Mn	P	S	Si	Mo	Ti	Al	Ca
57	0. 087	0. 034	0. 008	0. 005	96. 8		0. 10	0. 67	0. 73
64b	4. 30	. 208	. 012	. 062	1. 42				
66a	4. 39	19. 77	. 049	. 021	2. 26				
71						35. 3	. 06		
90			26. 2						
172	0. 234				3. 63			. 05	

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Analyses—Continued

SRM Nos.	Fe	Cr	B	V	N	Cu	Ni	Zr	Mg
57	0. 65	0. 025				0. 02	0. 002	0. 025	0. 01
64b		68. 03		0. 15	0. 033				
71	1. 92								
172			13. 68						

3.6. Nonferrous Alloys (Chip Form)

These SRMs provide materials of known composition for checking the performance of chemical methods of analysis The bearing-metal standard is furnished as approximately 60- to 200-mesh powder prepared by air-blowing a stream of molten metal. The aluminum-, magnesium-, and zinc-base alloys are furnished in the form of approximately 10- to 20-mesh chips. The remaining standards in the group are furnished as approximately 14- to 40-mesh chips prepared by cutting thin-wall castings or wrought bar stock. A Certificate of Analyses accompanies each material.

SRM Nos.	Kind	Approx. wt. in grams	Price	SRM Nos.	Kind	Approx. wt. in grams	Price
85b	Aluminum alloy, wrought	75	$10. 00	168	Co41-Mo4-Nb3-Ta1-W4	150	$15. 00
86c	Aluminum alloy, casting	75	10. 00	349	Nickel-base (Ni57-Co14-Cr20)	150	15. 00
87a	Aluminum-silicon alloy	75	10. 00	157a	Nickel silver (Cu58-Ni12-Zn29)	135	15. 00
54d	Bearing metal, tin-base	170	15. 00	162a	Monel-type (Ni64-Cu31)	150	15. 00
37e	Brass, sheet	150	15. 00	169	Ni77-Cr20 alloy	150	15. 00
52c	Bronze, cast	150	15. 00	171	Magnesium-base alloy	100	10. 00
184	Bronze, leaded-tin	150	15. 00	94b	Zinc-base die-casting alloy	150	10. 00
164a	Bronze, aluminum	150	15. 00				
124d	Bronze (Cu85-Pb5-Sn5-Zn5) ounce metal	150	15. 00				
158a	Bronze, silicon	150	15. 00				

Aluminum-Base Alloy Analyses

SRM Nos.	Cu	Mn	Si	Mg	Fe	Ti	Zn	Pb	V	Ga	Ni	Cr	Sn
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	0. 30	. 26	6. 24	. 37	. 61	. 18	0. 16	. 10	<. 01	. 02	. 57	. 11	0. 05

Copper-Base Alloy Analyses

SRM Nos.	Cu	Zn	Sn	Pb	Ni	Fe	Al	Mn
37e	69. 61	27. 85	1. 00	1. 00	0. 53	0. 004		
52c	89. 25	2. 12	7. 85	0. 011	. 76	. 004		
124d	83. 60	5. 06	4. 56	5. 20	. 99	. 18		
158a	90. 93	2. 08	0. 96	0. 097	. 001	1. 23	0. 46	1. 11
164a	82. 25	0. 07	. 04	. 04	3. 72	4. 05	9. 59	0. 22
184	88. 96	2. 69	6. 38	1. 44	0. 50	0. 005		
157a	58. 61	29. 09	0. 021	0. 034	11. 82	. 174		. 174

SRM Nos.	Sb	As	Ag	Si	S	P	Co
52c					0. 002	0. 001	
124d	0. 17	0. 02	0. 02		. 093	. 02	
158a				3. 03		. 26	
164a				0. 03			<0. 01
184						. 009	
157a						. 009	. 022

Cobalt-Base Alloy Analysis

SRM No.	Co	Ni	Cr	Mo	W	Nb	Ta	Fe	Mn	C	P
168	41. 20	20. 25	20. 33	3. 95	3. 95	2. 95	0. 95	3. 43	1. 50	0. 37	0. 008

SRM No.	S	Si	Cu	V	Ti
168	0. 005	0. 80	0. 035	0. 03	0. 06

Magnesium-Base Alloy Analysis

SRM No.	Al	Zn	Mn	Si	Cu	Pb	Fe	Ni
171	2. 98	1. 05	0. 45	0. 0118	0. 011	0. 0033	0. 0018	0. 0009

Nickel-Base Alloy Analyses

SRM Nos.	Ni	Cu	Mn	Si	Co	Fe	Cr	Al	Ti	C	S
169	77. 26	0. 015	0. 073	1. 42	0. 19	0. 54	20. 26	0. 095	0. 006	0. 043	0. 002
162a	63. 95	30. 61	1. 60	0. 93	. 076	2. 19	0. 042	. 50	. 005	. 079	. 007
349	57. 15	0. 006	0. 43	. 29	13. 95	0. 13	19. 50	1. 23	3. 05	. 08	----------

SRM Nos.	P	Zr	V	Ca	N	Mo	W	B	Nb	Ta
169	----------	0. 042	0. 018	0. 015	0. 031	----------	----------	----------	----------	----------
349	0. 002	. 081	----------	----------	----------	4. 04	<0. 01	0. 0046	<0. 01	<0. 01

Tin-Base Alloy Analysis

SRM No.	Pb	Sn	Sb	Bi	Cu	Fe	As	Ag	Ni
54d	0. 62	88. 57	7. 04	0. 044	3. 62	0. 027	0. 088	0. 0032	0. 0027

Zinc-Base Die-Casting Alloy Analysis

SRM 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

3.7. Copper-Base Alloys (Solid Form)

Several groups of copper-base alloy standards have been prepared to provide for analytical control by rapid instrumental methods in the copper industry. These standards are intended primarily for calibration of optical emission and x-ray spectroscopic equipment, and have been prepared in chill-cast form for the producer, and wrought form for the consumer—both forms having identical (or nearly identical) composition. Seven principal copper-base alloys are covered by a "nominal-composition" together with a low- and a high-composition standard. To make the standards more widely applicable, a number of trace elements were purposely added to the cartridge brass series, and these have been certified. Three beryllium copper standards have been prepared to be representative of the nominal composition for CABRA alloys 165–170, 25–172, and 10–175, respectively.

The materials are furnished in two basic forms: (1) unidirectional chill-cast samples (C1100 series) in the form of solid sections 1¼ in sq, ¾ in thick, and (2) wrought material (either forged or hot-extruded) in the form of disks 1¼ in in diameter, ¾ in thick (1100 series). Details on the preparation and use of the seven principal copper-base alloys are given in NBS Misc. Publ. 260–2, Preparation of NBS Copper-Base Spectrochemical Standards by R. E. Michaelis, LeRoy L. Wyman, and Richard Flitsch. Methods of chemical analyses employed at NBS for these alloys are described in NBS Misc. Publ. 260–7 by R. K. Bell. The beryllium copper standards were prepared similar to the other copper-base alloys. Further details on the analysis, where different, will appear in a subsequent 260 series publication.

(Values in parentheses are not certified, but are given for additional information on the composition.)

SRM Nos.		Kind	Price	SRM Nos.		Kind	Price
------	C1100	Cartridge Brass A	$35. 00	1112	C1112	Gilding Metal A	$35. 00
1101	C1101	Cartridge Brass B	35. 00	1113	C1113	Gilding Metal B	35. 00
1102	C1102	Cartridge Brass C	35. 00	1114	C1114	Gilding Metal C	35. 00
1103	C1103	Free-Cutting Brass A	35. 00	1115	C1115	Commercial Bronze A	35. 00
1104	C1104	Free-Cutting Brass B	35. 00	1116	C1116	Commercial Bronze B	35. 00
1105	C1105	Free-Cutting Brass C	35. 00	1117	C1117	Commercial Bronze C	35. 00
1106	C1106	Naval Brass A	35. 00	1118	C1118	Aluminum Brass A	35. 00
1107	C1107	Naval Brass B	35. 00	1119	C1119	Aluminum Brass B	35. 00
1108	C1108	Naval Brass C	35. 00	1120	C1120	Aluminum Brass C	35. 00
1109	C1109	Red Brass A	35. 00	1121	C1121	Beryllium Copper CABRA alloy 165–170	45. 00
1110	C1110	Red Brass B	35. 00				
1111	C1111	Red Brass C	35. 00	1122	C1122	Beryllium Copper CABRA alloy 25–172	45. 00
				1123	C1123	Beryllium Copper CABRA alloy 10–175	45. 00

Analyses

SRM Nos.		Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb	As
----------	C1100	67. 43	32. 20	0. 106	0. 072	0. 055	0. 052	0. 008	0. 018	0. 019
1101	----------	69. 60	30. 26	. 05	. 037	. 016	. 013	. 0006	. 012	. 009
----------	C1101	69. 50	30. 34	. 05	. 037	. 016	. 013	. 0006	. 012	. 009
1102	C1102	72. 85	27. 10	. 020	. 011	. 006	. 005	. 0007	. 005	. 004
1103	----------	59. 27	35. 7	3. 73	. 26	. 88	. 16	---------	---------	---------
----------	C1103	59. 19	35. 7	3. 81	. 26	. 88	. 16	---------	---------	---------
1104	C1104	61. 33	35. 3	2. 76	. 090	. 43	. 071	---------	---------	---------
1105	----------	63. 7	34. 0	2. 0	. 044	. 21	. 043	---------	---------	---------
----------	C1105	63. 72	34. 0	2. 01	. 044	. 21	. 043	---------	---------	---------
1106	C1106	59. 08	40. 08	0. 032	. 004	. 74	. 025	---------	---------	---------
1107	C1107	61. 21	37. 34	. 18	. 037	1. 04	. 098	---------	---------	---------
1108	C1108	64. 95	34. 42	. 063	. 050	0. 39	. 033	---------	---------	---------
1109	----------	82. 2	17. 4	. 075	. 053	. 10	. 10	---------	---------	---------
----------	C1109	82. 22	17. 43	. 075	. 053	. 10	. 10	---------	---------	---------
1110	C1110	84. 59	15. 20	. 033	. 033	. 051	. 053	---------	---------	---------
1111	C1111	87. 14	12. 81	. 013	. 010	. 019	. 022	---------	---------	---------
1112	C1112	93. 38	6. 30	. 057	. 070	. 12	. 100	---------	---------	---------
1113	C1113	95. 03	4. 80	. 026	. 043	. 064	. 057	---------	---------	---------
1114	C1114	96. 45	3. 47	. 012	. 017	. 027	. 021	---------	---------	---------
1115	C1115	87. 96	11. 73	. 013	. 13	. 10	. 074	---------	---------	---------
1116	C1116	90. 37	9. 44	. 042	. 046	. 044	. 048	---------	---------	---------
1117	C1117	93. 01	6. 87	. 069	. 014	. 021	. 020	---------	---------	---------
1118	----------	75. 1	21. 9	. 025	. 065	---------	---------	2. 80	. 010	. 007
----------	C1118	75. 07	21. 91	. 024	. 068	---------	---------	2. 80	. 010	. 007
1119	----------	77. 1	20. 5	. 050	. 030	---------	---------	2. 14	. 050	. 040
----------	C1119	77. 12	20. 53	. 051	. 032	---------	---------	2. 14	. 053	. 040
1120	----------	80. 1	18. 1	. 105	. 015	---------	---------	1. 46	. 100	. 090
----------	C1120	80. 14	18. 10	. 105	. 015	---------	---------	1. 46	. 104	. 088
1121	----------	97. 49	(0. 01)	(. 002)	. 085	. 01	. 012	0. 07	---------	---------
----------	C1121	97. 46	(. 01)	(. 002)	. 085	. 01	. 012	. 07	---------	---------
1122	C1122	97. 45	(. 01)	(. 003)	. 16	(. 01)	(. 01)	. 17	---------	---------
1123	C1123	97. 10	. 01	(. 001)	. 04	(. 01)	(. 01)	. 02	---------	---------

