



ARTUS 8 NICKEL CALIBRATION DATASHEET

CALIBRATION RANGES FOR NICKEL CALIBRATIONS

ARTUS 8 - Nickel																	
Elements	Model ● Ultimate ▲ Standard □ Visible	Ni Global Ni-8000		Low Alloy Ni-8020		Inconel Ni-8110		Hastelloy Ni-8120		Incoloy Ni-8130		Nimonic, Waspaloy Ni-8140		Monel Ni-8150		Marmalloy Ni-8160	
		Min %	Max %	Min %	Max %	Min %	Max %	Min %	Max %	Min %	Max %	Min %	Max %	Min %	Max %	Min %	Max %
Al	● ▲ □	0.05	8.5	0.002	0.04	0.007	6.5	0.005	1.6	0.005	6.5	0.002	6.6	0.002	5	0.007	8.5
B	● ▲	0.0001	0.02	---	---	0.0001	0.02	0.0001	0.01	0.0001	0.02	0.0001	0.02	---	---	0.0001	0.02
C	● ▲	0.005	0.45	0.0005	0.15	0.005	0.3	0.002	0.3	0.005	0.15	0.005	0.3	0.003	0.45	0.007	0.2
Co	● ▲ □	0.001	23	0.0001	0.15	0.0005	23	0.0002	3.7	0.002	23	0.002	17.5	0.001	0.2	0.001	17.5
Cr	● ▲ □	0.0005	35	0.0002	0.15	0.007	25	0.0004	30	0.003	25	0.008	35	0.0007	0.25	0.004	26
Cu	● ▲ □	0.001	37	0.0001	0.15	0.0006	2.4	0.0006	2.4	0.0005	2.8	0.001	2.3	0.0005	37	0.0005	0.3
Fe	● ▲ □	0.005	60	0.001	0.35	0.015	43	0.005	24	0.005	60	0.005	44	0.005	5.5	0.004	6.5
Mg	● ▲ □	0.0001	0.9	0.0001	0.05	0.0007	0.07	0.0001	0.07	0.0006	0.07	0.0007	0.07	0.0001	0.9	0.0007	0.07
Mn	● ▲ □	0.0005	3.6	0.0001	0.4	0.0007	1.7	0.0003	1.7	0.0006	1.7	0.0006	1.3	0.002	3.6	0.001	0.8
Mo	● ▲ □	0.002	40	---	---	0.001	18.8	0.0005	40	0.002	18.8	0.0006	18.8	0.001	0.03	0.0005	9
Nb	● ▲ □	0.005	6.2	---	---	0.008	6.2	0.006	4	0.002	5	0.008	1.5	0.007	1.2	0.008	5
P	● ▲	0.002	0.07	---	---	0.002	0.07	0.004	0.07	0.003	0.07	0.003	0.07	0.002	0.025	0.002	0.015
Pb	● ▲ □	0.003	0.06	---	---	---	---	---	---	---	---	---	---	0.003	0.06	---	---
S	● ▲	0.005	0.1	0.0005	0.01	0.003	0.06	0.007	0.06	0.006	0.06	0.005	0.06	0.003	0.1	0.005	0.025
Si	● ▲ □	0.02	5.5	---	---	0.002	1.75	0.001	1.75	0.008	1.75	0.005	1.75	0.001	5.5	0.005	3
Ti	● ▲ □	0.001	7	0.0002	0.05	0.0008	5.8	0.002	3.1	0.002	5.8	0.001	5.8	0.002	1.8	0.001	7
V	● ▲ □	0.0015	1.2	---	---	0.001	1.2	0.001	0.8	0.002	1.2	0.002	1.2	---	---	---	---
W	● ▲ □	0.01	16.2	---	---	0.002	16.2	0.003	8	0.002	12	0.007	14	---	---	0.003	16.2
Zr	● ▲ □	0.0002	0.2	---	---	0.0003	0.2	---	---	---	---	0.0003	0.1	---	---	0.0002	0.2
N	●	0.01	0.15	---	---	0.006	0.15	0.004	0.1	0.008	0.15	---	---	---	---	---	---
Ni	● ▲ □	Balance		Balance		Balance		Balance		Balance		Balance		Balance		Balance	

● Ultimate ▲ Standard □ Visible

Calculation of detection limit according to DIN 32645:2008-11 with a confidence limit of 99.7% (3 sigma).

