

National Bureau of Standards Certificate of Analysis

Standard Reference Material 368

Steel (AISI 1211)

(In Cooperation with the American Society for Testing and Materials)

This Standard is in the form of chips sized between 0.50 and 1.18 mm sieve openings (35 and 16 mesh). It is intended for use primarily in chemical methods of analysis.¹

Constituent	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	N
Certified Value, % by wt. ²	0.089	0.82	0.084	0.132	0.007	0.010	0.008	0.030	0.001	0.003	0.010
Estimated Uncertainty ³	0.002	0.01	0.002	0.003	0.002	0.002	0.001	0.002	-	0.001	0.001
Method Lab	Combustion - Infrared	Peroxydisulfate Arsenite	Photometric	Combustion - Infrared	Photometric	Photometric	Photometric	Photometric		Photometric	
1	0.089	0.83	0.086	0.132	^a 0.005	^b 0.008	^c 0.008	^d 0.031	^e < 0.001	-	-
2	.089	.83	.085	.133	.007	.010	.007	^f .030	^g < .001	0.002	^h 0.010
3	.092	.82	.085	{ .132 } { .131 }	^a .008	^k .012	.010	^f .026	^k .001	.004	.007
4	.086	.82	.082	{ .135 } { .137 }	.010	^b .010	{ .006 } { .007 }	{ ^f .031 } { ^k .029 }	^k .002	{ .002 } { .003 }	^h .010
5	{ .089 } { .091 }	.83	{ .082 } { .081 }	.129	.005	^m .010	^k .008	ⁿ .030	^o .001	.003	^p .010
6	.087	.82	.079	.131	^q .005	^r .009	^s .007	^t .031	^g .002	.003	^h .010

¹ This material also is to be made available in the form of disks, SRM 1221, 32 mm (1 1/4 in) in diameter and 19 mm (3/4 in) thick for optical emission and x-ray spectrometric methods of analysis.

² The certified value listed for a constituent is the *present best estimate* of the "true" value based on the results of the cooperative program for certification.

³ The estimated uncertainty listed for a constituent is based on judgment and represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material variability for samples 1.0 g or more. (No attempt was made to derive exact statistical measures of imprecision because several methods were involved in the analysis of most constituents).

^a Double dehydration with HClO₄.

^b Diethyldithiocarbamate photometric method.

^c Ether extraction of iron-dimethylglyoxime gravimetric.

^d NaHCO₃ hydrolysis - (NH₄)₂S₂O₈ oxidation - Fe(NH₄)₂(SO₄)₂ titration.

^e NaHCO₃ hydrolysis - HNO₃ oxidation - Fe(NH₄)₂(SO₄)₂ titration.

^f Diphenylcarbazide photometric.

^g Phenylbenzohydroxamic acid photometric.

^h Inert gas fusion - thermal conductivity.

ⁱ Alkalimetric method.

^j Combustion-iodate titration method.

^k Atomic absorption.

^l Combustion-thermal conductivity.

^m Neocuproine photometric.

ⁿ HClO₄ oxidation - Fe(NH₄)₂(SO₄)₂ - KMnO₄.

^o Mercury cathode - HNO₃ oxidation - Fe(NH₄)₂(SO₄)₂ - KMnO₄.

^p Kjeldahl distillation - titration.

^q Double dehydration with H₂SO₄.

^r Thioisulfate - iodide titration.

^s Dimethylglyoxime gravimetric.

^t (NH₄)₂S₂O₈ oxidation - Fe(NH₄)₂(SO₄)₂ - K₂Cr₂O₇.

PLANNING, PREPARATION, TESTING, ANALYSIS: The material for this standard was provided by the Lorain, Ohio Works, United States Steel Corporation, courtesy of R. H. Colin.

Homogeneity testing of the key elements carbon and sulfur was performed at NBS by S. A. Wicks. The material variability was determined to be within the method imprecision.

Cooperative analyses for certification were performed in the following laboratories:

Inland Steel Company, Indiana Harbor Works, East Chicago, Indiana; J. E. Joyce.

National Bureau of Standards, Analytical Chemistry Division, Washington, D.C.; S. A. Wicks, Tsai S. M. Lee, Visiting Scientist, Instituto de Pesquisas Tecnológicas, São Paulo, Brazil; and R. K. Bell, ASTM Assistant Research Associate.

Republic Steel Corporation, Central Alloy Division, Canton, Ohio; R. W. Jones.

Sharon Steel Corporation, Sharon, Pa.; N. J. Williams

Timken Company, Canton, Ohio; V. M. Chapman

United States Steel Corporation, Research Laboratory, Monroeville, Pa.; J. D. Selvaggio, J. B. Feron, H. R. Frisbie, D. T. Glaser, F. T. Hornak and H. S. Karp.

The overall coordination of the technical measurements leading to certification were performed under the direction of J. I. Shultz, Research Associate, ASTM-NBS Research Associate Program.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R. E. Michaelis.