

National Bureau of Standards

Certificate of Analysis

Standard Reference Material C2423a

Ductile Iron

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

This Standard Reference Material (SRM) is in the form of a disk, approximately 32mm (1 1/4 in) in diameter and 19mm (3/4 in) thick, intended for use in optical emission and x-ray spectrometric methods of analysis.

Constituent	Certified Value ¹ Percent by Weight	Estimated ² Uncertainty
Carbon	3.66	0.04
Manganese	0.91	.02
Phosphorus	.246	.006
Sulfur	(<.001)	---
Silicon	1.59	.03
Copper	1.61	.05
Nickel	0.147	.005
Chromium	.322	.008
Vanadium	.043	.003
Molybdenum	.159	.009
Magnesium	.076	.005
Cerium	.031	.004
Lanthanum	.0042	.0006
Titanium	.10	.01

¹The 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.

²The 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. (No attempt was made to derive exact statistical measures of imprecision because several methods were involved in the determination of most constituents.)

NOTE: The sulfur value given in parenthesis is not certified, but provided for information only. The concentration level of sulfur is an estimate of what may be expected in this material.

METALLURGICAL CONDITION: The specimens were chill cast by a rapid unidirectional solidification technique.

CERTIFIED PORTION: The certified portion for each specimen is that extending upward 16 mm (5/8 in) from the chill cast or test surface (the largest surface opposite the numbered surface). Only this portion was analyzed in the cooperative program for certification.

The overall coordination of the technical measurements leading to certification was 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 W.P. Reed.

PLANNING, PREPARATION, TESTING, ANALYSIS

The material for this standard was provided and prepared by the American Cast Iron Pipe Company, Birmingham, Ala. A water-cooled, copper plate mold assembly was used in the preparation of the chill castings.

Extensive homogeneity testing was performed at the National Bureau of Standards by optical emission analysis, J.A. Norris, Inorganic Analytical Research Division and by R.K. Bell, ASTM-NBS Research Associate Program.

Cooperative analyses for certification were performed in the following laboratories:

American Cast Iron Pipe Co., Birmingham, Ala., R.N. Smith, J.B. Hobby, L.J. Moore, D.R. Denney and R.G. Moffett.
Allegheny Ludlum Steel Corp., Research Center, Brackenridge, Pa., W.D. Heavner.

Armco Inc., Research and Technology, Middletown, Ohio, C.C. Borland, D.E. Gillum and H.P. Vail.

General Motors Research Laboratories, Warren, Mich., N. Potter and P.M. Hanley.

Inland Steel Co., Indiana Harbor Works, East Chicago, Ind., D.E. Smith.

Interlake, Inc., Globe Metallurgical Division, Beverly, Ohio, J.C. Cline and R. Pontello.

Interlake, Inc., Riverdale Plant, Riverdale, Ill., R.E. Nelson.

National Bureau of Standards, Inorganic Analytical Research Division, T.W. Vetter, B.I. Diamondstone, and by R.K. Bell, ASTM-NBS Research Associate Program.

University of Gent, Belgium, R. Dams and C. Vandecasteele.

Wagner Castings Co., Decatur, Ill., T.L. Ross.

CAUTIONS:

1. Determinations made on other than the chill-cast surface or test surface are not recommended because of the uni-directional solidification structure.
2. This chill-cast SRM is designed for calibration in the analysis of samples prepared in the same general manner; samples prepared by other casting techniques, or having different metallurgical condition, may exhibit a bias in the results.

Additional elements were determined in the cooperative analytical program. Although NOT CERTIFIED, the approximate values are given below:

<u>Element</u>	<u>Percent by Weight</u>
Aluminum	(0.08)
Boron	(0.01)
Cobalt	(0.02)