Calibrations created using Certified Reference Samples (CRMs) only. These values are taken from a production ARTUS 8 instrument, please note that detection limits of individual instruments may vary.

Calibrations can be extended using customer samples.

NI-8020 – LOW ALLOY CALIBRATION

Sample Data – B.S. 200A – Alloy 200

ID	C	Mg	Al	S	Ti	Mn	Fe	Co	Cu
Run1	0.0782	0.0132	0.0285	0.00373	0.0415	0.151	0.0760	0.0563	0.00391
Run2	0.0780	0.0127	0.0288	0.00530	0.0419	0.153	0.0767	0.0567	0.00341
Run3	0.0755	0.0133	0.0320	0.00470	0.0411	0.148	0.0717	0.0557	0.00317
Run4	0.0768	0.0132	0.0278	0.00407	0.0410	0.149	0.0728	0.0567	0.00341
AVG	0.0771	0.0131	0.0293	0.00445	0.0414	0.15	0.0743	0.0563	0.00347
CRM	0.077	0.013	0.029	0.004	0.043	0.15	0.076	0.057	0.004
SD	0.00122	0.000277	0.00185	0.000696	0.000388	0.00182	0.00241	0.000481	0.00031

3

Sample Data – BS 200-3 – Alloy 200

ID	C	Mg	Al	S	Ti	Cr	Mn	Fe	Co	Cu
Run1	0.0140	0.0234	0.00612	0.00335	0.0231	0.00877	0.158	0.133	0.103	0.109
Run2	0.0152	0.0240	0.00482	0.00226	0.0236	0.00926	0.156	0.134	0.103	0.109
Run3	0.0148	0.0239	0.00592	0.00325	0.0235	0.00952	0.158	0.135	0.103	0.110
Run4	0.0144	0.0242	0.00888	0.00373	0.0231	0.00879	0.156	0.135	0.103	0.109
AVG	0.0146	0.0239	0.0054	0.00315	0.0233	0.00908	0.157	0.135	0.103	0.109
CRM	0.0145	0.024	0.006	0.0032	0.0235	0.0091	0.157	0.138	0.103	0.108
SD	0.000511	0.000366	0.000295	0.000627	0.000247	0.000368	0.000903	0.00104	0.000297	0.000328

NI-8020 – LOW ALLOY CALIBRATION

Sample Data – BS 200-4 – Alloy 200

ID	C	Mg	S	Ti	Cr	Mn	Fe	Co	Cu
Run1	0.105	0.0313	0.00746	0.0192	0.133	0.311	0.293	0.0912	0.0481
Run2	0.108	0.0322	0.00818	0.0195	0.133	0.314	0.296	0.0914	0.0492
Run3	0.106	0.0317	0.00768	0.0191	0.131	0.311	0.292	0.0907	0.0485
Run4	0.106	0.0314	0.00755	0.0193	0.133	0.314	0.293	0.0912	0.0482
AVG	0.106	0.0316	0.00772	0.0193	0.133	0.313	0.293	0.0911	0.0485
CRM	0.107	0.0312	0.0076	0.0191	0.132	0.31	0.297	0.0911	0.0482
SD	0.00155	0.000394	0.000322	0.000178	0.000882	0.00177	0.00189	0.000316	0.000506

Analysis results obtained from **Certified Reference Samples BS 200A, BS 200-3, BS 200-4** using the **Ni-8020** calibration for low alloy nickel samples on a production ARTUS 8 instrument. Results given in mass-%.
Data provided is a typical representation of ARTUS 8 performance, individual instrument performance may vary.

