

CERTIFICATE OF ANALYSIS

IMZ 55/1A

CERTIFIED REFERENCE MATERIAL LOW ALLOY STEEL

Analysis listed as percent by weight [% m/m]

	Certified value	Uncertainty		Certified value	Uncertainty
C	0.401	± 0.005	Co	0.0039	± 0.0004
Si	0.406	± 0.005	Ti	0.012	± 0.001
Mn	0.490	± 0.006	Cu	0.112	± 0.003
P	0.019	± 0.001	Al	0.006	± 0.001
S	0.0053	± 0.0006	Nb	0.010	± 0.001
Cr	0.998	± 0.008	N	0.0023	± 0.0005
Ni	0.570	± 0.006	B	0.0018	± 0.0001
Mo	0.247	± 0.005	Sn	0.017	± 0.001
V	0.107	± 0.003	Sb	0.0051	± 0.0005

the uncertainty bases on 95% confidence limit and material inhomogeneity

Certificate Number: **IMZ55-1A-200325**

Certificate revision history on page 4

Analysis	C	*	Si	*	Mn	*	P	*	S	*	Cr	*	Ni	*	Mo	*
1	0.39	5	0.39	1	0.4743	7	0.0163	7	0.00302	7	0.98	1	0.54	9	0.23	7
2	0.39	5	0.393	12	0.48	5	0.0176	7	0.0048	5	0.98	7	0.55	6	0.24	5
3	0.3967	2	0.395	12	0.480	5	0.0178	5	0.005	5	0.986	12	0.5515	7	0.24	12
4	0.397	2	0.399	8	0.48	6	0.018	7	0.005	5	0.99	5	0.560	7	0.24	5
5	0.399	5	0.40	5	0.48	7	0.019	5	0.005	2	0.990	5	0.5623	5	0.245	5
6	0.40	2	0.40	5	0.48	5	0.019	12	0.005	5	0.99	5	0.569	1	0.2472	7
7	0.401	13	0.4000	5	0.483	5	0.019	6	0.0051	1	0.99	5	0.570	5	0.2475	5
8	0.402	2	0.40	6	0.487	12	0.019	5	0.0051	2	0.99	5	0.570	5	0.249	1
9	0.4025	5	0.40	7	0.489	1	0.0195	1	0.0055	2	0.996	9	0.57	5	0.249	5
10	0.403	2	0.4022	7	0.4890	5	0.020	5	0.0058	2	0.9977	7	0.57	7	0.250	7
11	0.4034	2	0.4034	7	0.49	5	0.020	5	0.0059	2	1.00	1	0.57	5	0.250	5
12	0.407	5	0.409	5	0.4914	7	0.020	5	0.0060	2	1.00	9	0.574	14	0.25	5
13	0.407	2	0.41	12	0.492	7	0.020	5	0.0060	2	1.00	6	0.575	12	0.25	1
14	0.409	2	0.41	5	0.495	7	0.020	12	0.0060	10	1.002	7	0.5771	7	0.25	6
15	0.411	2	0.41	5	0.497	5	0.02011	7	0.007	5	1.0033	5	0.578	7	0.25	7
16			0.411	1	0.50	7	0.022	7			1.00	5	0.58	7	0.2502	7
17			0.415	5	0.50	1	0.022	5			1.0190	4	0.580	5	0.26	5
18			0.42	5	0.502	14					1.02	5	0.58	5		
19			0.420	8	0.51	12					1.021	7	0.58	1		
20			0.424	7									0.584	5		
Average	0.4012		0.4056		0.4895		0.0194		0.0053		0.9978		0.5695		0.2469	
Standard deviation	0.0062		0.0094		0.0095		0.0015		0.0009		0.0122		0.0116		0.0065	
Certified value	0.401		0.406		0.490		0.019		0.0053		0.998		0.570		0.247	
C(95%)	0.0034		0.0044		0.0046		0.0007		0.0005		0.0059		0.0054		0.0034	
Standard deviation of homogeneity	0.004		0.003		0.004		0.0008		0.0004		0.006		0.003		0.003	
Uncertainty	0.005		0.005		0.006		0.001		0.0006		0.008		0.006		0.005	

