



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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## CRM – certified reference materials

### CRM SPL CZ 2015B-2024B (certified in Brammer Standard company)

	2015B	2016B	2017B	2018B	2019B	2020B	2021B	2022B	2023B	2024B
C	1.99	2.15	2.57	3.07	3.43	3.52	3.80	3.86	4.06	4.40
	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
S	0.017	0.0047	0.095	0.014	0.017	0.043	0.043	0.085	0.114	0.047
	0.001	0.0007	0.003	0.001	0.001	0.002	0.002	0.002	0.003	0.002

### Former CRM certified via Czech Metrological Institute

(Issued RM certificates after end of validity)

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

#### SPL RM CZ 2003 – 8 (CRM validity till 2022), SPL RM CZ 2025 A, 2026 A (CRM validity till 2022)

	2003 A	2004 A	2005 A	2006 A	2007 A	2008 A	2025 A*	2026 A*
C	0.0402	0.079	0.358	0.461	0.684	0.977	0.0020	0.068
	0.0008	0.001	0.004	0.002	0.006	0.003	0.0003	0.001
S	0.0316	0.0464	0.0250	0.0172	0.0106	0.0091	0.0018	0.255
	0.0006	0.0010	0.0005	0.0007	0.0004	0.0004	0.0002	0.005
N	0.0046	0.0038	0.0081	0.0066	0.0128	0.0066		
	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	2023 A
C	1.996	2.053	2.463	4.029
	0.011	0.016	0.023	0.016
S	0.0157	0.0048	0.0755	0.0886
	0.0004	0.0004	0.0026	0.0028

# 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.

	C	Mn	Si	P	S	Cr	Ni	Cu	Mo	Mg	Ce
<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		

	V	Ti	Al	Sn	Sb	Bi	B	Zn	Pb	W	Co
<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: 0.008% As in 6B

	<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>3C</b>	<b>3.68</b> 0.03	<b>0.333</b> 0.003	<b>2.15</b> 0.02	<b>0.026</b> 0.001	<b>0.007</b> 0.001	<b>0.100</b> 0.002	<b>0.040</b> 0.001	<b>0.421</b> 0.004	<b>0.490</b> 0.006	<b>0.006</b> 0.001	<b>0.013</b> 0.002
<b>4D</b>	<b>4.19</b> 0.03	<b>0.112</b> 0.002	<b>0.259</b> 0.004	<b>0.050</b> 0.002	<b>0.041</b> 0.002	<b>0.056</b> 0.001	<b>0.063</b> 0.002	<b>0.084</b> 0.002	<b>0.024</b> 0.001		
<b>4E</b>	<b>4.45</b> 0.04	<b>0.034</b> 0.002	<b>0.090</b> 0.005	<b>0.023</b> 0.001	<b>0.006</b> 0.001	<b>0.030</b> 0.001	<b>0.049</b> 0.002	<b>0.005</b> 0.001	<b>0.002</b> 0.001		
<b>5C</b>	<b>2.30</b> 0.02	<b>0.704</b> 0.004	<b>1.40</b> 0.02	<b>0.027</b> 0.001	<b>0.091</b> 0.003	<b>0.085</b> 0.002	<b>0.188</b> 0.003	<b>0.013</b> 0.001	<b>0.104</b> 0.002		
<b>6C</b>	<b>3.11</b> 0.03	<b>1.25</b> 0.01	<b>3.25</b> 0.03	<b>0.097</b> 0.003	<b>0.019</b> 0.002	<b>1.33</b> 0.01	<b>0.021</b> 0.001	<b>0.273</b> 0.003	<b>0.006</b> 0.001		
<b>7C</b>	<b>3.55</b> 0.03	<b>0.389</b> 0.004	<b>1.73</b> 0.02	<b>0.028</b> 0.002	<b>0.026</b> 0.002	<b>0.542</b> 0.004	<b>1.26</b> 0.01	<b>0.016</b> 0.001	<b>0.966</b> 0.010		
	<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>3C</b>	<b>0.016</b> 0.001	<b>0.021</b> 0.001	<b>0.024</b> 0.001	<b>0.009</b> 0.001		<b>0.002</b> 0.001	<b>0.0044</b> 0.0002		<b>0.005</b> 0.001	<b>0.003</b> 0.001	<b>0.026</b> 0.001
<b>4D</b>	<b>0.012</b> 0.001	<b>0.009</b> 0.001	<b>0.007</b> 0.001	<b>0.001</b> 0.001		<i>0.002</i>	<i>0.0001</i>	<b>0.009</b> 0.001	<b>0.007</b> 0.001		<b>0.003</b> 0.001
<b>4E</b>	<b>0.015</b> 0.001	<b>0.011</b> 0.001	<b>0.003</b> 0.001	<b>0.001</b> 0.001		<i>0.002</i>			<i>0.002</i>		<b>0.033</b> 0.001
<b>5C</b>	<b>0.054</b> 0.002	<b>0.008</b> 0.001	<b>0.103</b> 0.003	<b>0.002</b> 0.001	<i>0.002</i>	<b>0.007</b> 0.002	<b>0.0078</b> 0.0003				<b>0.013</b> 0.001
<b>6C</b>	<b>0.192</b> 0.002	<b>0.107</b> 0.004	<b>0.024</b> 0.001	<b>0.131</b> 0.003	<b>0.044</b> 0.002		<b>0.0024</b> 0.0002		<b>0.003</b> 0.001	<b>0.007</b> 0.001	<b>0.005</b> 0.001
<b>7C</b>	<b>0.067</b> 0.001	<b>0.026</b> 0.001	<b>0.040</b> 0.002	<b>0.004</b> 0.001		<i>0.002</i>	<b>0.0008</b> 0.0002			<b>0.037</b> 0.002	<b>0.048</b> 0.001

