



The SPL RM divide into four groups:

- CRM (with the status of national CRM)
- RM and QCM for quality control
- Hi Tec candidate materials to be ultimately certified by the user (instrument producers, big industrial labs etc.)

The following tables state the RM codes, certified values  $c$  and  $\pm$  interval of the expanded combined uncertainty  $U_c$ , respectively, both expressed in % m/m.

A consecutive replacement with slightly different figures, distinguished alphabetically in the code, is available for supply when the original batch is out of stock.

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# REFERENCE MATERIALS

[www.spl-labmat.cz](http://www.spl-labmat.cz)

## CRM – certified reference materials

SPL is authorised and regularly audited by the Czech Metrological Institute (CMI) to produce the national CRM, bearing a prefix CZ in their code. The entire course of projecting, candidate materials selection, processing and testing and a final characterisation comply with the ISO Guides 34, 35 and ISO 17025 and it is supervised and approved by the CMI. The certified values as results of the interlaboratory experiment with the international participation are traceable to the adequate references.

Currently available, a „C, S, N combustion line“ of steel and cast iron sets covers together the ranges of C from 0,002 through 4,5%, S from 0,002 through 0,25% and N from 0,004 through 0,013%.

## LOW ALLOY STEEL CRM FOR C, S, N in a 250 g packing (CRM CZ 2025 in a 200g packing)

### CRM CZ 2003 – 8 (valid till 2022), CRM CZ 2025 A, 2026 A (valid till 2022)

	2003 A	2004 A	2005 A	2006 A	2007 A	2008 A	2025 A*	2026 A*
C	<b>0.0402</b>	<b>0.079</b>	<b>0.358</b>	<b>0.461</b>	<b>0.684</b>	<b>0.977</b>	<b>0.0020</b>	<b>0.068</b>
	0.0008	0.001	0.004	0.002	0.006	0.003	0.0003	0.001
S	<b>0.0316</b>	<b>0.0464</b>	<b>0.0250</b>	<b>0.0172</b>	<b>0.0106</b>	<b>0.0091</b>	<b>0.0018</b>	<b>0.255</b>
	0.0006	0.0010	0.0005	0.0007	0.0004	0.0004	0.0002	0.005
N	<b>0.0046</b>	<b>0.0038</b>	<b>0.0081</b>	<b>0.0066</b>	<b>0.0128</b>	<b>0.0066</b>		
	0.0002	0.0002	0.0002	0.0004	0.0004	0.0003		

\*2025 A pure iron powder ( in a 200g packing)

\*2026 A free-cutting steel

## CAST IRON CRM FOR C, S in a 100 g packing

### CRM CZ 2015 A - 2024 A (valid till 2022)

	2015 A	2016 A	2017 A	2018 A	2019 A	2022 A	2023 A	2024 A
C	<b>1.996</b>	<b>2.053</b>	<b>2.463</b>	<b>3.173</b>	<b>3.270</b>	<b>3.826</b>	<b>4.029</b>	<b>4.512</b>
	0.011	0.016	0.023	0.020	0.014	0.014	0.016	0.022
S	<b>0.0157</b>	<b>0.0048</b>	<b>0.0755</b>	<b>0.0142</b>	<b>0.0116</b>	<b>0.0768</b>	<b>0.0886</b>	<b>0.0264</b>
	0.0004	0.0004	0.0026	0.0005	0.0004	0.0030	0.0028	0.0004

# CERTIFIED REFERENCE MATERIALS

## CRM CZ 02033 and CRM CZ 20034

**CRM CZ 02033 - Cast iron for solid sample spectrometry, CRM set 1-8** (valid till 2027)

Intended for calibration, validation and matrix-match verification of cast iron spectrometric analysis from a plane of solid sample: Atomic Emission Spectrometry with spark, glow-discharge or laser excitation, and X-ray Fluorescence Spectrometry.

Eight CRM 1–8 represent the most frequent unalloyed and low alloy cast iron types in sequence: unalloyed ductile iron, Ni-Cu ductile iron, vermicular iron (CGI), pig iron, malleable iron, Mn-Cr-V and Ni-Mo alloyed iron and plain grey iron.

Supplied in a set or as individual discs 40 mm in diameter and approximately 18 mm of total height, with two certified layers extending 6 mm upwards from either working surface. The discs are marked on the side by the CRM code and the certified layers' limits. When used to both limits, the remainder, which may contain minor structure defects, should be discarded.

	<b>C</b>	<b>Mn</b>	<b>Si</b>	<b>P</b>	<b>S</b>	<b>Cr</b>	<b>Ni</b>	<b>Cu</b>	<b>Mo</b>	<b>Mg</b>	<b>Ce</b>
<b>5A</b>	<b>2.30</b> 0.04	<b>0.804</b> 0.005	<b>1.26</b> 0.02	<b>0.035</b> 0.001	<b>0.100</b> 0.003	<b>0.054</b> 0.001	<b>0.096</b> 0.002	<b>0.014</b> 0.001	<b>0.100</b> 0.002		
<b>7A</b>	<b>3.11</b> 0.03	<b>0.321</b> 0.003	<b>1.83</b> 0.02	<b>0.043</b> 0.002	<b>0.019</b> 0.001	<b>0.479</b> 0.005	<b>1.29</b> 0.01	<b>0.022</b> 0.001	<b>1.07</b> 0.01		

	<b>V</b>	<b>Ti</b>	<b>Al</b>	<b>Sn</b>	<b>Sb</b>	<b>Bi</b>	<b>B</b>	<b>Zn</b>	<b>Pb</b>	<b>W</b>	<b>Co</b>
<b>5A</b>	<b>0.005</b> 0.001	<b>0.008</b> 0.001	<b>0.060</b> 0.003								
<b>7A</b>	<b>0.005</b> 0.001	<b>0.027</b> 0.001	<b>0.029</b> 0.001							<b>0.022</b> 0.003	<b>0.044</b> 0.002

	<b>C</b>	<b>Mn</b>	<b>Si</b>	<b>P</b>	<b>S</b>	<b>Cr</b>	<b>Ni</b>	<b>Cu</b>	<b>Mo</b>	<b>Mg</b>	<b>Ce</b>
<b>4B</b>	<b>3.95</b> 0.02	<b>0.145</b> 0.002	<b>0.252</b> 0.004	<b>0.041</b> 0.002	<b>0.046</b> 0.002	<b>0.049</b> 0.001	<b>0.023</b> 0.001	<b>0.062</b> 0.002	<b>0.005</b> 0.001		
<b>4C</b>	<b>4.06</b> 0.02	<b>0.250</b> 0.002	<b>0.423</b> 0.005	<b>0.054</b> 0.002	<b>0.038</b> 0.002	<b>0.080</b> 0.002	<b>0.084</b> 0.001	<b>0.085</b> 0.002	<b>0.002</b> 0.001		
<b>5B</b>	<b>2.42</b> 0.04	<b>0.812</b> 0.005	<b>1.32</b> 0.02	<b>0.033</b> 0.001	<b>0.073</b> 0.003	<b>0.061</b> 0.001	<b>0.188</b> 0.003	<b>0.031</b> 0.001	<b>0.089</b> 0.002		
<b>6B</b>	<b>2.95</b> 0.04	<b>1.15</b> 0.01	<b>3.23</b> 0.04	<b>0.095</b> 0.003	<b>0.020</b> 0.002	<b>1.36</b> 0.002	<b>0.026</b> 0.001	<b>0.272</b> 0.003	<b>0.005</b> 0.001		
<b>7B</b>	<b>3.61</b> 0.03	<b>0.304</b> 0.003	<b>1.82</b> 0.02	<b>0.021</b> 0.002	<b>0.020</b> 0.002	<b>0.536</b> 0.005	<b>1.28</b> 0.01	<b>0.036</b> 0.001	<b>0.96</b> 0.01		

	<b>V</b>	<b>Ti</b>	<b>Al</b>	<b>Sn</b>	<b>Sb</b>	<b>Bi</b>	<b>B</b>	<b>Zn</b>	<b>Pb</b>	<b>W</b>	<b>Co</b>
<b>4B</b>	<b>0.004</b> 0.001	<b>0.006</b> 0.001	<b>0.003</b> 0.001	<b>0.001</b> 0.001	0.001			<b>0.008</b> 0.001	<b>0.004</b> 0.001		<b>0.005</b> 0.001
<b>4C</b>	<b>0.015</b> 0.001	<b>0.010</b> 0.001	<b>0.005</b> 0.001	<b>0.002</b> 0.001	0.001			<b>0.016</b> 0.002	<b>0.003</b> 0.001		<b>0.035</b> 0.002
<b>5B</b>	<b>0.005</b> 0.001	<b>0.007</b> 0.001	<b>0.062</b> 0.001			<b>0.020</b> 0.003	<b>0.014</b> 0.001				
<b>6B</b>	<b>0.083</b> 0.002	<b>0.068</b> 0.003	<b>0.007</b> 0.001	<b>0.140</b> 0.004	<b>0.049</b> 0.003						
<b>7B</b>	<b>0.007</b> 0.001	<b>0.015</b> 0.001	<b>0.022</b> 0.001							<b>0.045</b> 0.004	<b>0.050</b> 0.002

