

Analytical Reference Materials International



Certificate of Analysis Certified Reference Material

Grade: **AISI 8740 / UNS G87400**
Part Number (Q.A. NO.): **IARM 252D**

Certificate Date: **07/11/2017**

Certificate No.: **252D-07112017-IARM-F**

Revision Date: **10/10/2017**

Interpretation of Data

- 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 and are reported as % wt. unless otherwise noted.
- 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.
- The "Inter laboratory Analysis Program" (ILAP) utilized in the establishment of the data are 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**.
Chips are not certified for Oxygen analysis.
- The **"±Estimated Uncertainty"** is enclosed by a **parentheses ()** below the individual **element's concentration** and is based on a Confidence Interval at 95%. Included in this estimated uncertainty, are the combined effects of method imprecision, material inhomogeneity, and any bias between methods.

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!

<u>Aluminum</u>	<u>Antimony</u>	<u>Arsenic</u>	<u>Bismuth</u>	<u>Boron</u>	<u>Calcium</u>	<u>Carbon</u>	<u>Chromium</u>	<u>Cobalt</u>
0.024	0.0024	0.0053	(0.0005)	0.0002	(0.001)	0.423	0.468	0.0078
(0.001)	(0.0009)	(0.0006)		(0.0001)		(0.003)	(0.007)	(0.0003)
<u>Copper</u>	<u>Lead</u>	<u>Magnesium</u>	<u>Manganese</u>	<u>Molybdenum</u>	<u>Nickel</u>	<u>Niobium</u>	<u>Nitrogen</u>	<u>Oxygen</u>
0.270	0.0004	(0.0002)	0.842	0.204	0.424	0.0013	0.0068	0.0013
(0.002)	(0.0003)		(0.006)	(0.002)	(0.004)	(0.0004)	(0.0003)	(0.0008)
<u>Phosphorus</u>	<u>Selenium</u>	<u>Silicon</u>	<u>Sulfur</u>	<u>Tantalum</u>	<u>Tin</u>	<u>Titanium</u>	<u>Tungsten</u>	<u>Vanadium</u>
0.0075	(<0.003)	0.256	0.0128	(<0.005)	0.012	0.0012	0.004	0.0022
(0.0008)		(0.002)	(0.0007)		(0.001)	(0.0002)	(0.002)	(0.0003)
<u>Zinc</u>	<u>Zirconium</u>							
0.0005	0.0013							
(0.0003)	(0.0007)							

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

Anderson Laboratories, Inc. - Greendale, WI	Lockheed Martin Astronautics - Littleton, CO
Cronimet Specialty Metals USA, Inc - Wheatland, PA	NSL Analytical Services - Cleveland, OH
Ellwood National Steel - Irvine, PA	Nucor Steel Norfolk - Norfolk, NE
Laboratorio Prove Materiali S. Marco srl - Schio, Italy	Special Metals IncoTest - Hereford, UK
Laboratory Testing, Inc. - Hatfield, PA	Tata Steel Limited - Jamshedpur, India
Latrobe Specialty Metals - Latrobe, PA	TimkenSteel Corporation - Canton, OH

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:

ALPHA AR1648	ASTM 3042	BCS 454	BS 12B	BS CA2A	IARM 355	JSS 191-1	LECO 501-510	NIST 1162	NIST 1264	NIST 32C
ALPHA AR1653	ASTM 4012	BCS 454/1	BS 13	BS CA-3	IARM 35C	JSS 192-1	LECO 501-529	NIST 1163	NIST 1264A	NIST 361
ALPHA AR306	ASTM CS LF2	BCS 456/2	BS 13B	BS CA3A	IARM 35F	JSS 193-1	LECO 501-550	NIST 1164	NIST 1265	NIST 362
ALPHA AR555	BAS 401/1	BCS 462/1	BS 14	BS CA-4	IARM 35G	JSS 194-1	LECO 501-551	NIST 1165	NIST 16F	NIST 363
ALPHA AR657	BAS 402/1	BCS/SS 112	BS 14B	BS XAAS	IH R5657	JSS 195-1	LECO 501-643	NIST 1166	NIST 1754	NIST 364
ALPHA AR660	BAS 403/1	BCS/SS 113	BS 156	BS XCCS	JSS 168-4	JSS ST01	LECO 501-644	NIST 1167	NIST 1761	NIST 367
ALPHA AR869	BAS 404/1	BCS/SS 404	BS 1931	BS XCCV	JSS 169-4	JSS ST02	LECO 501-674	NIST 1168	NIST 1762	NIST 368
ALPHA AR873	BAS 405/1	BCS/SS 407/2	BS 4142SE	CZECH 184A	JSS 170-4	JSS ST03	LECO 501-677	NIST 1169	NIST 1763	NIST 898
ALPHA AR875	BAS 406/1	BCS/SS 408/2	BS 56H	EN CRM 096/1	JSS 171-4	JSS ST04	LECO 502-102	NIST 1261	NIST 1763A	NIST C1152
ALPHA AR878	BAS 407/2	BCS/SS 451/1	BS 60C	EN CRM 097/1	JSS 172-4	JSS ST05	LECO 502-257	NIST 1261A	NIST 1764	NIST C1153
ASTM 2021	BAS 408/1	BCS/SS 454/1	BS 61B	IARM 252A	JSS 173-4	JSS ST06	LECO 502-320	NIST 1262	NIST 1765	NIST C1154
ASTM 2022	BAS 409/1	BCS/SS 459/1	BS CA-1	IARM 28D	JSS 174-4	LECO 501-503	LECO 502-416	NIST 1262A	NIST 1766	
ASTM 2042	BAS 410/2	BCS/SS 460/1	BS CA1A	IARM 31C	JSS 175-4	LECO 501-504	MBH 12X353	NIST 1262B	NIST 1767	
ASTM 2972	BCS 351	BS 12	BS CA-2	IARM 32D	JSS 190-1	LECO 501-506	NIST 1161	NIST 1263A	NIST 293	

