Brammer Standard Company, Inc.
14603 Benfer Road
Houston, Texas 77069 USA
Telephone (281) 440-9396 FAX (281) 440-4432

Certificate of Analysis

Reference Material for Carbon, Sulfur and Nitrogen in Steel

B.S. CSN 2-2

	Certified Value[1]	Estimate of Uncertainty[2]
Carbon	**0.548**	±0.004
Sulfur	**0.028**	±0.001
Nitrogen	**0.076**	±0.0013

Values expressed as weight percent

Due to slight variations in pin weights, best precision and accuracy will be obtained by weighing each pin before analysis.

[1] The certified value listed is the present best estimate of the true value.

[2] The uncertainties listed are based on the confidence interval formula:

$$c(95\%) = \frac{s_M \times t}{\sqrt{n}}$$

where: s_M = Standard Deviation of Laboratory Means
t = Students t value
n = number of laboratories

For further information regarding the confidence interval for the certified value see ISO Guide 35:1989, section 4

Certificate date: August 18, 1993 Certificate Number CSN2-2-081893

Description of the sample

This sample is avilable only in the form of pins with a diameter of 3.85 mm (0.151 in.) and a length of 11.1 mm (0.435 in.).

The material used for making BS CSN 2-2 is AISI grade 440A stainless steel. The estimated composition in percent by weight is:

Mn 0.4 P 0.004 Si 0.03 Ni 0.2 Cr 16.8 Mo 0.5

Interlaboratory Testing Procedure

Each participating laboratory received a set of test samples consisting of the new Brammer Reference Materials BS CSN 2-2, plus four Certified Reference Materials (CRMs) as shown in the table on the following page. The CRMs were submitted as unknown samples to each laboratory in coded containers. The participating laboratories were instructed to calibrate their instruments by their normal procedures and to analyze the samples in duplicate on two different days. All instruments used were manufactured by the Leco Corporation. The models used are listed below.

Lab	Carbon & Sulfur	Nitrogen	Lab	Carbon & Sulfur	Nitrogen
1	CS-244		6	CS-444	TN-114
2	CS-244	TC-136	7	CS-444	TC-136
3	CS-444		8	CS-244	TC-136
4	CS-444	TN-114	9	CS-244	TC-436
5	CS-444	TC-436	10		TC-136

Certified Values for BS CSN 2-2

The laboratory means and standard deviations are listed on the following page. The carbon, sulfur, and nitrogen analyses were determined on calibrations that were validated with NIST CRMs and are therefore traceable to NIST.

The certified values for the Certified Reference Materials used as unknown samples in the interlaboratory testing show acceptable agreement with the test data.

Carbon

Lab	CSN 2-2	sW	ECRM 186-1	sW	NIST SRM 32e	sW
1	0.5458	0.0038	0.6110	0.0052	0.4100	0.0029
2	0.5455	0.0037	0.6035	0.0026	0.4053	0.0029
3	0.5490	0.0009	0.6070	0.0009	0.4105	0.0018
4	0.5585	0.0010	0.6085	0.0013	0.4070	0.0058
5	0.5475	0.0078	0.6040	0.0036	0.4027	0.0006
6	0.5490	0.0024	0.6125	0.0039	0.4055	0.0013
7	0.5405	0.0047	0.6118	0.0026	0.4058	0.0047
8	0.5516	0.0042	0.6104	0.0014	0.4058	0.0008
9	0.5478	0.0031	0.6099	0.0018	0.4136	0.0012
Avg	0.5483	0.0035	0.6087	0.0026	0.4073	0.0024
Standard Deviation	0.0049		0.0033		0.0034	
Certified	0.548		0.610		0.409	
Uncertainty	0.004		0.004		----	

Sulfur

Lab	CSN 2-2	sW	ECRM 186-1	sW	NIST SRM 32e	sW
1	0.0289	0.0006	0.0347	0.0011	0.0200	0.0008
2	0.0286	0.0010	0.0340	0.0023	0.0190	0.0013
3	0.0293	0.0007	0.0355	0.0002	0.0208	0.0005
4	0.0278	0.0010	0.0335	0.0006	0.0190	0.0000
5	0.0280	0.0001	0.0346	0.0002	0.0185	0.0002
6	0.0285	0.0005	0.0377	0.0009	0.0204	0.0004
7	0.0278	0.0009	0.0355	0.0010	0.0209	0.0003
8	0.0286	0.0006	0.0343	0.0007	0.0204	0.0006
9	0.0287	0.0005	0.0354	0.0010	0.0204	0.0004
Average	0.0284	0.0007	0.0350	0.0009	0.0199	0.0005
Standard Deviation	0.0005		0.0012		0.0009	
Certified	0.028		0.035		0.021	
Uncertainty	0.001		0.002		----	

Nitrogen

Lab	CSN 2-2	sW	NIST SRM 343a	sW	ECRM 292-1	sW
2	0.0787	0.0017	0.0816	0.0015	0.0652	0.0023
4	0.0740	0.0000	0.0815	0.0013	0.0628	0.0010
5	0.0752	0.0001	0.0785	0.0004	0.0648	0.0002
6	0.0753	0.0010	0.0778	0.0010	0.0648	0.0005
7	0.0750	0.0002	0.0780	0.0002	0.0646	0.0002
8	0.0751	0.0003	0.0780	0.0005	0.0641	0.0002
9	0.0763	0.0014	0.0786	0.0008	0.0656	0.0004
10	0.0780	0.0012	0.0810	0.0012	0.0653	0.0005
Average	0.0759	0.0007	0.0794	0.0009	0.0646	0.0006
Standard Deviation	0.0016		0.0017		0.0009	
Certified	0.076		0.078		0.064	
Uncertainty	0.0013		----		0.0012	

sW = within laboratory standard deviation

Some of the participating laboratories were:

Allegheny Ludlum Steel Corp., Brackenridge, Pennsylvania
Bruce Boyles, John E. Begovich

Allegheny Ludlum Steel Corp., Lockport, New York
P. Widmer, G. Reinig

Brammer Standard Company, Houston, Texas
Richard Beaumont

Jessop Steel Company, Washington, Pennsylvania
Signa Fegley

LTV Steel Company, Indiana Harbor Works, E. Chicago, Indiana
John Hlebek

Republic Engineered Steels, Canton, Ohio
Chris Stefan, Sherry Stroup

The Timken Company, Harrison Steel Plant, Canton, Ohio
Doug Gapen, David Leatherbarrow, D. A. Wolfe

The Timken Company, Faircrest Steel Plant, Canton, Ohio
Jeff Noice, Barb Hykes

VacAir Alloys Corporation, Frewsburg, New York
Michele Shaver, Jeffrey Ohman

Source: The material for this reference material was melted and fabricated into wire by the Carpenter Technology Corporation in Reading, Pennsylvania. The wire was processed into pins by SKF Bearing Industries Company in Bremen, Indiana.

A Material Safety Data Sheet (MSDS) is not required for this material. This material will not release or otherwise result in exposure to a hazardous chemical, under normal conditions of use. Inquires concerning this Reference Material should be directed to:

Brammer Standard Co., Inc.
14603 Benfer Road
Houston, Texas 77069 USA

Phone: (281) 440-9396
Fax: (281) 440-4432

Certified by: G. R. Brammer _____ on August 18, 1993.

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