Further non-certified values are: 0.010% As in 4B, 0.008% As in 6B

	C	Mn	Si	P	S	Cr	Ni	Cu	Mo	Mg	Ce
1E	3.15 0.03	0.718 0.005	2.72 0.03	0.037 0.002	0.006 0.001	0.037 0.001	0.367 0.003	0.012 0.001	0.185 0.002	0.042 0.002	0.027 0.002
1F	3.23 0.03	0.693 0.005	2.68 0.03	0.043 0.002	0.005 0.001	0.035 0.001	0.373 0.003	0.018 0.001	0.182 0.002	0.070 0.003	0.036 0.003
1G	3.22 0.03	0.701 0.005	2.53 0.03	0.036 0.002	0.007 0.001	0.044 0.001	0.357 0.003	0.027 0.001	0.185 0.002	0.050 0.003	0.023 0.003
2E	3.47 0.03	0.168 0.002	1.03 0.02	0.106 0.003	0.010 0.001	0.043 0.001	0.620 0.003	0.893 0.010	0.002 0.001	0.038 0.003	0.017 0.002
2F	3.77 0.03	0.091 0.002	1.23 0.02	0.159 0.004	0.009 0.001	0.022 0.001	0.658 0.005	0.893 0.010	0.002 0.001	0.053 0.002	0.018 0.002
2G	3.78 0.04	0.096 0.002	1.10 0.02	0.125 0.003	0.009 0.001	0.027 0.001	0.650 0.005	0.880 0.010	0.002 0.001	0.036 0.002	0.013 0.002
3C	3.68 0.03	0.333 0.003	2.15 0.02	0.026 0.001	0.007 0.001	0.100 0.002	0.040 0.001	0.421 0.004	0.490 0.006	0.006 0.001	0.013 0.002
3D	3.24 0.03	0.317 0.002	2.12 0.02	0.008 0.001	0.006 0.001	0.236 0.003	0.025 0.001	0.396 0.004	0.453 0.005	0.016 0.002	0.006 0.002
4D	4.19 0.03	0.112 0.002	0.259 0.004	0.050 0.002	0.041 0.002	0.056 0.001	0.063 0.002	0.084 0.002	0.024 0.001		
4E	4.45 0.04	0.034 0.002	0.090 0.005	0.023 0.001	0.006 0.001	0.030 0.001	0.049 0.002	0.005 0.001	0.002 0.001		
5C	2.30 0.02	0.704 0.004	1.40 0.02	0.027 0.001	0.091 0.003	0.085 0.002	0.188 0.003	0.013 0.001	0.104 0.002		
6C	3.11 0.03	1.25 0.01	3.25 0.03	0.097 0.003	0.019 0.002	1.33 0.01	0.021 0.001	0.273 0.003	0.006 0.001		
7C	3.55 0.03	0.389 0.004	1.73 0.02	0.028 0.002	0.026 0.002	0.542 0.004	1.26 0.01	0.016 0.001	0.966 0.010		
8C	3.41 0.03	0.408 0.003	1.93 0.02	0.168 0.004	0.058 0.003	0.125 0.002	0.102 0.002	0.158 0.002	0.041 0.001		
	V	Ti	Al	Sn	Sb	Bi	B	Zn	Pb	W	Co
1E	0.015 0.001	0.046 0.001	0.058 0.002	0.032 0.002		0.002 0.001	0.0036 0.0003	0.009 0.001	0.007 0.001	0.021 0.002	0.022 0.001
1F	0.014 0.001	0.041 0.001	0.073 0.003	0.030 0.002		0.001 0.001	0.0043 0.0003	0.004 0.001	0.009 0.001	0.022 0.001	0.024 0.001
1G	0.019 0.001	0.054 0.001	0.062 0.002	0.028 0.002		0.005 0.001	0.0034 0.0003	0.003 0.001	0.016 0.002	0.015 0.001	0.010 0.001
2E	0.026 0.001	0.039 0.001	0.025 0.001	0.015 0.001	0.028 0.002	0.005 0.001	0.0024 0.0002	0.025 0.002	0.004 0.001	0.008 0.001	0.005 0.001
2F	0.010 0.001	0.021 0.001	0.024 0.001	0.014 0.001	0.028 0.002	0.002 0.001	0.0020 0.0002	0.018 0.001	0.005 0.001	0.003 0.001	0.003 0.001
2G	0.017 0.001	0.029 0.001	0.019 0.001	0.015 0.001	0.029 0.002	0.006 0.001	0.0023 0.0002	0.020 0.001	0.008 0.001	0.004 0.001	0.012 0.001
3C	0.016 0.001	0.021 0.001	0.024 0.001	0.009 0.001		0.002 0.001	0.0044 0.0002		0.005 0.001	0.003 0.001	0.026 0.001
3D	0.072 0.002	0.016 0.001	0.055 0.002	0.009 0.001	0.007 0.001	0.002 0.001	0.0071 0.0003		0.005 0.001		0.014 0.001
4D	0.012 0.001	0.009 0.001	0.007 0.001	0.001 0.001		0.002 0.001	0.0001	0.009 0.001	0.007 0.001		0.003 0.001
4E	0.015 0.001	0.011 0.001	0.003 0.001	0.001 0.001		0.002 0.001			0.002 0.001		0.033 0.001
5C	0.054 0.002	0.008 0.001	0.103 0.003	0.002 0.001	0.002	0.007 0.002	0.0078 0.0003				0.013 0.001
6C	0.192 0.002	0.107 0.004	0.024 0.001	0.131 0.003	0.044 0.002		0.0024 0.0002		0.003 0.001	0.007 0.001	0.005 0.001
7C	0.067 0.001	0.026 0.001	0.040 0.002	0.004 0.001		0.002	0.0008 0.0002			0.037 0.002	0.048 0.001
8C	0.015 0.001	0.022 0.001	0.004 0.001	0.067 0.002	0.014 0.002	0.009 0.001			0.008 0.001		0.030 0.001

Further non-certified values are 0.007% As in 3C, 0.018% As in 3D, 0.012% As in 4D, 0.006% As in 8C, 0.007% Te in 1F, 0.006% Te in 2E, 0.004% Te in 2G, 0.005% Te in 3C, 0.010% Te in 5C, 0.006% Te in 7C, 0.007% Zr in 1E, 0.008% Zr in 1F, 0.004% Zr in 1G, 0.005% Zr in 2F, 0.009% Zr in 5C (valid till 2030)

**CRM CZ 20034 - Cast iron for solid sample spectrometry, CRM set 11-17**

(valid till 2029)