Analyses

SRM Nos.		Be	Bi	Cd	Mn	P	Si	Ag	Te	Co	Cr
---------	C1100	0. 0015	0. 0010	0. 013	0. 003	0. 010	(0. 010)	0. 019	0. 0035	---------	---------
1101	C1101	. 00055	. 0004	. 0055	. 0055	. 0020	(. 005)	. 003	. 0015	---------	---------
1102	C1102	. 00003	. 0005	. 0045	. 0045	. 0048	(. 002)	. 0010	. 0003	---------	---------
1103	C1103	---------	---------	---------	---------	. 003	---------	---------	---------	---------	---------
1104	C1104	---------	---------	---------	---------	. 005	---------	---------	---------	---------	---------
1105	C1105	---------	---------	---------	---------	. 003	---------	---------	---------	---------	---------
1106	C1106	---------	---------	---------	. 005	---------	---------	---------	---------	---------	---------
1107	C1107	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
1108	C1108	---------	---------	---------	. 025	---------	---------	---------	---------	---------	---------
1109	C1109	---------	---------	---------	---------	. 006	---------	---------	---------	---------	---------
1110	C1110	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
1111	C1111	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
1112	C1112	---------	---------	---------	---------	. 009	---------	---------	---------	---------	---------
1113	C1113	---------	---------	---------	---------	. 008	---------	---------	---------	---------	---------
1114	C1114	---------	---------	---------	---------	. 009	---------	---------	---------	---------	---------
1115	C1115	---------	---------	---------	---------	. 005	---------	---------	---------	---------	---------
1116	C1116	---------	---------	---------	---------	. 008	---------	---------	---------	---------	---------
1117	C1117	---------	---------	---------	---------	. 002	---------	---------	---------	---------	---------
1118	---------	---------	---------	---------	---------	. 13	. 0021	---------	---------	---------	---------
---------	C1118	---------	---------	---------	---------	. 125	. 0021	---------	---------	---------	---------
1119	C1119	---------	---------	---------	---------	. 070	. 0015	---------	---------	---------	---------
1120	C1120	---------	---------	---------	---------	. 018	. 0011	---------	---------	---------	---------
1121	---------	1. 89	---------	---------	(. 004)	(. 005)	. 11	(. 005)	---------	0. 295	(0. 002)
	C1121	1. 92	---------	---------	(. 004)	(. 005)	. 11	(. 005)	---------	. 295	(. 002)
1122	C1122	1. 75	---------	---------	(. 004)	(. 004)	. 17	(. 005)	---------	. 220	(. 002)
1123	C1123	0. 46	---------	---------	(. 002)	(. 002)	. 03	(. 009)	---------	2. 35	(. 001)

3.8. High Temperature Alloys (Solid Form)

High temperature alloy standards have been prepared to meet the critical needs of industry and government, particularly the Department of Defense and the aerospace industries, for alloys of this type. These standards are useful in instrument calibration, primarily for optical emission and x-ray spectroscopic methods of analysis.

Some samples are issued in the wrought form (1184, 1185, 1193, 1194, and 1195); some as disks 1¼ inches in diameter and ¾ in thick; and others in chill-cast form (1190, 1204, and 1205) as sections 1¼ inches sq. and ¾ in thick.

(Values in parentheses are not certified, but are given for additional information on the composition.)

SRM Nos.	Kind	Price	SRM Nos.	Kind	Price
1184	19–9DL	$35. 00	1194	A 286	$35. 00
1185	AMS 5360A, AISI 316	35. 00	1195	Discaloy 24	35. 00
1190	Udimet 500	35. 00	1204	Inco 713–B	35. 00
1193	W 545	35. 00	1205	Inco 713–C	35. 00

Analyses

SRM Nos.	C	Mn	Si	Cr	Ni	Co	Mo	W	Nb
1184	(0. 25)	1. 04	0. 70	19. 44	9. 47		1. 46	1. 39	0. 49
1185	. 11	1. 22	. 40	17. 09	13. 18		2. 01		<. 001
1190	(. 10)	0. 61	. 22	17. 00	51. 9	19. 1	3. 80	0. 08	<. 01
1193	. 004	. 65	. 110	11. 95	28. 35		1. 47		
1194	. 081	. 67	. 71	16. 35	24. 06	2. 77	1. 27		
1195	. 006	. 38	1. 11	13. 83	26. 07		2. 97		
1204	(. 03)	. 41	0. 56	12. 75	70. 6		4. 28	. 028	1. 31
1205	(. 19)	. 29	. 63	13. 82	67. 5		5. 75	. 019	1. 95

SRM Nos.	Ti	Al	Fe	P	S	Cu	Ta	Zr	V	B
1184	0. 056			0. 015	0. 012		0. 022			
1185	<. 001			. 019	. 016	0. 067	<. 001			
1190	3. 57	2. 83	(0. 6)			. 093	<. 01	0. 11		
1193	3. 0	0. 21	54. 2	. 003	. 030	. 103		. 006	0. 051	0. 0023
1194	1. 45	. 39	51. 3	. 011	. 008	. 047		. 026	. 32	. 0090
1195	1. 28	. 074	54. 0	. 016	. 008	. 016		. 004	. 45	. 0043
1204	0. 63	5. 60	(3. 1)			. 12	. 46	. 12		
1205	. 36	6. 68	(1. 55)			. 056	. 67	. 46		

3.9. Nickel Oxides

Three nickel oxide standards are available primarily for application in the electronics industry to the analysis of cathode grade nickel. The ASTM Standard Method for Spectrochemical Analysis of Thermionic Nickel Alloys by the Powder-D-C Arc Technique (E129) is based on calibration with these standards. The values given are for the percentage of the element in nickle oxide.

SRM Nos.	Kind	Price
671	Nickel oxide 1	$15. 00
672	Nickel oxide 2	15. 00
673	Nickel oxide 3	15. 00

Analyses

SRM Nos.	Co	Cu	Fe	Mg	Mn	Si	Ti	Al	Cr
671	0. 31	0. 20	0. 39	0. 030	0. 13	0. 047	0. 024	0. 009	0. 025
672	. 55	. 018	. 079	. 020	. 095	. 11	. 009	. 004	. 003
673	. 016	. 002	. 029	. 003	. 0037	. 006	. 003	. 001	. 0003

3.10. Tin Metal (Solid Form)

This tin metal SRM has been prepared primarily for the tin-plate industry; it is useful for the calibration of optical emission spectroscopic equipment by the "point-to-point" technique. It is furnished as rods ¼ in in diameter and 4 in long with a provisional Certificate of Analysis.

SRM No.	Kind	Price
432	Tin B	$15. 00

Analysis

SRM No.	Cu	Pb	As	Sb	Ni	Zn	Ag	Bi	Cd	Co
432	0. 097	0. 094	0. 075	0. 095	0. 020	0. 020	0. 0095	0. 0098	0. 0095	0. 011

3.11. Titanium-Base Alloys

A number of titanium-base alloy standard reference materials, primarily for the aerospace industries, are available for analytical control and equipment calibration purposes. Included are materials intended for chemical analysis, for spectroscopic analysis, and for vacuum fusion analysis.

Titanium-base alloy standards 173a, 174, and 176 are furnished in 100-g portions as chips sized between 16 and 35 mesh sieves, and are intended to furnish material of known composition to check the accuracy of chemical methods of analysis of these alloys. Standards 641, 642, 643, 644, 645, 646, 653, and 654 are furnished in the forms of disks 1¼ in in diameter ¾ in thick, and are intended as calibration materials for optical emission and x-ray spectroscopic methods of analysis of similar materials. Standards 352, 353, and 354 are furnished in 20-g portions of ¼ in square cut from a sheet about 0.05 in thick, and are intended to check methods for the determination of hydrogen only.

SRMs 355 and 356 provide material of known composition primarily for the determination of oxygen by vaucum fusion or inert gas fusion. The materials are supplied in rods approximately ½ in in diameter and 2 in long. (Note that a group of ferrous materials, section 3.2.5, page 9, SRMs 1041, 1090, 1091, and 1092, also are available for the determination of oxygen.)

3.11.1. Titanium-Base Materials (Chip Form)

SRM Nos.	Kind Approx. wt. 100 g)	Price	SRM No.	Kind (Approx. wt. 100 g)	Price
173a	6Al-4V	$15. 00	176	5Al-2.5Sn	$15. 00
174	4Al-4Mn	15. 00			

Analyses

SRM Nos.	Al	V	Mn	Fe	Si	Mo	C	N	Sn	Cu
173a	6. 47	4. 06	----------	0. 15	0. 037	0. 005	0. 025	0. 018	--------	0. 002
174	4. 27	----------	4. 57	. 175	. 015	----------	--------	. 012	--------	--------
176	5. 16	----------	0. 0008	. 070	----------	. 0003	. 015	. 010	2. 47	. 003

3.11.2. Titanium-Base Materials (Solid Form)

SRM Nos.	Kind (disks)	Price	SRM Nos.	Kind (disks)	Price
641	8Mn (A)	$25. 00	645	2Cr-2Fe-2Mo (B)	$25. 00
642	8Mn (B)	25. 00	646	2Cr-2Fe-2Mo (C)	25. 00
643	8Mn (C)	25. 00	653	6A1–4V (A)	25. 00
644	2Cr-2Fe-2Mo (A)	25. 00	654	6A1–4V (B)	25. 00

Analyses

SRM Nos.	Mn	Cr	Fe	Mo	Al	V
641	6. 68					
642	9. 08					
643	11. 68					
644		1. 03	1. 36	3. 61		
645		1. 96	2. 07	2. 38		
646		3. 43	2. 14	1. 11		
653					7. 25	2. 58
654					6. 03	3. 83

3.11.3. Titanium-Base Materials (For Oxygen and Hydrogen)

SRM Nos.	Kind	Oxygen, ppm	Hydrogen, percent	Price
352	Unalloyed titanium for hydrogen		0. 0032	$20. 00
353	Unalloyed titanium for hydrogen		. 0098	20. 00
354	Unalloyed titanium for hydrogen		. 0215	20. 00
355	Unalloyed	3031		20. 00
356	Alloy, 6Al-4V	1332		20. 00

3.12. Zirconium-Base Alloys

Several zirconium-base standard reference materials of particular importance to the field of atomic energy have been prepared and are available for analytical control and instrumental calibration. A number of trace elements at the parts-per-million level critical to the application of zirconium metal and Zircaloy-2 have been certified in these standards.