Further non-certified values are 0.007% As in 3C, 0.012% As in 4D, 0.005% Te in 3C, 0.010% Te in 5C, 0.006% Te in 7C, 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>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>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>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

	Mo	Mg	Ce	V	Ti	Al	Sn	Sb
<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>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>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>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	

	<b>Bi</b>	<b>B</b>	<b>Zn</b>	<b>Pb</b>	<b>W</b>	<b>Co</b>	<b>Zr</b>	<b>As</b>
<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>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	0.02	<b>0.002</b> 0.001
<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>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, 0.006% 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, $\varnothing$ 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>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>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>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>Nb</b>	<b>N</b>
<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>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>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

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.

CI-SPL-22 Reference Materials 44A-53A

	C	Mn	Si	P	S	Cr	Ni	Cu	Mo	Mg	Ce	V	Ti
<b>44A</b> <b>(1H)</b>	<b>3.20</b>	<b>0.711</b>	<b>2.51</b>	<b>0.033</b>	<b>0.005</b>	<b>0.063</b>	<b>0.521</b>	<b>0.018</b>	<b>0.174</b>	<b>0.015</b>	<b>0.005</b>	<b>0.014</b>	<b>0.084</b>
	0.03	0.005	0.03	0.002	0.001	0.002	0.006	0.001	0.003	0.001	0.002	0.001	0.002
<b>45A</b> <b>(1J)</b>	<b>3.33</b>	<b>0.778</b>	<b>2.83</b>	<b>0.031</b>	<b>0.010</b>	<b>0.058</b>	<b>0.405</b>	<b>0.008</b>	<b>0.182</b>	<b>0.066</b>	<b>0.032</b>	<b>0.022</b>	<b>0.079</b>
	0.03	0.005	0.02	0.002	0.001	0.002	0.004	0.001	0.004	0.003	0.003	0.001	0.001
<b>46A</b> <b>(2H)</b>	<b>3.66</b>	<b>0.098</b>	<b>1.42</b>	<b>0.109</b>	<b>0.010</b>	<b>0.014</b>	<b>0.628</b>	<b>0.86</b>	<b>0.011</b>	<b>0.047</b>	<b>0.005</b>	<b>0.008</b>	<b>0.046</b>
	0.03	0.002	0.02	0.003	0.001	0.001	0.005	0.02	0.001	0.002	0.001	0.001	0.002
<b>47A</b> <b>(2J)</b>	<b>3.82</b>	<b>0.084</b>	<b>1.07</b>	<b>0.137</b>	<b>0.011</b>	<b>0.016</b>	<b>0.606</b>	<b>0.82</b>	<i>0.002</i>	<b>0.035</b>	<b>0.010</b>	<b>0.007</b>	<b>0.027</b>
	0.04	0.002	0.02	0.003	0.001	0.001	0.005	0.02		0.002	0.001	0.001	0.001
<b>48A</b> <b>(3E)</b>	<b>3.63</b>	<b>0.338</b>	<b>2.15</b>	<b>0.025</b>	<b>0.006</b>	<b>0.128</b>	<b>0.043</b>	<b>0.407</b>	<b>0.482</b>	<b>0.019</b>	<b>0.009</b>	<b>0.016</b>	<b>0.030</b>
	0.03	0.003	0.03	0.001	0.001	0.002	0.001	0.005	0.006	0.002	0.002	0.001	0.002
<b>49A</b> <b>(3F)</b>	<b>3.12</b>	<b>0.328</b>	<b>2.06</b>	<b>0.038</b>	<b>0.009</b>	<b>0.300</b>	<b>0.132</b>	<b>0.384</b>	<b>0.475</b>	<b>0.007</b>	<i>0.005</i>	<b>0.081</b>	<b>0.024</b>
	0.02	0.003	0.03	0.002	0.001	0.004	0.003	0.004	0.006	0.002		0.003	0.001
<b>50A</b> <b>(8E)</b>	<b>3.39</b>	<b>0.529</b>	<b>2.14</b>	<b>0.179</b>	<b>0.055</b>	<b>0.137</b>	<b>0.113</b>	<b>0.151</b>	<b>0.045</b>	-	-	<b>0.015</b>	<b>0.030</b>
	0.02	0.005	0.02	0.004	0.002	0.002	0.002	0.003	0.001			0.001	0.001
<b>51A</b> <b>(8F)</b>	<b>3.46</b>	<b>0.405</b>	<b>1.63</b>	<b>0.147</b>	<b>0.044</b>	<b>0.075</b>	<b>0.111</b>	<b>0.152</b>	<b>0.037</b>	-	-	<b>0.017</b>	<b>0.033</b>
	0.03	0.005	0.02	0.004	0.003	0.001	0.002	0.003	0.001			0.001	0.001
<b>52A</b> <b>(14D)</b>	<b>3.03</b>	<b>0.301</b>	<b>2.38</b>	<b>0.021</b>	<b>0.0094</b>	<b>0.025</b>	<b>0.021</b>	<b>0.607</b>	<b>0.621</b>	<b>0.008</b>	<b>0.012</b>	<b>0.023</b>	<b>0.029</b>
	0.02	0.003	0.02	0.001	0.0005	0.001	0.001	0.009	0.009	0.001	0.002	0.001	0.001
<b>53A</b> <b>(15D)</b>	<b>3.56</b>	<b>0.052</b>	<b>1.60</b>	<b>0.053</b>	<b>0.0097</b>	<b>0.071</b>	<b>0.687</b>	<b>1.357</b>	<b>0.002</b>	<b>0.032</b>	<b>0.023</b>	<b>0.013</b>	<b>0.035</b>
	0.03	0.002	0.02	0.003	0.0005	0.002	0.008	0.018	0.001	0.002	0.003	0.001	0.002