	<b>C</b>	<b>Mn</b>	<b>Si</b>	<b>P</b>	<b>S</b>	<b>Cr</b>	<b>Ni</b>	<b>Cu</b>
<b>11A</b>	<b>2.37</b> 0.02	<b>0.343</b> 0.007	<b>3.31</b> 0.04	<b>0.271</b> 0.009	<b>0.163</b> 0.007	<b>1.219</b> 0.015	<b>0.084</b> 0.002	<b>0.086</b> 0.003
<b>11B</b>	<b>2.44</b> 0.02	<b>0.382</b> 0.008	<b>3.67</b> 0.04	<b>0.271</b> 0.009	<b>0.140</b> 0.007	<b>1.178</b> 0.016	<b>0.082</b> 0.002	<b>0.130</b> 0.003
<b>12A</b>	<b>2.82</b> 0.02	<b>0.996</b> 0.010	<b>2.57</b> 0.03	<b>0.480</b> 0.011	<b>0.073</b> 0.003	<b>0.640</b> 0.008	<b>0.174</b> 0.002	<b>0.160</b> 0.004
<b>12B</b>	<b>2.92</b> 0.02	<b>1.047</b> 0.011	<b>2.96</b> 0.03	<b>0.484</b> 0.011	<b>0.077</b> 0.003	<b>0.638</b> 0.008	<b>0.174</b> 0.002	<b>0.223</b> 0.005
<b>13A</b>	<b>3.13</b> 0.03	<b>0.691</b> 0.006	<b>2.19</b> 0.02	<b>0.0244</b> 0.0016	<b>0.0046</b> 0.0004	<b>0.122</b> 0.003	<b>1.266</b> 0.016	<b>0.021</b> 0.002
<b>13B</b>	<b>3.12</b> 0.03	<b>0.692</b> 0.006	<b>2.12</b> 0.02	<b>0.0243</b> 0.0017	<b>0.0041</b> 0.0004	<b>0.125</b> 0.003	<b>1.313</b> 0.017	<b>0.021</b> 0.002
<b>13C</b>	<b>3.15</b> 0.03	<b>0.704</b> 0.007	<b>2.23</b> 0.02	<b>0.0261</b> 0.0017	<b>0.0044</b> 0.0004	<b>0.124</b> 0.003	<b>1.299</b> 0.017	<b>0.089</b> 0.003
<b>14B</b>	<b>3.26</b> 0.02	<b>0.240</b> 0.003	<b>2.34</b> 0.02	<b>0.0115</b> 0.0011	<b>0.0096</b> 0.005	<b>0.042</b> 0.002	<b>0.020</b> 0.002	<b>0.640</b> 0.008
<b>14C</b>	<b>3.14</b> 0.02	<b>0.275</b> 0.003	<b>2.49</b> 0.02	<b>0.0162</b> 0.0011	<b>0.0081</b> 0.005	<b>0.045</b> 0.002	<b>0.030</b> 0.002	<b>0.585</b> 0.008
<b>15B</b>	<b>3.52</b> 0.03	<b>0.048</b> 0.002	<b>1.66</b> 0.02	<b>0.054</b> 0.003	<b>0.0031</b> 0.0003	<b>0.067</b> 0.002	<b>0.681</b> 0.008	<b>1.322</b> 0.018
<b>15C</b>	<b>3.47</b> 0.03	<b>0.060</b> 0.002	<b>1.68</b> 0.02	<b>0.054</b> 0.003	<b>0.0028</b> 0.0003	<b>0.078</b> 0.003	<b>0.728</b> 0.009	<b>1.123</b> 0.018
<b>16A</b>	<b>3.80</b> 0.03	<b>1.292</b> 0.012	<b>1.00</b> 0.01	<b>0.171</b> 0.006	<b>0.0266</b> 0.0014	<b>0.374</b> 0.006	<b>0.390</b> 0.004	<b>0.332</b> 0.007
<b>16B</b>	<b>3.78</b> 0.03	<b>1.327</b> 0.013	<b>1.00</b> 0.01	<b>0.170</b> 0.006	<b>0.0236</b> 0.0014	<b>0.378</b> 0.006	<b>0.388</b> 0.005	<b>0.332</b> 0.007
<b>16C</b>	<b>3.87</b> 0.03	<b>1.311</b> 0.013	<b>0.95</b> 0.01	<b>0.173</b> 0.006	<b>0.0243</b> 0.0014	<b>0.332</b> 0.006	<b>0.376</b> 0.005	<b>0.345</b> 0.007
<b>17A</b>	<b>4.30</b> 0.04	<b>0.494</b> 0.005	<b>0.170</b> 0.008	<b>0.115</b> 0.005	<b>0.0034</b> 0.0004	<b>0.200</b> 0.004	<b>2.38</b> 0.03	<b>0.082</b> 0.004
<b>17B</b>	<b>4.38</b> 0.04	<b>0.501</b> 0.005	<b>0.178</b> 0.009	<b>0.089</b> 0.005	<b>0.0040</b> 0.0004	<b>0.200</b> 0.005	<b>2.34</b> 0.03	<b>0.111</b> 0.005
<b>17C</b>	<b>4.08</b> 0.04	<b>0.503</b> 0.005	<b>0.150</b> 0.008	<b>0.104</b> 0.005	<b>0.0033</b> 0.0004	<b>0.178</b> 0.005	<b>2.32</b> 0.03	<b>0.037</b> 0.002

	<b>Mo</b>	<b>Mg</b>	<b>Ce</b>	<b>V</b>	<b>Ti</b>	<b>Al</b>	<b>Sn</b>	<b>Sb</b>
<b>11A</b>	<b>1.130</b> 0.019			<b>0.184</b> 0.004	<b>0.028</b> 0.002	<b>0.046</b> 0.002	<b>0.070</b> 0.003	<b>0.013</b> 0.003
<b>11B</b>	<b>1.144</b> 0.020			<b>0.182</b> 0.005	<b>0.041</b> 0.002	<b>0.067</b> 0.003	<b>0.074</b> 0.003	<b>0.011</b> 0.003
<b>12A</b>	<b>0.114</b> 0.002			<b>0.340</b> 0.005	<b>0.085</b> 0.003	<b>0.077</b> 0.003	<b>0.041</b> 0.003	<b>0.046</b> 0.004
<b>12B</b>	<b>0.117</b> 0.002			<b>0.326</b> 0.005	<b>0.071</b> 0.003	<b>0.077</b> 0.003	<b>0.042</b> 0.003	<b>0.046</b> 0.004
<b>13A</b>	<b>0.364</b> 0.006	<b>0.053</b> 0.003	<b>0.011</b> 0.002	<b>0.048</b> 0.002	<b>0.014</b> 0.001	<b>0.017</b> 0.001	<b>0.014</b> 0.001	0.002
<b>13B</b>	<b>0.364</b> 0.007	<b>0.054</b> 0.003	<b>0.011</b> 0.002	<b>0.048</b> 0.002	<b>0.012</b> 0.001	<b>0.019</b> 0.001	<b>0.014</b> 0.001	0.002
<b>13C</b>	<b>0.360</b> 0.007	<b>0.064</b> 0.004	<b>0.011</b> 0.002	<b>0.043</b> 0.002	<b>0.015</b> 0.001	<b>0.022</b> 0.001	<b>0.014</b> 0.001	0.002
<b>14B</b>	<b>0.635</b> 0.009	<b>0.015</b> 0.002	<b>0.012</b> 0.002	<b>0.012</b> 0.001	<b>0.021</b> 0.001	<b>0.012</b> 0.001	<b>0.028</b> 0.002	<b>0.016</b> 0.003
<b>14C</b>	<b>0.646</b> 0.009	<b>0.017</b> 0.002	<b>0.019</b> 0.003	<b>0.013</b> 0.001	<b>0.018</b> 0.001	<b>0.007</b> 0.001	<b>0.025</b> 0.002	<b>0.020</b> 0.003
<b>15B</b>	<b>0.004</b> 0.001	<b>0.037</b> 0.002	<b>0.021</b> 0.003	<b>0.013</b> 0.001	<b>0.025</b> 0.002	<b>0.029</b> 0.002	<b>0.005</b> 0.001	<b>0.058</b> 0.006
<b>15C</b>	<b>0.002</b> 0.001	<b>0.040</b> 0.002	<b>0.030</b> 0.003	<b>0.019</b> 0.001	<b>0.036</b> 0.002	<b>0.010</b> 0.001	<b>0.006</b> 0.001	<b>0.056</b> 0.006
<b>16A</b>	<b>0.203</b> 0.004			<b>0.021</b> 0.001	<b>0.073</b> 0.002	<b>0.007</b> 0.001	<b>0.125</b> 0.006	<b>0.011</b> 0.002
<b>16B</b>	<b>0.202</b> 0.004			<b>0.029</b> 0.001	<b>0.070</b> 0.002	<b>0.007</b> 0.001	<b>0.121</b> 0.006	<b>0.011</b> 0.002
<b>16C</b>	<b>0.195</b> 0.004			<b>0.027</b> 0.001	<b>0.057</b> 0.002	<b>0.004</b> 0.001	<b>0.125</b> 0.006	<b>0.010</b> 0.002
<b>17A</b>	<b>0.030</b> 0.002	<b>0.007</b> 0.001	<b>0.003</b> 0.001	<b>0.086</b> 0.003	<b>0.016</b> 0.001	<b>0.002</b> 0.001	<b>0.002</b> 0.001	
<b>17B</b>	<b>0.030</b> 0.002	<b>0.009</b> 0.001	<b>0.003</b> 0.001	<b>0.086</b> 0.003	<b>0.016</b> 0.001	<b>0.002</b> 0.001	<b>0.002</b> 0.001	
<b>17C</b>	<b>0.030</b> 0.002	<b>0.007</b> 0.001	<b>0.003</b> 0.001	<b>0.076</b> 0.003	<b>0.015</b> 0.001	<b>0.002</b> 0.001	<b>0.002</b> 0.001	