Standard 360a is furnished in the form of chips (18- to 40-mesh) to check chemical methods of analysis for Zircaloy-2. Standards 1210, 1211, 1214, and 1215 are furnished as wrought disks 1¼ in in diameter and ¾ in. thick, to provide material of known composition for the calibration of optical emission and x-ray spectroscopic methods of analysis for zirconium metal (SRM Nos. 1210 and 1211) and Zircaloy-2 (SRM Nos. 1214 and 1215).

(Values in parentheses are not certified, but are given for additional information on the composition.)

SRM No.	Kind	Price
360a	Zircaloy–2	$30. 00

Analysis

SRM No.	Sn	Fe	Cr	Ni	Cu	Mn	U	Ti	Si	C	N
	%	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*
360a	1. 42	1441	1060	554	140	3	0. 15	27	51	136	43

SRM Nos.	Kind	Price	SRM Nos.	Kind	Price
1210	Zirconium metal A	$60.00	1214	Zircaloy–2 E	$60.00
1211	Zriconium metal B	60.00	1215	Zircaloy–2 F	60.00

Analyses

SRM Nos.	Parts per million											Percent			
	Al	B	Cr	Cu	Mn	Mo	Ni	Si	Ti	U	W	Sn	Cr	Fe	Ni
1210	(60)	(<0. 25)	95	10	(5)	------	8	(30)	26	1. 8	(4)	------	------	0. 25	------
1211	(90)	------	95	44	(7)	22	26	(100)	50	2. 3	(40)	------	------	. 102	------
1214	------	------	------	55	38	30	------	(120)	(50)	45	(40)	1. 60	0. 108	. 067	0. 051
1215	------	------	------	140	------	(100)	------	(350)	------	9	------	0. 95	. 190	. 259	. 097

3.13. Zinc-Base Die-Casting Alloys and Zinc Spelter (Solid Form)

These standards are intended for instrument calibration by optical emission spectroscopic methods of analysis primarily for ASTM alloys AG40A and AC41A. The materials are supplied as bar segments 1¾ in square and ¾ in thick. They were prepared by a continuous chill-casting process. The certified portion of each standard is that part included between 3/16 in and 11/16 in from each side of the square sample. The center core, 3/16 in square; and the outer portion, 3/16 in from the outer surface, are parts which may differ in composition for some elements from the certified portion, and should not be used.

A Certificate of Analysis supplied with the standard gives the chemical composition determined at the National Bureau of Standards, and all except the spelter include values obtained by outside laboratories cooperating in the certification of the standards.

(Values in parentheses are not certified, but are given for additional information on the composition.)

SRM Nos.	Kind	Price	SRM Nos.	Kind	Price
625	Zinc-base A	$25.00	629	Zinc-base E	$25.00
626	Zinc-base B	25.00	630	Zinc-base F	25.00
627	Zinc-base C	25.00	631	Zinc spelter (modified)	25.00
628	Zinc-base D	25.00			

ANALYSES

SRM Nos.	Cu	Al	Mg	Fe	Pb	Cd	Sn	Cr	Mn	Ni	Si
625	0.034	3.06	0.070	0.036	0.0014	0.0007	0.0006	0.0128	0.031	0.0184	0.017
626	.056	3.56	.020	.103	.0022	.0016	.0012	.0395	.048	.047	.042
627	.132	3.88	.030	.023	.0082	.0051	.0042	.0038	.014	.0029	.021
628	.611	4.59	.0094	.066	.0045	.0040	.0017	.0087	.0091	.030	.009
629	1.50	5.15	.094	.017	.0135	.0155	.012	.0008	.0017	.0075	.078
630	0.976	4.30	.030	.023	.0083	.0048	.0040	.0031	.0106	.0027	.022
631	.0013	0.50	(<.001)	.005	(.001)	.0002	.0001	.0001	.00015	(<.0005)	(<.002)

SRM No.	In	Ga	Ca	Ag	Ge
631	0.0023	(0.002)	(<0.001)	(<0.0005)	(0.0002)

3.14. Ores

These materials of known composition are intended for use in checking the accuracy of assay methods. They are certified for the element(s) of economic interest, and occasionally have additional data given as a matter of information. This group is furnished in the form of fine powders, usually passing a 100-mesh or finer sieve.

SRM Nos.	Kind	Approx. wt. in grams	Price	SRM Nos.	Kind	Approx. wt. in grams	Price
69a	Bauxite	50	$10.00	25c	Manganese ore	100	$10.00
27e	Iron ore, Sibley	100	10.00	120a	Phosphate rock	45	10.00
28a	Iron ore, Norrie	50	5.00	138	Tin ore (N.E.I. concentrate)	50	10.00
181	Lithium ore (Spodumene)	45	10.00				
182	Lithium ore (Petalite)	45	10.00	113	Zinc ore (Tri-State concentrate)	50	10.00
183	Lithium ore (Lepidolite)	45	10.00				

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SRM Nos.	Kind	Elements certified
27e	Iron, Sibley	Fe, 66.58; P, 0.042; SiO_2, 3.65
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 Ore	Mn, 57.85; available O_2, 16.70
138	Tin (N.E.I. concentrate)	Sn, 74.8
113	Zinc (Tri-State concentrate)	Zn, 61.1

SRM Nos.	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	ZrO	MnO	P_2O_5	Cr_2O_3	CaO	BaO	MgO
69a	6.0	55.0	5.8	2.8	0.18	<0.01	0.08	0.05	0.29	0.01	0.02
120a	----	0.94	1.00	0.12	----	.02	34.4	----	50.3	----	.26

SRM Nos.	Na_2O	K_2O	SO_3	F	CO_2	Loss on ignition
69a	<0.01	<0.01	0.04	----	----	29.55
120a	.41	.10	----	3.92	3.18	----

3.15. Cements

These materials are furnished as standards for x-ray spectroscopic analysis and for chemical analysis of cements and related materials. Because these materials are hygroscopic, each unit consists of three sealed vials each containing approximately 5 g of material.

SRM Nos.	Kind	Price	SRM Nos.	Kind	Price
1011	Portland cement	$10.00	1015	Portland cement	$10.00
1013	Portland cement	10.00	1016	Portland cement	10.00
1014	Portland cement	10.00			

ANALYSES

SRM Nos.	SiO_2	Al_2O_3	F_2O_3	TiO_2	P_2O_5	CaO (+SrO)	SrO	MgO	SO_3	Mn_2O_3	Na_2O	K_2O	Loss on ignition
1011	21.03	5.38	2.07	0.25	0.33	66.60	0.11	1.12	1.75	0.03	0.08	0.26	1.13
1013	24.17	3.30	3.07	.20	.20	64.34	.08	1.39	1.80	.05	.20	.32	0.99
1014	19.49	6.38	2.50	.25	.32	63.36	.26	2.80	2.70	.07	.24	.99	.81
1015	20.65	5.04	3.27	.26	.05	61.48	.11	4.25	2.28	.06	.16	.87	1.70
1016	21.05	4.97	3.71	.34	.13	65.26	.25	0.42	2.27	.04	.55	.04	1.20

3.16. Ceramic Materials

This group of standards is supplied in the form of powders, usually 100 mesh or finer. They are inteded to provide materials for checking the accuracy of methods used in the analysis of similar materials, primarily in the glass, ceramics, and steel industries. Note that Silica brick No. 102 is a density sample with density of 2.33 g/cm³ at 25 °C.

SRM Nos.	Kind	Approx. wt. in grams	Price	SRM Nos.	Kind	Approx. wt. in grams	Price
1b	Limestone, argillaceous	50	$12. 00	99a	Feldspar, soda	40	$10. 00
70a	Feldspar, potash	40	10. 00	102	Silica brick	60	10. 00
77	Burned refractory (60% Al_2O_3)	60	10. 00	103a	Chrome refractory	60	10. 00
				104	Burned magnesite	60	10. 00
78	Burned refractory (70% Al_2O_3)	60	10. 00	112	Silicon carbide	85	10. 00
				154a	Titanium dioxide	40	10. 00
88a	Limestone, dolomitic	50	12. 00	198	Silica refractory (0.2% Al_2O_3)	45	10. 00
89	Glass, lead-barium	45	10. 00				
91	Glass, opal	45	10. 00	199	Silica refractory (0.5% Al_2O_3)	45	10. 00
92	Glass, low boron	45	10. 00				
93	Glass, high boron	45	10. 00				

Analyses

SRM Nos.	Kind	SiO_2	Al_2O_3	Fe_2O_3	FeO	TiO_2	ZrO_2	MnO	P_2O_5
77	Alumina refractory	32. 4	59. 4	0. 90		2. 9	0. 09		0. 45
78	Alumina refractory	20. 7	70. 0	. 79		3. 4	. 12		. 62
103a	Chrome refractory	4. 6	29. 96		12. 43	0. 22	. 01	0. 11	. 01
198	Silica refractory		0. 16	. 66		. 02	<. 01	<. 01	. 02
199	Silica refractory		. 48	. 74		. 06	. 01	<. 01	. 01

SRM Nos.	Kind	V_2O_5	Cr_2O_3	CaO	MgO	Li_2O	Na_2O	K_2O	Loss on ignition
77	Alumina refractory	0. 03		0. 26	0. 50	0. 35	0. 06	2. 11	0. 21
78	Alumina refractory	. 05		. 38	. 51	. 20	. 06	2. 83	. 26
103a	Chrome refractory		32. 06	. 69	18. 54				
198	Silica refractory			2. 71	0. 07	. 001	. 01	0. 02	. 21
199	Silica refractory			2. 41	. 13	. 002	. 01	. 09	. 17

