**Brammer Standard Company, Inc.**

# Certificate of Analysis

## REVISION of BS 263

**Reference Material for Specialty Nickel Base Alloy Number 263**

| | Certified Value[1] | Estimate of Uncertainty[2] | Information Values[3] | |
|---|---|---|---|---|
| | | **Analysis listed as percent by weight** | | |
| **C** | **0.071** | 0.003 | *B* | *0.001* |
| **Mn** | **0.36** | 0.02 | *Zr* | *0.002* |
| **P** | **0.005** | 0.002 | *Ni* | *50.65* |
| **S** | **<0.002** | | | |
| **Si** | **0.28** | 0.02 | | |
| **Cu** | **0.024** | 0.003 | | |
| **Cr** | **19.84** | 0.08 | | |
| **Fe** | **0.47** | 0.02 | | |
| **Al** | **0.38** | 0.01 | | |
| **Co** | **19.92** | 0.10 | | |
| **Mo** | **5.70** | 0.08 | | |
| **Nb** | **0.04** | 0.01 | | |
| **W** | **0.24** | 0.01 | | |
| **Ti** | **2.21** | 0.05 | | |
| **V** | **0.004** | 0.01 | | |

[1] The certified value listed is the present best estimate of the true value based on the results of a second interlaboratory testing program.

[2] The uncertainties listed are based on value judgments of the material inhomogeneity and the 95% confidence interval. The half-width confidence interval C(95%) is shown on page 2.

[3] Information values are not certified and are provided for information only.

See reverse side for more information.

**Certificate Number REV-263-012601p1**

**Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069-2895**
**Telephone (281) 440-9396 Fax (281) 440-4432**

| Analysis | * | C | * | Mn | * | P | * | S | * | Si | * | Cu | * | Cr | * | Fe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | C | 0.0688 | AA | 0.35 | AIC | 0.0040 | C | <0.0001 | AES | 0.256 | AIC | 0.019 | XRF | 19.75 | AIC | 0.439 |
| 2 | C | 0.0703 | XRF | 0.35 | AIC | 0.004 | C | <0.002 | AIC | 0.262 | AIC | 0.023 | TCr | 19.75 | AIC | 0.45 |
| 3 | C | 0.071 | AIC | 0.35 | XRF | 0.0052 | C | 0.0002 | AES | 0.265 | AIC | 0.023 | AIC | 19.77 | AIC | 0.46 |
| 4 | C | 0.0718 | AA | 0.35 | AIC | 0.006 | C | 0.0004 | GSi | 0.266 | AIC | 0.0237 | AIC | 19.79 | AIC | 0.468 |
| 5 | C | 0.072 | AES | 0.353 | AES | 0.0072 | C | 0.00047 | AA | 0.27 | AES | 0.0239 | AES | 19.83 | AIC | 0.47 |
| 6 | | | AIC | 0.36 | | | | | AIC | 0.274 | AIC | 0.024 | TCr | 19.85 | XRF | 0.47 |
| 7 | | | AIC | 0.36 | | | | | AIC | 0.295 | AA | 0.0254 | TCr | 19.86 | AGX | 0.474 |
| 8 | | | AIC | 0.36 | | | | | AIC | 0.30 | AA | 0.026 | TCr | 19.88 | AIC | 0.475 |
| 9 | | | AIC | 0.367 | | | | | AIC | 0.30 | AIC | 0.031 | XRF | 19.896 | AA | 0.476 |
| 10 | | | AIC | 0.367 | | | | | AIC | 0.31 | | | TCr | 19.90 | AIC | 0.48 |
| 11 | | | AGX | 0.373 | | | | | | | | | TCr | 19.94 | AES | 0.492 |
| 12 | | | MnP | 0.391 | | | | | | | | | | | XRF | 0.492 |
| 13 | | | XRF | 0.395 | | | | | | | | | | | | |
| Average | | 0.0708 | | 0.364 | | 0.0053 | | | | 0.280 | | 0.0243 | | 19.838 | | 0.471 |
| Std Dev | | 0.0013 | | 0.015 | | 0.0014 | | | | 0.019 | | 0.0032 | | 0.065 | | 0.015 |
| Certified | | 0.071 | | 0.36 | | 0.005 | | <0.002 | | 0.28 | | 0.024 | | 19.84 | | 0.47 |
| t | | 2.7764 | | 2.1788 | | 2.7764 | | | | 2.2622 | | 2.306 | | 2.2281 | | 2.201 |
| C(95%) | | 0.0016 | | 0.009 | | 0.0017 | | | | 0.014 | | 0.0024 | | 0.044 | | 0.010 |
| ** Old COA | | 0.071 | | 0.38 | | 0.005 | | <0.002 | | 0.26 | | 0.029 | | 19.84 | | 0.47 |