	Bi	B	Zn	Pb	W	Co	Zr	As
<b>11A</b>	<b>0.011</b> 0.001	<b>0.0018</b> 0.0003		<b>0.017</b> 0.003	0.005	<b>0.005</b> 0.001	<b>0.007</b> 0.001	<b>0.005</b> 0.001
<b>11B</b>	<b>0.007</b> 0.001	<b>0.0032</b> 0.0004		<b>0.007</b> 0.001	0.005	<b>0.005</b> 0.001	<b>0.007</b> 0.001	<b>0.005</b> 0.001
<b>12A</b>	<b>0.005</b> 0.001	<b>0.036</b> 0.002	<b>0.003</b> 0.001	<b>0.007</b> 0.001	<b>0.011</b> 0.002	<b>0.004</b> 0.001	0.002	<b>0.022</b> 0.002
<b>12B</b>	<b>0.006</b> 0.001	<b>0.047</b> 0.002	<b>0.004</b> 0.001	<b>0.009</b> 0.001	<b>0.007</b> 0.002	<b>0.008</b> 0.001	0.002	<b>0.024</b> 0.002
<b>13A</b>					0.003	<b>0.024</b> 0.001	<b>0.029</b> 0.003	<b>0.002</b> 0.001
<b>13B</b>					0.003	<b>0.024</b> 0.001	<b>0.023</b> 0.003	<b>0.002</b> 0.001
<b>13C</b>					0.003	<b>0.024</b> 0.001	<i>0.02</i>	<b>0.002</b> 0.001
<b>14B</b>	<b>0.007</b> 0.001	<b>0.0100</b> 0.0006	<b>0.009</b> 0.001	0.005	0.005	<b>0.005</b> 0.001	<b>0.014</b> 0.001	<b>0.034</b> 0.004
<b>14C</b>		<b>0.0123</b> 0.0006	<b>0.010</b> 0.001		0.003	<b>0.009</b> 0.001	<b>0.013</b> 0.001	<b>0.035</b> 0.004
<b>15B</b>	<b>0.010</b> 0.001	<b>0.0033</b> 0.0003			<b>0.007</b> 0.001	<b>0.027</b> 0.001		0.003
<b>15C</b>	<b>0.008</b> 0.001	<b>0.0057</b> 0.0004			<b>0.004</b> 0.001	<b>0.026</b> 0.001		0.003
<b>16A</b>		<b>0.018</b> 0.001	<b>0.019</b> 0.002	<b>0.006</b> 0.001	<b>0.019</b> 0.002	<b>0.010</b> 0.001	0.002	<b>0.005</b> 0.001
<b>16B</b>		<b>0.018</b> 0.001	<b>0.020</b> 0.002	<b>0.007</b> 0.001	<b>0.019</b> 0.002	<b>0.010</b> 0.001	0.002	<b>0.005</b> 0.001
<b>16C</b>		<b>0.020</b> 0.001	<b>0.017</b> 0.002	<b>0.015</b> 0.003	<b>0.015</b> 0.002	<b>0.006</b> 0.001	0.002	<b>0.003</b> 0.001
<b>17A</b>	0.001	0.0002		<b>0.002</b> 0.001	<b>0.004</b> 0.001	<b>0.043</b> 0.002		<b>0.007</b> 0.001
<b>17B</b>	0.001	0.0002		<b>0.002</b> 0.001	<b>0.004</b> 0.001	<b>0.043</b> 0.002		<b>0.008</b> 0.001
<b>17C</b>	0.002	0.0006		<b>0.002</b> 0.001	<b>0.004</b> 0.001	<b>0.043</b> 0.002		<b>0.005</b> 0.001

Further non-certified values : Nb: 0.007% in 11A, 0.008% in 12A, 0.01% in 14B, 0.006% in 16A, 0.03% in 16B,  
Te: 0.005% in 11A, 0.01% in 11B, 0.006% in 16A, 16B and 0.007% in 16C



## RM for spectrometry

fully compliant with the ISO Guide 35 definition of Reference Material – with the values confirmed and their uncertainties assessed.

Intended for calibration and the control of matrix-match and of the state of statistic regulation in the automated spectrometry of low alloy steel from a plane of solid sample. They may not substitute CRM in establishing traceability of the results. A single analysis area of at least 4 mm in diameter defines the minimum sample intake.

### RM CI-SPL-17 – RM of cast iron for solid sample spectrometry, ø 40 mm, h = 18 mm

	<b>C</b>	<b>Mn</b>	<b>Si</b>	<b>P</b>	<b>S</b>	<b>Cr</b>	<b>Ni</b>	<b>Cu</b>	<b>Mo</b>	<b>Mg</b>	<b>Ce</b>	<b>V</b>
<b>31A</b>	<b>3.54</b>	<b>0.041</b>	<b>2.10</b>	<b>0.025</b>	<b>0.006</b>	<b>0.019</b>	<b>0.538</b>	<b>0.005</b>	<b>0.004</b>	<b>0.070</b>	<i>0.004</i>	<b>0.008</b>
(ID-0A)	0.04	0.002	0.02	0.001	0.001	0.001	0.004	0.001	0.001	0.003		0.001
<b>32A</b>	<b>3.39</b>	<b>0.288</b>	<b>2.74</b>	<b>0.037</b>	<b>0.007</b>	<b>0.060</b>	<b>0.015</b>	<b>0.306</b>	<b>0.116</b>	<b>0.024</b>	<i>0.004</i>	<b>0.005</b>
(ID-1B)	0.02	0.003	0.03	0.002	0.001	0.002	0.001	0.005	0.002	0.002		0.001
<b>33A</b>	<b>2.75</b>	<b>0.710</b>	<b>3.10</b>	<b>0.060</b>	<b>0.007</b>	<b>0.239</b>	<b>0.389</b>	<b>0.730</b>	<b>0.220</b>	<b>0.021</b>	<b>0.026</b>	<b>0.356</b>
(ID-3B)	0.02	0.006	0.03	0.002	0.001	0.002	0.004	0.010	0.003	0.002	0.003	0.004
<b>34A</b>	<b>3.48</b>	<b>0.980</b>	<b>2.29</b>	<b>0.105</b>	<b>0.008</b>	<b>0.102</b>	<b>0.493</b>	<b>0.230</b>	<b>0.072</b>	<b>0.026</b>	<b>0.008</b>	<b>0.073</b>
(ID-5B)	0.03	0.010	0.02	0.003	0.001	0.002	0.004	0.004	0.002	0.002	0.002	0.002
<b>35A</b>	<b>4.55</b>	<b>0.096</b>	<b>0.078</b>	<b>0.024</b>	<b>0.011</b>	<b>0.022</b>	<b>0.024</b>	<b>0.004</b>	<b>0.003</b>			<b>0.009</b>
(IP-1B)	0.04	0.003	0.004	0.001	0.001	0.002	0.002	0.001	0.001			0.001
<b>36A</b>	<b>3.02</b>	<b>0.057</b>	<b>2.13</b>	<b>0.026</b>	<b>0.010</b>	<b>0.014</b>	<b>0.011</b>	<b>0.007</b>	<b>0.004</b>	<b>0.012</b>	<b>0.007</b>	<b>0.021</b>
(IG-0A)	0.02	0.002	0.02	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002
<b>37A</b>	<b>3.07</b>	<b>0.211</b>	<b>3.30</b>	<b>0.025</b>	<b>0.023</b>	<b>0.328</b>	<b>0.106</b>	<b>0.149</b>	<b>0.325</b>			<b>0.122</b>
(IG-1B)	0.02	0.003	0.03	0.001	0.001	0.002	0.002	0.003	0.004			0.003
<b>38A</b>	<b>3.39</b>	<b>0.401</b>	<b>2.37</b>	<b>0.067</b>	<b>0.036</b>	<b>0.141</b>	<b>0.306</b>	<b>0.510</b>	<b>0.101</b>			<b>0.061</b>
(IG-2B)	0.03	0.004	0.02	0.002	0.002	0.002	0.003	0.006	0.002			0.002
<b>39A</b>	<b>3.70</b>	<b>0.812</b>	<b>1.90</b>	<b>0.160</b>	<b>0.045</b>	<b>0.488</b>	<b>0.032</b>	<b>0.298</b>	<b>0.203</b>			<b>0.232</b>
(IG-3B)	0.03	0.011	0.02	0.003	0.002	0.003	0.001	0.005	0.003			0.004
<b>40A</b>	<b>3.38</b>	<b>0.042</b>	<b>1.98</b>	<b>0.021</b>	<b>0.0035</b>	<b>0.031</b>	<b>0.045</b>	<b>0.010</b>	<b>0.005</b>	<b>0.007</b>	<b>0.012</b>	<b>0.014</b>
(IG-4A)	0.02	0.002	0.02	0.002	0.0005	0.001	0.001	0.001	0.001	0.001	0.002	0.001
<b>41A</b>	<b>3.41</b>	<b>0.512</b>	<b>1.92</b>	<b>0.199</b>	<b>0.068</b>	<b>0.125</b>	<b>0.104</b>	<b>0.151</b>	<b>0.041</b>			<b>0.011</b>
(IG-5B)	0.03	0.004	0.02	0.004	0.002	0.002	0.002	0.003	0.003			0.001
<b>42A</b>	<b>3.94</b>	<b>0.764</b>	<b>1.94</b>	<b>0.294</b>	<b>0.0040</b>	<b>0.145</b>	<b>0.492</b>	<b>0.199</b>	<b>0.021</b>	<i>0.06</i>	<b>0.039</b>	<b>0.093</b>
(ID-2B)	0.03	0.010	0.03	0.004	0.0005	0.002	0.004	0.003	0.002		0.003	0.002
<b>43A</b>	<b>3.98</b>	<b>1.322</b>	<b>1.63</b>	<b>0.190</b>	<b>0.008</b>	<b>0.032</b>	<b>0.411</b>	<b>0.385</b>	<b>0.152</b>	<i>0.04</i>	<b>0.017</b>	<b>0.152</b>
(ID-4B)	0.03	0.016	0.02	0.004	0.001	0.002	0.005	0.006	0.003		0.002	0.002