Glass Analyses

SRM Nos.	Kind	SiO_2	PbO	Al_2O_3	Fe_2O_3	ZnO	MnO	TiO_2	ZrO_2	CaO	BaO	Loss on ignition
89	Lead-barium	65. 35	17. 50	0. 18	0. 049		0. 088	0. 01	0. 005	0. 21	1. 40	0. 32
91	Opal	67. 53	0. 097	6. 01	. 081	0. 08	. 008	. 019	. 01	10. 48		
93	High-boron	80. 60		1. 94	. 076			. 027	. 013			

SRM Nos.	Kind	MgO	K_2O	Na_2O	B_2O_3	P_2O_5	As_2O_5	As_2O_3	SO_3	Cl	F
89	Lead-barium	0. 03	8. 40	5. 70		0. 23	0. 36	0. 03	0. 03	0. 05	
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		. 14	. 085	. 009	. 036	

SRM Nos.	Kind	SiO_2	Fe_2O_3	Al_2O_3	TiO_2	MnO	CaO	SrO	MgO
1b	Limestone, argillaceous	4. 92	0. 75	1. 12	0. 046	0. 20	50. 9	0. 14	0. 36
70a	Feldspar, potash	67. 1	. 075	17. 9	. 01		0. 11		
88a	Limestone, dolomitic	1. 20	. 28	0. 19	. 02	. 03	30. 1_5	. 01	21. 3
99a	Feldspar, soda	65. 2	. 065	20. 5	. 007		2. 14		
102	Silica brick	93. 94	. 66	1. 96	. 16	. 005	2. 29		. 21
104	Burned magnesite	2. 54	7. 07	0. 84	. 03	. 43	3. 35		85. 67
154a	Titanium dioxide				99. 6				

SRM Nos.	Kind	Na_2O	K_2O	BaO	Rb_2O	P_2O_5	CO_2	Loss on ignition	Density
1b	Limestone, argillaceous	0. 04	0. 25			0. 08	40. 4	41. 1	
70a	Feldspar, potash	2. 55	11. 8	0. 02	0. 06			0. 40	
88a	Limestone, dolomitic	0. 01	0. 12			. 01	46. 6	46. 7	
99a	Feldspar, soda	6. 2	5. 2	. 26	. 02			. 26	
102	Silica brick	. 015	. 32			. 025		0. 38	2.38 g/cm³ at 25 °C.
104	Burned magnesite	. 015	. 015			. 057			

Silicon Carbide Analysis

SRM No.	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

3.17. Hydrocarbon Blends

These standard hydrocarbon blends were prepared for calibration of mass spectrometric and other instrumental procedures used in the analysis of gasolines, naphthas, and blending stocks. Each SRM comprises ten ampoules, each ampoule containing about 0.03 ml of the blend. To retard the effects of possible fractionation of the components after the ampoule is opened, each ampoule is intended to provide material for only one calibration analysis. For the individual components present in the mixtures in the amount of 10 percent or less, the limits of error in composition are not greater than ± 0.01 percent and for components present in over 10 percent, the limits of error are not greater than ± 0.10 percent. The composition of each blend is given in volume percent. A certificate is supplied with each of these samples.

SRM Nos.	Kind	Unit of issue	Price
592	Blend no. 1. C_7 Paraffins in typical virgin naphthas	10 ampoules	$12. 00
593	Blend no. 2. C_7 Paraffins in typical catalytically cracked naphthas	10 ampoules	12. 00
594	Blend no. 3. C_8 Paraffins in typical virgin naphthas	10 ampoules	12. 00
595	Blend no. 4. C_8 Paraffins in catalytically cracked naphthas	10 ampoules	12. 00
596	Blend no. 5. C_7 Cycloparaffins in typical virgin naphthas	10 ampoules	12. 00
597	Blend no. 6. C_7 Cycloparaffins in catalytically cracked naphthas	10 ampoules	12. 00
598	Blend no. 7. C_8 Cycloparaffins in typical virgin naphthas	10 ampoules	12. 00
599	Blend no. 8. C_8 Cycloparaffins in catalytically cracked naphthas	10 ampoules	12. 00

SRM Nos.	592	593	594	595	596	597	598	599
Blend No.	1	2	3	4	5	6	7	8
n-Heptane	45	17						
2-Methylhexane	23	25						
3-Methylhexane	16	30						
2,2-Dimethylpentane	4							
2,3-Dimethylpentane	6	20						
2,4-Dimethylpentane	5	8						
3,3-Dimethylpentane	1							
n-Octane			39	12				
2-Methylheptane			19	25				
3-Methylheptane			16	23				
4-Methylheptane			8	8				
3-Ethylhexane			3	3				
2,3-Dimethylhexane			4	9				
2,4-Dimethylhexane			5	5				
2,5-Dimethylhexane			6	9				
3,4-Dimethylhexane				6				
Methylcyclohexane					57	32		
Ethylcyclopentane					9	14		
1,1-Dimethylcyclopentane					4	3		
1,*trans*-2-Dimethylcyclopentane					14	30		
1,*trans*-3-Dimethylcyclopentane					16	21		
Ethylcyclohexane							20	17
1,*trans*-2-Dimethylcyclohexane							18	7
1,*cis*-3-Dimethylcyclohexane							25	19
1,*trans*-4-Dimethylcyclohexane							11	14
1-Methyl-*cis*-2-ethylcyclopentane							7	20
1,1,3-Trimethylcyclopentane							5	4
1,*trans*-2-*cis*-3-Trimethylcyclopentane							9	6
1,*trans*-2-*cis*-4-Trimethylcyclopentane							5	13

3.18. Metallo-Organic Compounds

This group of standards is intended to provide oil-soluble materials of known and reproducible composition. Possession of an adequate collection will permit preparation of any desired blend of known concentration in any appropriate lubricating oil. It has been prepared primarily for the transportation industry and the defense program for the analysis of lubricating oils to determine wear of engine parts. Details of the selection, preparation, and analysis of the compounds can be found in National Bureau of Standards Monograph 54, Analytical Standards for Trace Elements in Petroleum Products (1962).

A certificate is supplied with each standard giving the amount of the element of interest present, and directions for the preparation of a solution of known concentration in lubricating oil.

SRM Nos.	Kind (approximate wt. 5 grams)	Constituents determined	%	Price
1075a	Aluminum 2-ethylhexanoate	Al	7.5	$15.00
1051a	Barium cyclohexanebutyrate	Ba	29.1	15.00
1063a	Menthyl borate	B	2.4	15.00
1053	Cadmium cyclohexanebutyrate	Cd	24.0	15.00
1074a	Calcium 2-ethylhexanoate	Ca	12.5	15.00
1078a	Tris(1-phenyl-1,3-butanediono)chromium (III)	Cr	9.6	15.00
1055a	Cobalt cyclohexanebutyrate	Co	17.4	15.00
1080	Bis(1-phenyl-1,3-butanediono)copper (II)	Cu	16.5	15.00
1079a	Tris(1-phenyl-1,3-butanediono)iron (III)	Fe	10.3	15.00
1059a	Lead cyclohexanebutyrate	Pb	36.9	15.00
1060a	Lithium cyclohexanebutyrate	Li	4.1	15.00
1061a	Magnesium cyclohexanebutyrate	Mg	6.8	15.00
1062a	Manganous cyclohexanebutyrate	Mn	13.8	15.00
1064	Mercuric cyclohexanebutyrate	Hg	36.2	15.00
1065b	Nickel cyclohexanebutyrate	Ni	16.8	15.00
1071a	Triphenyl phosphate	P	9.5	15.00
1066	Octaphenylcyclotetrasiloxane	Si	14.1	15.00
1076	Potassium erucate	K	10.1	15.00
1077	Silver 2-ethylhexanoate	Ag	42.4	15.00
1069a	Sodium cyclohexanebutyrate	Na	11.9	15.00
1070a	Strontium cyclohexanebutyrate	Sr	20.7	15.00
1057a	Dibutyltin bis(2-ethylhexanoate)	Sn	23.2	15.00
1052a	Bis(1-phenyl-1,3-butanediono)oxovanadium (IV)	V	13.1	15.00
1073a	Zinc cyclohexanebutyrate	Zn	16.7	15.00

3.19. Microchemical Standards

This group of materials is furnished as fine crystals of suitable homogeneity for use as standards in the conventional microchemical methods of analysis employing samples of approximately 5 mg.

SRM Nos.	Kind	Constituents determined or intended use	Approx. wt. in grams	Price
140b	Benzoic acid	C, H	2	$9. 00
141b	Acetanilide	N, C, H	2	9. 00
142	Anisic acid	Methoxyl	2	9. 00
143b	Cystine	S, C, H, N	2	11. 00
147	Triphenyl phosphate	P	2	9. 00

3.20. Chemicals

3.20.1. Primary Chemicals

These chemicals are primary standards. The sucrose and dextrose, standards 17 and 41, are useful in the assay of sugar-containing materials. The remaining standards are furnished for the preparation or standardization of solutions used in titrimetric methods of chemical analysis.

SRM Nos.	Kind		Approx. wt. in grams	Price
17	Sucrose (cane sugar)	Saccharimetric value	60	$6. 00
41	Dextrose (glucose)	Reducing value	70	6. 00
40g	Sodium oxalate	Oxidimetric value	60	6. 00
83c	Arsenic trioxide	Oxidimetric value	75	6. 00
84h	Acid potassium phthalate	Acidimetric value	60	6. 50
136b	Potassium dichromate	Oxidimetric value	60	6. 00
350	Benzoic acid	Acidimetric value	30	6. 00
950a	Uranium oxide (U_3O_8)	Uranium standard	25	7. 50

SRM Nos.	Kind	Purity on basis of titration
		Percent
40g	Sodium oxalate	99. 95
83c	Arsenic trioxide	99. 99
84h	Acid potassium phthalate	99. 99
136b	Potassium dichromate	99. 98
350	Benzoic acid	99. 98
950a	Uranium oxide (U_3O_8)	99. 94

SRM Nos.	Kind	Moisture, percent	Reducing substances, percent	Ash, percent
17	Sucrose	<0. 01	<0. 02	0. 003
41	Dextrose	< . 01	------	. 003

3.20.2. Intermediate Purity Chemicals

This group of materials is intended to bridge the gap between commercial materials available in bulk and materials available in primary or purer grades. They should prove useful to the small research laboratory or individual engaged in purification, as a characterized starting material. Such materials are also useful in analytical procedures when a high-purity primary grade is neither necessary nor available.

SRM Nos.	Kind	Constituents determined or intended use	Approx. wt.	Price
726	Selenium	Limits for Al, As, B, Ca, Cr, Cu, halogens, Fe, Pb, Mg, Mn, Mo, Ni, Ag, S, Te, Tl, Sn, Be, Bi, Cd, In, and V.	1 lb	$40. 00
727	Rubidium chloride	Isotopic ratio, assay	1. 0 g	20. 00

3.21. Special Nuclear Materials

This group of standards consists of a plutonium metal standard issued to check chemical methods of assay, a plutonium sulfate isotopic standard with an isotopic analysis by mass spectrometry and intended for the calibration of such instruments, and a group of 16 uranium oxide isotopic standards ranging from 0.5% U–235 to 93.27% U–235. Certificates of Analysis giving isotopic percentage determined by mass spectrometry are furnished and the standards are intended to serve as calibration materials for the standardization of mass spectrometers.

