



# National Institute of Standards & Technology

## Certificate of Analysis

### Standard Reference Material 1767

#### Low Alloy Steel

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

This Standard Reference Material (SRM) is in the form of a disk, approximately 34 mm (1 3/8 in) in diameter and 19 mm (3/4 in) thick, and is intended for use in optical emission and X-ray spectrometric methods of analysis.

<u>Element</u>	<u>Certified Value<sup>1</sup></u> <u>% by Wt.</u>	<u>Estimated<sup>2</sup></u> <u>Uncertainty</u>
Carbon	0.052	0.003
Manganese	0.022	0.001
Phosphorus	0.0031	0.0002
Sulfur	0.0090	0.0003
Silicon	0.026	0.003
Copper	0.0014	0.0002
Nickel	0.002	0.001
Chromium	0.0015	0.0005
Vanadium	0.033	0.001
Molybdenum	0.020	0.001
Titanium	0.011	0.001
Cobalt	0.0050	0.0002
Tin	0.006	0.001
Aluminum	0.004	0.001
Niobium	0.010	0.001
Arsenic	0.0005	0.0002
Antimony	0.0020	0.0005
Silver	0.0008	0.0001
Boron	0.0010	0.0001
Nitrogen	0.0008	0.0002

<sup>1</sup>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.

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

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

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Standard Reference Materials Program by P. A. Lundberg.

Gaithersburg, MD 20899

June 9, 1993

(Revision of certificate dated 2-26-1993)

William P. Reed, Chief  
Standard Reference Materials Program

SUPPLEMENTAL INFORMATION

Atomic emission and X-ray spectrometric homogeneity test results showed the following standard deviations of the mean ( $1\sigma$ ) for this SRM. Values are given in percent. These standard deviations are attributed to both material and instrumental variability and are method specific.

Standard Deviation of the Mean

<u>Element</u>	<u>Atomic Emission</u> <sup>3</sup>	<u>X-ray</u> <sup>4</sup>
Carbon	0.00235	---
Manganese	0.00036	0.0013
Phosphorus	0.00057	0.0006
Sulfur	0.00040	0.0004
Silicon	0.00055	0.0033
Copper	0.0012	0.00023
Nickel	0.00081	0.00015
Chromium	0.00056	0.00057
Vanadium	0.00057	0.0002
Molybdenum	0.00037	0.00040
Cobalt	0.00029	0.0006
Titanium	0.00034	0.0001
Aluminum	0.0011	0.00086
Tin	0.0034	---
Zirconium	0.00067	0.00023
Niobium	0.00057	0.00053
Boron	0.000077	---

<sup>3</sup>ASTM Method E415-85.

<sup>4</sup>ASTM Method E322-67 (1985).

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, % by Wt.</u>
Zirconium	(0.004)
Bismuth	(<0.0001)
Lead	(<0.0001)
Magnesium	(<0.0001)
Tellurium	(0.0003)
Calcium	(0.0003)
Tantalum	(0.002)

PLANNING, PREPARATION, TESTING, ANALYSIS

The material for this standard was vacuum induction melted followed by vacuum arc remelting at the Carpenter Technology Corporation, Reading, PA, under a contract with the NIST. The ingots were processed by Carpenter Technology Corporation to provide material of high homogeneity.

Following acceptance of the composition based on analyses at NIST, selected portions of the ingot material were extensively tested for homogeneity at NIST by J.A. Norris and D.E. Brown. Only that material meeting a critical evaluation was processed to the final size. The final material was tested for homogeneity by atomic emission and X-ray spectrometry at NIST.

Cooperative analyses for certification were performed in the following laboratories:

Allegheny Ludlum Steel Corporation, Technical Center, Brackenridge, PA, W.D. Heavner, C.C. Gabrielli and J.L. Powell.

Analytical Associates, Inc., Detroit, MI, C.K. Deak.

Bethlehem Steel Corporation, Sparrows Point, MD, P. Sells.

General Motors Research Laboratories, Warren, MI, N.M. Potter, M.P. Balogh, and R.L. Passeno.

National Steel Corporation, Granite City Division, Granite City, IL, B. McKee and D. Schmidt.

National Institute of Standards & Technology, Inorganic Analytical Research Division, R.W. Burke, L.E. Creasy, W.F. Koch, A.F. Marlow, P.A. Pella, M.V. Smith, T.W. Vetter, Xie Guirong, and Xu Fu Zheng.

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

Central Bureau for Nuclear Measurements, Geel, Belgium, A. Lamberty, L. Van Nevel, and P. DeBievre.

Note: Data for nitrogen was provided by AISI's Technical Committee on Chemical Analysis, courtesy of D.E. Gillum, ARMCO Research Technology.

The following laboratories participated in the testing program:

Acme Steel Company, Riverdale, IL, V. Beaucaire, D. Bekeza.

Algoma Steel Corporation, Sault Ste. Marie, Ontario, Canada, J. DeJong, J. Gale.

Armco Research & Technology, Middletown, OH, D.E. Gillum, T. Minor.

Armco Steel Company, Ashland, KY, R. Peterson, G. Richardson, E. Cornelly, T. Scherer.

Bethlehem Steel Corporation, Steelton, PA, D. Vares.

Lukens Steel, Coatesville, PA, J. Morris, S. Forese.

Mc Louth Steel, Trenton, MI, M. Wiers, D. Robillard.

Inland Steel, East Chicago, IN, R. Hawkins.

Wheeling-Pittsburgh Steel, Steubenville, OH, B. Fazio, G. Wayt.

Dofasco Steel, Hamilton, Ontario, Canada, R. Dalrymple, K. Barker.