| Analysis | * | Al | * | Co | * | Mo | * | Nb | * | W |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AIC | 0.363 | GCo | 19.82 | GMo | 5.61 | AES | 0.0302 | AIC | 0.222 |
| 2 | AIC | 0.365 | AIC | 19.85 | AIC | 5.63 | AIC | 0.031 | XRF | 0.227 |
| 3 | AA | 0.37 | XRF | 19.852 | XRF | 5.655 | AIC | 0.032 | AIC | 0.229 |
| 4 | AA | 0.37 | AIC | 19.86 | AIC | 5.66 | AIC | 0.032 | AIC | 0.23 |
| 5 | AIC | 0.37 | TCT | 19.90 | XRF | 5.67 | AIC | 0.034 | AGX | 0.232 |
| 6 | AES | 0.377 | AA | 19.90 | AGX | 5.69 | AIC | 0.034 | AIC | 0.24 |
| 7 | AIC | 0.378 | TCo | 19.94 | AIC | 5.70 | AGX | 0.037 | AIC | 0.24 |
| 8 | XRF | 0.38 | TCo | 19.97 | AIC | 5.75 | MNA | 0.038 | ADC | 0.246 |
| 9 | AIC | 0.38 | TCo | 20.04 | MM | 5.78 | MNA | 0.039 | AIC | 0.246 |
| 10 | AA | 0.38 | TCo | 20.07 | GMo | 5.78 | AIC | 0.040 | MW | 0.247 |
| 11 | AIC | 0.380 | | | GMo | 5.79 | AIC | 0.0408 | MW | 0.249 |
| 12 | ADC | 0.382 | | | | | XRF | 0.042 | XRF | 0.25 |
| 13 | XRF | 0.382 | | | | | XRF | 0.044 | AIC | 0.253 |
| 14 | ADC | 0.384 | | | | | AIC | 0.049 | | |
| 15 | AGD | 0.391 | | | | | | | | |
| Average | | 0.377 | | 19.920 | | 5.701 | | 0.0374 | | 0.239 |
| Std Dev | | 0.008 | | 0.084 | | 0.064 | | 0.0055 | | 0.010 |
| Certified | | 0.38 | | 19.92 | | 5.70 | | 0.04 | | 0.24 |
| t | | 2.1448 | | 2.2622 | | 2.2281 | | 2.1604 | | 2.1788 |
| C(95%) | | 0.004 | | 0.060 | | 0.043 | | 0.0032 | | 0.006 |
| ** Old COA | | 0.47 | | 19.96 | | 5.66 | | (0.04) | | (0.26) |

| Analysis | * | Ti | * | V | * | B | * | Zr | * | Ni |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AIC | 2.12 | AIC | 0.004 | AGD | 0.0003 | AIC | 0.0005 | EN | 50.65 |
| 2 | MT | 2.17 | AIC | 0.004 | AIC | 0.0005 | ADC | 0.0012 | | |
| 3 | MTD | 2.19 | AA | 0.004 | AIC | 0.0005 | AIE | 0.0014 | | |
| 4 | AGX | 2.20 | AIC | 0.004 | AIC | 0.0010 | AIC | 0.0030 | | |
| 5 | AIC | 2.21 | AIC | 0.0043 | AIC | 0.0013 | AIC | 0.0033 | | |
| 6 | XRF | 2.22 | AIC | 0.006 | AES | 0.00177 | | | | |
| 7 | XRF | 2.237 | | | AIC | 0.0018 | | | | |
| 8 | AIC | 2.24 | | | AIC | 0.0020 | | | | |
| 9 | AES | 2.25 | | | | | | | | |
| 10 | AIC | 2.25 | | | | | | | | |
| Average | | 2.209 | | 0.0044 | | 0.0011 | | 0.0019 | | |
| Std Dev | | 0.041 | | 0.0008 | | 0.0007 | | 0.0012 | | |
| Certified | | 2.21 | | 0.004 | | (0.001) | | (0.002) | | |
| t | | 2.2622 | | 2.5706 | | 2.3646 | | 2.7764 | | |
| C(95%) | | 0.029 | | 0.0008 | | 0.0006 | | 0.0015 | | |
| ** Old COA | | 2.25 | | (0.004) | | | | | | |

* Methods of analysis listed below.
** Original data certified on March 25, 1988.
Data in parentheses are not certified but are provided for information only.
Data listed as mass fraction expressed as percent.