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 010/10/2017.

252D	Al	Sb	As	Bi	B	Ca	C	Cr	Co	Cu	Pb	Mg	Mn	Mo	Ni	Nb
1	0.0195	0.0012	0.0038	0.00002	0.0001	0.0003	0.410	0.4387	0.0071	0.260	0.0001	0.0001	0.827	0.199	0.4128	0.0001
2	0.02225	0.002	0.0038	0.000025	0.0001	0.0005	0.4179	0.45875	0.0072	0.266	0.0001	0.0002	0.829	0.200	0.418	0.0007
3	0.0227	0.002075	0.0050	0.0003	0.0001	0.000525	0.41898	0.464	0.0072	0.2668	0.0001	0.0002	0.831	0.200	0.420	0.0009
4	0.02285	0.0021	0.0052	0.0018	0.00015	0.0006	0.41963	0.464	0.0076	0.2671	0.0002	0.0003	0.8325	0.201	0.420	0.001
5	0.023	0.0021	0.00535	<0.00002	0.0002	0.0006	0.420	0.4644	0.0076	0.270	0.0002	0.0004	0.841	0.2018	0.421	0.001
6	0.023	0.0024	0.0057		0.0002	0.0004	0.422	0.466	0.0077	0.2702	0.0004		0.8413	0.202	0.422	0.00123
7	0.0238	0.0025	0.0059		0.0003	<0.001	0.423	0.466	0.0079	0.2703	0.0006		0.84225	0.2025	0.42275	0.0013
8	0.0239	0.005	0.0061		0.0003		0.423	0.466	0.008	0.2704	0.0012		0.8429	0.204	0.423	0.0014
9	0.024		0.0061		0.0003		0.4241	0.4663	0.008	0.271			0.8432	0.2049	0.424	0.0014
10	0.024		0.0063		0.0004		0.4244	0.47	0.008	0.271			0.846	0.205	0.4241	0.0016
11	0.0246				0.00049		0.4272	0.4763	0.0081	0.272			0.848	0.205	0.4272	0.0019
12	0.025						0.4274	0.480	0.008384	0.272			0.848	0.205	0.4281	0.0025
13	0.0253						0.4275	0.482	0.0086	0.276954			0.850	0.210	0.43288	
14	0.027703						0.435	0.4918		0.2770			0.8664	0.212143	0.443	
15																
Mean	0.024	0.0024	0.0053	0.0005	0.0002	0.001	0.423	0.468	0.0078	0.270	0.0004	0.0002	0.842	0.204	0.424	0.0013
STDV.	0.002	0.0011	0.0009	0.0009	0.0001	0.001	0.006	0.012	0.0005	0.004	0.0004	0.0001	0.010	0.004	0.007	0.0006
Certified	0.024	0.0024	0.0053	(0.0005)	0.0002	(0.001)	0.423	0.468	0.0078	0.270	0.0004	(0.0002)	0.842	0.204	0.424	0.0013
95% C.I.	0.001	0.0009	0.0006		0.0001		0.003	0.007	0.0003	0.002	0.0003		0.006	0.002	0.004	0.0004
Methods	X,O,IM,I	X,O,IM,H	X,O,IM,I	O,IM,H	O,IM,I	O,IM,I	O,C	X,O,IM,I	X,O,IM,I	X,O,IM,I	O,IM	O,IM,I,H	X,O,IM,I	X,O,IM,I	X,O,IM,I	X,O,IM,I

Legend: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, IM=ICP-MS, D = DC Arc, O = AES, X = XRF, G = GDAES or GDMS, H = Hollow Cathode AES