	Ti	Al	Sn	Sb	Bi	B	Zn	Pb	W	Co	Nb	N
<b>31A</b> (ID-0A)	<b>0.007</b>	<b>0.005</b>	<i>0.003</i>			<i>0.0004</i>			<i>0.005</i>	<b>0.022</b>		<b>0.0042</b>
	0.001	0.001								0.001		0.0003
<b>32A</b> (ID-1B)	<b>0.044</b>	<b>0.029</b>	<i>0.012</i>	<b>0.023</b>	<i>0.007</i>	<i>0.0005</i>	<b>0.011</b>	<b>0.022</b>	<i>0.008</i>	<i>0.002</i>		<b>0.0042</b>
	0.001	0.001		0.002			0.001	0.002				0.0003
<b>33A</b> (ID-3B)	<b>0.130</b>	<b>0.054</b>	<b>0.039</b>	<b>0.019</b>	<i>0.002</i>	<b>0.0064</b>	<b>0.009</b>	<b>0.010</b>	<b>0.079</b>	<b>0.015</b>	<b>0.032</b>	<b>0.0043</b>
	0.005	0.002	0.001	0.002		0.0003	0.001	0.001	0.003	0.001	0.002	0.0003
<b>34A</b> (ID-5B)	<b>0.044</b>	<b>0.010</b>	<b>0.051</b>	<b>0.007</b>	<i>0.005</i>	<b>0.0076</b>	<b>0.007</b>	<i>0.006</i>	<b>0.016</b>	<b>0.025</b>	<b>0.014</b>	<b>0.0041</b>
	0.001	0.001	0.002	0.002		0.0003	0.001		0.002	0.001	0.001	0.0003
<b>35A</b> (IP-1B)	<i>0.002</i>	<i>0.002</i>	<i>0.002</i>			<i>0.0002</i>		<i>0.002</i>	<i>0.005</i>	<b>0.023</b>		<b>0.0036</b>
										0.002		0.0003
<b>36A</b> (IG-0A)	<b>0.021</b>	<i>0.003</i>	<i>0.002</i>		<i>0.007</i>	<b>0.022</b>	<i>0.002</i>	<b>0.016</b>		<i>0.004</i>		<b>0.0038</b>
	0.001					0.002		0.002				0.0003
<b>37A</b> (IG-1B)	<b>0.008</b>	<b>0.039</b>	<b>0.073</b>		<i>0.002</i>	<b>0.0124</b>	<i>0.001</i>	<i>0.002</i>	<b>0.026</b>	<b>0.031</b>		<b>0.0089</b>
	0.001	0.002	0.002			0.0005			0.002	0.001		0.0004
<b>38A</b> (IG-2B)	<b>0.012</b>	<b>0.034</b>	<b>0.032</b>	<b>0.018</b>	<i>0.002</i>	<b>0.0027</b>	<b>0.028</b>	<i>0.003</i>	<i>0.005</i>	<b>0.021</b>	<b>0.008</b>	<b>0.0100</b>
	0.001	0.001	0.001	0.002		0.0002	0.002			0.001	0.002	0.0004
<b>39A</b> (IG-3B)	<i>0.074</i>	<b>0.008</b>	<i>0.003</i>	<b>0.037</b>	<b>0.008</b>	<b>0.0195</b>	<b>0.035</b>	<b>0.017</b>		<i>0.002</i>		<b>0.0037</b>
		0.001		0.002	0.002	0.0006	0.003	0.002				0.0003
<b>40A</b> (IG-4A)	<b>0.015</b>	<b>0.096</b>	<i>0.004</i>			<b>0.0008</b>	<i>0.002</i>			<b>0.027</b>		<b>0.0063</b>
	0.001	0.003				0.0002				0.001		0.0004
<b>41A</b> (IG-5B)	<b>0.048</b>	<i>0.003</i>	<b>0.066</b>	<b>0.016</b>	<i>0.007</i>	<i>0.0004</i>	<i>0.001</i>	<b>0.010</b>	<b>0.012</b>	<b>0.031</b>		<b>0.0070</b>
	0.001		0.002	0.002				0.001	0.002	0.001		0.0003
<b>42A</b> (ID-2B)	<b>0.126</b>	<b>0.087</b>	<b>0.027</b>	<b>0.015</b>	<i>0.002</i>	<b>0.0036</b>	<b>0.013</b>	<b>0.020</b>	<b>0.020</b>	<b>0.010</b>	<b>0.045</b>	<b>0.0027</b>
	0.005	0.003	0.001	0.002		0.0003	0.002	0.003	0.002	0.001	0.002	0.0003
<b>43A</b> (ID-4B)	<b>0.065</b>	<b>0.024</b>	<b>0.067</b>	<i>0.004</i>	<i>0.002</i>	<b>0.0014</b>	<b>0.013</b>	<b>0.014</b>	<b>0.038</b>	<b>0.045</b>	<b>0.008</b>	<b>0.0045</b>
	0.002	0.001	0.003			0.0002	0.002	0.002	0.002	0.001	0.002	0.0003

Further non-certified values are: 0.041% As in 37A, 0.025% As in 32A, 0.016% As in 33A, 0.008% As in 41A, 0.008% Te in 33A, 0.007% Te in 37A and 39A.

## RM of steel for solid sample spectrometry

### RM LA 0 – LA 5

- sample of 37 mm in diameter, height 25 mm or an agreed option

RM	C	Mn	Si	P	S	Cu	Cr	Ni
LA-0A	0.006 ±0.0015	0.045 ±0.005	0.0015 ±0.0003	0.005 ±0.0005	0.005 ±0.0003	0.012 ±0.001	0.022 ±0.002	0.028 ±0.002
LA-1B	0.005 ±0.001	0.13 ±0.006	0.020 ±0.002	0.004 ±0.001	0.017 ±0.002	0.01 ±0.002	0.042 ±0.003	0.014 ±0.002
LA-2E	0.081 ±0.002	0.111 ±0.003	1.725 ±0.019	0.060 ±0.003	0.044 ±0.002	0.577 ±0.010	0.149 ±0.003	2.015 ±0.022
LA-3F	0.467 ±0.009	0.782 ±0.008	0.88 ±0.01	0.036 ±0.002	0.031 ±0.002	0.218 ±0.005	1.024 ±0.008	1.017 ±0.006
LA-4C	0.95 ±0.012	1.63 ±0.025	0.07 ±0.01	0.021 ±0.003	0.012 ±0.001	0.056 ±0.002	1.78 ±0.03	0.045 ±0.004
LA-5B	0.38 ±0.01	1.75 ±0.03	0.39 ±0.014	0.017 ±0.002	0.010 ±0.001	0.12 ±0.005	3.60 ±0.04	2.43 ±0.03
RM	Al	Mo	W	V	Ti	Co	As	Sn
LA-0A	0.0015 ±0.0005	0.0044 ±0.0010			0.001 ±0.0003	0.002 ±0.0003	0.0015	0.001
LA-1B	0.003 ±0.001	0.007 ±0.001	0.010 ±0.002	0.004 ±0.001	0.001	0.002	0.002	0.001
LA-2E	0.357 ±0.010	0.652 ±0.004	0.307 ±0.010	0.310 ±0.005	0.343 0.010	0.268 ±0.009	0.083 ±0.005	0.087 ±0.002
LA-3F	0.061 ±0.002	0.347 ±0.004	0.103 ±0.004	0.231 ±0.003	0.125 ±0.004	0.125 ±0.003	0.061 ±0.005	0.028 ±0.001
LA-4C	0.048 ±0.003	0.008 ±0.001	0.008 ±0.001	0.010 ±0.002	0.002 ±0.001	0.006 ±0.002	0.003 ±0.001	0.006 ±0.001
LA-5B	0.073 ±0.005	0.75 ±0.02	0.59 ±0.03	0.47 0.014	0.05 ±0.004	0.075 ±0.005	0.016 ±0.002	0.028 ±0.002
RM	B	Nb	Pb	Sb	Zr	Ca	Ta	N
LA-0A			0.001	0.0007				0.0023 ±0.0002
LA-1B	0.010 ±0.001	0.001	0.0007	0.002	0.002	0.0016 ±0.0003	0	0.003 ±0.0004
LA-2E	0.0043 ±0.0004	0.111 ±0.003	0.068 ±0.007	0.033 ±0.004				0.0071 ±0.0006
LA-3F	0.0047 ±0.0003	0.033 ±0.002	0.009 ±0.002	0.026 ±0.002	0.106 ±0.009	0.0006	Zn 0.010 ±0.002	0.012 ±0.001
LA-4C	0.0005 ±0.0001	0.053 ±0.004						0.012 ±0.001
LA-5B	0.0009 ±0.0001	0.060 ±0.005	0.015 ±0.002	0.011 0.002	0.017 ±0.002			0.02 ±0.001

## RM CM and SP (CM-1C, 3A, 4B, 5C, 6A, 7A, 8A, 9B, 14A, 14B, 15C, 16A, 17A, 18A, 19A, SP-2B, 2C, 3C, 3D, 4C, BO-2B)

- sample of 35 - 43 mm in diameter. Height 25 mm or an agreed option.