Standards are available to AEC contractors, AEC or State licensees, and foreign governments which have entered an Agreement for Cooperation with the U.S. Government concerning the Civil Uses of Atomic Energy. The purchase request for these standards must be made on special forms obtainable from the National Bureau of Standards, Office of Standard Reference Materials, Washington, D.C. 20234.

SRM No.	Kind	Certified for	Unit	Price
		Plutonium content	*Pu*	
949b	Plutonium metal	99. 99%	0. 5g	$88. 00

SRM Nos.	Kind	Isotopic abundance (wt. %)					Unit, g	Price
		Pu-238	*Pu-239*	*Pu-240*	*Pu-241*	*Pu-242*	*Pu*	
948	Plutonium sulfate hydrate	0. 011	91. 417	7. 911	0. 628	0. 033	0. 25	$40. 00
	Uranium oxide U_3O_8		*U-234*	*U-235*	*U-236*	*U-238*	*U*	
U–005	U-235-depleted		0. 0023	0. 483	0. 0046	99. 51	1. 0	20. 50
U–010	U-235-enriched		. 0054	. 991	. 0067	98. 99	1. 0	20. 50
U–015	U-235-enriched		. 009	1. 51	. 016	98. 47	1. 0	20. 50
U–020	U-235-enriched		. 012	2. 01	. 016	97. 96	1. 0	21. 00
U–030	U-235-enriched		. 018	3. 01	. 020	96. 95	1. 0	21. 00
U–050	U-235-enriched		. 028	4. 95	. 048	94. 98	1. 0	21. 00
U–100	U-235-enriched		. 0666	10. 075	. 038	89. 821	1. 0	22. 00
U–150	U-235-enriched		. 0978	15. 143	. 0656	84. 693	1. 0	23. 00
U–200	U-235-enriched		. 1225	19. 811	. 2103	79. 856	1. 0	23. 50
U–350	U-235-enriched		. 2467	34. 903	. 1667	64. 684	1. 0	26. 50
U–500	U-235-enriched		. 5 26	49. 383	. 0754	50. 029	1. 0	29. 00
U–750	U-235-enriched		. 5580	75. 129	. 2502	24. 033	1. 0	33. 50
U–800	U-235-enriched		. 6519	80. 088	. 2450	19. 015	1. 0	34. 50
U–850	U-235-enriched		. 6399	84. 988	. 3713	14. 001	1. 0	35. 00
U–900	U-235-enriched		. 7735	90. 098	. 3337	8. 795	1. 0	36. 00
U–930	U-235-enriched		1. 0759	93. 276	. 2034	5. 445	1. 0	37. 50

3.22. Isotopic Reference Standards

Standard reference materials for chlorine, copper, bromine, silver, chromium, and magnesium are natural-ratio materials furnished in 0.25 g units with a certificate of isotopic composition. The lead standards, SRM Nos. 981, 982, and 983, are furnished as purified (99.9+ percent) metal, consisting of 1 g of 50-mil wire sealed in a 10-ml ampoule, and are available only as a set of three.

The isotopic composition of all the standards has been determined by mass-spectrometry, by comparison with mixtures prepared from high-purity separated isotopes. These are useful as standard reference materials for those looking for small variations in the isotopic composition of the elements, and for the measurement of mass-discrimination effects encountered in the operation of mass spectrometers.

SRM Nos.	Kind	Element	Price
975	Sodium chloride	Chlorine	$20. 00
976	Copper metal	Copper	20. 00
977	Sodium bromide	Bromine	20. 00
978	Silver nitrate	Silver	20. 00
979	Chromium nitrate	Chromium	20. 00
980	Magnesium metal	Magnesium	20. 00
981	Natural lead	Lead	100. 00 per set
982	Equal atom (206/208) lead	Lead	
983	Radiogenic lead	Lead	

3.23. Analyzed Gases

These standard reference materials are intended for the calibration of apparatus used for the measurement of various components in gas mixtures. Each sample is certified accurately within limits and is primarily intended to monitor and correct for long-term drifts in instruments used.

SRM Nos.	Kind	Constituents determined (ppm)	Volume (liters at STP)	Price
1601	Carbon dioxide in nitrogen	CO_2 308 ±3	68	$145.00
1602	Carbon dioxide in nitrogen	CO_2 346 ±3	68	145.00
1603	Carbon dioxide in nitrogen	CO_2 384 ±4	68	145.00

4. Standards of Certified Properties and Purity

4.1. *p*H Standards

These materials are furnished as crystals for the preparation of solutions of known hydrogen ion concentration for calibrating and checking the performance of commercially available *p*H materials. The samples are furnished with certificates giving directions for preparation of the solutions and tables of *p*H values at various temperatures.

The standards 186Ic and 186IIb are certified for use in admixture only. At an equimolar (0.025 molal) mixture of the two salts a *p*H(S) of 6.865 at 25 °C is obtained. Directions are also furnished for the preparation of a physiological reference solution having a *p*H(S) of 7.413 at 25 °C.

SRM Nos.	Kind	*p*H(S) (at 25 °C)	Approx. wt. in grams	Price
185d	Acid potassium phthalate	4.004	60	$7.50
186Ic	Potassium dihydrogen phosphate	See above	30	7.00
186IIb	Disodium hydrogen phosphate	See above	30	5.00
187a	Borax	9.180	30	5.00
188	Potassium hydrogen tartrate	3.557	60	5.00
189	Potassium tetroxalate	1.679	65	5.00

4.2. Freezing-Point Standards

4.2.1. Defining fixed pionts—International Practical Temperature Scale

The purity of these materials is such that they are suitable for realizing the defining fixed points on the International Practical Temperature Scale of 1948.

SRM Nos.	Kind	Value assigned to defining fixed point °C (Int. 1948)	Approximate weight in grams	Price
740	Zinc	419.505	350	$65.00

4.2.2. Secondary Reference Points

These are intended for the calibration of resistance thermometers and thermocouples.

SRM Nos.	Kind	Determined freezing point °C (Int. 1948)	Approx. wt. in grams	Price
44e	Aluminum	660.0	200	$12.00
45d	Copper	1083.3	450	12.00
49e	Lead	327.417	600	12.00
42f	Tin	231.88	350	12.00

4.3. Thermometric Cells (Discontinued)

4.4. Calorimetric Standards

These standards are issued primarily to check the performance of calorimetric methods for the determination of the heat of combustion and the heat of solution. Standard 724 is a homogeneous material for use in interlaboratory correlation and standardization of solution calorimeters. It is not certified with a value for the heat of solution. 217b–8S is contained in a special ampoule with an internal break-off tip, the others are sealed "in vacuum" in a plain glass ampoule.

SRM Nos.	Kind	Amount	Price	SRM Nos.	Kind	Amount	Price
39i	Benzoic acid, 26.434 absolute kilojoules	30 g	$6.00	217b–25	2,2,4-Trimethylpentane	25 ml	$175.00
				217b–50	2,2,4-Trimethylpentane	50 ml	325.00
217b-5	2, 2, 4-Trimethylpentane, 47.713 absolute kilojoules	5 ml	35.00	724	Tris(hydroxymethyl) aminomethane	50 g	15.00
217b–8S	2,4,2-Trimethylpentane	8 ml	60.00				

4.5. Radioactivity Standards

Because of the nature of these materials, all, except the radium rock samples and the carbon 14 dating standard, are shipped by express only (shipping charges collect) to destinations in the United States and Canada.

In the case of shipments to other countries, consignee should apply to the National Bureau of Standards for pro forma invoices, and establish credit in advance at any bank in the United States, or send payment by international money order or UNESCO coupons, to cover the cost of the standards. Consignee can either appoint an agent in the United States to handle shipments abroad, or shipments can be made by air freight or express (shipping charges collect) subject to the laws and regulations of the importing country.

A certificate containing pertinent information is sent under separate cover. Information concerning the standard appears on the standard or container.

Prices of certain materials may change as current stocks are depleted and are replaced by new issues. In these instances, buyers will be notified before orders are filled.

4.5.1. Alpha-Ray Standards

Standard Reference Material No. 4902 consists of a practically weightless deposit of polonium-210 on a monel disk 2.54-cm in diameter and 0.16-cm thick. SRM No. 4904–C consists of a practically weightless deposit of americium-241 on a platinum foil 1.27-cm in diameter and 0.015-cm thick. The foil is cemented onto a monel disk 2.54-cm in diameter and 0.16-cm thick. The activities are restricted to a 0.3-cm diameter in the center of the mount.

These samples can now be ordered under the general licensing provisions of the Atomic Energy Act of 1954 (Please refer to Title 10, Code of Federal Regulations).

SRM Nos.	Radionuclide	Approximate α-particle emission rate in 2π geometry	Price
4902	Polonium-210	500 αps	$50.00
4904–C	Americium-241	20 αps	76.00

Samples in the 100–250 αps range will now be made on request only, as a special test, see item 204.202z on page 94 of the "Calibration and Test Services (MP 250), Radioactivity Section."

4.5.2. Beta-Ray and Gamma-Ray Solution Standards (Combined with 4.5.3.)

4.5.3. Beta-Ray, Gamma-Ray and Electron-Capture Solution Standards

These Standard Reference Materials are contained in flame-sealed glass ampoules. The calibration radiation listed is the radiation for which the radionuclide is intended to be used as a standard.

Standards 4944–D (iodine-125) and 4948 (cerium-praseodymium-144) 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. The activity of the other standards in this group is such that they may be ordered singly under the general licensing provisions of the Atomic Energy Act of 1954.

SRM No.	Radionuclide	Calibration radiation	Approximate activity or emission rate at time of calibration (month, year)	Approximate weight of solution, g	Price
4921–C	Sodium-22	β^+	1×10^4 β^+ps/g (8/64)	3	$37.00
4922–E	Sodium-22	γ	2×10^5 β^+ps/g (3/67)	5	62.00
4924	Carbon-14 (water)	β^-	1×10^3 dps/g (7/58)	25	32.00
4925	Carbon-14 (benzoic acid in toluene)	β^-	2×10^4 dps/g (7/58)	3	32.00
4926	Hydrogen-3 (water)	β^-	9×10^3 dps/g (9/61)	25	45.00
4927	Hydrogen-3 (water)	β^-	9×10^5 dps/g (9/61)	3	45.00
4929–B	Iron-55	X	2×10^4 dps/g (5/64)	3	46.00
4940	Promethium-147	β^-	8×10^4 dps/g (5/61)	3	40.00
4943	Chlorine-36	β^-	1×10^4 β^-ps/g (1962)	3	26.00
4944–D	Iodine-125	X	1×10^5 dps/g (12/66)	5	66.00
4947	Hydrogen-3 (tritiated toluene)	β^-	3×10^5 dps/g (2/64)	4	30.00
4948	Cerium-Praseodymium-144	β^-	2×10^5 dps/g (12/65)	3.3	80.00

4.5.4. Beta Gas Standard

Sample No. 4935–B contains krypton-85 in inert krypton at a pressure of approximately one atmosphere in a 10 ml break-seal glass ampoule.

