



CALIBUS

Aluminium Calibration Datasheet

Calibration Ranges for Aluminium Calibrations

CALIBUS 5 - Aluminium												
Elements	Al Global Al-2000		Low Alloy Al-2010		Al Si Alloys Al-2020		Al Mg Alloys Al-2030		Al Cu Alloys Al-2040		Al Zn Alloys Al-2050	
	Min %	Max %	Min %	Max %	Min %	Max %	Min %	Max %	Min %	Max %	Min %	Max %
Bi									0.02	0.57	0.02	0.57
Cr	0.01	0.36	0.01	0.15	0.01	0.32	0.01	0.36	0.01	0.32	0.01	0.36
Cu	0.005	12.2	0.005	5.1	0.005	6	0.005	5	0.051	12.2	0.015	4.3
Fe	0.01	3.9	0.01	3.9	0.026	3.9	0.01	3.9	0.072	1.9	0.072	1
Mg	0.005	10.1	0.005	1.2	0.026	1.8	0.005	10.1	0.024	2.7	0.024	4
Mn	0.01	2.4	0.01	2.4	0.01	1	0.01	2.4	0.03	1	0.02	0.82
Ni	0.01	2.47	0.01	0.25	0.01	2.47	0.01	2.1	0.012	2.2	0.01	0.2
Pb					0.01	0.42			0.01	1.1	0.01	0.42
Si	0.01	24	0.01	1.2	0.2	24	0.01	8.5	0.028	6.9	0.028	9.35
Ti	0.01	0.45	0.01	0.25	0.01	0.45	0.01	0.3	0.01	0.25	0.01	0.26
Zn	0.01	12	0.01	0.48	0.01	3	0.01	0.6	0.01	2	0.023	12

Calibrations created using Certified Reference Samples (CRMs) only. These values are taken from a production CALIBUS instrument, please note that detection limits of individual instruments may vary.

The calibration ranges represented are provisional and subject to further testing.

Aluminium Calibrations – Accuracy and Repeatability

Content Range	Non-Global Programs (e.g. Low Alloy Steel, Tool Steel)	Global Program
≤ 0.3	0.06	0.08
0.3 - 1	0.1	0.12
1 - 2	0.15	0.2
2 - 5	0.25	0.3
5 - 10	0.5	0.5
≥ 10	0.6	0.6

The accuracy standard for the CALIBUS instrument requires the average of test values to fall within the given ranges from those certified for a CRM.

Accuracy ranges are given for mass-% content ranges, and differ between global programs (e.g. Al-2000) and non-global programs (e.g. Al-2010, Al-2020, etc).

Content Range	Carbon	Other Elements
0.1 - 0.3	10	8
0.3 - 2	8	5
2 - 100	5	3

The precision standard for the CALIBUS instrument requires the relative standard deviation (RSD) value to be less than the values given, dependent on content range. Carbon RSD values given separately.

For content lower than 0.1%, the content range of a sample set of at least 8 values should be less than 0.04.

Calculated using data measured on production CALIBUS instruments.

Data provided is a typical representation of CALIBUS performance, individual instrument performance may vary.

