

Brammer Standard Company, Inc.

Certificate of Analysis

B.S. 400C

Nickel Alloy Monel 400

(analysis listed as percent by weight)

| | | | |
|------------|--------|---------------------------|----------|
| Carbon | 0.16 | Vanadium | 0.004 |
| Manganese | 1.03 | Cobalt | 0.054 |
| Phosphorus | 0.012 | Aluminum | 0.055 |
| Sulfur | <0.001 | Niobium | (0.020) |
| Silicon | 0.18 | Titanium | 0.056 |
| Copper | 31.7 | Boron | (0.0002) |
| Chromium | 0.48 | Magnesium | 0.008 |
| Molybdenum | 0.06 | Lead | 0.0006 |
| Iron | 1.61 | Nickel (by difference) | 64.6 |

Some of the co-operating laboratories were:

Allegheny Ludlum Steel Corp., Brackenridge, Pennsylvania
Allegheny Ludlum Steel Corp., Lockport, New York
Brammer Standard Co., Inc., Houston, Texas
J. Dirats and Co., Inc., Westfield, Massachusetts
Ledoux & Company, Teaneck, New Jersey
VHG Laboratories, Inc., Manchester, New Hampshire

CAUTION: Because this Reference Material contains a high percent of copper, care must be taken in its application. Make certain that corrections are made for possible element interference and dilution effects.

See reverse side for more information.

Certificate Number 400C-060391

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

BS 400C

Certificate Number 400C-060391

| Analysis | C | Mn | P | S | Si | Cu | Cr | Mo | Fe |
|-----------|-------|-------|--------|---------|-------|--------|-------|--------|-------|
| 1 | 0.16 | 0.999 | 0.011 | <0.0002 | 0.18 | 31.58 | 0.455 | 0.050 | 1.58 |
| 2 | 0.16 | 1.01 | 0.012 | <0.0005 | 0.18 | 31.63 | 0.47 | 0.051 | 1.59 |
| 3 | 0.16 | 1.04 | 0.0121 | <0.001 | 0.185 | 31.67 | 0.479 | 0.055 | 1.60 |
| 4 | 0.161 | 1.05 | 0.013 | | 0.19 | 31.70 | 0.479 | 0.0617 | 1.62 |
| 5 | | 1.05 | 0.013 | | | 31.78 | 0.492 | 0.064 | 1.63 |
| 6 | | 1.05 | 0.013 | | | 31.81 | | | 1.63 |
| Average | 0.160 | 1.033 | 0.0124 | | 0.184 | 31.695 | 0.475 | 0.056 | 1.608 |
| Std Dev | 0.001 | 0.023 | 0.0008 | | 0.005 | 0.088 | 0.014 | 0.006 | 0.021 |
| Certified | 0.16 | 1.03 | 0.012 | <0.001 | 0.18 | 31.7 | 0.48 | 0.05 | 1.61 |

| Analysis | V | Co | Al | Nb | Ti | B | Mg | Pb |
|-----------|--------|--------|--------|---------|--------|----------|--------|---------|
| 1 | 0.003 | 0.047 | 0.051 | 0.019 | 0.052 | 0.0001 | 0.008 | 0.0005 |
| 2 | 0.0035 | 0.0508 | 0.054 | 0.0214 | 0.054 | 0.0003 | 0.008 | 0.0006 |
| 3 | 0.004 | 0.054 | 0.055 | | 0.054 | | 0.0083 | 0.00075 |
| 4 | 0.006 | 0.0552 | 0.0564 | | 0.055 | | 0.009 | |
| 5 | | 0.056 | 0.058 | | 0.0602 | | | |
| 6 | | 0.060 | | | 0.061 | | | |
| Average | 0.0041 | 0.0538 | 0.0549 | 0.0202 | 0.0560 | 0.0002 | 0.0083 | 0.00062 |
| Std Dev | 0.0013 | 0.0045 | 0.0026 | 0.0017 | 0.0037 | 0.0001 | 0.0005 | 0.00013 |
| Certified | 0.004 | 0.054 | 0.055 | (0.020) | 0.056 | (0.0002) | 0.008 | 0.0006 |

Data in parentheses are not certified but provided for information only.

Chemical analyses were made on millings from cross-sections of the bars. The individual values listed above are the average of each analyst's analytical results. The bar stock used for this material was produced by hot-rolling billets. The entire depth of the disc may be used.

Methods of analysis used were a combination of ASTM Standard Methods E 76, E 1019, plus additional ICP, and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRMs 882, C1248; British CRM BCS 363/1; Chinese CRM CSB 2751-1

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 NIST Certified Reference Material SRM C1248.

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. Inquires 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 June 3, 1991.
G. R. Brammer