Analytical Reference Materials International
Certificate of Analysis
Certified Reference Material

Grade: AISI 304

Part Number (Q.A. NO.): IARM 2E

Certification Date: 02/10/2000 **Certificate No.: 2E-02102000-IARM-F**

Interpretation of Data

1. Certified values listed below reflect analysis results submitted by qualified analytical laboratories using a combination of methods and instrumentation that emulate actual methods and instrumental techniques currently utilized in the analytical community.
2. Any data reported and enclosed by a **parentheses ( ) is a "best estimate" and is NOT CERTIFIED.** This data could not be quantified sufficiently for certification. It was however, reported by enough laboratories to be considered as potentially present in the matrix of the material being examined.
3. The "Inter-laboratory Analysis Program" (ILAP) utilized in the establishment of the data is an ongoing program with permanent membership. Certain elements may be selected by a consensus of the members for more extensive testing. Therefore the data in **brackets [ ] indicates further testing is in process.**
4. The **"± Confidence Interval at 95%"** is enclosed by a **parentheses ( ) below the individual element's concentration.**

IMPORTANT: A "USER REGISTRATION CARD" ACCOMPANIES ALL SHIPMENTS. THIS CARD SHOULD BE COMPLETED IMMEDIATELY UPON RECEIPT OF MATERIALS WITH THE APPROPRIATE USER INFORMATION. THIS IS THE ONLY WAY IN WHICH ARMI CAN GUARANTEE CUSTOMER UPDATES OR POSSIBLE DATA MODIFICATIONS!

Aluminum	Boron	Carbon	Cobalt	Chromium	Copper	Manganese
0.004	0.0003	0.059	0.083	18.21	0.142	1.43
(0.001)	(0.0002)	(0.001)	(0.002)	(0.06)	(0.003)	(0.01)
Molybdenum	**Nitrogen**	**Niobium**	**Nickel**	**Oxygen**	**Phosphorus**	**Sulfur**
0.076	0.051	0.004	8.08	0.0050	0.025	0.020
(0.004)	(0.001)	(0.002)	(0.04)	(0.0003)	(0.001)	(0.001)
Silicon	**Tin**	**Titanium**	**Vanadium**	**Tungsten**		
0.43	0.005	0.002	0.065	0.014		
(0.01)	(0.001)	(0.001)	(0.003)	(0.005)		

The laboratories participating in the "Inter-Laboratory Analysis Program" (ILAP) and certification of this material are as follows:

Allegheny Ludlum Corp. - Brackenridge, PA
Allvac Steel - Lockport, NY
Armco Research & Technology - Middletown, OH
Bodycote Metals Analysis, Inc. - Huntington Park, CA
Jorgensen Forge Corp. - Seattle, WA
Lockheed Martin Astronautics - Littleton, CO
Allegheny Ludlum Corp. - Brackenridge, PA
Anderson Laboratories, Inc. - Greendale, WI
Armco, Inc. - Butler, PA
Chicago Spectro Service Laboratories - Chicago, IL
Laboratory Testing, Inc. - Dublin, PA
Wisconsin Centrifugal, Inc. - Waukesha, WI

Traceability: All members of the "Inter-Laboratory Analysis Program" (ILAP) listed above validate test methods and instrument performance utilizing SRMs produced by the National Institute of Standards and Technology, (NIST) as well as other CRMs and RMs produced by recognized Certifying Bodies from around the world. The specific SRMs, CRMs and RMs applicable to the material covered by this certificate are: NIST 1226, 1261A, 1262A, 1265A, C1151, C1152, C1153, C1154, 1155, 1193, 1194, 1195, 1230, C2400, JSS 650, 651, 652, 653, 654, 655, BCS331, 332, 333, 334, 335, 336, 337, 338, ARMCO 8709, 8710, 8711, 8712, MBH14933, 14934, 14935, BSC 401/1, 402/1, 403/1, 404/1, 405/1, 406/1, 407/1, 408/1, 409/1, 410/1, IARM 1B, 2B, 4B, 5B, 9B, 11B, 152A, 157A162A, 163A, 205A, 27B, 28B, 29B, 30B, 31B, 32B, 33B, 34B, 35B, 36B, 48B, 49B, 155A, 156A, 164A, 165A, 166A, 167A, 168A, 169A, 170A, 171A, 172A, NBS 348A, 12D, 101G, LECO 501-553, 501-644, BS81F, TASN-100, TBIN-250, TPBN-250, TSEN-100, TTEH-100, NIST 136e, 101f, 865, 897, 898, BS 81G, NIST 15h, 125b, 343a, C1152a, 73a, BS CA304-2, LECO 501-550, B84, LECO 501-501, 501-553, IARM 2A, NIST 1152, 442, IARM 2A, 2B, LECO 501-502, 501-676, 501-553, IARM 2A, 801474, 847942, BSCA304-2, RU22, BS81N, BS82E, LECO 501-675, 501-674, 502-106, NIST 2167, 15G, BAS SS468, LECO 501-644