NI-8110 – INCONEL CALIBRATION

Sample Data – BS 600C – Alloy 600

ID	C	Al	Si	Ti	Cr	Mn	Fe
Run1	0.0754	0.187	0.303	0.201	15.60	0.446	9.28
Run2	0.0741	0.185	0.304	0.209	15.55	0.449	9.30
Run3	0.0739	0.189	0.31	0.205	15.58	0.443	9.28
Run4	0.0713	0.190	0.299	0.196	15.59	0.441	9.34
Run5	0.0724	0.186	0.298	0.198	15.61	0.443	9.27
Run6	0.0733	0.189	0.307	0.209	15.59	0.446	9.26
AVG	0.0734	0.188	0.304	0.203	15.62	0.444	9.29
CRM	0.071	0.21	0.39	0.21	15.64	0.5	9.31
SD	0.00144	0.00194	0.00475	0.00548	0.00521	0.00299	0.028

Sample Data – 28X 6253 – Alloy 625

5

ID	C	Si	P	S	Ti	Cr	Mn	Fe	Co	Cu	Nb	Mo
Run1	0.128	1.14	0.0132	0.0188	0.360	21.54	0.708	5.33	0.424	0.296	4.19	7.65
Run2	0.129	1.15	0.0133	0.0189	0.359	21.46	0.704	5.31	0.423	0.297	4.23	7.71
Run3	0.128	1.12	0.0133	0.0187	0.360	21.65	0.708	5.33	0.425	0.296	4.20	7.68
Run4	0.130	1.14	0.0134	0.0201	0.363	21.4	0.700	5.28	0.426	0.297	4.21	7.7
AVG	0.129	1.14	0.0133	0.0191	0.36	21.51	0.705	5.31	0.425	0.297	4.21	7.68
CRM	0.126	1.13	0.013	0.0211	0.36	21.66	0.677	5.23	0.417	0.299	4.202	7.69
SD	0.000904	0.0108	0.00008	0.000665	0.00153	0.106	0.00382	0.0233	0.00103	0.000789	0.0178	0.0264

Analysis results obtained from **Certified Reference Sample BS 600C and 28X6253** using the **Ni-8110** calibration for Inconel samples on a production ARTUS 8 instrument. Results given in mass-%.

Data provided is a typical representation of ARTUS 8 performance, individual instrument performance may vary.

NI-8120 – HASTELLOY CALIBRATION

Sample Data – BSH3B – Hastelloy Type X

ID	C	Al	Si	P	Ti	Cr	Mn	Fe	Co	Cu	Nb	Mo	W
Run1	0.0755	0.148	0.63	0.0164	0.02	22.13	0.167	19.8	1.97	0.264	0.248	8.76	0.439
Run2	0.0747	0.145	0.623	0.0161	0.0193	22.23	0.166	19.81	1.97	0.265	0.243	8.68	0.434
Run3	0.0749	0.146	0.62	0.0166	0.0192	22.34	0.168	19.88	1.98	0.262	0.247	8.69	0.442
Run4	0.0747	0.147	0.627	0.0164	0.0194	22.01	0.166	19.46	2	0.266	0.249	8.82	0.442
Run5	0.0734	0.145	0.628	0.0165	0.0192	22.19	0.165	19.73	1.97	0.264	0.248	8.78	0.443
AVG	0.0746	0.146	0.626	0.0164	0.0194	22.18	0.166	19.74	1.98	0.264	0.247	8.74	0.44
CRM	0.078	0.14	0.63	0.013	0.02	22.23	0.11	19.92	1.96	0.27	0.28	8.84	0.49
SD	0.000769	0.00141	0.00429	0.000204	0.000321	0.124	0.00115	0.163	0.0129	0.00143	0.00217	0.0591	0.00403

Analysis results obtained from **Certified Reference Sample BSH3B** using the **Ni-8120** calibration for Hastelloy samples on a production ARTUS 8 instrument. Results given in mass-%.

Data provided is a typical representation of ARTUS 8 performance, individual instrument performance may vary.