*C(95%) = (t x sd)/√n The half-width confidence interval, where t is the appropriate Student's t value, sd is the interlaboratory standard deviation, and n is the number of acceptable mean values. For further information regarding the confidence interval for the certified value see ISO Guide 35:1989 section 4.*

## Methods of Analysis

| Method Code | Element | Method |
|---|---|---|
| AA | | Flame Atomic Absorption Spectrometry |
| ADC | | AES - DCP - Direct Current Plasma Spectrometry |
| AES | | AES - Spark Source Optical Emission Spectrometry |
| AGD | | AES - GD - Glow Discharge Spectrometry |
| AGX | | Glow Discharge and X-Ray Fluorescence Spectrometry average |
| AIC | | AES - ICP -Inductively Coupled Plasma Spectrometry |
| AIE | | AES - ICP -Inductively Coupled Plasma Spectrometry after ion exchange |
| C | C, S | Combustion-Infrared Absorption (ASTM E 1019) |
| EN | Ni | Electroplating |
| GCo | Co | Gravimetry, 1-nitroso2 -naphtole |
| GMo | Mo | Gravimetry, Benzolnoxime |
| GSi | Si | Gravimetry with perchloric acid |
| MM | Mo | MAS - Photometric analysis |
| MNA | Nb | MAS - Absorptionmetric determination method with (4-(2-pyridylazo))-Resorcinol |
| MnP | Mn | MAS - Periodate oxidation |
| MT | Ti | MAS - Photometric |
| MTD | Ti | MAS - Diantipyrylmethane photometric |
| MW | W | MAS - Thiocyanate-chlorpromazine hydrochloride-chloroform extraction photometric |
| TCo | Co | Titrimetry with ferricyanide |
| TCr | Cr | Persulfate oxidation, ferrous sulfate titrimetric |
| TCT | Co | Potentiometric titration |
| XRF | | X-Ray Fluorescence spectrometry |

AES = Atomic Emission Spectrometry
MAS = Molecular Absorption Spectrometry (photometric, spectrophotometric methods)

**Co-operating Laboratories:** The co-operating laboratories were:

| Laboratory | Laboratory contact |
|---|---|
| AK Steel Research, Middletown, Ohio | Howard P. Vail |
| ANAREM, Prague, Czech Republic | Karel Bičovský |
| Allegheny Ludlum Technical Center, Brackenridge, Pennsylvania | Sally Bissell-Seymour |
| Allegheny Ludlum Technical Center, Brackenridge, Pennsylvania | Shawn D. Cooper |
| Allvac, Lockport, New York | Thomas A. Herdlein |
| Allvac, Monroe, North Carolina | Patrick M. Cole |
| Brammer Standard Co., Inc., Houston, Texas | Richard P. Beaumont |
| China National Analysis Center for Iron and Steel, Beijing, China | Prof. Wang Haizhou |
| Crucible Specialty Steel, Syracuse, New York | William Mastroe |
| J. Dirats and Co., Inc., Westfield, Massachusetts | Eric E. Dirats |
| IncoTest, Huntington, West Virginia | M. G. Staley |
| LECO Corporation, St. Joseph, Michigan | Dennis Lawrenz |
| Luvak, Teakneck, New Jersey | |
| Shiva Analyticals (India) Ltd., Hoskote, Bangalore, India | Dr. T. V. Ramakrishna |
| VHG Laboratories, Inc., Manchester, New Hampshire | Julie M. McIntosh |

**Revision information**: A new interlaboratory testing program (ITP) was initiated for this material as a result of customer feedback concerning the originally certified aluminum value at 0.47%. A review of the data accumulated in 1988 for the original certificate of analysis preparation revealed that the original ITP did not meet current requirements and procedures used by Brammer Standard Company. The new ITP obtained the services of fifteen laboratories using more diversified methods including definitive methods of analysis. The new certified value for aluminum at 0.38% was the most dramatic change in analysis. The originally values certified on March 25, 1988, using data from six laboratories, are listed on page 2 at the bottom of each table.

**Certification Process**: The requirements of ISO Guide 31, ISO Guide 34, ISO Guide 35, and ASTM Standard Guides E 1724 and E 1831 were followed for the preparation of this reference material and certificate of analysis. This is a reference material as defined by ISO Guide 30.

**Analysis**: Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs in accordance with ASTM Standard Practice E 1806. The laboratories participating in the testing normally followed the requirements of ISO Guide 25 and/or ISO Standard 17025. Individual values listed on page 2 are the average of each analyst's results. Methods of analysis used were a combination of ASTM Standard Test Method E 1019 plus ICP, ICP, and AA spectrometric methods.