A specific line of traceability is established to NIST and other Certifying Bodies for those elements that are noted as "Certified Values" on the Certificates of Analyses referenced above.

See Reverse Side for Statistical Data and Additional Information Regarding this Material.

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The following data and accompanying statements represent all pertinent information reported in the ILAP as it applies to the chemical characterization of this material as of 09/29/2000.

2E	Al	B	C	Co	Cr	Cu	Mn	Mo	N	Nb	Ni	O	P	S	Si
1	0.005	0.0003	0.057	0.082	18.30	0.149	1.47	0.07	0.049	0.003	8.18	0.0050	0.028	0.019	0.42
2	0.0054	0.0001	0.061	0.0812	18.130	0.142	1.459	0.068	0.052	0.001	8.010	0.0045	0.028	0.020	0.441
3	0.0024	0.0003	0.0587	0.080	18.39	0.1390	1.432	0.08	0.0519	0.0014	8.063	0.0053	0.0227	0.0187	0.454
4	0.00594	0.0002	0.0565	0.087	18.33	0.144	1.42	0.0843	0.0486	0.0016	8.095	0.0051	0.024	0.019	0.42
5	0.003	0.0006	0.0594	0.0850	18.201	0.140	1.403	0.0707	0.0523	0.002	8.097	0.0053	0.0261	0.022	0.427
6	0.004	0.0005	0.0584	0.082	18.088	0.148	1.43	0.070	0.0496	0.007	8.009	0.0050	0.0245	0.0192	0.440
7			0.061	0.082	18.133	0.140	1.403	0.084	0.0512	0.0089	8.005	0.0047	0.023	0.019	0.430
8			0.0595	0.086	18.14	0.137	1.448	0.0836	0.0528	0.007	8.069		0.0231	0.022	0.454
9			0.061	0.080	18.18	0.135	1.41	0.083	0.051	0.005	8.14		0.0247	0.0207	0.437
10			0.059		18.216	0.140	1.425	0.077	0.052	0.002	8.11		0.024	0.019	0.430
11			0.0605		18.12	0.149	1.460	0.072		0.003	8.058		0.026	0.0196	0.430
12					18.26		1.42	0.072			8.00		0.025	0.0198	0.43
							1.456				8.161				0.439
Mean	0.0043	0.0003	0.0593	0.0828	18.2073	0.1421	1.4335	0.0762	0.0510	0.0038	8.0767	0.0050	0.0249	0.0198	0.4348
STDV.	0.0014	0.0002	0.0016	0.0026	0.0946	0.0048	0.0228	0.0064	0.0015	0.0027	0.0608	0.0003	0.0018	0.0012	0.0109
Certified	**0.004**	**0.0003**	**0.059**	**0.083**	**18.21**	**0.142**	**1.43**	**0.076**	**0.051**	**0.004**	**8.08**	**0.0050**	**0.025**	**0.020**	**0.43**
95% C.I.	**0.001**	**0.0002**	**0.001**	**0.002**	**0.06**	**0.003**	**0.01**	**0.004**	**0.001**	**0.002**	**0.04**	**0.0003**	**0.001**	**0.001**	**0.01**
Methods	X,D,I,O	I,O,D	C	X,I,O	X,W,O	X,I,O	X,I,O	X,I,O	F	X,I,O	X,W,O	F	X,I,O	C	X,W,I,O

Methods: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, D = DC Arc, O = OE, X = XRF, G=GDMS

