

Certificate of Analysis

B.S. CA4A

Chill-cast Low Alloy Steel with Calcium and Boron

Certified Elements			Uncertified Elements	
	Certified Value ¹	Estimate of Uncertainty ²	Information values	
C	0.252	0.01	Co	0.006
Mn	1.12	0.02	N	0.0101
P	0.034	0.002	Ti	0.002
S	0.006	0.002		
Si	0.31	0.015		
Cu	0.032	0.002		
Ni	0.017	0.003		
Cr	0.068	0.003		
Mo	0.046	0.003		
Al	0.011	0.002		
As	0.029	0.002		
B	0.0013	0.0002		
Ca	0.0001	0.00004		
Nb	0.068	0.003		
Sn	0.034	0.003		
V	0.014	0.002		

Analysis listed as percent by weight

¹ The certified value listed is the present best estimate of the true value.

² The uncertainties listed are based on value judgments of the material inhomogeneity and possible bias in the determined analytical values.

See reverse side for more information.

Certificate Number CA4A-021593

BS CA4A		analysis listed as percent by weight					Certificate CA4A-021593			
Analysis	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	
1	0.244	1.098	0.0310	0.0045	0.298	0.0306	0.015	0.065	0.043	
2	0.249	1.105	0.033	0.0048	0.301	0.031	0.015	0.066	0.044	
3	0.250	1.105	0.033	0.005	0.304	0.031	0.016	0.067	0.0453	
4	0.2503	1.114	0.0332	0.0055	0.309	0.031	0.017	0.0683	0.0455	
5	0.251	1.12	0.034	0.0057	0.3124	0.0314	0.0170	0.0690	0.046	
6	0.252	1.12	0.034	0.006	0.313	0.0315	0.0177	0.0690	0.0463	
7	0.260	1.12	0.0346	0.006	0.313	0.0320	0.018	0.069	0.047	
8	0.260	1.126	0.035	0.0061	0.320	0.032	0.019	0.070	0.048	
9		1.13		0.0062	0.321	0.032	0.019	0.070	0.049	
10					0.321	0.032	0.020	0.071	0.0492	
Average	0.2520	1.115	0.0335	0.0055	0.3112	0.0315	0.0174	0.0684	0.0463	
Std Dev	0.0055	0.011	0.0012	0.0006	0.0082	0.0005	0.0017	0.0019	0.0020	
Certified	0.252	1.12	0.034	0.006	0.31	0.032	0.017	0.068	0.046	

Analysis	Al	As	B	Ca	Co	N	Nb	Sn	V	Ti
1	0.0093	0.028	0.00101	0.0001	0.006	0.0097	0.065	0.031	0.012	0.0020
2	0.010	0.0283	0.0013	0.0001	0.0062	0.0098	0.0655	0.0318	0.0138	0.002
3	0.0105	0.029	0.0013	0.0001	0.0062	0.0104	0.067	0.0323	0.014	0.0027
4	0.011	0.029	0.0013	0.0001		0.0106	0.0673	0.033	0.014	
5	0.011	0.029	0.0013	0.0001			0.0678	0.0336	0.014	
6	0.012	0.0292	0.0013	0.00012			0.068	0.0338	0.014	
7	0.0124	0.0302	0.0014	0.0003			0.068	0.034	0.0145	
8		0.0305	0.0014				0.069	0.034	0.0147	
9			0.0016				0.071	0.0358	0.015	
10								0.036	0.015	
Average	0.0109	0.0292	0.00132	0.00013	0.0061	0.0101	0.0676	0.0335	0.0141	0.0022
Std Dev	0.0011	0.0008	0.00015	0.00007	0.0001	0.0004	0.0018	0.0016	0.0009	0.0004
Certified	0.011	0.029	0.0013	0.0001	(0.006)	(0.0101)	0.068	0.034	0.014	(0.002)

Analysis: Chemical analyses were made on chips prepared by a lathe from the certified portion of the discs. The individual values listed above are the average of each analyst's results. Methods of analysis used were a combination of ASTM Standard Methods E 350, E 415, E 1019, plus additional ICP, and AA spectrometric methods. The following Certified Reference Materials were used to validate the analytical data listed above: NIST SRM 125b, 361 to 365; BAM 044-1; BCS 455/1; ECRM 082-1, 085-1, 088-1, 096-1, 097-1; GBW 01402; CKD 164, 167

Co-operating Laboratories: Some of the co-operating laboratories were:

- Acme Steel Company, Riverdale, Illinois
- Analytika Co., Ltd., Prague, Czechoslovakia
- Anderson Laboratories, Greendale, Wisconsin
- Brammer Standard Co., Inc., Houston, Texas
- Crucible Specialty Metals, Syracuse, New York
- J. Dirats and Co., Inc., Westfield, Massachusetts
- Hoesch Stahl AG, Dortmund, Germany
- The Timken Company, Canton, Ohio
- VHG Laboratories, Inc., Manchester, New Hampshire

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 C1173, 1261A to 1265A, 1761 to 1767
Europe: ECRM 186-1, 191-1, SS 457/1, 458/1
Japan: JSS 169-4, 170-6, 171-4
Czechoslovakia: CKD 165D, 170H

Source: This material was melted and cast by American Centrifugal, Birmingham, Alabama, using an electric arc furnace. It was chill-cast into a water-cooled sample mold producing 648 discs simultaneously.

Description and Use: This Reference Material is in the form of a disc, approximately 32 mm in diameter and 17 mm thick. It is intended for the use in optical emission and x-ray spectrometric methods of analysis.

Certified Area: The area certified of each disc is the portion extending upward 10 mm from the larger diameter surface.

Note: Shrinkage cavities may appear in the top portion of some discs. These cavities are normal and will not affect the certified portion of the disc.

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.

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

Certified by: _____ on February 15, 1993.
G. R. Brammer

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