RM	C	Mn	Si	P	S	Cu	Cr	Ni	Al	Mo	W	V
CM-1C	<b>0.72</b>	<b>1.73</b>	<b>0.31</b>	<b>0.023</b>	<b>0.025</b>	<b>0.18</b>	<b>0.47</b>	<b>0.52</b>	<b>0.034</b>	<b>0.084</b>	<b>0.064</b>	<b>0.073</b>
	0.01	0.01	0.01	0.001	0.002	0.01	0.015	0.015	0.001	0.004	0.002	0.002
CM-3A	<b>0.295</b>	<b>0.37</b>	<b>0.27</b>	<b>0.016</b>	<b>0.0013</b>	<b>0.16</b>	<b>1.87</b>	<b>1.82</b>	<b>0.05</b>	<b>0.33</b>	<b>0.015</b>	<b>0.007</b>
	0.013	0.01	0.02	0.002	0.0003	0.005	0.04	0.04	0.002	0.01	0.003	0.002
CM-4B	<b>0.72</b>	<b>0.50</b>	<b>0.80</b>	<b>0.023</b>	<b>0.012</b>	<b>0.40</b>	<b>2.23</b>	<b>1.40</b>	<b>0.025</b>	<b>0.33</b>	<b>0.116</b>	<b>0.18</b>
	0.02	0.01	0.02	0.003	0.002	0.01	0.03	0.03	0.002	0.01	0.005	0.01
CM-5C	<b>1.04</b>	<b>1.17</b>	<b>0.54</b>	<b>0.029</b>	<b>0.021</b>	<b>0.151</b>	<b>2.45</b>	<b>0.42</b>	<b>0.063</b>	<b>0.132</b>	<b>0.034</b>	<b>0.106</b>
	0.02	0.02	0.02	0.002	0.002	0.004	0.05	0.01	0.003	0.003	0.005	0.002
CM-6A	<b>0.52</b>	<b>0.37</b>	<b>0.27</b>	<b>0.016</b>	<b>0.058</b>	<b>0.05</b>	<b>0.37</b>	<b>0.19</b>	<b>0.02</b>	<b>0.04</b>	<b>0.04</b>	<b>0.05</b>
	0.015	0.013	0.014	0.002	0.003	0.003	0.01	0.006	0.002	0.003	0.003	0.003
CM-7A	<b>0.05</b>	<b>1.17</b>	<b>0.56</b>	<b>0.011</b>	<b>0.016</b>	<b>0.09</b>	<b>0.10</b>	<b>0.05</b>	<b>0.13</b>	<b>0.015</b>	<b>0.01</b>	<b>0.012</b>
	0.005	0.02	0.016	0.002	0.002	0.003	0.006	0.003	0.01	0.002	0.002	0.001
CM-8A	<b>0.16</b>	<b>2.13</b>	<b>0.18</b>	<b>0.007</b>	<b>0.011</b>	<b>0.03</b>	<b>1.38</b>	<b>0.03</b>	<b>0.02</b>	<i>0.001</i>	<b>0.01</b>	<b>0.008</b>
	0.006	0.03	0.006	0.001	0.002	0.003	0.01	0.003	0.003		0.002	0.002
CM-9B	<b>0.17</b>	<b>2.27</b>	<b>0.89</b>	<b>0.008</b>	<b>0.010</b>	<b>0.04</b>	<b>1.36</b>	<b>0.023</b>	<b>0.049</b>	<i>0.002</i>		<b>0.006</b>
	0.01	0.03	0.02	0.002	0.002	0.003	0.01	0.003	0.003			0.001
CM-14A	<b>0.523</b>	<b>1.58</b>	<b>1.15</b>	<b>0.051</b>	<b>0.028</b>	<b>0.30</b>	<b>1.13</b>	<b>1.14</b>	<b>0.063</b>	<b>0.395</b>	<b>0.021</b>	<b>0.345</b>
	0.012	0.03	0.02	0.003	0.002	0.01	0.02	0.02	0.003	0.010	0.002	0.01
CM-14B	<b>0.55</b>	<b>1.63</b>	<b>1.18</b>	<b>0.017</b>	<b>0.023</b>	<b>0.36</b>	<b>1.38</b>	<b>1.10</b>	<b>0.26</b>	<b>0.40</b>	<b>0.03</b>	<b>0.36</b>
	0.012	0.03	0.02	0.002	0.002	0.01	0.02	0.02	0.01	0.01	0.002	0.01
CM-15C	<b>0.075</b>	<b>1.13</b>	<b>0.006</b>	<b>0.063</b>	<b>0.32</b>	<b>0.141</b>	<b>0.052</b>	<b>0.072</b>		<b>0.021</b>		
	0.006	0.04	0.002	0.003	0.01	0.004	0.003	0.004		0.003		
CM-16A	<b>0.355</b>	<b>0.92</b>	<b>0.77</b>	<b>0.043</b>	<b>0.033</b>	<b>0.293</b>	<b>0.70</b>	<b>0.72</b>	<b>0.125</b>	<b>0.405</b>	<b>0.141</b>	<b>0.319</b>
	0.007	0.02	0.01	0.002	0.002	0.003	0.01	0.01	0.004	0.007	0.003	0.006
CM-17A	<b>0.142</b>	<b>0.524</b>	<b>0.612</b>	<b>0.0310</b>	<b>0.0175</b>	<b>0.201</b>	<b>9.58</b>	<b>0.520</b>	<b>0.0089</b>	<b>1.116</b>	<b>0.099</b>	<b>0.247</b>
	0.003	0.006	0.009	0.0010	0.0012	0.004	0.05	0.015	0.0012	0.017	0.004	0.005
CM-18A	<b>0.143</b>	<b>1.792</b>	<b>0.903</b>	<b>0.0182</b>	<b>0.0119</b>	<b>2.393</b>	<b>20.59</b>	<b>20.44</b>	<b>0.0344</b>	<b>2.282</b>	<b>0.097</b>	<b>0.113</b>
	0.003	0.018	0.021	0.0015	0.0009	0.041	0.12	0.09	0.0027	0.037	0.007	0.004
CM-19A	<b>0.361</b>	<b>0.783</b>	<b>1.588</b>	<b>0.0440</b>	<b>0.0182</b>	<b>0.986</b>	<b>13.12</b>	<b>15.27</b>	<b>0.0788</b>	<b>1.023</b>	<b>0.311</b>	<b>1.235</b>
	0.008	0.010	0.015	0.0020	0.0008	0.031	0.11	0.16	0.0045	0.018	0.022	0.055
CM-20A	<b>0.63</b>	<b>0.594</b>	<b>1.74</b>	<b>0.0383</b>	<b>0.020</b>	<b>0.237</b>	<b>0.97</b>	<b>1.007</b>	<b>0.076</b>	<b>0.365</b>	<b>0.104</b>	<b>0.225</b>
	0.01	0.005	0.02	0.0015	0.001	0.008	0.01	0.015	0.002	0.007	0.007	0.004
SP-1B	<b>0.050</b>	<b>1.67</b>	<b>0.505</b>	<b>0.039</b>	<b>0.30</b>	<b>0.47</b>	<b>17.42</b>	<b>8.32</b>	<i>0.003</i>	<b>0.40</b>	<b>0.032</b>	<b>0.060</b>
	0.002	0.03	0.017	0.003	0.02	0.01	0.12	0.16		0.01	0.003	0.004
SP-2B	<b>1.42</b>	<b>26.1</b>	<b>0.51</b>	<b>0.10</b>	<b>0.009</b>	<b>0.096</b>	<b>1.36</b>	<b>0.32</b>	<b>0.008</b>	<b>0.38</b>	<b>0.084</b>	<b>0.155</b>
	0.03	0.25	0.02	0.01	0.001	0.006	0.03	0.03	0.002	0.02	0.006	0.009
SP-2C	<b>1.40</b>	<b>14.50</b>	<b>0.29</b>	<b>0.037</b>	<b>0.016</b>	<b>0.35</b>	<b>1.56</b>	<b>0.050</b>	<b>0.030</b>	<b>0.050</b>	<b>0.033</b>	<b>0.051</b>
	0.03	0.21	0.02	0.003	0.002	0.03	0.03	0.003	0.002	0.002	0.005	0.003
SP-3C	<b>0.30</b>	<b>0.43</b>	<b>0.84</b>	<b>0.026</b>	<b>0.011</b>	<b>0.185</b>	<b>16.42</b>	<b>5.31</b>	<b>0.095</b>	<b>0.26</b>	<b>0.12</b>	<b>0.19</b>
	0.02	0.03	0.04	0.003	0.003	0.011	0.11	0.07	0.010	0.01	0.01	0.01
SP-3D	<b>0.171</b>	<b>0.34</b>	<b>0.71</b>	<b>0.021</b>	<b>0.015</b>	<b>0.73</b>	<b>16.44</b>	<b>5.36</b>	<b>0.037</b>	<b>0.25</b>	<b>0.12</b>	<b>0.11</b>
	0.007	0.02	0.03	0.003	0.003	0.04	0.23	0.15	0.003	0.01	0.01	0.01
SP-4C	<b>0.34</b>	<b>1.66</b>	<b>1.75</b>	<b>0.020</b>	<b>0.010</b>	<b>0.056</b>	<b>22.1</b>	<b>37.1</b>	<b>0.011</b>	<b>0.105</b>	<i>0.01</i>	<b>0.059</b>
	0.02	0.04	0.04	0.004	0.002	0.007	0.1	0.2	0.003	0.008		0.005
BO-2B	<b>0.515</b>	<b>0.745</b>	<b>0.309</b>	<b>0.0093</b>	<b>0.0016</b>	<b>0.100</b>	<b>0.212</b>	<b>0.057</b>	<b>0.0196</b>	<b>0.006</b>	<i>0.005</i>	<i>0.001</i>
	0.010	0.011	0.007	0.0007	0.0003	0.005	0.004	0.002	0.0008	0.001		