	Al	Sn	Sb	Bi	B	Zn	Pb	W	Co	Nb	Zr	As
<b>44A</b> <b>(1H)</b>	<b>0.046</b>	<b>0.026</b>	<b>0.018</b>	<b>0.009</b>	<b>0.0037</b>	<b>0.009</b>	<b>0.017</b>	<b>0.018</b>	<b>0.024</b>	<i>0.014</i>	<i>0.007</i>	-
	0.002	0.002	0.002	0.001	0.0003	0.002	0.002	0.002	0.002			
<b>45A</b> <b>(1J)</b>	<b>0.078</b>	<b>0.034</b>	-	-	<b>0.022</b>	-	<b>0.005</b>	<b>0.015</b>	<b>0.031</b>	-	<i>0.015</i>	-
	0.003	0.002			0.002		0.001	0.002	0.001			
<b>46A</b> <b>(2H)</b>	<b>0.026</b>	<b>0.014</b>	<b>0.024</b>	<b>0.005</b>	<b>0.0021</b>	<b>0.018</b>	<b>0.021</b>	<b>0.008</b>	-	<i>0.012</i>	<i>0.004</i>	<i>0.003</i>
	0.001	0.001	0.002	0.001	0.0002	0.002	0.002	0.001				
<b>47A</b> <b>(2J)</b>	<b>0.024</b>	<b>0.016</b>	<b>0.026</b>	-	<i>0.0005</i>	<b>0.027</b>	<b>0.012</b>	<b>0.004</b>	<i>0.002</i>	-	<i>0.010</i>	-
	0.001	0.001	0.002			0.002	0.001	0.001				
<b>48A</b> <b>(3E)</b>	<b>0.021</b>	<b>0.010</b>	-	-	<b>0.0045</b>	-	<b>0.015</b>	-	<b>0.025</b>	-	-	<i>0.021</i>
	0.001	0.001			0.0002		0.001		0.001			
<b>49A</b> <b>(3F)</b>	<b>0.064</b>	<b>0.011</b>	<i>0.007</i>	-	<b>0.0075</b>	<i>0.003</i>	<b>0.008</b>	<b>0.013</b>	<b>0.094</b>	<i>0.005</i>	-	<b>0.020</b>
	0.003	0.001			0.0005		0.001	0.001	0.003			0.001
<b>50A</b> <b>(8E)</b>	<b>0.004</b>	<b>0.068</b>	<b>0.011</b>	<b>0.011</b>	<i>0.0008</i>	-	<b>0.004</b>	<i>0.006</i>	<b>0.029</b>	-	-	-
	0.001	0.002	0.002	0.002			0.001		0.001			
<b>51A</b> <b>(8F)</b>	<b>0.006</b>	<b>0.072</b>	<b>0.012</b>	<i>0.008</i>	-	<i>0.002</i>	<b>0.006</b>	<i>0.005</i>	<b>0.035</b>	-	-	<i>0.007</i>
	0.001	0.002	0.002				0.001		0.001			
<b>52A</b> <b>(14D)</b>	<b>0.011</b>	<b>0.032</b>	<b>0.014</b>	<b>0.011</b>	<b>0.0082</b>	<b>0.004</b>	<i>0.003</i>	<i>0.004</i>	<b>0.010</b>	<i>0.003</i>	<b>0.015</b>	<b>0.041</b>
	0.001	0.001	0.001	0.001	0.0004	0.001			0.001		0.001	0.003
<b>53A</b> <b>(15D)</b>	<b>0.047</b>	<b>0.007</b>	<b>0.066</b>	<i>0.007</i>	<b>0.0046</b>	<i>0.004</i>	-	<b>0.010</b>	<b>0.032</b>	-	-	<i>0.004</i>
	0.002	0.001	0.006		0.0003			0.001	0.001			

## 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	<b>0.006</b> ±0.0015	<b>0.045</b> ±0.005	<b>0.0015</b> ±0.0003	<b>0.005</b> ±0.0005	<b>0.005</b> ±0.0003	<b>0.012</b> ±0.001	<b>0.022</b> ±0.002	<b>0.028</b> ±0.002
LA-0B	<b>0.0036</b> ±0.0011	<b>0.0380</b> ±0.0014	<i>0.0043</i>	<b>0.0037</b> ±0.0007	<b>0.0023</b> ±0.0003	<b>0.0074</b> ±0.0005	<b>0.0091</b> ±0.0016	<b>0.0070</b> ±0.0009
LA-1B	<b>0.005</b> ±0.001	<b>0.13</b> ±0.006	<b>0.020</b> ±0.002	<b>0.004</b> ±0.001	<b>0.017</b> ±0.002	<b>0.01</b> ±0.002	<b>0.042</b> ±0.003	<b>0.014</b> ±0.002
LA-3G	<b>0.626</b> ±0.004	<b>0.687</b> ±0.010	<b>1.296</b> ±0.011	<b>0.0472</b> ±0.0010	<b>0.0351</b> ±0.0011	<b>0.236</b> ±0.004	<b>1.377</b> ±0.007	<b>1.019</b> ±0.010
LA-4C	<b>0.95</b> ±0.012	<b>1.63</b> ±0.025	<b>0.07</b> ±0.01	<b>0.021</b> ±0.003	<b>0.012</b> ±0.001	<b>0.056</b> ±0.002	<b>1.78</b> ±0.03	<b>0.045</b> ±0.004
LA-4D	<b>1.143</b> ±0.005	<b>1.266</b> ±0.009	<b>0.181</b> ±0.005	<b>0.0289</b> ±0.0011	<b>0.0091</b> ±0.0002	<b>0.066</b> ±0.004	<b>1.831</b> ±0.021	<b>0.367</b> ±0.007
LA-5C	<b>0.439</b> ±0.007	<b>1.873</b> ±0.012	<b>0.394</b> ±0.008	<b>0.0179</b> ±0.0011	<b>0.0088</b> ±0.0008	<b>0.138</b> ±0.002	<b>3.815</b> ±0.026	<b>2.591</b> ±0.020