NI-8130 – INCOLOY CALIBRATION

Sample Data – BS800 – Alloy type 800

ID	C	Al	Si	Ti	Cr	Mn	Fe	Co	Cu	Mo
Run1	0.0710	0.253	0.526	0.458	19.93	0.712	44.86	0.0644	0.336	0.185
Run2	0.0719	0.254	0.533	0.480	19.92	0.719	44.76	0.0643	0.337	0.186
Run3	0.0730	0.257	0.528	0.474	19.83	0.708	44.73	0.0647	0.333	0.182
Run4	0.0713	0.257	0.534	0.440	19.88	0.715	44.76	0.0634	0.330	0.182
Run5	0.0717	0.255	0.530	0.464	19.93	0.719	44.67	0.0640	0.340	0.184
AVG	0.0718	0.255	0.53	0.463	19.9	0.715	44.76	0.0641	0.335	0.184
CRM	0.075	0.28	0.55	0.475	19.92	0.79	44.8	0.056	0.32	0.19
SD	0.000772	0.00174	0.00328	0.0156	0.0441	0.00459	0.0708	0.000523	0.00394	0.00169

Sample Data – BS750A – Alloy type 750

ID	C	Al	Ti	Cr	Fe	Co	Nb	Mo
Run1	0.0510	0.737	2.57	15.43	7.03	0.305	1.07	0.217
Run2	0.0484	0.741	2.58	15.44	7.00	0.306	1.07	0.216
Run3	0.0471	0.733	2.61	15.46	6.96	0.307	1.07	0.216
Run4	0.0480	0.734	2.60	15.43	6.96	0.306	1.08	0.215
Run5	0.0471	0.741	2.54	15.29	6.88	0.306	1.06	0.212
Run6	0.0484	0.736	2.59	15.30	6.90	0.306	1.07	0.213
AVG	0.0483	0.737	2.58	15.39	6.95	0.306	1.07	0.215
CRM	0.047	0.74	2.6	15.68	7.07	0.29	1.07	0.22
SD	0.00143	0.00336	0.0236	0.0759	0.0554	0.000689	0.00537	0.00213

Analysis results obtained from **Certified Reference Sample BS800 and BS750A** using the **Ni-8130** calibration for Incoloy alloy samples on a production ARTUS 8 instrument. Results given in mass-%.

Data provided is a typical representation of ARTUS 8 performance, individual instrument performance may vary.

NI-8140 – NIMONIC/ WASPALLOY CALIBRATION

Sample Data – B.C.S./S.S. 310 – Nimonic `90` Alloy

ID	C	Al	Si	Ti	Cr	Mn	Fe	Co
Run1	0.0681	1.06	0.483	2.40	19.32	0.310	0.204	17.22
Run2	0.0682	1.06	0.482	2.40	19.53	0.304	0.201	17.34
Run3	0.0690	1.06	0.485	2.39	19.45	0.306	0.203	17.26
Run4	0.0678	1.05	0.472	2.38	19.32	0.300	0.202	17.44
Run5	0.0688	1.07	0.482	2.43	19.17	0.307	0.196	17.16
AVG	0.0684	1.06	0.481	2.40	19.36	0.305	0.201	17.28
CRM	0.068	1.06	0.46	2.43	19.4	0.35	0.25	17
SD	0.000502	0.00609	0.00503	0.0197	0.138	0.00345	0.00307	0.108

8

Sample Data – B.C.S./S.S. 387 – Nimonic 901 Alloy

ID	C	Al	Si	Ti	Cr	Fe	Mo
Run1	0.0298	0.225	0.272	2.92	12.34	36.02	5.8
Run2	0.0318	0.228	0.281	2.96	12.36	35.7	5.8
Run3	0.0319	0.223	0.276	2.92	12.29	35.22	5.87
Run4	0.0304	0.227	0.273	2.9	12.2	35.74	5.81
AVG	0.031	0.226	0.276	2.92	12.3	35.67	5.82
CRM	0.03	0.24	0.28	2.95	12.4	35.7	5.83
SD	0.00107	0.00209	0.00382	0.0241	0.0731	0.336	0.035

NI-8140 – NIMONIC/ WASPALLOY CALIBRATION

Sample Data – B.S. 199A – Waspaloy

ID	C	Al	Ti	Cr	Fe	Co	Mo
Run1	0.0338	1.26	3.08	19.25	1.12	13.64	3.98
Run2	0.0346	1.26	3.09	19.28	1.1	13.68	3.95
Run3	0.0346	1.26	3.07	19.26	1.09	13.74	3.97
Run4	0.034	1.26	3.12	19.38	1.09	13.59	3.94
AVG	0.0342	1.26	3.09	19.29	1.1	13.66	3.96
CRM	0.033	1.26	3.07	19.25	1.05	13.65	3.99
SD	0.000421	0.000803	0.0209	0.0598	0.0116	0.0634	0.0181