SRM No.	Radionuclide	Calibration radiation	Approximate activity at time of calibration (month, year)	Volume	Price
4935–B	Krypton-85	β^-	6×10^7 dps per gram mole (10/62)	10 ml	$23.00

4.5.5. Point-Source Gamma-Ray Standards

These standards are deposited between two layers of polyester tape approximately 0.006-cm thick and mounted on aluminum annuli, 0.8-cm wide and 5.5-cm outside diameter. Standard 4203–B (cobalt-60) 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. The activity of the other standards in this group is such that they may be ordered singly under the general licensing provisions of the Atomic Energy Act of 1954.

SRM No.	Radionuclide	Approximate emission rate at time of calibration (month, year)	Price
4991–B	Sodium-22	6×10^4 γps (1/65)	$57.00
4997–D	Manganese-54	5×10^4 γps (6/66)	53.00
4999–D	Cerium-139	2×10^5 γps (7/67)	65.00
4200	Cesium-137	5×10^4 γps (8/63)	46.00
4201	Niobium-94	1×10^4 γps (7/65)	55.00
4203–A	Cobalt-60	3×10^5 γps (8/66)	65.00
4203–B	Cobalt-60	7×10^5 γps (8/66)	65.00

4.5.6. Radium Rock Samples

This sample consists of 100 g of pulverized rock taken from bulk material analyzed for radium content. Petrographic data and the chemical analysis of a typical specimen of the rock is also given in a certificate accompanying the sample. The sample is shipped parcel post prepaid.

SRM No.	Rock	Average radium content (picogram of radium per gram of rock)	Price
4984	Triassic Diabase	0.18 ± 0.03	$11.00

4.5.7. Radium Solution Standards (for Radon Analysis)

These samples are contained in flame-sealed glass ampoules.

SRM Nos.	Radium content (in grams) as of 1956	Approximate weight, g	Price
4950–A	10^{-9}	100	$42.00
4951	10^{-11}	100	32.00
4952	Blank solution	100	7.50

4.5.8. Radium Gamma-Ray Solution Standards

These samples are contained in flame-sealed glass ampoules.

SRM Nos.	Nominal radium content (in micrograms)	Approximate weight, g	Price
4955	0.1	5	$34.00
4956	0.2	5	34.00
4957	0.5	5	34.00
4958	1.0	5	34.00
4959	2.0	5	34.00
4960	5.0	5	34.00
4961	10	5	34.00
4962	20	5	34.00
4963	50	5	34.00
4964–B	102	5	43.00

4.5.9. Contemporary Standard for Carbon-14 Dating Laboratories

SRM No.	Description	Price
4990–B	1 lb. of oxalic acid; no specific activity is given NOTE: These samples are shipped parcel post, prepaid to domestic and overseas purchasers.	$6.00

4.6. Standard Rubbers and Rubber Compounding Materials

These standards have been established to provide the rubber industry with standard materials for rubber compounding. They are useful for the testing of rubber and rubber compounding materials in connection with quality control of raw materials and for the standardization of rubber testing.

Each material has been statistically evaluated for uniformity by mixing rubber compounds and vulcanizing them in accordance with ASTM Designation D–15 and determining the stress-strain properties of the resulting vulcanizates. Certificates are issued for the rubbers since the properties of different lots are not the same. Replacement lots of rubber compounding materials impart essentially the same characteristics to rubber vulcanizates so that certificates are not issued for these materials.

4.6.1. Standard Rubbers

SRM Nos.	Kind	Approx. wt. in grams	Price
386f	Styrene-butadiene, type 1500	34, 000	$45. 00
388d	Butyl	27, 000	105. 00
389	Styrene-butadiene, type 1503	34, 000	49. 00
390	Butyl (Mooney Viscosity Only)	27, 000	95. 00

4.6.2. Rubber Compounding Materials

SRM Nos.	Kind	Approx. wt. in grams	Price	SRM Nos.	Kind	Approx. wt. in grams	Price
370c	Zinc oxide	2, 000	$6.50	378a	Oil furnace black	7, 000	$7.00
371e	Sulfur	1, 400	4.50	379	Conducting black	5, 500	7.00
372d	Stearic acid	600	3.80	380	Calcium carbonate	6, 000	5.00
373e	Benzothiazyl disulfide	500	9.00	381	Calcium silicate	4, 000	5.00
374b	Tetramethylthiuram disulfide	500	8.00	382	Gas furnace black	7, 500	7.00
				383	Mercaptobenzothiazole	800	5.50
375f	Channel Black	7, 000	16.00	384	N-tertiary-Butyl-2-benzothiazolesulfenamide	800	5.00
376a	Light magnesia	450	4.80				
377	Phenyl-beta-naphthylamine	600	8.00				

4.7. Polystyrene Molecular Weight Standards

Two samples of polystyrene are available for use in calibrating non-absolute techniques of measuring the number-average (M_n) and weight-average (M_w) molecular weights. Also these polymeric samples can be used for determining the feasibility of some fractionating techniques since the ratios of the M_n, M_w, and z-average molecular weight are also given. The intrinsic viscosities at a high rate of shear both in benzene and cyclohexane are also stated.

In addition, these samples represent highly purified polystyrene samples for polymeric research requiring the following chemical characteristics:

Standard 705 has a relatively narrow molecular weight distribution with a M_w 1.8×10^5. The sample was prepared by the polymerization of styrene in benzene using butyl lithium as an intiator. Ash content and volatiles are 0.05 and 0.5 percent, respectively. The polystyrene is in pellet form, each pellet weighing about 10 mg.

Standard 706 has a reasonably broad molecular weight distribution, the ratio M_w/M_n being 2.1, and an M_w of 2.7×10^5. The sample was prepared by the thermal polymerization of styrene at 140 °C to 37 percent conversion. Ash content and volatile content are 0.001 percent and 0.8 percent respectively. The polystyrene is in pellet form, each pellet weighing about 80 mg.

SRM Nos.	Kind	Weight in grams	Price
705	Polystyrene, narrow molecular weight distribution	2	$18.00
706	Polystyrene broad molecular weight distribution	18	12.00

4.8. Viscometer Calibrating Liquids

As of July 1, 1967, the National Bureau of Standards has discontinued the sale of the viscometor calibrating liquids identified as oils D, H, I, J, K, L, M, N, OB, P, SB, and SF. Liquids of comparable viscosity are available elsewhere.

4.9. Glass Viscosity Standards

Standard Reference Materials 710 and 711 are furnished as rectangular-shaped bars, and are certified for viscosity between values of 10^2 and 10^{12} poises. They are furnished to check the performance of high-temperature viscosity equipment (rotating cylinders) and low-temperature viscosity equipment (fiber elongation). In addition, values are furnished for the softening point, annealing point, and strain point by ASTM Designations (C388–61 and C336–61). Certificates of data from 8 laboratories are furnished for these two glasses.

Standards 712, 713, 714, 715, and 716 are furnished in cone, gobs, or patties as listed, and are certified only for softening point, annealing point, and strain point. Certificates of data from three laboratories are furnished for these glasses.

SRM Nos.	Kind	Unit of issue	Price
710	Soda-lime silica glass-type 523/586	2 lb	$40.00
711	Lead-silica glass-type 617/366	3 lb	60.00
712	Mixed alkali lead silicate glass, ¼ in patties (6 pcs.)	0.5 lb	25.00
713	Dense barium crown 620/603 glass, 1⅜ in diam × ⅝ in thick gobs (4 pcs.)	.5 lb	25.00
714	Alkaline earth alumina silicate glass, ¼ in diam cane (16 pcs—6 in long)	.5 lb	25.00
715	Alkali-free aluminosilicate glass, ¼ in diam cane (13 pcs—6 in long)	200 g	25.00
716	Neutral (borosilicate) glass, ½ in diam cane (6 pcs—6 in long)	250 g	25.00

Certified Properties

Viscosity poises	SRM 710 (Temp. °C)	SRM 711 (Temp. °C)	SRM 712 (Temp. °C)	SRM 713 (Temp. °C)	SRM 714 (Temp. °C)	SRM 715 (Temp. °C)	SRM 716 (Temp. °C)
10^2	1434.3	1327.1					
10^3	1181.7	1072.8					
10^4	1019.0	909.0					
10^5	905.3	794.7					
10^6	821.5	710.4					
10^7	757.1	645.6					
10^8	706.1	594.3					
10^9	664.7	552.7					
10^{10}	630.4	518.2					
10^{11}	601.5	489.2					
10^{12}	576.9	464.5					
Softening point	724	602	528	738	908	961	794
Annealing point	546	432	386	631	710	764	574
Strain point	504	392	352	599	662	714	530

4.10. Color Standards for Spectrophotometer-Tristimulus Integrator Systems

This set of 5 transparent colored glass standards is available to check the performance of spectrophotometer-tristimulus integrator systems, the automatic recording and computing devices used in routine color measurements. The set consists of five 2-inch square glass filters (approximately 3.0 mm thick) with polished faces. A chart of tristimulus values for CIE sources A, B, and C, representing incandescent-lamp light, noon sunlight, and average daylight; and a detailed report on the changes in tristimulus values caused by errors in the 100-percent and zero adjustments of the photometric scale, wavelength errors, slit-width errors, errors due to stray energy, and inertia errors of the recording mechanism, are furnished with each set of glasses. Through the use of these standards the user of a spectrophotometer-integrator combination will be able not only to determine when the instrument goes out of adjustment, but also from the pattern of the discrepancies between measured and reported tristimulus values, to obtain some clue as to the type of maladjustment.

The glasses are available *only* in sets of five.

SRM Nos.	Kind	Price
2101	Orange-red glass	$250.00 per set.
2102	Signal yellow glass	
2103	Sextant green glass	
2104	Cobalt blue glass	
2105	Selective neutral glass	

4.11. The ISCC-NBS Centroid Color Charts

The ISCC-NBS centroid colors are available to illustrate a characteristic color for each of the ISCC-NBS color-name blocks in the Color Names Dictionary, NBS Circular 553. This chart set along with the table containing the history of the color-names project, the centroid number and the Munsell renotation of each of the 251 color chips included, constitute the Supplement to the Color Names Dictionary. Each chart set contains 18 constant-hue centroid color charts. These centroid colors represent a systematic sampling of the whole color solid, each color of which has been carefully measured. Each centroid color has its own specification and can be used as a color standard. The centroid color charts can also be used for approximate color specifications wherever the ISCC-NBS color designations are applicable, for statistical studies of trends in industrial color usage, or for planning lines of merchandise intended to have coordinated colors.