RM	Al	Mo	W	V	Ti	Co	As	Sn
LA-0A	<b>0.0015</b> ±0.0005	<b>0.0044</b> ±0.0010			<b>0.001</b> ±0.0003	<b>0.002</b> ±0.0003	0.0015	0.001
LA-0B	<b>0.0010</b> ±0.0005	0.0016				0.0017	<b>0.0024</b> ±0.0004	0.0013
LA-1B	<b>0.003</b> ±0.001	<b>0.007</b> ±0.001	<b>0.010</b> ±0.002	<b>0.004</b> ±0.001	0.001	0.002	0.002	0.001
LA-3G	<b>0.047</b> ±0.002	<b>0.326</b> ±0.005	<b>0.105</b> ±0.004	<b>0.232</b> ±0.002	<b>0.143</b> ±0.004	<b>0.127</b> ±0.003	<b>0.051</b> ±0.004	<b>0.031</b> ±0.001
LA-4C	<b>0.048</b> ±0.003	<b>0.008</b> ±0.001	<b>0.008</b> ±0.001	<b>0.010</b> ±0.002	<b>0.002</b> ±0.001	<b>0.006</b> ±0.002	<b>0.003</b> ±0.001	<b>0.006</b> ±0.001
LA-4D	<b>0.067</b> ±0.002	<b>0.136</b> ±0.004	<b>0.0251</b> ±0.0025	<b>0.103</b> ±0.002	<b>0.0154</b> ±0.0007	<b>0.0370</b> ±0.0013	<b>0.0104</b> ±0.0016	<b>0.0142</b> ±0.0010
LA-5C	<b>0.081</b> ±0.003	<b>0.867</b> ±0.011	<b>0.631</b> ±0.008	<b>0.536</b> ±0.006	<b>0.048</b> ±0.001	<b>0.088</b> ±0.002	<b>0.026</b> ±0.002	<b>0.031</b> ±0.001

RM	B	Nb	Pb	Sb	Zr	Ca	Ta	N
LA-0A			0.001	0.0007				<b>0.0023</b> ±0.0002
LA-0B								<b>0.0027</b> ±0.0005
LA-1B	<b>0.010</b> ±0.001	0.001	0.0007	0.002	0.002	<b>0.0016</b> ±0.0003		<b>0.003</b> ±0.0004
LA-3G	<b>0.0039</b> ±0.0002	<b>0.0711</b> ±0.0015	<b>0.0098</b> ±0.0005	<b>0.0242</b> ±0.0036	<b>0.068</b> ±0.003	<b>0.0016</b> ±0.0002		<b>0.0115</b> ±0.0010
LA-4C	<b>0.0005</b> ±0.0001	<b>0.053</b> ±0.004						<b>0.012</b> ±0.001
LA-4D		<b>0.0046</b> ±0.0009	<b>0.0401</b> ±0.0035					<b>0.0064</b> ±0.0005
LA-5C		<b>0.057</b> 0.002	<b>0.0156</b> 0.0011	<b>0.018</b> ±0.003			<i>Zn 0.013</i>	<b>0.0248</b> 0.0012