2E	Sn	Ti	V	W	Ag	As	Bi	Ca	H	Mg	Pb	Se	Ta	Te	Zr
0	0.005	0.002	0.059	0.010	<0.0001	0.0041	0.00006	0.0022	0.0004	0.001	0.0017	<0.0001	0.0065	<0.0001	0.003
1	0.0052	0.0015	0.0600	0.007		0.00658	<0.001	0.001		<0.001	<0.001	<0.01	0.0041	<0.0001	0.0007
2	0.004	0.001	0.07	0.014		<0.01	<0.0001			<0.0005	<0.0001	<0.0001	<0.01		<0.01
3	0.005	0.0007	0.0744	0.010		<0.0001					<0.00005				0.004
4	0.004	0.001	0.0683	0.0131							<0.00050				
5	0.0063	0.0019	0.0614	0.020							<0.001				
6	0.005	0.002	0.068	0.024							<0.0001				
7		0.002	0.0651	0.014							<0.0005				
8		0.003	0.063												
9			0.068												
10			0.062												
11			0.063												
12															
Mean	0.0049	0.0017	0.0652	0.0140		0.0053	0.0001	0.0016	0.0004	0.0010	0.0017		0.0053		0.0026
STDV.	0.0008	0.0007	0.0046	0.0056		0.0018		0.0008					0.0017		0.0017
Certified	**0.005**	**0.002**	**0.065**	**0.014**	**<0.001**	**(0.005)**	**<0.001**	**(0.002)**	**<0.001**	**<0.001**	**<0.002**	**<0.001**	**(0.005)**	**<0.001**	**(0.003)**
95% C.I.	**0.001**	**0.001**	**0.003**	**0.005**											
Methods	X,I,A,O	X,D,I,O	X,I,O	X,I,O		A,O,D	A,D	I,O	F	I,D,O	X,D,A,O	A,O	I,O	A	D,I,O,X

Methods: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, D = DC Arc, O = OE, X = XRF, G=GDMS

The International Standards Organization (ISO) definitions, expressed in ISO Guide 30-1981-(E) list the following:

Certifying Body: A technically competent body (organization or firm, public or private) that issues a Reference Material Certificate. The only generally accepted certifying body in the United States is the U. S. Department of Commerce, National Institute of Standards & Technology, (NIST), Gaithersburg, MD.

Reference Material (RM): A material or substance with one or more properties which are sufficiently well established to be used for calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Certified Reference Material (CRM): A reference material with one or more properties whose values are certified by a technically valid procedure accompanied by or traceable to a certificate or other documentation, which is issued by a Certifying Body.

Inter-Laboratory Analysis Program (ILAP): Although ASTM Standard E691-87 applies to inter-laboratory studies to "Determine the Precision of a Single Test Method", it is also a well thought out and logical plan for conducting an inter-laboratory program involving multiple techniques. Therefore, the planning, conducting, analyzing, protocol and treatment of data resulting from this inter-laboratory program were performed utilizing the guidelines established in ASTM E691-87.

Methods of Analysis: In view of the fact, that the "Inter-Laboratory Analysis Program" entails a wide variety of materials, no single method would provide optimum data results. Therefore the methods utilized were a combination of ASTM Standard Methods for classical wet chemistry, ICP, AA, Optical Emission and X-Ray spectrometric methods. The determinations for Carbon, Sulfur, Nitrogen and Oxygen are the result of combustion instrument procedures.

Selection of Materials: A **"batch"** or **"series"** is defined as a single bar of one continuous length. The majority of materials are in wrought condition. Other methods of manufacture are utilized as a last resort, only in the case of those materials being unavailable in wrought condition. "Batch" samples are taken by removing a one-inch cross section for every thirteen inches of total length from the entire bar. Twenty-five percent of the one inch cross section is converted to chips for analysis by classical wet chemistry, ICP, AA, and combustion procedures and seventy-five percent remains in a solid disk form for OES and X-Ray analysis where applicable. Each member of the ILAP is furnished both a solid sample and the corresponding supply of chips from a specific location on the batch bar. This massive sampling procedure results in the homogeneity being reflected as a product of the overall statistics and certified data.

Certified by: William D. Britt

William D. Britt, President/General Manager
Analytical Reference Materials International

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