Analysis results obtained from **Certified Reference Samples B.C.S./S.S. 310, B.C.S./S.S. 387 , B.S. 199A** using the **Ni-8140** calibration for Nimonic/ Waspaloy samples on a production ARTUS 8 instrument. Results given in mass-%.
Data provided is a typical representation of ARTUS 8 performance, individual instrument performance may vary.

NI-8150 – MONEL CALIBRATION

Sample Data – BS400C – Monel 400 Alloy

ID	C	Al	Si	Ti	Mn	Fe	Cu
Run1	0.152	0.0559	0.152	0.0597	1.07	1.62	31.39
Run2	0.152	0.0554	0.152	0.0587	1.08	1.62	31.25
Run3	0.150	0.0551	0.152	0.0573	1.08	1.62	31.22
Run4	0.151	0.0535	0.151	0.0570	1.08	1.61	31.41
AVG	0.151	0.055	0.152	0.0582	1.08	1.62	31.32
CRM	0.16	0.056	0.18	0.056	1.05	1.61	31.68
SD	0.000915	0.00103	0.000785	0.00124	0.00187	0.00383	0.0973

Sample Data – 212X 4001 – Monel 400 Alloy

ID	C	Mg	Al	Si	S	Ti	Mn	Fe	Co	Cu
Run1	0.0544	0.135	0.106	1.52	0.0206	0.109	3.08	0.434	0.151	26.98
Run2	0.0539	0.134	0.106	1.49	0.0215	0.109	3.07	0.434	0.149	26.85
Run3	0.0544	0.134	0.108	1.5	0.0207	0.109	3.08	0.43	0.148	27.03
Run4	0.0534	0.14	0.106	1.49	0.0225	0.108	3.14	0.43	0.147	27.11
Run5	0.0533	0.134	0.108	1.48	0.0208	0.109	3.06	0.428	0.149	26.85
AVG	0.0539	0.135	0.107	1.5	0.0212	0.109	3.08	0.431	0.149	26.96
CRM	0.06	0.13	0.1	1.51	0.02	0.1	3.01	0.43	0.15	26.6
SD	0.000543	0.00256	0.000981	0.0133	0.000793	0.000814	0.0315	0.00281	0.00164	0.113

Analysis results obtained from **Certified Reference Sample BS400C and 212X 4001** using the **Ni-8150** calibration for Monel samples on a production ARTUS 8 instrument. Results given in mass-%.
Data provided is a typical representation of ARTUS 8 performance, individual instrument performance may vary.

NI-8160 – MARMALLOY CALIBRATION

Sample Data – 213X 200M7 – MAR M 200 type

ID	C	Al	Si	Ti	Cr	Mn	Fe	Co	Zr	Nb	W
Run1	0.164	4.46	0.342	1.85	10.42	0.0912	1.22	10.38	0.152	1.03	13.31
Run2	0.167	4.5	0.355	1.87	10.53	0.0934	1.21	10.39	0.157	1.04	13.13
Run3	0.174	4.48	0.345	1.89	10.54	0.0923	1.2	10.31	0.141	1.06	13.29
Run4	0.165	4.45	0.337	1.87	10.49	0.0915	1.2	10.37	0.139	1.04	13.38
AVG	0.168	4.47	0.345	1.87	10.5	0.0921	1.21	10.36	0.147	1.04	13.28
CRM	0.18	4.4	0.37	1.86	9.9	0.09	1.24	10.3	0.14	1.05	13.5
SD	0.0048	0.0236	0.00786	0.0138	0.0531	0.000984	0.00817	0.0362	0.00833	0.00961	0.103

11

Analysis results obtained from **Certified Reference Sample 213X 200M7** using the **Ni-8160** calibration for Marmalloy samples on a production ARTUS 8 instrument. Results given in mass-%.

Data provided is a typical representation of ARTUS 8 performance, individual instrument performance may vary.