



# National Institute of Standards & Technology

## Certificate of Analysis

### Standard Reference Material<sup>®</sup> 33e

#### Nickel Steel

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

This Standard Reference Material (SRM) is in the form of chips sized between 0.50 and 1.18 mm sieve openings (35 and 16 mesh). SRM 33e is intended primarily for use in chemical methods of analysis.

Element	Analysts					Certified Value <sup>1</sup> (Wt %)	Estimated Uncertainty <sup>2</sup>
	1	2	3	4	5		
Carbon	0.186	0.190	0.184	0.185	0.187	0.186	0.004
Manganese	0.528 <sup>a</sup>		0.526	0.528	0.521 <sup>b</sup> 0.523	0.525	0.005
Phosphorus	0.005				0.005	0.005	0.001
Sulfur	0.009	0.010	0.010	0.009	0.009	0.009	0.001
Silicon	0.262		0.264	0.262	0.260	0.262	0.002
Copper	0.070 <sup>a</sup>		0.071 <sup>c</sup>		0.069 <sup>d</sup>	0.070	0.001
Nickel	3.34		3.34	3.41	3.37	3.36	0.04
Chromium	0.068 <sup>a</sup>		0.070 <sup>e</sup>		0.067 <sup>f</sup>	0.068	0.002
Molybdenum	0.222 <sup>a</sup>		0.220 <sup>g</sup>		0.230 <sup>h,i</sup>	0.224	0.006
Aluminum	0.030 <sup>a</sup>		0.031 <sup>c</sup>		0.028 <sup>j</sup>	0.030	0.002

<sup>1</sup>The certified value listed for the constituent is the *present best estimate* of the "true" value based on the results of the cooperative program for certification.

<sup>2</sup>The estimated uncertainty listed for the constituent is based on judgment and represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material variability of samples of 0.5 g or more. (No attempt was made to derive exact statistical measures of imprecision because several methods were involved in the determination of most constituents.)

*This Certificate of Analysis has undergone editorial review to reflect program and organizational changes at NIST and the Department of Commerce. No attempt has been made to reevaluate the certificate values or any other technical data presented on this certificate.*

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

The technical and support aspects involved in the original preparation, certification, and issuance of this SRM were coordinated through the Office of Standard Reference Materials Program by W.P. Reed. Revision of this certificate was coordinated through the Standard Reference Materials Program by P.A. Lundberg.

Gaithersburg, MD 20899  
March 15, 1995  
(Revision of Certificate dated 11-26-84)

Thomas E. Gills, Chief  
Standard Reference Materials Program

(over)

## METHODS/TECHNIQUES

Combustion Infrared - Carbon, Sulfur  
Persulfate - Arsenite  
Photometric - Phosphorus  
Perchloric Acid Dehydration - Silicon  
Gravimetric - Nickel

- <sup>a</sup> Atomic absorption
- <sup>b</sup> Sodium bismuthate oxidation-arsenite titration
- <sup>c</sup> Optical emission spectroscopy
- <sup>d</sup> Neocuproine spectrophotometric method
- <sup>e</sup> Chromium separated from the bulk of the iron in a 10 g sample by NaHCO<sub>3</sub> hydrolysis, oxidized with peroxydisulfate and titrated potentiometrically with ferrous ammonium sulfate solution
- <sup>f</sup> HClO<sub>4</sub> oxidation-Fe (NH<sub>4</sub>)<sub>2</sub> (SO<sub>4</sub>)<sub>2</sub>-KMnO<sub>4</sub> titration
- <sup>g</sup> Alpha-benzoinoxime gravimetric method
- <sup>h</sup> Spectrophotometric method
- <sup>i</sup> Same value obtained by gravimetric method
- <sup>j</sup> Mercury cathode-8 hydroxyquinoline

## PLANNING, PREPARATION, TESTING, ANALYSIS

The material for this standard was provided by The Timken Company, Canton, OH, through the courtesy of V.R. Chapman. Homogeneity testing was performed at the National Institute of Standards and Technology by J.A. Norris, optical emission analysis; D.E. Brown, and B.I. Diamondstone, chemical analysis, Analytical Chemistry Division and by R.K. Bell, ASTM/NIST Research Associate Program.

Cooperative analyses for certification were performed in the following laboratories:

Amax Metals Group, Research Laboratory, Ann Arbor, MI, R.C. Binns.

LTV Steel, Warren, OH, I. Shepler.

National Institute of Standards & Technology, Analytical Chemistry Division, Gaithersburg, MD, D.E. Brown, B.I. Diamondstone, and R.K. Bell, ASTM/NIST Research Associate Program.

Standard Steel Co., Burnham, PA, J. Arp.

The Timken Co., Canton, OH, N.J. Stecyk

Elements other than those certified may be present in this material as indicated below. These are *not certified*, but are given as additional information on the composition.

<u>Element</u>	<u>Concentration,</u> <u>Wt %</u>
Co	(0.06)
Ti	(0.001)
Sn	(0.002)
Zr	(0.001)
V	(0.001)