

Brammer Standard Company, Inc.

# Certificate of Analysis

B.S. T-23  
Titanium Alloy

Aluminum	0.003	Carbon	0.006
Vanadium	0.93	Magnesium	(0.001)
Chromium	0.91	Niobium	(<0.01)
Copper	0.012	Nitrogen	(0.007)
Iron	0.93	Oxygen	(0.13)
Manganese	3.70	Sulfur	(0.002)
Molybdenum	0.91	Silicon	(<0.01)
Nickel	0.004	Tungsten	0.87
Tin	0.025	Zirconium	(0.002)

*(analysis listed as percent by weight)*

Some of the co-operating laboratories were:  
Analytical Associates, Detroit, Michigan  
Brammer Standard Co., Inc., Houston, Texas  
J. Dirats and Co., Inc., Westfield, Massachusetts  
Axel Johnson Metals Inc., Morgantown, Pennsylvania  
Oregon Metallurgical Corporation, Albany, Oregon  
VHG Laboratories, Inc., Manchester, New Hampshire

CAUTION: Because this Reference Material is alloyed, 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 T23-072491

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

BS T-23

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Analysis	Al	V	Cr	Cu	Fe	Mn	Mo	Ni	Sn
1	0.0025	0.90	0.877	0.011	0.90	3.628	0.87	0.0019	0.023
2	0.003	0.914	0.89	0.011	0.918	3.65	0.89	0.0035	0.024
3	0.0033	0.93	0.91	0.012	0.92	3.70	0.92	0.004	0.026
4	0.0038	0.94	0.91	0.014	0.94	3.71	0.92	0.004	0.027
5		0.94	0.92		0.95	3.72	0.939	0.004	
6		0.95	0.92		0.95	3.74	0.94		
7			0.94		0.95	3.75			
Average	0.0032	0.929	0.910	0.0120	0.933	3.700	0.913	0.0035	0.0250
Std Dev	0.0005	0.019	0.021	0.0014	0.020	0.045	0.028	0.0009	0.0018
Certified	0.003	0.93	0.91	0.012	0.93	3.70	0.91	0.004	0.025

Analysis	C	Mg	Nb	N	O	S	Si	W	Zr
1	0.006	0.0001	<0.01	0.0053	0.123	0.0021	0.0005	0.86	0.0023
2	0.0065	0.00053		0.0073	0.131		0.0067	0.862	
3	0.0069	0.002		0.0084			<0.002	0.87	
4								0.87	
Average	0.0065	0.0009		0.0070	0.1270			0.867	
Std Dev	0.0005	0.0010		0.0016	0.0057			0.005	
Certified	0.006	(0.001)	(<0.01)	(0.007)	(0.13)	(0.002)	(<0.01)	0.87	(0.002)

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

Chemical analyses were made on chips taken from cross-sections of the bars. The individual values listed above are the average of each analyst's results.

Methods of analysis used were a combination of ASTM Standard Method E 120 plus additional ICP, and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRMs 173b, 176, 647, 648, 650, 651, 652; Chinese CRMs GBW 02501 and 02502; British CRMs BCS 356 and 357.

This Reference Material was tested for homogeneity using ASTM Standard Method E 826 and found acceptable. Tungsten is in this material because it was produced by an electric arc furnace using tungsten electrodes.

This material was examined by optical emission spectrometry and found to be compatible with the following NIST Certified Reference Materials: SRM 641, 642, 643, 644, and 1133.

The bar stock used for this material was produced by hot-rolling billets. The entire depth of the disc may be used.

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. Phone: (281) 440-9396  
 14603 Benfer Road  
 Houston, Texas 77069-2895 USA Fax: (281) 440-4432

Certified by: \_\_\_\_\_ on July 24, 1991  
 G. R. Brammer