

# CERTIFICATE OF ANALYSIS

## IMZ 171

### REFERENCE MATERIAL OF STEEL

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

C	0.195	Al	0.036
Si	0.21	Sn	0.008
Mn	0.42	Co	0.024
P	0.020	N	0.057
S	0.014	V	0.26
Cr	11.44	Sb	(0.003)
Ni	0.59	Ti	(0.001)
Mo	1.23		
Cu	0.116		

Values in brackets are informative

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Analysis	C	Si	Mn	P	S	Cr	Ni	Mo
1	0.1857	0.180	0.403	0.0184	0.0128	11.220	0.560	1.170
2	0.1867	0.183	0.405	0.0189	0.0130	11.250	0.560	1.187
3	0.1871	0.210	0.406	0.0192	0.0130	11.267	0.569	1.193
4	0.1877	0.210	0.410	0.0200	0.0136	11.267	0.570	1.205
5	0.1900	0.214	0.410	0.0200	0.0137	11.288	0.584	1.230
6	0.1907	0.214	0.420	0.0200	0.0138	11.310	0.587	1.240
7	0.1910	0.217	0.420	0.0205	0.0140	11.366	0.588	1.242
8	0.1930	0.219	0.420	0.0210	0.0140	11.408	0.595	1.263
9	0.1935	0.220	0.420	0.0223	0.0142	11.500	0.600	1.288
10	0.1997	0.227	0.420		0.0142	11.547	0.616	1.297
11	0.2000	0.230	0.424		0.0146	11.650	0.617	
12	0.2000		0.430		0.0150	11.800		
13	0.2000		0.430		0.0157	11.900		
14	0.2017		0.433		0.0160			
15	0.2038		0.438					
16	0.2090							
Average	0.1950	0.211	0.419	0.0200	0.0141	11.444	0.586	1.232
SD	0.0071	0.0160	0.0107	0.0012	0.0010	0.222	0.020	0.043
<b>Certified</b>	<b>0.195</b>	<b>0.21</b>	<b>0.42</b>	<b>0.020</b>	<b>0.014</b>	<b>11.44</b>	<b>0.59</b>	<b>1.23</b>
C(95%)	0.0039	0.011	0.006	0.0010	0.0006	0.140	0.014	0.032
Analysis	Cu	Al	V	Sn	N	Co	Ti*	Sb*
1	0.1050	0.0296	0.230	0.0064	0.0557	0.0202	0.0007	0.0021
2	0.1100	0.0300	0.236	0.0080	0.0559	0.0230	0.0010	0.0022
3	0.1115	0.0345	0.237	0.0084	0.0568	0.0249	0.0023	0.0038
4	0.1129	0.0350	0.250	0.0084	0.0573	0.0262		
5	0.1135	0.0354	0.250	0.0090	0.0575			
6	0.1143	0.0420	0.259		0.0598			
7	0.1170	0.0433	0.260					
8	0.1180		0.270					
9	0.1180		0.272					
10	0.1220		0.277					
11	0.1300		0.288					
12			0.290					
Average	0.1157	0.0357	0.260	0.0080	0.0572	0.0236	0.0013	0.0027
SD	0.0066	0.0053	0.020	0.0010	0.0015	0.0026	0.0009	0.0010
<b>Certified</b>	<b>0.116</b>	<b>0.036</b>	<b>0.26</b>	<b>0.008</b>	<b>0.057</b>	<b>0.024</b>		
C(95%)	0.0047	0.0053	0.013	0.0014	0.0017	0.0048		
Analysis	W	Pb	As	Nb	Bi	Al(sol)	* informative values	
1	0.142	0.0003	0.0064	0.0001	0.0001	0.023		
2	0.158	0.0004	0.0096	0.0008				
3								
Average								
SD								

$C(95\%) = (t \cdot SD) / \sqrt{n-1}$  - 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. For further information regarding the confidence interval for the certified value see ISO Guide 35:1989 section 4.

**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 of the certified portion of the bars and also for some solid samples. Single values in the above table are the means obtained by individual laboratories. The following methods were used for analysis:

<b>C and S</b>	- high frequency infra-red absorption (HFIR), AES spark;
<b>Mn</b>	- flame AAS, AES spark, XRF, ICP-AES, photometric, titrimetric;
<b>Si</b>	- ICP-AES, AES spark, XRF, ICP-AES, photometric, gravimetric;
<b>P</b>	- ICP-AES, AES spark, XRF, photometric, titrimetric;
<b>Cr</b>	- flame AAS, AES spark, XRF, ICP-AES, photometric, titrimetric;
<b>Ni</b>	- flame AAS, AES spark, XRF, ICP-AES, photometric, gravimetric;
<b>Cu, Mo</b>	- flame AAS, AES spark, XRF, ICP-AES, photometric;
<b>V</b>	- flame AAS, AES spark, XRF, ICP-AES, photometric;
<b>Ti</b>	- GF AAS, ICP-AES;
<b>Co, Nb</b>	- AES spark, ICP-AES;
<b>Al</b>	- flame AAS, AES spark, ICP-AES, photometric;
<b>Sn</b>	- GF AAS, AES spark, ICP-AES;
<b>N</b>	- high temperature extraction;
<b>Pb</b>	- GF AAS, ICP-AES;
<b>As, Sb, Bi</b>	- GF AAS;
<b>W</b>	- AES spark;
<b>Al(soluble)</b>	- ICP-AES.

**The laboratories participating in the testing of this Reference Material were:**

- Alstom Power, Elbląg, Poland
- Ferrostal, Gliwice, Poland
- Huta Lucchini, Warszawa, Poland
- Huta Małapanew, Ozimek, Poland
- Huta Trzyniec, Czech Republic
- Instytut Metalurgii Żelaza, Gliwice, Poland
- ISH Ołomuniec, Czech Republic
- Laboratorio Aplikacyjne firmy GNR, Italy
- Laboratorio Aplikacyjne firmy LECO, Praga, Czech Republic
- Laboratorio Aplikacyjne firmy Thermo-ARL, Switzerland
- Magnesy Baildon, Katowice, Poland
- Mittal Steel Poland, Oddział Dąbrowa Górnicza, Poland
- Mittal Steel Poland, Oddział Kraków, Poland
- US Steel - Labortest, Koszyce, Slovakia

**Homogeneity:** The homogeneity of this Reference Material was evaluated with the use of statistic parameters obtained during interlaboratory tests in 1996 and found acceptable. 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:

BS 34D, 36D, 37E and CKD 180-180A.

**Production of melt:** This material was produced by Huta Baildon, Katowice. The melt was made in an open induction furnace.

**Available form:** Discs: 40 mm in diameter and 40 mm thick; chips: bottles 100g.

**Intended use:** This Reference Material is intended for use in optical emission and X-ray spectrometric methods (bulks sample) and also in classical wet methods, UV-Vis spectrometry, AAS, ICP-AES, C,S- and N- analyzers and other wet methods (chips).

Caution: In optical emission spectrometry with spark excitation the central part of the surface of discs (approximately 5 mm) should be avoided because of possible segregation of the material.

**Validity of certification:** The certification of IMZ 171 is valid indefinitely 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.

Chips: if the contents of the bottle becomes changed (for example oxidized) or contaminated, the whole contents of bottle should be discarded.

**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](mailto:rm@git.lukasiewicz.gov.pl)**

Approved by  
Director of the Institute

Prof. Dr. Hab. Eng. Adam Zieliński

Certificate issue date: 21 of January 2024

Certificate revision history:

21 January 2024 (editorial changes); 21 January 2021 (change of information regarding validity of certification, editorial changes); November 2003 (Original certificate date)