RM	Ti	Co	As	Sn	B	Nb	Pb	Sb	Zr	Ca	Ta	N
CM-1C	<b>0.066</b>	<b>0.026</b>		<b>0.012</b>	<b>0.0020</b>	<b>0.054</b>	<b>0.005</b>	<b>0.01</b>		<b>0.0007</b>		<b>0.009</b>
	0.002	0.001		0.001	0.0002	0.002	0.002	0.002		0.0002		0.001
CM-3A	<b>0.006</b>	<b>0.012</b>	<b>0.005</b>	<b>0.007</b>	<b>0.0002</b>	<b>0.006</b>						<b>0.007</b>
	0.0003	0.002	0.002	0.002	0.0001	0.001						0.001
CM-4B	<b>0.12</b>	<b>0.115</b>	<b>0.015</b>	<b>0.028</b>	<b>0.017</b>	<b>0.071</b>	<b>0.022</b>	<b>0.052</b>		<b>Zn 0.007</b>		<b>0.013</b>
	0.01	0.004	0.001	0.002	0.001	0.002	0.003	0.002		0.001		0.001
CM-5C	<b>0.031</b>	<b>0.022</b>	<b>0.020</b>	<b>0.018</b>	<b>0.0012</b>	<b>0.014</b>	<b>0.009</b>	<b>0.005</b>	<i>0.07</i>	<i>0.0006</i>		<b>0.014</b>
	0.002	0.002	0.003	0.003	0.0002	0.001	0.002	0.002				0.001
CM-6A	<b>0.03</b>	<b>0.03</b>	<b>0.025</b>	<b>0.017</b>	<b>0.015</b>	<b>0.028</b>	<b>0.017</b>	<b>0.03</b>	<b>0.04</b>			<b>0.009</b>
	0.003	0.005	0.002	0.002	0.001	0.002	0.001	0.003	0.003			0.001
CM-7A	<b>0.14</b>	<b>0.007</b>	<b>0.005</b>	<b>0.008</b>	<b>0.0003</b>	<b>0.004</b>	0.0014	0.0003	<b>0.042</b>			<b>0.01</b>
	0.005	0.001	0.001	0.002	0.0001	0.001			0.003			0.002
CM-8A	0.001	<b>0.004</b>	0.002	0.003	<b>0.004</b>	<b>0.034</b>						
		0.001			0.001	0.003						
CM-9B	<b>0.002</b>	<b>0.004</b>	0.002	<b>0.003</b>	<b>0.004</b>	<b>0.06</b>	<b>0.002</b>	<b>0.003</b>	<b>0.003</b>			
	0.001	0.001		0.001	0.001	0.01	0.001	0.001	0.001			
CM-14A	<b>0.40</b>	<b>0.015</b>	<b>0.016</b>	<b>0.027</b>	<b>0.0062</b>	<b>0.115</b>	<b>0.013</b>	<b>0.006</b>	<b>0.044</b>	0.004	<b>0.015</b>	<b>0.0095</b>
	0.01	0.002	0.001	0.002	0.0005	0.005	0.001	0.001	0.003		0.002	0.0010
CM-14B	<b>0.36</b>	<b>0.026</b>	<b>0.015</b>	<b>0.040</b>	<b>0.0205</b>	<b>0.165</b>	<b>0.007</b>	<b>0.010</b>	<b>0.040</b>			<b>0.0072</b>
	0.01	0.002	0.001	0.003	0.0010	0.006	0.001	0.001	0.003			0.001
CM-15C		<i>0.01</i>					<b>0.29</b>					
							0.01					
CM-16A	<b>0.099</b>	<b>0.056</b>	<b>0.058</b>	<b>0.025</b>	<b>0.012</b>	<b>0.066</b>	<b>0.053</b>	<b>0.027</b>	<b>0.062</b>	<b>0.0006</b>		<b>0.015</b>
	0.002	0.003	0.003	0.001	0.001	0.002	0.006	0.001	0.003	0.0001		0.001
CM-17A	<b>0.0236</b>	<b>0.0329</b>	<b>0.0105</b>	<b>0.0109</b>	<b>0.0060</b>		<b>0.0177</b>					<b>0.0743</b>
	0.0016	0.0022	0.0014	0.0011	0.0005		0.0032					0.0040
CM-18A		<b>0.097</b>										<b>0.0848</b>
		0.005										0.0029
CM-19A	<b>0.254</b>	<b>0.222</b>		<b>0.0283</b>	<i>0.091</i>	<b>0.091</b>				<i>0.0036</i>		<i>0.021</i>
	0.009	0.007		0.0030		0.004						
CM-20A	<b>0,175</b>	<b>0,124</b>	<b>0,073</b>	<b>0,033</b>	<b>0,0071</b>	<b>0,074</b>	<b>0,015</b>	<b>0,025</b>	<b>0,083</b>		<b>Zn 0.007</b>	<b>0,0086</b>
	0,008	0,002	0,005	0,001	0,0004	0,003	0,002	0,001	0,004		0,001	0,0012
SP-1B	<i>0.002</i>	<b>0.161</b>	<i>0.003</i>	<b>0.013</b>	<b>0.0007</b>	<b>0.012</b>						<b>0.063</b>
		0.003		0.001	0.0002	0.002						0.005
SP-2B	<b>0.025</b>	<b>0.040</b>										
	0.003	0.006										
SP-2C	<b>0.014</b>	<b>0.044</b>	<i>0.005</i>	<b>0.037</b>	<i>0.003</i>							<b>0.027</b>
	0.001	0.003		0.003								0.001
SP-3C	<i>0.17</i>	<b>0.041</b>	0.03	0.02	<b>1.67</b>	<i>0.04</i>						
		0.004			0.03							
SP-3D	<b>0.088</b>	<b>0.033</b>	<i>0.03</i>	<i>0.04</i>	<b>2.45</b>	<i>0.04</i>						
	0.008	0.004			0.03							
SP-4C	<b>0.031</b>	<b>0.065</b>				<b>0.022</b>				<i>Fe 36.6</i>		<i>0.04</i>
	0.003	0.007				0.002						
BO-2B	<b>0.0017</b>	<b>0.0055</b>	<b>0.0057</b>	<b>0.0062</b>						<i>0.0008</i>		<b>0.004</b>
	0.0003	0.0005	0.0005	0.0005								0.001

## RM of silicon steel SST – (1A, 2A, 3A, 4A)

- sample of 37 mm in diameter. Height 25 mm or an agreed option, **steel chips on request.**

	<b>C</b>	<b>Mn</b>	<b>Si</b>	<b>P</b>	<b>S</b>	<b>Cu</b>	<b>Cr</b>	<b>Ni</b>
<b>SST-1A</b>	<b>0.072</b> 0.003	<b>0.062</b> 0.004	<b>2.57</b> 0.04	<b>0.041</b> 0.002	<b>0.0043</b> 0.0004	<b>0.654</b> 0.013	<b>0.209</b> 0.005	<b>0.155</b> 0.004
<b>SST-2A</b>	<b>0.083</b> 0.003	<b>0.160</b> 0.004	<b>3.07</b> 0.04	<b>0.026</b> 0.002	<b>0.0089</b> 0.0008	<b>0.205</b> 0.006	<b>0.138</b> 0.004	<b>0.066</b> 0.002
<b>SST-3A</b>	<b>0.035</b> 0.003	<b>0.221</b> 0.005	<b>3.27</b> 0.05	<b>0.007</b> 0.002	<b>0.0093</b> 0.001	<b>0.096</b> 0.004	<b>0.043</b> 0.002	<b>0.061</b> 0.002
<b>SST-4A</b>	<b>0.062</b> 0.004	<b>0.376</b> 0.010	<b>4.73</b> 0.05	<b>0.031</b> 0.003	<b>0.020</b> 0.002	<b>0.111</b> 0.004	<b>0.105</b> 0.005	<b>0.082</b> 0.002

	<b>Al</b>	<b>Mo</b>	<b>W</b>	<b>V</b>	<b>Ti</b>	<b>Co</b>	<b>As</b>	<b>Sn</b>
<b>SST-1A</b>	<b>0.061</b> 0.003	<i>0.002</i>		<b>0.006</b> 0.002	<b>0.004</b> 0.001	<b>0.005</b> 0.001	<b>0.002</b> 0.001	<b>0.110</b> 0.006
<b>SST-2A</b>	<b>0.010</b> 0.002	<b>0.054</b> 0.002	<b>0.019</b> 0.002	<b>0.024</b> 0.002	<b>0.016</b> 0.002	<b>0.022</b> 0.002		<b>0.055</b> 0.004
<b>SST-3A</b>	<b>0.009</b> 0.002	<b>0.036</b> 0.002	<b>0.016</b> 0.002	<b>0.041</b> 0.002	<b>0.009</b> 0.001	<b>0.038</b> 0.003	<b>0.003</b> 0.001	<b>0.015</b> 0.002
<b>SST-4A</b>	<b>0.514</b> 0.018	<b>0.019</b> 0.002	<b>0.026</b> 0.003	<b>0.031</b> 0.002	<b>0.035</b> 0.002	<b>0.012</b> 0.002	<b>0.004</b> 0.001	<b>0.025</b> 0.003

	<b>B</b>	<b>Pb</b>	<b>Sb</b>	<b>Zr</b>	<b>Zn</b>	<b>N</b>
<b>SST-1A</b>	<b>0.0003</b> 0.0001	<i>0.002</i>	<i>0.002</i>			<b>0.0059</b> 0.0005
<b>SST-2A</b>	<b>0.0089</b> 0.0006	<b>0.015</b> 0.003	<b>0.008</b> 0.002	<b>0.017</b> 0.002	<b>0.011</b> 0.003	<b>0.0078</b> 0.0007
<b>SST-3A</b>	<b>0.0019</b> 0.0004	<b>0.013</b> 0.002			<b>0.011</b> 0.003	<b>0.0088</b> 0.0012
<b>SST-4A</b>	<b>0.0006</b> 0.0002	<b>0.008</b> 0.002	<i>0.003</i>	<i>0.003</i>	<i>0.002</i>	<b>0.0058</b> 0.0007

## QCM for spectrometry

The quality control materials comply with the latest ISO Guide 35 definition of the Reference Material. They are primarily intended for quality control of the automated analysers.

