National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1763b

Low Alloy Steel
(disk form)

This Standard Reference Material (SRM) is low alloy steel intended primarily for evaluation of methods for analysis of elements in low alloy steel and materials of similar matrix. It can be used to validate value assignment of in-house reference materials. A unit of SRM 1763b consists of a disk approximately 34 mm in diameter and 19 mm thick.

Certified Mass Fraction Values: Certified values for constituents in SRM 1763b are listed in Table 1 as mass fractions of the total amounts of the elements in a steel matrix [1]. A NIST-certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been taken into account [2]. A certified value is the present best estimate of the true value. The certified values are metrologically traceable to the SI derived unit of mass fraction expressed as percent. The expanded uncertainty estimates are expressed at a coverage level of approximately 95 %, using a coverage factor $k = 2.00$ [3,4].

Table 1. Certified Mass Fraction Values in SRM 1763b Low Alloy Steel

Constituent	Mass Fraction (%)	Expanded Uncertainty (%)
Aluminum (Al)	0.0422	0.0044
Antimony (Sb)	0.0110	0.0012
Arsenic (As)	0.0539	0.0010
Boron (B)	0.00535	0.00032
Carbon (C)	0.201	0.023
Cobalt (Co)	0.09248	0.00056
Chromium (Cr)	0.5039	0.0063
Copper (Cu)	0.04170	0.00058
Manganese (Mn)	1.605	0.034
Molybdenum (Mo)	0.491	0.015
Niobium (Nb)	0.0998	0.0026
Nickel (Ni)	0.5075	0.0020
Phosphorus (P)	0.01233	0.00049
Silicon (Si)	0.6275	0.0030
Sulfur (S)	0.0229	0.0024
Tantalum (Ta)	0.0119	0.0011
Tin (Sn)	0.01098	0.00083
Titanium (Ti)	0.313	0.016
Tungsten (W)	0.00216	0.00017
Vanadium (V)	0.3075	0.0042
Zirconium (Zr)	0.0445	0.0057

Expiration of Certification: The certification of **SRM 1763b** is valid indefinitely, within the measurement uncertainty specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Storage, Handling and Use"). Periodic recalibration or recertification of this SRM is not required. The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

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Gaithersburg, MD 20899
Certificate Issue Date: 15 March 2019

Steven J. Choquette, Director
Office of Reference Materials

Maintenance of SRM Certification: NIST will monitor this material over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

INSTRUCTIONS FOR STORAGE, HANDLING AND USE

The test surface is the side opposite to the labeled surface, which includes the SRM number. The entire thickness of the unit is certified. However, the user is cautioned not to measure disks less than 2 mm thick when using X-ray fluorescence spectrometry. Each packaged disk has been prepared by finishing the test surface using a milling machine. The user must determine the correct surface preparation procedure for each analytical technique. The user is cautioned to use care when either resurfacing the disk or performing additional polishing as these processes may contaminate the surface. It was found by NIST that abrasive paper must be changed frequently during surface grinding. Used paper loses its ability to remove contaminants from the surface of the steel. When not in use, the material should be stored in its original container in a cool, dry location. This material was tested using both the solid disks and chips prepared from the disks.

PREPARATION AND ANALYSIS[(1)]

The material for SRM 1763b was vacuum induction melted at Carpenter Technology Corp. (Reading, PA) and supplied in the form of rods. The material was sliced and packaged at NIST by the NIST Office of Reference Materials. Homogeneity testing was performed at NIST using X-ray fluorescence spectrometry.

Coordination of technical measurements for the certification of this SRM was performed by J.R. Sieber of the NIST Chemical Sciences Division. Statistical consultation for this SRM was provided by J.H. Yen of the NIST Statistical Engineering Division. Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

Measurements for value assignment of SRM 1763b were performed by A.F. Marlow, R.L. Paul and J.R. Sieber of the NIST Chemical Sciences Division. Additional analyses were performed by L. Dilks of Laboratory Testing, Inc. (Hatfield, PA). The test methods employed are listed in Table 3.

