U. S. Department of Commerce
Frederick B. Dent
Secretary
National Bureau of Standards
Richard W. Roberts, Director

National Bureau of Standards Certificate of Analysis

Standard Reference Materials 1140a, 1141a, 1142a

Ductile Iron Standards

SRM No.	1140a Ductile Iron 1	1141a Ductile Iron 2	1142a Ductile Iron 3
Element	Percent by Weight		
Carbon	3.34	2.98	2.72
Manganese	0.74	0.53	0.17
Phosphorus	.015	.070	.18
Sulfur	.013	.013	.015
Silicon	2.12	1.22	3.19
Copper	0.089	0.212	1.02
Nickel	$.04_8$	.57	1.6_9
Chromium	.034	$.15_0$	0.051
Vanadium	.034	.010	.004
Molybdenum	$.15_3$	$.05_2$	$.02_2$
Titanium	.13	.012	.007
Aluminum	(.014)[a]	(.013)	(.088)
Arsenic	.080	.03	(.01)
Magnesium	.017	$.04_2$	$.11_6$
Cerium	(.06)	(.04)	(.02)
Yttrium	(<.002)	.040	$.01_2$
Lead	(.013)	(.0004)	(.0003)
Bismuth	(.003)	(.00006)	(.00002)

[a] Values in parenthesis are not certified but are provided for additional information on the composition.

SIZE AND METALLURGICAL CONDITION: Samples are approximately 32 mm (1 1/4 in) square and 13 mm (1/2 in) thick; they were chill- cast by a rapid unidirectional solidification technique.

CERTIFIED PORTION: The certified portion for each sample is that extending upward 8 mm (5/16 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.

CERTIFICATION: The value listed for an element is the best estimate of the "true" value based on the results of the cooperative analytical program. The value listed is not expected to deviate from the "true" value by more than ±1 in the last significant figure reported; for a subscript figure, the deviation is not expected to be more than ±5. Based on the results of homogeneity testing, maximum variations within and among samples are estimated to be less than the uncertainty figures given above.

Washington, D. C. 20234
September 15, 1973

J. Paul Cali, Chief
Office of Standard Reference Materials

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PLANNING, PREPARATION, TESTING, ANALYSIS: The three ductile iron standards are made available as a result of the cooperative program between the National Bureau of Standards and the American Cast Iron Pipe Company. The standards were developed at the request of the Ductile Iron Society and the American Foundrymen's Society.

The material for the standards was melted and cast at the American Cast Iron Pipe Company, Birmingham, Alabama, with use of the NBS chill-cast mold assembly. The preparation and homogeneity testing was similar to that described in NBS Misc. Publ. 260-1, Standard Reference Materials: Preparation of NBS White Cast Iron Spectrochemical Standards, Robert E. Michaelis and LeRoy L. Wyman, June 19, 1964.

Homogeneity testing was performed at NBS by D. M. Bouchette and was found to be satisfactory for the elements certified.

Cooperative analyses for certification were performed at the American Cast Iron Pipe Company, Birmingham, Alabama, by I. Glaze, J. B. Hobby, W. R. Kennedy, and R. N. Smith; and Clow Corporation, Coshocton, Ohio, by J. R. Boyd.

Analyses were performed in the NBS Analytical Chemistry Division by J. R. Baldwin, D. M. Bouchette, M. M. Darr, E. L. Garner, P. D. LaFleur, G. J. Lutz, E. J. Maienthal, M. Margoshes, L. T. McClendon, T. J. Murphy, T. C. Rains, S. D. Rasberry, T. A. Rush, B. A. Thompson, and J. L. Weber, Jr.

Technical measurements performed at NBS for final certification were coordinated by J. I. Shultz and J. L. Weber, Jr. under the chairmanship of B. F. Scribner.

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

CAUTIONS:

1. Determinations made on other than the chill-cast or test surface are not recommended because of the unidirectional solidification structure.

2. These chill-cast standards are designed for calibration in the analysis of samples prepared in the same manner; samples prepared by other casting techniques or having other than a white structure may result in considerable bias.

3. Because the samples exhibit a change with respect to the columnar structure, both among standards and from bottom to tope of the certified portion of the samples, the surface preparation for x-ray spectroscopic analysis may be critical. (A metallographic polishing technique is recommended).

4. Because of the poor heat conductivity of the ductile irons, difference in volatility rates for certain elements in emission spectroscopic analysis may occur depending on the location of the burn and the source parameters.