252D	N	O	P	Se	Si	S	Ta	Sn	Ti	W	V	Zn	Zr
1	0.0059	0.0001	0.0060	0.00002	0.251	0.0103	0.001	0.0065	0.0007	0.0010	0.001	0.0002	0.0002
2	0.0062	0.00055	0.0060	<0.0003	0.252799	0.0115	0.0037	0.0109	0.0009	0.0010	0.0016	0.0002	0.0009
3	0.006486	0.00057	0.0063		0.2532	0.01151	0.004	0.0110	0.0010	0.0013	0.0019	0.0002	0.001
4	0.0065	0.0006	0.0067		0.2545	0.01161	0.0048	0.011	0.001	0.0020	0.0020	0.000425	0.0013
5	0.0065	0.000873	0.00675		0.2551	0.0125	<0.0001	0.012	0.0011	0.0022	0.0020	0.0008	0.0014
6	0.0066	0.0009	0.00685		0.257	0.0127	<0.001	0.012	0.0011	0.0037	0.002	0.0009	0.0023
7	0.00675	0.001	0.0070		0.257	0.013		0.012	0.0011	0.0048	0.0022		0.0023
8	0.006795	0.00126	0.0073		0.2573	0.0132		0.0125	0.00115	0.0053	0.002399		
9	0.0069	0.0017	0.0074		0.2575	0.0133		0.0125	0.0012	0.0077	0.0024		
10	0.0070	0.0018	0.0080		0.2575	0.01338		0.0126	0.0013	0.008	0.0025		
11	0.0071	0.0046	0.0084		0.2578	0.0137		0.0126	0.00145		0.0025		
12	0.0071		0.0085		0.2583	0.0138		0.0127	0.0015		0.00255		
13	0.0072		0.008661		0.260	0.01425			0.002		0.0026		
14	0.0076		0.0108		0.2609	0.0143					0.003		
15													
Mean	0.0068	0.0013	0.0075	0.00002	0.256	0.0128	0.0034	0.012	0.0012	0.004	0.0022	0.0005	0.0013
STDV.	0.0004	0.0012	0.0013		0.003	0.0012	0.0017	0.002	0.0003	0.003	0.0005	0.0003	0.0008
Certified	0.0068	0.0013	0.0075	(<0.003)	0.256	0.0128	(<0.005)	0.012	0.0012	0.004	0.0022	0.0005	0.0013
95% C.I.	0.0003	0.0008	0.0008		0.002	0.0007		0.001	0.0002	0.002	0.0003	0.0003	0.0007
Methods	O,F	F	X,O,IM,I,F	H,A	X,O,IM,I	O,C	X,O,IM,I	X,O,IM,I	X,O,IM,I	X,O,IM,I	X,O,IM,I	X,O,IM,I,H	X,O,IM,I

Legend: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, IM=ICP-MS, D = DC Arc, O = AES, X = XRF, G = GDAES or GDMS, H = Hollow Cathode AES

The International Standards Organization (ISO) definitions, expressed in ISO Guide 30-1992 list the following:

Certifying Body: Any technically competent body (organization or firm, public or private) that issues a reference material certificate, which provides the information, detailed in ISO Guide 31. The only generally accepted certifying body in the United States for primary standards - Standard Reference Materials (SRM) is the U. S. Department of Commerce, National Institute of Standards & Technology, (NIST), Gaithersburg, MD. All other certifying bodies in the United States produce Reference Materials (RM) or Certified Reference Materials (CRM).

Reference Material (RM): Material or substance one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Certified Reference Material (CRM): Reference material, accompanied by a certificate, one or more of whose property values are certified by a procedure, which establishes its traceability to an accurate realization of the unit in which the property values are expressed, and for which each certified value is accompanied by an uncertainty at a stated level of confidence.


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 analytical 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 and OE instrument procedures.

Expiration of Certification: The certification of this IARM is valid indefinitely, within the uncertainty specified, provided the IARM is handled and stored in accordance with the instructions stated on this certificate. The certification is nullified if the IARM is damaged, contaminated, otherwise modified, or used in a manner for which it was not intended.

Instructions for Use: The test surface is the side opposite to the labeled surface, which includes the IARM number. The entire thickness of the unit is certified. However, the user is cautioned not to measure disks less than 2 mm thick when using X-ray fluorescence spectrometry. Each packaged disk has been prepared by finishing the test surface using a lathe. The user must determine the correct surface preparation procedure for each analytical technique. The user is cautioned to use care when either resurfacing the disk or performing additional polishing as these processes may contaminate the surface. When not in use, the material should be stored in a cool, dry location. This material was tested using both the solid disks and chips prepared from the disks. The certified values are considered representative of the overall average composition of the material. Chips are not to be used for Oxygen analysis.

Selection of Materials: A "batch" or "series" is defined as a single bar of one continuous length and heat. The majority of materials are in wrought condition; other methods of manufacture are utilized as a less desirable resort. ILAP samples are taken by removing a section, a minimum of, every one-twelfth of total length from the entire bar. A portion of the section is converted to chips and thin (pin) disk for analysis by classical wet chemistry, ICP, AA, and combustion procedures, and the balance remains as a thick disk for OES and X-Ray analysis. This systematic sampling procedure results in the homogeneity being reflected as a product of the overall statistics and certified data. This method of homogeneity testing is in accordance with ISO Guide 34, regarding the systematic selection and testing of a representative number of units for the assessment of homogeneity.


 David Coler, General Manager
 Analytical Reference Materials International

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