## RM CM and SP

- 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-1D	<b>0.735</b>	<b>1.800</b>	<b>0.341</b>	<b>0.0218</b>	<b>0.0268</b>	<b>0.186</b>	<b>0.456</b>	<b>0.547</b>	<b>0.0245</b>	<b>0.100</b>	<b>0.063</b>	<b>0.089</b>
	0.005	0.015	0.006	0.0004	0.0011	0.003	0.007	0.006	0.0011	0.002	0.002	0.002
CM-2B	<b>0.247</b>	<b>0.894</b>	<b>1.950</b>	<b>0.082</b>	<b>0.0114</b>	<b>0.994</b>	<b>1.538</b>	<b>1.205</b>	<b>0.0464</b>	<b>0.332</b>	<b>0.223</b>	<b>0.109</b>
	0.004	0.007	0.040	0.002	0.0007	0.019	0.015	0.014	0.0011	0.011	0.013	0.005
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-8B	<b>0.185</b>	<b>1.95</b>	<b>0.112</b>	<b>0.015</b>	<b>0.014</b>	<b>0.081</b>	<b>1.22</b>	<b>0.032</b>	<b>0.0028</b>	<b>0.011</b>	<i>0.009</i>	<b>0.0078</b>
	0.006	0.02	0.003	0.001	0.001	0.003	0.02	0.002	0.0006	0.001		0.0005
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-12C	<b>0.0389</b>	<b>0.275</b>	<b>3.770</b>	<b>0.0103</b>	<b>0.0110</b>	<b>0.175</b>	<b>0.081</b>	<b>0.046</b>	<b>0.145</b>	<b>0.0128</b>	<i>0.004</i>	<b>0.0271</b>
	0.0017	0.003	0.150	0.0006	0.0004	0.004	0.002	0.002	0.005	0.0011		0.0014
CM-14C	<b>0.586</b>	<b>1.723</b>	<b>1.352</b>	<b>0.0169</b>	<b>0.0266</b>	<b>0.365</b>	<b>1.316</b>	<b>1.141</b>	<b>0.226</b>	<b>0.432</b>	<b>0.0238</b>	<b>0.325</b>
	0.005	0.009	0.014	0.0009	0.0006	0.004	0.008	0.008	0.005	0.005	0.0019	0.004
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-16B	<b>0.421</b>	<b>0.762</b>	<b>0.574</b>	<b>0.0508</b>	<b>0.0376</b>	<b>0.296</b>	<b>0.635</b>	<b>0.733</b>	<b>0.128</b>	<b>0.424</b>	<b>0.141</b>	<b>0.272</b>
	0.002	0.003	0.005	0.0011	0.0006	0.002	0.004	0.004	0.003	0.003	0.002	0.002
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
CM-23A	<b>0.917</b>	<b>0.803</b>	<b>0.934</b>	<b>0.0609</b>	<b>0.0348</b>	<b>0.234</b>	<b>3.064</b>	<b>0.230</b>	<b>0.323</b>	<b>0.816</b>	<b>0.104</b>	<b>0.157</b>
	0.004	0.010	0.020	0.0035	0.0011	0.005	0.022	0.007	0.011	0.010	0.005	0.006
CM-25A	<b>0.097</b>	<b>0.781</b>	<b>0.656</b>	<b>0.0036</b>	<b>0.0051</b>	<b>0.0040</b>	<b>0.0248</b>	<b>0.0214</b>	<b>0.0030</b>		<b>0.0048</b>	<b>0.0161</b>
	0.002	0.004	0.008	0.0006	0.0004	0.0004	0.0006	0.0006	0.0006		0.0020	0.0006
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-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-2D	<b>1.369</b>	<b>26.90</b>	<b>0.558</b>	<b>0.0725</b>	<b>0.0031</b>	<b>0.106</b>	<b>1.507</b>	<b>0.388</b>	<b>0.0043</b>	<b>0.391</b>	<b>0.083</b>	<b>0.178</b>