Analysis	Co	*	V	*	W**	*	Ti	*	Cu	*	Al	*	Nb	*	N	*
1	0.00285	7	0.09639	7	0.0005	7	0.011	1	0.10	5	0.0041	6	0.009	5	0.0015	5
2	0.0033	7	0.10	6	0.00093	7	0.01176	7	0.10286	7	0.005	5	0.009	5	0.0021	3
3	0.0034	7	0.10	7	0.001	5	0.012	5	0.11	7	0.0050	5	0.009	5	0.0022	3
4	0.0034	7	0.10	5	0.002	6	0.012	5	0.11	12	0.0053	5	0.0091	7	0.0022	3
5	0.0036	6	0.104	5	0.003	5	0.012	5	0.11	6	0.0058	7	0.00965	7	0.0026	3
6	0.0040	5	0.104	1	0.0033	5	0.012	7	0.11	7	0.006	5	0.010	5	0.0027	3
7	0.004	5	0.106	5	0.0035	7	0.012	5	0.111	5	0.006	5	0.010	5	0.0030	5
8	0.004	5	0.107	5	< 0.003	5	0.012	6	0.112	5	0.006	5	0.010	1		
9	0.0040	5	0.108	1	< 0.02	5	0.012	7	0.113	7	0.006	7	0.010	6		
10	0.0045	5	0.108	5			0.0122	7	0.11	5	0.0065	7	0.010	7		
11	0.0049	1	0.11	5			0.0128	7	0.115	1	0.007	5	0.011	1		
12	0.005	5	0.11	7			0.013	5	0.115	5	0.00823	7	0.011	5		
13			0.11	5			0.013	5	0.1150	5	0.009	5	0.0110	5		
14			0.1119	7			0.013	1	0.1159	7			0.0116	7		
15			0.1120	5			0.0130	5	0.12	5			0.012	5		
16			0.116	7			0.013	5	0.12	5						
Average	0.0039		0.1065		0.00203		0.0123		0.1120		0.0061		0.0101		0.0023	
Standard deviation	0.0007		0.0054		0.00125		0.0006		0.0053		0.0013		0.0009		0.0005	
Certified value	0.0039		0.107				0.012		0.112		0.006		0.010		0.0023	
C(95%)	0.0004		0.0029				0.0003		0.0028		0.0008		0.0005		0.0005	
Standard deviation of homogeneity			0.001				0.0005		0.001		0.0003		0.0005			
Uncertainty	0.0004		0.003				0.001		0.003		0.001		0.001		0.0005	

Analysis	Sn	*	As**	*	Sb	*	Pb**	*	B	*
1	0.014	7	0.0008	7	0.004	5	0.0002	7	0.0016	5
2	0.0149	7	0.001	5	0.00416	7	0.0002	5	0.00161	7
3	0.015	6	0.0010	5	0.005	5	0.0002	6	0.0017	5
4	0.016	5	0.0012	7	0.005	4	0.0003	4	0.0017	6
5	0.016	5	0.0013	1	0.005	5	0.0004	4	0.0018	5
6	0.016	5	0.0013	5	0.0054	4	0.0007	1	0.0018	5
7	0.01605	7	0.0058	4	0.0056	5	0.0008	5	0.0018	5
8	0.017	5	0.00671	7	0.0057	6	0.0010	5	0.0018	5
9	0.017	5	0.0070	6	0.0058	1	0.001	5	0.0018	5
10	0.0172	1	< 0.001	5			0.00142	7	0.0019	7
11	0.0173	7					< 0.001	5	0.0020	5
12	0.0176	5					< 0.001	14	0.0021	7
13	0.018	5								
14	0.018	1								
15	0.019	4								
Average	0.0166		0.00290		0.00507		0.00062		0.0018	
Standard deviation	0.0013		0.00272		0.00064		0.00034		0.0001	
Certified value	0.017				0.0051				0.0018	
C(95%)	0.0007				0.0005				0.0001	
Standard deviation of homogeneity	0.0008								0.0001	
Uncertainty	0.001				0.0005				0.0001	

* - analytical method used

** - informative value

$C(95\%) = (t \cdot sd) / \sqrt{n - 1}$ - The half-width confidence interval calculated for the 95 % confidence level where t is the appropriate Student's t value, sd is the interlaboratory standard deviation and n is the number of acceptable mean values

Certification Process: Both preparation of this reference material and certification process were prepared according to requirements of ISO Guide 31, ISO Guide 34 and ISO Guide 35. This reference material is in agreement with ISO Guide 30.