**Outliers:** Some outlying data was excluded from the data listed on page 2 due to technical assessment of the cooperating laboratories and statistical evaluation.

**Traceability:** The following Certified Reference Materials were used to validate the analytical data listed on page 2:
NIST SRM 349a, 865, 866, 867; BCS 310/1. Pure metals were used for calibration and/or validation by two laboratories.

**Homogeneity**: This Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. It was also examined by optical emission spectrometry and found to be compatible with the following Certified Reference Materials:
NIST SRM 1243; BS 198, 199A, 617; MBH 24X10992D, 11002F, 11005F, 14939F.

**Validity:** ISO Guide 31 states that the certification should contain an expiration date for all materials where instability has been demonstrated or is considered possible, after which the certified value is no longer guaranteed by the certifying body. Whereas this material is in a solid form and stable, no expiration date is specified.

**Source**: This material was produced by Cabot Corporation, Kokomo, Indiana. It was melted by an electric arc furnace and vacuum degassed.

**Form**: This Reference Material is in the form of a disc, approximately 50 mm in diameter and 12 mm thick.

**Use**: This Reference Material is intended for use in spark optical emission and x-ray fluorescence spectrometric methods of analysis. Refer to ISO Guide 33 for information about the use of Reference Materials.

**Certified area:** The entire depth of the disc may be used.

> **Caution:** As with any bar material, avoid optical emission spectrometric burns in the center of the disc (5 mm radius), as some segregation may be present. Because this Reference Material contains a high percent of alloying elements, care must be taken in its application. Make certain that corrections are made for possible interference and dilution effects.

**Sample Preparation**: For best analytical results, use the same method for preparing the analytical surface on all reference materials as you use for production specimens. Avoid overheating the disc during surface preparation.

**Certificate Number**: The unique identification number for this certificate of analysis is REV-263-012601-px, where x indicates the page number. Refer to future Brammer Standard Company catalogs for information on any new revisions to this or other Brammer Standard reference materials. You may also obtain information on revisions of certificates from the internet at brammerstandard.com.

**Safety Notice:** A Material Safety Data Sheet (MSDS) is not required for this material. This material will not release or otherwise result in exposure to a hazardous chemical, under normal conditions of use. Inquiries concerning this Reference Material should be directed to:

Brammer Standard Co., Inc.
14603 Benfer Road
Houston, Texas 77069-2895 USA

Phone: (281) 440-9396
Fax: (281) 440-4432

Certified by: _____ on January 26, 2001.
G. R. Brammer

**By Certificate Number 10539, the Quality System of Brammer Standard Company, Inc., is registered to ISO 9002:1994 by National Quality Assurance, U.S.A.**

**Brammer Standard Company's Chemical Laboratory is accredited to ISO Standard 17025 by A2LA. (Certificate Number 656.01)**

## References:


*ASTM documents available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, Telephone: 610-832-9500 Fax: 610-832-9555 e-mail: service@astm.org Website: www.astm.org*

E 826 - 85 (Reapproved 1996) Standard Practice for Testing Homogeneity of Materials for the Development of Reference Materials

E 1019 - 2000 Standard Test Methods for Determination of Carbon, Sulfur, Nitrogen, and Oxygen in Steel and in Iron, Nickel, and Cobalt Alloys

E 1724 - 95 Standard Guide for Testing and Certification of Metal and Metal-Related Reference Materials

E 1806 - 96 Standard Practice for Sampling Steel and Iron for Determination of Chemical Composition

E 1831 - 96 Standard Guide for Preparing Certificates for Reference Materials Relating to Chemical Composition of Metals, Ores, and Related Materials.

*ISO Guides available from Global Engineering - www.global@ihs.com*

ISO Standard 17025 (First edition, 1999), General requirements for the competence of calibration and testing laboratories.

ISO Guide 25 (Third edition, 1990), General requirements for the competence of calibration and testing laboratories.

ISO Guide 30 (Second edition, 1992), Terms and definitions used in connection with reference materials.

ISO Guide 31 (Second edition, 2000), Reference materials -Contents of certificates and labels.

ISO Guide 33 (Second edition, 2000), Uses of certified reference materials.

ISO Guide 34 (Second edition, 2000), General requirements for the competence of reference material producers.

ISO Guide 35 (Second edition, 1989), Certification of reference materials - General and statistical principles.

*Other useful documents available from NIST, U.S. Department of Commerce, Gaithersburg, MD 20899.*

NIST Special Publication 260-100, Handbook for SRM Users

NIST Special Publication 829, Use of NIST Standard Reference Materials for Decisions on Performance of Analytical Chemical Methods and Laboratories