	0.009	0.32	0.012	0.0018	0.0009	0.005	0.008	0.007	0.0013	0.009	0.007	0.004
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-1D	<b>0.054</b>	<b>0.029</b>		<b>0.0144</b>	<b>0.0017</b>	<b>0.050</b>		<b>0.0112</b>				<b>0.0124</b>
	0.004	0.001		0.0009	0.0002	0.004		0.0008				0.0005
CM-2B	<b>0.342</b>	<b>0.454</b>	<b>0.120</b>	<b>0.091</b>	<b>0.0010</b>	<i>0.58</i>	<b>0.087</b>	<b>0.020</b>	<b>0.013</b>			<b>0.0062</b>
	0.008	0.022	0.017	0.003	0.0001		0.008	0.004	0.002			0.0007
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>		Zn 0.007		<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-8B	<b>0.0008</b>	<b>0.007</b>	<b>0.0035</b>	<b>0.0126</b>	<b>0.0023</b>	<i>0.002</i>	<i>0.003</i>	<i>0.004</i>	<i>0.002</i>			<b>0.0075</b>
	0.0002	0.001	0.0003	0.0007	0.0003							0.0004
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-12C	<b>0.0128</b>	<b>0.0044</b>	<b>0.0030</b>	<b>0.0055</b>	<b>0.0033</b>	<b>0.0066</b>				<b>0.0010</b>		<b>0.0056</b>
	0.0004	0.0006	0.0007	0.0010	0.0002	0.0005				0.0002		0.0005
CM-14C	<b>0.420</b>	<b>0.0306</b>	<b>0.0165</b>	<b>0.048</b>	<b>0.0249</b>	<b>0.248</b>	<b>0.0090</b>	<b>0.0170</b>	<b>0.037</b>			<b>0.0092</b>
	0.008	0.0009	0.0006	0.002	0.0015	0.007	0.0009	0.0018	0.002			0.0005
CM-15C		<i>0.01</i>					<b>0.29</b>					
							0.01					
CM-16B	<b>0.121</b>	<b>0.058</b>	<b>0.065</b>	<b>0.0289</b>	<b>0.0128</b>	<b>0.094</b>	<b>0.0294</b>	<b>0.0282</b>	<b>0.102</b>	<b>0.00033</b>	Bi 0.045	<b>0.0154</b>
	0.002	0.001	0.001	0.0003	0.0004	0.002	0.0015	0.0008	0.005	0.00004	Zn 0.0156	0.0002
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>		Zn 0.007	<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
CM-23A	<b>0.154</b>	<b>0.510</b>	<b>0.0146</b>	<b>0.059</b>	<b>0.0129</b>	<b>0.628</b>	<b>0.0034</b>	<b>0.137</b>	<b>0.137</b>	<b>0.0004</b>	<i>0.051</i>	<b>0.0149</b>
	0.004	0.008	0.0011	0.002	0.0014	0.021	0.0005	0.011	0.010	0.0002	Zn 0.025	0.0007
CM-25A												<b>0.0061</b>
												0.0004
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-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-2D	<b>0.0213</b>	<b>0.0432</b>	<i>0.0031</i>	<i>0.0026</i>	<i>0.0008</i>	<b>0.0163</b>						<b>0.0203</b>
	0.0012	0.0019				0.0014						0.0009
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>				Fe 36.6		<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>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>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