AI-2010 – Low Alloy Calibration

Sample Data – GOOH3 B

ID	Al	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Be	Bi	Li	Pb	Sn	V	Ag
Run1	98.0	0.668	0.256	0.206	0.337	0.0176	0.135	<0.001	0.0356	<0.001	0.00208	0.00956	<0.001	0.210	0.0803	0.0484	<0.001
Run2	98.2	0.596	0.188	0.201	0.319	0.0155	0.138	0.00626	0.0341	0.00183	0.00122	0.00626	<0.001	0.158	0.0681	0.0397	<0.001
Run3	98.2	0.638	0.204	0.212	0.328	0.0153	0.133	0.0134	0.0358	0.00274	0.00147	0.00571	<0.001	0.138	0.0581	0.0400	0.00115
Run4	98.3	0.595	0.172	0.206	0.309	0.0139	0.138	0.00393	0.0347	0.00142	0.00195	0.00466	<0.001	0.133	0.0631	0.0349	<0.001
Run5	98.4	0.560	0.146	0.188	0.311	0.0137	0.142	0.0180	0.0330	0.00110	0.00127	0.00539	0.00281	0.108	0.0611	0.0496	<0.001
Run6	98.4	0.569	0.165	0.205	0.295	0.0133	0.133	0.0115	0.0335	0.00138	0.00183	0.00366	0.00121	0.095	0.0617	0.0408	0.00104
Run7	98.3	0.575	0.157	0.204	0.298	0.0123	0.144	0.0146	0.0312	0.00134	0.00194	0.00307	0.00119	0.149	0.0715	0.0370	<0.001
Run8	98.2	0.634	0.173	0.221	0.309	0.0138	0.142	0.0135	0.0327	0.00131	0.00216	0.00308	0.00117	0.140	0.0643	0.0370	<0.001
Run9	98.3	0.606	0.143	0.210	0.297	0.0150	0.136	0.00630	0.0320	0.00129	0.00142	0.00327	0.00116	0.123	0.0672	0.0448	<0.001
Run10	98.4	0.528	0.139	0.191	0.296	0.0138	0.134	0.0127	0.0289	0.00127	0.00139	0.00332	0.00115	0.152	0.0583	0.0414	<0.001
Run11	98.1	0.680	0.184	0.245	0.316	0.0152	0.133	0.0130	0.0356	0.00125	0.00204	0.00370	0.00114	0.143	0.0734	0.0356	0.00220
Run12	98.2	0.651	0.155	0.235	0.299	0.0127	0.145	0.0183	0.0338	0.00124	0.00194	0.00497	0.00113	0.152	0.0694	0.0453	0.00102
AVG	98.2	0.608	0.174	0.210	0.310	0.0143	0.138	0.0110	0.0334	0.00143	0.00172	0.00472	0.00124	0.142	0.0664	0.0412	0.00104
CRM		0.65	0.23	0.23	0.34	0.01	0.11	0.01	0.04	0.01				0.05	0.1		
SD PPM		444	310	157	130	14	42		19		3	18		275	63	47	
RSD		7.30	17.9	7.46	4.20	9.64	3.08		5.83		19.2	38.2		19.4	9.55	11.3	

Analysis results obtained from **Certified Reference Sample GOOH3 B** using the **AI-2010** calibration for low alloy aluminium samples on a production CALIBUS instrument. Results given in mass-%.

Data set includes data from 12 burns, the average composition values for the data set, the certified composition values for the CRM used, the standard deviation of the data for each element expressed in Parts Per Million (PPM), and the relative standard deviation (RSD).

Data provided is a typical representation of CALIBUS performance, individual instrument performance may vary.

AI-2020 – Al Si Alloy Calibration

Sample Data – KE-380 L

ID	Al	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Be	Bi	Pb	Sn	V	Ag
Run1	85.1	9.96	1.08	3.40	0.242	0.00706	0.0307	0.0238	0.0296	0.0410	0.00133	0.00743	0.0200	<0.001	0.0359	<0.001
Run2	85.5	9.78	1.05	3.28	0.240	0.00659	0.0158	0.0149	0.0282	0.0399	0.00155	0.00795	0.0138	0.00718	0.0309	<0.001
Run3	86.0	9.39	0.972	3.27	0.216	0.00715	0.0224	0.0161	0.0269	0.0392	0.00121	0.00705	0.0089	0.00245	0.0326	<0.001
Run4	85.8	9.46	1.06	3.29	0.235	0.00719	0.0235	0.0169	0.0259	0.0392	0.00112	0.00724	0.0145	0.00218	0.0343	<0.001
Run5	85.8	9.54	1.00	3.27	0.226	0.00643	0.0250	0.0174	0.0251	0.0384	0.00108	0.00615	0.0103	0.00768	0.0313	<0.001
Run6	85.6	9.58	1.03	3.35	0.225	0.00701	0.0375	0.0086	0.0266	0.0398	0.00105	0.00655	0.0143	0.00562	0.0309	<0.001
Run7	85.2	10.1	1.05	3.20	0.235	0.00691	0.0327	0.0180	0.0280	0.0404	0.00114	0.00638	0.0155	0.00801	0.0275	<0.001
Run8	85.7	9.73	0.985	3.17	0.227	0.00693	0.0278	0.0159	0.0278	0.0392	0.00103	0.00624	0.0133	0.00319	0.0234	<0.001
Run9	85.5	9.73	1.03	3.33	0.231	0.00729	0.0221	0.0191	0.0284	0.0351	<0.001	0.00684	0.0126	0.00685	0.0298	<0.001
Run10	85.4	9.86	1.01	3.30	0.224	0.00697	0.0227	0.0141	0.0269	0.0381	<0.001	0.00783	0.0142	0.00402	0.0262	<0.001
Run11	85.4	9.87	1.03	3.28	0.224	0.00693	0.0299	0.0231	0.0263	0.0376	<0.001	0.00695	0.00811	0.00305	0.0253	<0.001
Run12	85.0	10.2	1.08	3.31	0.232	0.00722	0.0327	0.0233	0.0289	0.0390	<0.001	0.00686	0.0146	0.00257	0.0268	<0.001
AVG	85.5	9.77	1.03	3.29	0.230	0.00697	0.0269	0.0176	0.0274	0.0389	0.00109	0.00696	0.0133	0.00447	0.0296	<0.001
CRM		9.66	1.09	3.57	0.21	0.0012	0.023	0.033	0.003	0.033						
SD PPM		2379	335	587	72	2	58	42	13	15		6	30		36	
RSD		2.44	3.25	1.79	3.12	3.43	21.5	23.8	4.63	3.77		8.04	22.8		12.3	

Analysis results obtained from **Certified Reference Sample KE380 L** using the **AI-2020** calibration for aluminium-silicon alloy samples on a production CALIBUS instrument. Results given in mass-%.