For each constituent, the certified value is the mean of the available method estimates. Each method estimate is the mean of the measurements available for that element. The uncertainty of each method mean is the standard error of that mean. The expanded uncertainty of each certified value was estimated using a bootstrap procedure based on a Gaussian random effects model for the between-method effects [4–6]. For As, Mn, Mo, Nb, and V, the uncertainty incorporates an additional uncertainty component for possible inhomogeneity based on the standard deviation of the NIST X-ray fluorescence measurements.

ADDITIONAL CONSTITUENTS: Noncertified values are provided for the following additional constituents in SRM 1763b.

Information Mass Fraction Value: An information value for iron is reported in Table 2 as the mass fraction of total Fe a steel matrix. The value reported is an estimate based on technical evaluation of the results reported from one test method. An information value is a value that may be of interest to the SRM user, but insufficient information is available to assess the uncertainty associated with the value. Information values cannot be used to establish metrological traceability.

Table 2. Information Mass Fraction Value for SRM 1763b Low Alloy Steel

Constituent	Mass Fraction (%)
Iron (Fe)	95.0

[(1)] Certain commercial organizations, services, equipment, or materials are identified in this certificate to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the NIST, nor does it imply that the organizations, services, materials, or equipment identified are necessarily the best available for the purpose.

Table 3. Test Methods for SRM 1763b Low Alloy Steel

Method	Constituents Determined
Arc-spark optical emission spectrometry:	B, C, Al, Si, P, S, Ti, V, Cr, Mn, Co, Ni, Cu, As, Zr, Nb, Mo, Sn, Sb, Ta, W
Thermal neutron prompt gamma-ray activation analysis:	B
X-ray fluorescence spectrometry:	B, C, Al, Si, P, S, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, As, Zr, Nb, Mo, Sn, Sb, Ta, W

NOTICE TO USERS

NIST strives to maintain the SRM inventory supply, but NIST cannot guarantee the continued or continuous supply of any specific SRM. Accordingly, NIST encourages the use of this SRM as a primary benchmark for the quality and accuracy of the user's in-house reference materials and working standards. As such, the SRM should be used to validate the more routinely used reference materials in a laboratory. Comparisons between the SRM and in-house reference materials or working measurement standards should take place at intervals appropriate to the conservation of the SRM and the stability of relevant in-house materials. For further guidance on how this approach can be implemented, contact NIST by email at srms@nist.gov.

REFERENCES

[1] Thompson, A.; Taylor, B.N.; Guide for the Use of the International System of Units (SI); NIST Special Publication 811; U.S. Government Printing Office: Washington, DC (2008); available at https://www.nist.gov/pml/pubs/sp811/index.cfm (accessed Mar 2019).

[2] May, W.; Parris, R.; Beck II, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; Definition of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements; NIST Special Publication 260-136 U.S. Government Printing Office: Washington, DC (2000); available at https://www.nist.gov/srm/upload/SP260-136.PDF (accessed Mar 2019).

[3] JCGM 100:2008; Evaluation of Measurement Data - Guide to the Expression of Uncertainty in Measurement; (GUM 1995 with Minor Corrections), Joint Committee for Guides in Metrology (JCGM) (2008); available at https://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Mar 2019); see also Taylor, B.N.; Kuyatt, C.E.; Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at https://www.nist.gov/pml/nist-technical-note-1297 (accessed Mar 2019).

[4] JCGM 101:2008; Evaluation of Measurement Data – Supplement 1 to the Guide to the Expression of Uncertainty in Measurement – Propagation of Distributions Using a Monte Carlo Method; Joint Committee for Guides in Metrology (JCGM) (2008); available at https://www.bipm.org/utils/common/documents/jcgm/JCGM_101_2008_E.pdf (accessed Mar 2019).

[5] Efron, B.; Tibshirani, R.J.; An Introduction to the Bootstrap; Chapman & Hall (1993).

[6] Searle, S. R.; Casella, G.; McCulloch, C.E.; Variance Components; John Wiley & Sons, Hoboken, NJ (2006).

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at https://www.nist.gov/srm.