SRM Nos.	Kind	Price per set
2106	Centroid color charts	$5.00

4.12. Standard Colors for Kitchen and Bathroom Accessories

These commercial standards establish certain colors having the greatest general acceptance. They provide references whereby manufacturers can produce, and buyers can stock, items of colored kitchen and bathroom accessories with assurance that the purchaser can obtain from different sources and at different times, materials that will match one another in color. Calibration of these standards for use with 3-filter reflectometers may be obtained by applying to NBS.

SRM No.	Kind	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

4.13. Paint Pigment Standards for Color and Tinting Strength

Material standards are the most practical means of designating color, tinting strength, and character of tint of paint pigments. The present series of color pigment standards has been developed for that purpose, Reference is made to these standard materials in the Federal Specifications for pigments. Methods of making the required color comparisons between standard and the delivered product are set forth in detail in the certificate supplied with each sample. The procedures given are similar to those covered by Methods 4220 and 4221 of Federal Standard 141 and by ASTM Designation D 387–60.

Paint-Pigment Standards for Color and Tinting Strength only

SRM Nos.	Kind	Approx. wt. in grams	Price	SRM Nos.	Kind	Approx. wt. in grams	Price
300	Toluidine red toner	40	$3.00	315	Yellow iron oxide, lemon	20	$3.00
301	Yellow ocher	45	3.00	316	Yellow iron oxide, orange	25	3.00
302	Raw sienna	45	3.00	317	Yellow iron oxide, dark orange	40	3.00
303	Burnt sienna	50	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
307	Metallic brown	60	3.00	321	Medium chrome yellow	65	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
314	Yellow iron oxide, light lemon	20	3.00	328	Dark chrome green	45	3.00

4.14. Phosphors

These materials are issued without certification. They are issued so that those interested in developing methods of measurement for phosphor materials can work on a common source of materials.

SRM Nos.	Kind	Approx. wt. in grams	Price	SRM Nos.	Kind	Approx. wt. 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
1024	Zinc-cadmium sulfide phosphor (Cu activator)	14	3.00	1030	Magnesium arsenate phosphor	28	3.00
1025	Zinc phosphate phosphor	28	3.00	1031	Calcium halophosphate phosphor	28	3.00
				1032	Barium silicate phosphor	28	3.00
				1033	Calcium phosphate phosphor	28	3.00

4.15. Light-Sensitive Papers and Plastic Chips

4.15.1. Light-Sensitive Papers

Standard light-sensitive paper and booklets of standard faded strips of this paper are available for use in standardizing the dosage of radiant energy when testing textiles for color fastness by exposure in commercial carbon-arc fading lamps. The paper is distributed in units of 100 pieces 2⅝ in by 3¼ in. The booklets contain six strips of the paper 1¼ in wide that have been faded by exposure in the NBS master lamp. A copy of NBS Misc. Publ. 260–15 which describes the preparation and use of the materials, is furnished with each booklet.

SRM Nos.	Kind	Unit of issue	Price
700b	Light-sensitive paper	Pkg. of 100 pieces	$25.00
701b	Booklet of standard faded strips	Booklet	110.00

4.15.2. Light-Sensitive Plastic Chips

Standard light-sensitive plastic chips are available for use in calibration and standardization of artificial weathering and fading apparatus. These chips are distributed in two thicknesses (0.060 and 0.124 in) in units of five plates 2 in by 4⅛ in, and have been standardized by the measurement of the change of transmittance as a function of exposure (in standard fading hours) to the NBS master lamps.

SRM Nos.	Kind	Unit of Issue	Price
702	Light-sensitive plastic chips (0.124 in)	Package of 5 chips	$35.00
703	Light-sensitive plastic chips (0.060 in)	Package of 5 chips	35.00

4.16. Internal Tearing Resistance Standard Paper

This standard is available for calibration of instruments used for the determination of the internal tearing resistance of paper according to methods ASTM Designation D689 and TAPPI Standard T414. Sufficient material is furnished in each unit to provide 40 or more measurements. Initial distribution is in a set of twelve packages, one package shipped at approximately monthly intervals. Packages are also available on a four month cycle, or by individual package. The tearing strength value of the material is approximately 40 g. The exact value will be given in the certificate accompanying the standard.

SRM No.	Kind	Price
704a	Internal tearing resistance of paper	$7.00 per package.

4.17. Microcopy Resolution Test Chart

This chart is used to test the resolving power of whole microcopying systems. It is printed photographically on paper, and has high-contrast five line patterns ranging in spatial frequency from one cycle per millimeter to ten cycles per millimeter. Instructions for the use of this chart are supplied with each order.

SRM No.	Kind	Unit of issue (minimum)	Price per chart
1010	Resolution chart for testing the resolving power of microcopying cameras.	5 charts	$0.60

4.18. Glass Spheres for Particle Size

Standard Reference Materials 1018 and 1019 are issued for evaluating the effective openings of testing sieves in the size range U.S. Standard No. 8 through No. 70. These standards are used by placing the entire sample on a clean sieve or on the top of a stack of clean sieves and shaking them in a shaking device or by hand. Each of the sieve fractions of glass spheres is weighed to the nearest 0.01 gram, and the weight percent retained on each sieve is calculated. The effective opening of each sieve is then determined from the calibration data on the certificate supplied with each sample. The reproducibility of calibrations made with these standards varies from ± 2 to ± 5 percent of the nominal width of the sieve openings.

SRM 1003 is furnished to calibrate equipment used to determine particle sizes in the 5 to 30 micron range. A certificate is supplied showing particle size distribution by volume and by weight, and Stoke's Law distribution for air and water.

SRM Nos.	Kind	Weight in grams	Price
1003	Calibrated glass spheres (5–30 micron)	40–45	$15.00
1018	Calibrated glass spheres (for calibrating sieves No. 20–70)	40	9.50
1019	Calibrated glass spheres (for calibrating sieves No. 8–18)	100	9.50

4.19. Turbidimetric and Fineness Standard

This standard is available to calibrate the Blaine fineness meter according to the latest issue of Federal Test Method Standard 158, Method 2101 or ASTM Designation C204; to calibrate the Wagner turbidimeter according to ASTM Designation C115; and to determine sieve residue according to ASTM Designation C430. Each unit consists of two sealed vials, each containing approximately 10 grams of cement.

SRM No.	Kind	Certification	Price
114k	Cement	No. 325 sieve residue, 7.1 percent Surface area, 1780 cm^2/g (Wagner turbidimeter) Air permeability, 3030 cm^2/g Mean particle diameter (air permeability), 6.29 microns	$2.50

4.20. Surface Flammability Standard

This standard is issued for checking the operation of radiant panel test equipment in accordance with Interim Federal Standard No. 00136 and later revisions. Flame spread Index, I_s, = 131; Heat Evolution Factor, Q, = 27.0; Smoke Deposit, weight in mg, = 0.7.

SRM No.	Kind	Unit	Price
1002a	Hardboard sheet	4 specimens, 6 x 18 inches	$8.00

4.21. Coating Thickness

Nominal thickness only is given below. The certified thickness appears on the cards accompanying the samples.

SRM Nos.	Prev. Desig.	Nominal Thickness (inch)	Coating	Substrate	Price
	Type I	0–0.08	Nonmagnetic	Magnetic	
1301		0.00010	copper+chromium	steel	$7.50
1302	AA	.00025	do	do	7.50
1303	AB	.00050	do	do	7.50
1304	AM	.00075	do	do	7.50
1305	AC	.0010	do	do	7.50
1306	CA	.0015	do	do	7.50
1307	AD	.0020	do	do	7.50
1308		.0025	do	do	7.50
1309	CM	.0027	do	do	7.50
1310	CB	.0032	do	do	7.50
1311	CC	.0055	do	do	7.50
1312	CD	.0080	do	do	7.50
1313	DA	.010	do	do	7.50
1314	DB	.015	do	do	7.50
1315	DC	.020	do	do	7.50
1316	DD	.025	do	do	7.50
1317	HA	.03	do	do	7.50
1318	HB	.04	do	do	7.50
1319	HC	.06	do	do	7.50
1320	HD	.08	do	do	7.50
	Type II	0–0.0025	Magnetic	Magnetic	
1331	BA	0.00012	nickel	steel	$7.50
1332	BB	.00035	do	do	7.50
1333	BC	.00055	do	do	7.50
1334	BD	.00075	do	do	7.50
1335	EA	.0010	do	do	7.50
1336	EB	.0013	do	do	7.50
1337	EC	.0016	do	do	7.50
1338	ED	.0020	do	do	7.50
1339	EE	.0025	do	do	7.50
	Type III	0–0.002	Magnetic	Nonmagnetic	
1341	FA	0.00012	nickel/chromium	brass	$7.50
1342	FB	.00035	do	do	7.50
1343	FC	.00065	do	do	7.50
1344	FD	.0010	do	do	7.50
1345	FE	.0015	do	do	7.50
1346	FF	.0020	do	do	7.50

4.22. Thermal Emittance Standards

Standards of normal spectral emittance are available in three materials, platinum-13 percent rhodium alloy having low emittance, sandblasted and oxidized Kanthal (an iron-chromium-aluminum alloy) having intermediate emittance, and sandblasted and oxidized Inconel (a nickel-chromium-iron alloy) having high emittance. Standards of all three materials have been calibrated for normal spectral emittance at 800 and 1100 °K, the Kanthal and Inconel standards at 1300 °K and the platinum-13 percent rhodium at 1400 and 1600 °K. Normal spectral emittance data is supplied at 156 wavelengths in the one to fifteen micron range for all the combinations listed above. In addition, data for the platinum-13 percent rhodium standards is supplied in the fifteen to thirty-five micron range at 1100 °K.