Data set includes data from 12 burns, the average composition values for the data set, the certified composition values for the CRM used, the standard deviation of the data for each element expressed in Parts Per Million (PPM), and the relative standard deviation (RSD).

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AI-2030 – Al Mg Alloy Calibration

Sample Data – SS-535 X

Mode	Al	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Be	Bi	Pb	Sn	V	Ag
Run1	92.5	0.108	0.0474	0.0455	0.156	6.89	<0.001	0.00332	0.0598	0.157	<0.001	<0.001	0.0105	<0.001	0.0373	<0.001
Run2	92.3	0.110	0.0939	0.0483	0.155	6.94	0.0301	0.0243	0.0615	0.142	0.00390	<0.001	0.0138	<0.001	0.0318	<0.001
Run3	92.5	0.0993	0.0836	0.0490	0.155	6.79	0.0370	0.00955	0.0639	0.166	0.00307	<0.001	0.00656	0.00338	0.0280	<0.001
Run4	92.3	0.105	0.0993	0.0501	0.159	7.03	0.0290	0.00666	0.0610	0.159	0.00276	<0.001	0.00561	0.00505	0.0290	<0.001
Run5	92.4	0.121	0.102	0.0505	0.165	6.86	0.0182	0.0173	0.0638	0.170	0.00353	<0.001	0.00452	0.00188	0.0173	<0.001
Run6	92.7	0.109	0.107	0.0497	0.159	6.57	0.0148	0.0208	0.0618	0.173	0.00337	<0.001	0.00946	0.00186	0.0296	<0.001
Run7	92.4	0.116	0.121	0.0497	0.157	6.84	0.0272	0.00833	0.0621	0.166	0.00410	<0.001	0.00446	0.00619	0.0168	<0.001
Run8	92.1	0.120	0.136	0.0500	0.161	7.16	0.0135	0.0255	0.0665	0.150	0.00422	<0.001	0.00917	0.00206	0.0187	<0.001
Run9	92.2	0.121	0.128	0.0498	0.159	6.97	0.0534	0.0217	0.0624	0.160	0.00368	<0.001	0.0127	0.00383	0.0206	<0.001
Run10	92.4	0.115	0.130	0.0481	0.167	6.80	0.0273	0.0161	0.0618	0.174	0.00423	<0.001	0.0170	0.00203	0.0239	<0.001
Run11	92.4	0.115	0.114	0.0501	0.158	6.85	0.0144	0.0100	0.0613	0.166	0.00425	<0.001	0.0131	0.00197	0.0248	<0.001
Run12	92.2	0.115	0.135	0.0505	0.169	7.01	0.0390	0.0199	0.0635	0.153	0.00500	<0.001	0.0191	0.00191	0.0280	<0.001
AVG	92.4	0.113	0.108	0.0493	0.160	6.89	0.0254	0.0153	0.0624	0.161	0.00357	<0.001	0.0105	0.00267	0.0255	<0.001
CRM		0.11	0.098	0.029	0.18	6.96	0.021	0.02	0.031	0.18	0.006					
SD PPM		63	244	14	46	1402		71	17	93			46		60	
RSD		5.63	22.6	2.75	2.85	2.03		46.7	2.70	5.76			43.8		23.7	

Analysis results obtained from **Certified Reference Sample SS-535 X** using the **AI-2030** calibration for aluminium-magnesium alloy samples on a production CALIBUS instrument. Results given in mass-%.

Data set includes data from 12 burns, the average composition values for the data set, the certified composition values for the CRM used, the standard deviation of the data for each element expressed in Parts Per Million (PPM), and the relative standard deviation (RSD).

Data provided is a typical representation of CALIBUS performance, individual instrument performance may vary.