Chemical Analysis: Chemical analyses were carried out on chips prepared by milling and also for bulk samples. Single values in the above table are the means obtained by individual laboratories. The following methods were used for analysis:

- 1 – wavelength dispersive x-ray fluorescence spectrometry,
- 2 – high frequency infra red absorption,
- 3 – high temperature extraction,
- 4 – graphite furnace atomic absorption spectrometry,
- 5 – spark atomic emission spectrometry,
- 6 – inductive coupled plasma mass spectrometry,
- 7 – inductive coupled plasma atomic emission spectrometry,
- 8 – gravimetry,
- 9 – potentiometric titration,
- 10 – titrimetry,
- 12 – spectrophotometry,
- 13 – coulometry,
- 14 – flame atomic emission spectrometry.

The laboratories participating in certification analysis:

- Deutsche Edelstahlwerke GmbH; Abteilung PP-CH, Witten, Germany - accreditation DakkS D-PL-19654-01-00, DIN EN ISO/IEC 17025;
- Enviform a.s., Třinec, Czech Republic; Testing laboratory Nr. 1371; Accreditation Certificate No. 219/2016 by the Czech Accreditation Institute; ČSN EN ISO/IEC 17025:2005;

- Huta Stali Jakościowych Stalowa Wola, Zakładowe Laboratorium Badawczo-Doświadczalne; UDT LB-032/22-16;
- Institute for Certified Reference Materials, Jekatierinburg, Russia, accreditation RU.0001.510008;
- Institute for Ferrous Metallurgy – Gliwice, Poland; PCA 17025 - AB554;
- Lithea, Ltd. Czech Republic;
- OnderzoeksCentrum voor de Aanwending van Staal, Zelzate, Belgium;
- PJSC “Electrometallurgical works “Dneprospetsstal”, Zaporozhye, Ukraine;
- U.S. Steel Košice - Labortest, s.r.o., Slovakia, Slovenská národná akreditačná služba ISO/IEC 17025:2005, Reg. No. 026/S-010 and 026/S-011;
- ŽĎAS. a.s. Žďár nad Sázavou. Czech Republic.

Homogeneity: The homogeneity of this Reference Material was evaluated in accordance with ASTM E826-81 standard. Optical emission spectrometry with spark excitation method was used.

Traceability: This Reference Material was tested with the use of optical emission spectrometry with spark excitation and was found compatible to the following CRMs: 28C1-2, 39C1-2, AR1653, AR645, BCS 451, BCS/SS456, BCS/SS460, BCS409, BCS433, BCS456, BCS460, BS1962, BS 50F, CKD165B, CKD166B, CKD180B, CKD181A-189A, CM16A, CZ2006A, EURO-AKP 178-1, EURONORM 85, EURONORM 86, EURONORM 87, EZRM 085-1, EZRM 231-2, Euronorm 281-1, IC5-1, IC6-1, IMZ1.10/1, IMZ1.11/2, IMZ1.12/1, IMZ1.3/7, IMZ1.33, IMZ1.71, IMZ1.72, IMZ1.81, IMZ112, IMZ117, IMZ124, IMZ138, IMZ103A, IMZ55/1, IMZ56, IMZ57, IMZ61/1, IMZ74, IMZ75, IMZ76, IMZ77, LECO 501-550, LECO 501-675, LECO 501-676, MBH 12X353, MBH 12X353 (F), MBH 12X356, MBH 12X365, MBH 12X41530, MBH 12xLA6B, MBH12xLA6, MBH 13X43100, SPL RM 2014, SPL RM 2005, SPL RM 2006, U13-4, UNL16-1, UNL17, UNL6-3, UNL7-3

Production of melt: This material was manufactured by Institute for Ferrous Metallurgy, Gliwice, Poland.

Available form: Discs 38 mm in diameter and 20 mm high.

Intended use: This Reference Material is intended for use in optical emission and X-ray spectrometric methods.

Note: In optical emission spectrometry with spark excitation it is recommended to avoid using the central part of the surface (diameter approx. 5 mm) due to possible segregation of material.

Validity of certification: The certification of IMZ 55/1A is valid indefinitely within the uncertainty specified provided this Reference Material is stored in dry place and in environment free from chemical or other aggressive vapours. Periodic recertification is not required. The certification is nullified if this Reference Material is damaged, contaminated or otherwise modified.

Safety: This Reference Material and packing does not contain substances which can directly influence health.

Storage: This Reference Material should be stored in dry place and in environment free from chemical or other aggressive vapours.

Inquiries regarding this Reference Material should be directed to:
rm@git.lukasiewicz.gov.pl

Approved by
 Director of the Institute

Prof. Dr. Hab. Eng. Adam Zieliński

Certificate issue date: 20 March 2025

Certificate revision history:

20 March 2025 (editorial changes)

22 May 2020 (change of information regarding validity of certification, editorial changes);

December 2017 (Original certificate date)