SRM Nos.	Unit	Price
1402	Emittance standards, ½ in disks Pt-13% Rh	$175.00
1403	Emittance standards, ⅞ in disks Pt-13% Rh	185.00
1404	Emittance standards, 1 in disks Pt-13% Rh	200.00
1405	Emittance standards, 1⅛ in disks Pt-13% Rh	235.00
1406	Emittance standards, 1¼ in disks Pt-13% Rh	250.00
1407	Emittance standards, 2 in x 2 in squares Pt-13% Rh	385.00
1408	Emittance standards, 1 in x 10 in strips Pt-13% Rh	750.00
1409	Emittance standards, ¾ in x 10 in strips Pt-13% Rh	600.00
1420	Emittance standards, ½ in disks Kanthal	175.00
1421	Emittance standards, ⅞ in disks Kanthal	175.00
1422	Emittance standards, 1 in disks Kanthal	175.00
1423	Emittance standards, 1⅛ in disks Kanthal	175.00
1424	Emittance standards, 1¼ in disks Kanthal	175.00
1425	Emittance standards, 2 in x 2 in squares Kanthal	175.00
1427	Emittance standards, ¾ in x 10 in strips Kanthal	175.00
1428	Emittance standards, ¼ in x 8 in strips Kanthal	175.00
1440	Emittance standards, ½ in disks Inconel	175.00
1441	Emittance standards, ⅞ in disks Inconel	175.00
1442	Emittance standards, 1 in disks Inconel	175.00
1443	Emittance standards, 1⅛ in disks Inconel	175.00
1444	Emittance standards, 1¼ in disks Inconel	175.00
1445	Emittance standards, 2 in x 2 in squares Inconel	175.00

4.23. Permittivity Standards

These standards are furnished in three different shapes and are certified for relative permittivity (approximately 6.3 in the case of the 1723 glass and 3.83 in the case of the 7940 fused silica) in the frequency range 10^3 to 10^{10} hertz. These standards are intended for use in checking and improving measurement systems for complex permittivity.

SRM Nos.	Kind	Price
1501	1723 glass, 2¼ in x 2¼ in x 3/16 in rough cut blank for making 2 in disk for low-frequency, capacity-type holder	$87.50
1502	1723 glass, 1 in x ½ in x ½ in rough-cut blank for X-band waveguide	87.50
1503	1723 glass, 1¼ in x 1¼ in x ⅜ in rough-cut blank for making nominal 1 in cylindrical waveguide for dielectrometer	87.50
1504	7940 fused silica, 2¼ in x 2¼ in x ¼ in for making 2 in disk for low-frequency, capacity-type holder	87.50
1505	7940 fused silica, 1 in x ½ in x ½ in rough-cut blank for X-band waveguide	87.50
1506	7940 fused silica, 1¼ in x 1¼ in x ⅜ in rough-cut blank for making 1 in cylindrical waveguide for dielectrometer	87.50

4.24. Mössbauer Differential Chemical Shift for Iron-57

This standard reference material is intended to furnish a base (zero) point for Mössbauer spectrometry. It is furnished as a platelet 1 cm x 1 cm x 0.0775 cm cut from a single crystal of sodium nitroprusside along the 100 crystal plane. The natural iron concentration is 25.0 mg/cm^2 ±4 percent. This standard reference material has an average value for the chemical shift of 0.0000 ±0.0002 cm/sec, and an average value for the electric quadrupole splitting of 0.1726 ±0.0002 cm/sec at 25 °C.

SRM No.	Kind	Price
725	Mössbauer Differential Chemical Shift for Iron-57 (Sodium Nitroprusside)	$150.00

4.25. Carbon-14 and Hydrogen-3 Labeled Sugars

These standards are furnished to supply a series of carbohydrates, labeled with carbon-14 and tritium, which are unavailable elsewhere. They are intended primarily for use as radioactive tracers in chemical and biochemical research.

4.25.1. Terminal Carbon-14 Sugars

SRM Nos.	Kind	Amount of activity	Price
1525 series	Carbon-14 labeled sugars and related products, Type 1 (carbohydrates labeled at carbon 1).	10 microcuries.	$12.50

4.25.2. Interior Carbon-14 Sugars

SRM Nos.	Kind	Amount of activity	Price
1550 series	Carbon-14 labeled sugars and related products, Type 2 (carbohydrates labeled in positions other than carbon 1).	10 microcuries.	$17.50

4.25.3. Tritium Labeled Sugars

SRM Nos.	Kind	Amount of activity	Price
1575 series	Tritium-labeled carbohydrates (carbohydrates labeled without extensive alteration of the carbon skeleton).	10 microcuries.	$12.50

4.26. Density and Refractive Index Standards

These standard reference materials 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. 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. 217b–8S is contained in a special ampoule with an internal breakoff tip, the others are sealed "in vacuum" in plain glass ampoules.

SRM Nos.	Kind	Approx. d^{20}	Approx. n_D^{20}	Amount, ml	Price
217b–5	2,2,4-Trimethylpentane	0.6918	1.3915	5	$35.00
217b–8S	2,2,4-Trimethylpentane	.6918	1.3915	8	60.00
217b–25	2,2,4-Trimethylpentane	.6918	1.3915	25	175.00
217b–50	2,2,4-Trimethylpentane	.6918	1.3915	50	325.00

5. Index By SRM Number

6. Appendix I. Typical Certificate of Characterization

U.S. Department of Commerce
Alexander B. Trowbridge, Secretary

National Bureau of Standards
A. V. Astin, Director

Certificate of Analysis

Standard Reference Material 131a
Low-Carbon Silicon Steel

ANALYST*	METHOD	CARBON
		Percent
1	Combustion-conductometric [a]	0.004_1
2	Combustion-conductometric [a]	$.004_1$
3	Combustion-conductometric [a]	$.004_3$
4	Combustion-conductometric [a]	$.004_4$
5	Combustion-conductometric [a]	$.004_4$
6	Combustion-conductometric [a]	$.004_5$
7	Combustion-thermal conductivity [a]	$.004_3$
8	Combustion-conductometric [a]	$.004_3$
9	Combustion-conductometric [a]	$.004_5$
	Average	0.004_4

[a] 1-g sample.

* List of Analysts

1. E. R. Deardorff and J. I. Shultz, Division of Analytical Chemistry, National Bureau of Standards.
2. D. P. Bartell and R. B. Fricioni, Allegheny Ludlum Steel Corp., Brackenridge Works, Brackenridge, Pa.
3. T. D. McKinley, E. I. Du Pont de Nemours and Co., Pigments Department, Experimental Station, Wilmington, Del.
4. W. F. Harris and R. N. Revesz, Westinghouse Electric Corp., Research and Development Center, Pittsburgh, Pa.
5. R. R. Ralston and K. P. Kreis, General Electric Co., Transformer Division, Pittsfield, Mass.
6. L. M. Melnick, J. F. Martin, and J. B. Ferons, United States Steel Corp., Applied Research Laboratory, Monroeville, Pa.
7. L. M. Melnick and M. J. Nardozzi, United States Steel Corp., Applied Research Laboratory, Monroeville, Pa.
8. P. P. Eismont, United States Steel Corp., Duquesne Works, Duquesne, Pa.
9. Armco Steel Corporation, Research and Technology, Chemical Laboratory, Arba Thomas, in charge. Analyses by L. C. Bartels and D. E. Swanger.

The material for the preparation of this standard was furnished by the Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Washington, D.C. 20234
September 15, 1967

W. Wayne Meinke, Chief
Office of Standard Reference Materials.

7. Appendix II. Guide for Submission of Requests

U.S. DEPARTMENT OF COMMERCE—NATIONAL BUREAU OF STANDARDS
INSTITUTE FOR MATERIALS RESEARCH
OFFICE OF STANDARD REFERENCE MATERIALS

GUIDE FOR THE SUBMISSION OF REQUESTS FOR THE DEVELOPMENT OF NEW OR RENEWAL STANDARD REFERENCE MATERIALS

August 20, 1964

Introduction

The National Bureau of Standards presently has available more than 500 standard reference materials. It is also working on the development of about 50 new ones and has on hand requests for the preparation of many others. The requests have always far exceeded the Bureau's capacity to produce and certify these materials.

Policy

One of the main functions of the NBS Institute for Materials Research is to develop, produce, and distribute standard reference materials which provide a basis for comparison of measurements on materials and aid in the control of production processes in industry. To help carry out this function the Office of Standard Reference Materials evaluates the requirements of science and industry for carefully characterized reference materials, and directs their production and distribution. Emphasis is given to providing NBS Standard Reference Materials (a) where attainment of needed accuracy of analysis or accuracy of measurement of characteristics is not economically or technically feasible elsewhere, and where such accuracy is generally important to users, (b) where industry-wide standards for commerce are needed from a neutral supplier who is not otherwise available, and (c) where continuing availability of highly characterized material from a common source is important to science or industry.

The National Bureau of Standards recognizes the need for broadening the present program on reference materials to include all types of well-characterized materials that can be used to calibrate a measurement system or to produce scientific data that can be readily referred to a common base. With this broadening, however, it still remains apparent that the demand for new Standard Reference Materials will continue to far exceed the Bureau's capacity for development. Therefore, requests for new Standard Reference Materials which will have limited use and for which the need is not very great will have to be passed by in favor of requests clearly showing a critical need. For the purpose of determining which requests are to receive top priority, the National Bureau of Standards will need, and will rely heavily upon, the information supplied by industry, either through its own representatives or through interested committees, such as those of the American Society for Testing and Materials, the American Standards Association, the International Organization for Standardization, etc.

Accordingly, while the Bureau welcomes all requests for the development of new Standard Reference Materials, it will help both the Bureau, and industry as well, if requests are accompanied by such information as will permit an assessment of the urgency and importance of proposed new reference materials.

Information Needed

Those requesting the development of new Standard Reference Materials should supply as much as possible of the following information:

(1) Short title of Standard Reference Material.
(2) Purpose for which the new standard material is needed.
(3) Reasons why the new standard material is needed.
(4) Special characteristics and/or requirements for the material. Include additional requirements and reasons, if more than one standard material is necessary for standardization in this area.
(5) Your estimate of the possible present and future (10 year) demand for this new standard in your own operations and elsewhere.
(6) Whether this standard, or a similar standard, can be produced by, or obtained from, a source other than the National Bureau of Standards. If so, give reasons to justify its preparation by NBS.
(7) Miscellaneous pertinent comments to aid justification for the new standard reference material, such as: (a) an estimate of the range of application, monetary significance, and scientific and/or technological significance including when feasible estimates of the impact upon industrial productivity or growth, and (b) supporting letters from industry leaders, trade organizations, interested committees and others.

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Other NBS Publications of Interest

NBS Misc. Publ. 260–1, Standard Reference Materials: Preparation of NBS White Cast Iron Spectrochemical Standards, June 1964. 30 cents.
NBS Misc. Publ. 260–2, Standard Reference Materials: Preparation of NBS Copper-Base Spectrochemical Standards, October 1964. 35 cents.
NBS Misc. Publ. 260–3, Standard Reference Materials: Metallographic Characterization of an NBS Spectrometric Low-Alloy Steel Standard, October 1964. 20 cents.
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NBS Misc. Publ. 260–15, Standard Reference Materials: Recommended Method of Use of Standard Light-Sensitive Paper for Calibrating Carbon Arcs Used in Testing Textiles for Colorfastness to Light, July 1967. 20 cents.

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