## 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-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-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

- 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-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-8B	0.05	0.13	0.13	0.075	0.05	0.06	0.03	0.04		

## QCM CM

- 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
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
QCM	B	Nb	Pb	Sb	N	Zr	Ta	Zn
CM-5B	0.002	0.015	0.01	0.006	0.0135	0.09		



## 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 ± 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>
	±49	±21	±0.30	±0.07	±0.04	±0.03	±0.17	±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>
	±58	±25	±0.46	±0.10	±0.04	±0.01	±0.18	±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>
	±115	±49	±0.50	±0.06	±0.04	±0.01	±0.15	±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>22.95</b>	<b>4.43</b>
	±80	±34	±0.45	±0.10	±0.04	±0.01	±0.22	±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>
	±110	±47	±0.44	±0.06	±0.03	±0.01	±0.12	±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>26.84</b>	<b>27.21</b>
	±93	±40	±0.36	±0.05	±0.05	±0.05	±0.23	±0.11
SF-07-14 BROWN COAL Uc	<b>21023</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>
	±140	±37	±0.28	±0.08	±0.04	±0.04	±0.20	±0.05
SFA-01-14 BLACK COAL ASH Uc			<b>3.10</b>			<b>0.029</b>		<b>96.60</b>
			±0.19			±0.008		±0.17