

Brammer Standard Company, Inc.
Certificate of Analysis

B.S. CE 209

Rare Earth Cast Iron Reference Material

	Certified Value ¹	Estimate of Uncertainty ²		Certified Value ¹	Estimate of Uncertainty ^{2,3}
Analysis listed as percent by weight					
C	2.47	0.03	Al	0.006	0.002
Mn	0.39	0.01	As	0.003	0.001
P	0.167	0.007	Co	0.030	0.002
S	0.027	0.002	Mg	0.0013	0.0003
Si	2.13	0.01	Mo	(0.001)	
Cu	0.211	0.005	La	0.008	0.002
Ni	0.045	0.004	Te	(<0.002)	
Cr	0.010	0.001	Ti	0.062	0.005
Ce	0.026	0.002	V	0.030	0.003
Total Rare Earths	0.049	0.002			

¹ The certified value listed is the present best estimate of the true value based on the results of an interlaboratory testing program.

² The uncertainties listed are based on value judgments of the material inhomogeneity and possible bias in the determined analytical values. No attempt is made to derive exact statistical measurements of imprecision because several methods were used in the determination of most constituents.

³ The values in parentheses are not certified and are provided for information only.

The requirements of ISO Guide 31 and ISO Guide 35 were generally followed for the preparation of this reference material and certificate of analysis. This is a reference material as defined by ISO Guide 30.

See reverse side for more information.

Certificate Number CE209-063095

Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Ce	Total Rare Earths
1	2.43	0.373	0.160	0.0246	2.119	0.20	0.0424	0.010	0.0239	0.0470
2	2.44	0.380	0.160	0.025	2.12	0.202	0.043	0.010	0.024	0.0478
3	2.47	0.380	0.162	0.026	2.12	0.208	0.043	0.0104	0.0245	0.0484
4	2.47	0.380	0.164	0.026	2.12	0.210	0.044	0.0105	0.0245	0.0484
5	2.48	0.383	0.167	0.026	2.123	0.210	0.045	0.011	0.0250	0.0485
6	2.48	0.387	0.168	0.027	2.13	0.210	0.051	0.011	0.0252	0.0486
7	2.49	0.390	0.170	0.027	2.13	0.210			0.0255	0.0490
8	2.49	0.390	0.172	0.027	2.14	0.211			0.0257	0.0494
9		0.39	0.172	0.0270	2.14	0.211			0.026	0.0500
10		0.39	0.173	0.027	2.14	0.211			0.0263	
11		0.391		0.027	2.14	0.213			0.0264	
12		0.395		0.027	2.14	0.215			0.0269	
13		0.395		0.0272	2.15	0.218			0.0277	
14		0.405		0.028	2.15	0.22			0.0284	
15				0.029						
Average	2.469	0.388	0.1668	0.0267	2.133	0.2106	0.0447	0.0105	0.0257	0.0486
Std Dev	0.022	0.008	0.0050	0.0011	0.011	0.0053	0.0032	0.0004	0.0013	0.0009
Certified	2.47	0.39	0.167	0.027	2.13	0.211	0.045	0.010	0.026	0.049

Analysis	Al	As	Co	Mg	Mo	La	Te	Ti	V
1	0.00514	0.0017	0.028	0.0011	0.0004	0.006	<0.0001	0.0598	0.0283
2	0.0052	0.003	0.030	0.0013	0.0004	0.0077	<0.0005	0.0607	0.0298
3	0.006	0.0031	0.0304	0.0014	0.0010	0.0086	0.00004	0.061	0.030
4	0.007	0.0041	0.0307	0.0014	0.0024	0.009	0.0011	0.063	0.031
5	0.0080	0.0046	0.031	0.0014		0.0101	0.0015	0.067	0.032
6			0.032						
Average	0.0063	0.0033	0.0304	0.00132	0.0010	0.0083		0.0623	0.0302
Std Dev	0.0012	0.0011	0.0013	0.00013	0.0009	0.0015		0.0029	0.0014
Certified	0.006	0.003	0.030	0.0013	(0.001)	0.008	(<0.002)	0.062	0.030

The values in parentheses are not certified and are provided for information only.

Certified Values: The original certificate for this material was produced in 1981 for the China Metallurgical Import & Export Corporation. Additional interlaboratory testing was concluded by Brammer Standard Company, Inc., in 1994. The analysis listed above represents the original test data plus the data resulting from the recent interlaboratory testing program.

Analysis: Chemical analyses were made on chips sampled from the bulk material. The laboratories participating in the testing normally followed the requirements of ISO Guide 25. The individual values listed above are the average of each analyst's results. Methods of analysis used were ASTM Standard Methods E 350, E 351 and E 1019 plus additional ICP and AA spectrometric methods.

Co-operating Laboratories: Some of the co-operating laboratories were:

Anarem, Praha, Czech Republic
Analytical Associates Inc., Detroit, Michigan
Brammer Standard Company, Inc., Houston, Texas
China Metallurgical Import & Export Corporation, Beijing, China
Crucible Specialty Steel, Syracuse, New York
J. Dirats and Co., Inc., Westfield, Massachusetts
Shiva Technologies, Inc., Cicero, New York
VHG Laboratories, Inc., Manchester, New Hampshire

References :

ASTM documents available from ASTM, 1916 Race Street, Philadelphia, PA, 19103.

E 350-90 Standard Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

E 351 - 93 Standard Test Methods for Chemical Analysis of Cast Iron - All Types

E 826 - 85 (Reapproved 1990) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

E 1019-93 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

ISO Guides available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

ISO Guide 25 (Third edition, 1990), General requirements for the competence of calibration and testing laboratories.

ISO Guide 30 (Second edition, 1991), Terms and definitions used in connection with reference materials.

ISO Guide 31 (First edition, 1981), Contents of certificates of reference materials.

ISO Guide 33 (First edition, 1989), Uses of certified reference materials.

ISO Guide 35 (Second edition, 1989), Certification of reference materials - General and statistical principles.

Other useful documents available from NIST, U.S. Department of Commerce, Gaithersburg, MD 20899.

NBS Special Publication 260-100, Handbook for SRM Users

NIST Special Publication 829, Use of NIST Standard Reference Materials for Decisions on Performance of Analytical Chemical Methods and Laboratories

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