The current three flexible sets of alloy (SL, HS), special (SP) and custom-made (CM) steel QCM for spectrometry cover a broad range of elements/concentrations relevant to the contemporary steel production.

The combination of the individual QCM may be tailored to fit for any particular task of the spectrometric steel analysis.

### QCM SL 1 – SL 6, HS 1 – HS 2

- sample of 35 - 43 mm in diameter, height 25 mm or an agreed option

QCM	C	Mn	Si	P	S	Cu	Cr	Ni	Al	Mo
SL-1A	0.078	0.46	1.39	0.024	0.011	0.09	13.4	0.23	0.86	0.03
SL-2A	0.015	1.84	0.64	0.025	0.027	0.50	16.9	11.0	0.005	2.03
SL-3A	0.043	1.73	0.53	0.024	0.002	0.22	24.6	19.6	0.007	0.38
SL-4A	1.38	2.85	2.28	0.038	0.017	0.75	26.3	2.04	0.12	0.92
SL-5A	0.37	5.8	0.36	0.021	0.014	2.90	11.7	4.94	0.035	4.12
SL-6A	0.17	0.24	0.23	0.015	0.029	0.22	6.8	32.3	0.26	0.13
HS-1A	0.72	0.28	0.28	0.023	0.011	0.08	4.15	0.14	0.03	0.06
HS-2A	1.24	0.27	0.24	0.024	0.017	0.08	4.15	0.21	0.035	3.75
QCM	W	V	Ti	Co	As	Sn	Nb	N	B	Ta
SL-1A	0.1	0.017	0.004	0.02		0.01		0.025		
SL-2A	0.03	0.075	0.06	0.09	0.008	0.01		0.04	0.002	
SL-3A	0.03	0.066	0.003	0.06		0.006	0.013	0.065	0.002	
SL-4A	0.35	0.54	0.8	0.11		0.02	1.11		0.0013	
SL-5A	0.78	0.21	0.004	0.26	0.005	0.004	0.20			0.07
SL-6A	1.74	0.15	1.8	0.69	0.004	0.006	0.36			
HS-1A	17.5	1.33	0.003	4.7		0.02				
HS-2A	9.3	3.4	0.003	9.9		0.01				

### QCM SP 1 – SP 8

- sample of 35 - 43 mm in diameter, height 25 mm or an agreed option

QCM	C	Mn	Si	P	S	Cu	Cr	Ni	Al	Mo
SP-3B	0.27	0.29	0.72	0.023	0.008	0.62	15.1	5.65	0.08	0.24
SP-5B	0.20	1.86	3.07	0.108	0.023	0.15	0.38	3.00	0.18	0.13
SP-6A	0.10	0.38	4.65	0.017	0.009	0.12	0.11	0.04	0.32	0.01
SP-7A	0.006	0.08	0.036	0.007	0.010	0.08	0.01	47.3	0.003	0.01
SP-8B	2.37	0.86	1.40	0.022	0.012	0.075	37.6	2.72	0.13	0.10
QCM	W	V	Ti	Co	As	Sn	B	Nb	Pb	Sb
SP-3B	0.12	0.10	0.13	0.02		0.01	0.88			
SP-5B	0.62	0.71	0.35	0.135	0.19	0.08	0.14	0.09	0.09	0.07
SP-6A	0.02	0.016	0.008	0.003	0.003	0.01				
SP-7A		0.001	0.004	0.003						
SP-8B	0.05	0.13	0.13	0.075	0.05	0.06	0.03	0.04		

## QCM CM (2A, 5B, 10A,12A)

- sample of 35 - 43 mm in diameter, height 25 mm or an agreed option

QCM	C	Mn	Si	P	S	Cu	Cr	Ni
CM-5B	1.09	1.28	0.39	0.021	0.012	0.13	2.07	0.23
CM-10A	0.694	1.00	0.817	0.040	0.022	0.31	5.48	2.38
QCM	Al	Mo	W	V	Ti	Co	As	Sn
CM-5B	0.083	0.10	0.03	0.06	0.02	0.022	0.018	0.012
CM-10A	0.086	1.234	0.96	0.908	0.0189	0.114	0.03	0.062
QCM	B	Nb	Pb	Sb	N	Zr	Ta	Zn
CM-5B	0.002	0.015	0.01	0.006	0.0135	0.09		
CM-10A	0.05							



## REFERENCE MATERIALS OF SOLID FUEL AND ASH for thermodynamic, chemical and technological properties

The SF and SFA Reference Materials comply with the ISO Guide 35 definition of the Reference Material.

**Intended** for quality control and validation of methods for gross calorific content measurement, elemental analysis of C, N, H, S content and determination of the conventional of volatile matter and ash content. For this, the values in the set are evenly distributed over the entire application ranges.

**Supplied** in 50g packing.

Certified dry-basis values in bold with $\pm$ uncertainty shown below in regular								
Property	Gross calorific content		Elemental composition				Volatile matter	Ash
			C	H	N	S		
Unit	kJ/kg	BTU/Lb	Mass fraction wt. %				Mass fraction wt. %	
SF-01-14 BROWN COAL Uc	<b>14617</b>	6284	<b>36.40</b>	<b>3.31</b>	<b>0.60</b>	<b>1.33</b>	<b>31.72</b>	<b>44.90</b>
	$\pm 49$	$\pm 21$	$\pm 0.30$	$\pm 0.07$	$\pm 0.04$	$\pm 0.03$	$\pm 0.17$	$\pm 0.14$
SF-02-14 BLACK COAL Uc	<b>33090</b>	14226	<b>91.84</b>	<b>2.09</b>	<b>0.65</b>	<b>0.16</b>	<b>13.10</b>	<b>2.80</b>
	$\pm 58$	$\pm 25$	$\pm 0.46$	$\pm 0.10$	$\pm 0.04$	$\pm 0.01$	$\pm 0.18$	$\pm 0.06$
SF-03-14 BLACK COAL Uc	<b>32060</b>	13783	<b>96.30</b>	<b>0.21</b>	<b>0.32</b>	<b>0.14</b>	<b>1.15</b>	<b>2.98</b>
	$\pm 115$	$\pm 49$	$\pm 0.50$	$\pm 0.06$	$\pm 0.04$	$\pm 0.01$	$\pm 0.15$	$\pm 0.03$
SF-04-14 BLACK COAL Uc	<b>34618</b>	14883	<b>85.53</b>	<b>4.59</b>	<b>1.35</b>	<b>0.48</b>	<b>23.67</b>	<b>4.43</b>
	$\pm 80$	$\pm 34$	$\pm 0.45$	$\pm 0.10$	$\pm 0.04$	$\pm 0.01$	$\pm 0.22$	$\pm 0.06$
SF-05-14 COKE Uc	<b>30410</b>	13074	<b>90.40</b>	<b>0.20</b>	<b>0.98</b>	<b>0.45</b>	<b>1.28</b>	<b>7.84</b>
	$\pm 110$	$\pm 47$	$\pm 0.44$	$\pm 0.06$	$\pm 0.03$	$\pm 0.01$	$\pm 0.12$	$\pm 0.04$
SF-06-14 BLACK COAL Uc	<b>23990</b>	10314	<b>58.28</b>	<b>3.51</b>	<b>3.80</b>	<b>3.13</b>	<b>27.36</b>	<b>27.21</b>
	$\pm 93$	$\pm 40$	$\pm 0.36$	$\pm 0.05$	$\pm 0.05$	$\pm 0.05$	$\pm 0.22$	$\pm 0.11$
SF-07-14 BROWN COAL Uc	<b>21337</b>	9173	<b>50.97</b>	<b>4.26</b>	<b>1.05</b>	<b>2.52</b>	<b>38.80</b>	<b>28.73</b>
	$\pm 86$	$\pm 37$	$\pm 0.28$	$\pm 0.08$	$\pm 0.04$	$\pm 0.04$	$\pm 0.20$	$\pm 0.05$
SFA-01-14 BLACK COAL ASH Uc			<b>3.10</b>			<b>0.029</b>		<b>96.60</b>
			$\pm 0.19$			$\pm 0.008$		$\pm 0.17$