Al-2040 – Al Cu Alloy Calibration

Sample Data – G12 H1

Mode	Al	Si	Fe	Cu	Mn	Mg	Ni	Zn	Ti	Bi	Pb	Ag
Run1	85.9	3.45	1.41	6.94	<0.001	0.655	0.429	1.13	0.101	0.0114	0.0215	<0.001
Run2	85.5	3.69	1.50	6.93	<0.001	0.723	0.475	1.08	0.0905	0.0115	0.0223	<0.001
Run3	86.2	3.34	1.44	6.71	<0.001	0.654	0.422	1.07	0.102	0.0108	0.0117	<0.001
Run4	86.3	3.27	1.47	6.66	<0.001	0.657	0.432	1.07	0.107	0.0117	0.00933	<0.001
Run5	87.0	3.05	1.38	6.39	<0.001	0.605	0.416	1.03	0.109	0.00913	0.0141	<0.001
Run6	86.3	3.33	1.55	6.53	<0.001	0.690	0.434	1.05	0.0977	0.0108	0.0257	<0.001
Run7	86.3	3.32	1.53	6.56	<0.001	0.693	0.423	1.02	0.0957	0.0108	0.0244	<0.001
Run8	86.3	3.26	1.58	6.57	<0.001	0.675	0.469	1.03	0.102	0.0104	0.0266	<0.001
Run9	86.4	3.24	1.49	6.49	<0.001	0.695	0.501	1.03	0.0997	0.0101	0.0233	<0.001
Run10	86.6	3.19	1.53	6.40	0.00443	0.686	0.428	1.03	0.102	0.00877	0.0227	<0.001
Run11	86.8	3.01	1.57	6.38	0.00107	0.621	0.441	1.02	0.106	0.0105	0.0104	<0.001
Run12	86.6	3.11	1.55	6.44	0.00379	0.667	0.435	1.01	0.109	0.00865	0.0165	<0.001
AVG	86.4	3.27	1.50	6.58	0.00142	0.668	0.442	1.05	0.102	0.0104	0.0190	<0.001
CRM		3.24	1.45	6.7	0.01	0.49	0.41	1.07	0.11		0.04	
SD PPM		1772	603	1858		315	247	307	53	10	60	
RSD		5.42	4.02	2.82		4.71	5.59	2.93	5.22	9.52	31.4	

Analysis results obtained from **Certified Reference Sample G12 H1** using the **Al-2040** calibration for aluminium-copper alloy samples on a production CALIBUS instrument. Results given in mass-%.

Data set includes data from 12 burns, the average composition values for the data set, the certified composition values for the CRM used, the standard deviation of the data for each element expressed in Parts Per Million (PPM), and the relative standard deviation (RSD).

Data provided is a typical representation of CALIBUS performance, individual instrument performance may vary.

Al-2050 – Al Zn Alloy Calibration

Sample Data – SS-712 J

Mode	Al	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Ag
Run1	91.5	0.176	0.496	0.193	0.0832	0.791	0.533	<0.001	6.10	0.142	0.00601
Run2	91.8	0.171	0.485	0.181	0.0918	0.742	0.546	<0.001	5.80	0.165	0.00683
Run3	91.7	0.176	0.543	0.189	0.0960	0.750	0.530	<0.001	5.89	0.155	0.00958
Run4	91.9	0.176	0.470	0.177	0.0916	0.705	0.534	<0.001	5.75	0.161	0.00661
Run5	91.9	0.171	0.498	0.183	0.0932	0.707	0.556	<0.001	5.73	0.181	0.00657
Run6	92.0	0.170	0.492	0.178	0.0983	0.701	0.530	<0.001	5.66	0.161	0.00767
Run7	92.0	0.176	0.506	0.176	0.0959	0.693	0.548	<0.001	5.61	0.169	0.00837
Run8	92.1	0.175	0.404	0.177	0.0877	0.706	0.530	<0.001	5.56	0.231	0.00856
Run9	91.9	0.177	0.504	0.184	0.0931	0.710	0.498	<0.001	5.76	0.165	0.00815
Run10	91.9	0.168	0.482	0.186	0.100	0.710	0.523	<0.001	5.75	0.152	0.00829
Run11	91.9	0.170	0.391	0.189	0.0881	0.736	0.526	<0.001	5.80	0.167	0.00624
Run12	92.0	0.173	0.452	0.184	0.0995	0.702	0.536	<0.001	5.70	0.180	0.00633
AVG	91.9	0.173	0.477	0.183	0.0932	0.721	0.532	<0.001	5.76	0.169	0.00743
CRM		0.19	0.5	0.15	0.1	0.64	0.48	0.0019	5.89	0.14	
SD PPM		30	413	52	49	271	139		1341	214	11
RSD		1.72	8.67	2.83	5.28	3.76	2.60		2.33	12.7	14.8

Analysis results obtained from **Certified Reference Sample SS-712 J** using the **Al-2050** calibration for aluminium-zinc alloy samples on a production CALIBUS instrument. Results given in mass-%.

Data set includes data from 12 burns, the average composition values for the data set, the certified composition values for the CRM used, the standard deviation of the data for each element expressed in Parts Per Million (PPM), and the relative standard deviation (RSD).

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