

Metal and Quality, LLC
CERTIFICATE OF ANALYSIS
DSZU CH09 – DSZU CH012
Cast Iron



INFORMATION Certified reference materials DSZU CH09 – DSZU CH012 are intended for calibration of measuring instruments at definition of the chemical composition of foundry and pig iron by using optical emission and X-ray spectrometry methods

MANUFACTURER Metal and Quality, LLC

CERTIFIED VALUES

Mass fraction in %		C	Si	Mn	P	S	Cr	Ni	Ti	Cu	V
CH09	M(M)	2.75	0.69	0.336	0.269	0.073	0.070	0.096	0.032	0.177	0.004
	C(95%)	0.03	0.02	0.004	0.010	0.004	0.001	0.003	0.001	0.007	-
CH010	M(M)	3.14	1.16	0.779	0.058	0.020	0.105	0.024	0.017	0.018	0.002
	C(95%)	0.03	0.04	0.014	0.002	0.001	0.004	0.002	0.001	0.002	-
CH011	M(M)	3.31	1.65	1.576	0.410	0.035	0.033	0.043	0.023	0.106	0.021
	C(95%)	0.02	0.02	0.013	0.007	0.003	0.002	0.003	0.001	0.004	0.002
CH012	M(M)	3.56	0.252	1.122	0.097	0.046	0.309	0.198	0.030	0.328	0.003
	C(95%)	0.03	0.007	0.014	0.004	0.004	0.007	0.004	0.001	0.005	-

M(M) is the mean of the intralaboratory means

C(95%) is the uncertainty estimated as the half-width of the Student's t-distribution confidence interval, where s(M) is the standard deviation of the laboratory mean values and n is the number of laboratory mean values (see page 2)

$$C(95\%) = \frac{t \cdot s(M)}{\sqrt{n}}$$

Italics - approximate values

SPECIFICATION Reference materials CH09 – CH012 in the form of blocks 30-35 mm x 40-35mm, 18-21 mm thick have a double analytical surface with a white structure obtained by rapid crystallization of the melt after induction melting

HOMOGENEITY The assessment of homogeneity of these reference materials was evaluated in one laboratory using OES method and the homogeneity was found to be acceptable

TRACEABILITY The establishment of metrological traceability of certified values CH09 – CH012 complies with ISO 33405:2024. The metrological characteristics were obtained as a result of an interlaboratory experiment, during which the participating laboratories used standardized analytical methods and certified reference materials

THE METHODS USED C - Combustion with infrared and coulometric, OES
S - Combustion with infrared and coulometric, OES, XRF, Titrimetric
P - OES, ICP-OES, XRF, Photometric
Si - OES, ICP-OES, XRF, Gravimetric
Mn, Cr, Ni, Ti, Cu, V - OES, ICP-OES, XRF

VALIDITY The shelf life of the reference materials is not limited. The working surface of the sample should be purified before use. Reference material will remain stable provided that it is not subjected to excessive heat (e.g. during preparation of the working surface)

DATE OF ISSUE February 2025

DELIVERY Samples in a cardboard box and a certificate

SAFETY A Safety Data Sheet (SDS) is not required for CRMs CH09 – CH012. Reference materials and packing does not contain hazardous chemical, explosives and radioactive substances and substances which might influence health and the environment

LABORATORY MEANS, mass fraction in %

CH09	C	Si	Mn	P	S	Cr	Ni	Ti	Cu	V
1	2.680	0.612	0.330	0.244	0.0597	0.067	0.083	0.0300	0.165	0.0029
2	2.694	0.661	0.330	0.247	0.0610	0.068	0.093	0.0300	0.168	0.0031
3	2.706	0.665	0.330	0.254	0.0688	0.069	0.094	0.0302	0.169	0.0033
4	2.740	0.679	0.330	0.259	0.0690	0.069	0.096	0.0302	0.170	0.0035
5	2.757	0.685	0.331	0.264	0.0731	0.069	0.097	0.0308	0.172	0.0040
6	2.765	0.688	0.334	0.274	0.0735	0.069	0.097	0.0310	0.173	0.0049
7	2.765	0.689	0.335	0.274	0.0735	0.070	0.098	0.0313	0.176	
8	2.768	0.691	0.335	0.275	0.0745	0.070	0.099	0.0315	0.181	
9	2.778	0.692	0.336	0.280	0.0752	0.071	0.099	0.0315	0.183	
10	2.797	0.698	0.337	0.281	0.0754	0.071	0.100	0.0320	0.191	
11	2.800	0.706	0.338	0.284	0.0764	0.071	0.101	0.0330	0.198	
12		0.710	0.340	0.294	0.0810	0.073		0.0350		
13		0.714	0.346		0.0833	0.074		0.0360		
14		0.722	0.350							
15		0.738								
M(M)	2.750	0.690	0.336	0.269	0.0726	0.070	0.096	0.0317	0.177	0.0036
s(M)	0.040	0.030	0.006	0.016	0.0068	0.002	0.005	0.0019	0.010	0.0007
CH010	C	Si	Mn	P	S	Cr	Ni	Ti	Cu	V
1	3.090	1.014	0.750	0.0500	0.0157	0.099	0.019	0.0140	0.0133	0.0013
2	3.090	1.061	0.750	0.0554	0.0180	0.099	0.021	0.0152	0.0148	0.0016
3	3.097	1.130	0.750	0.0556	0.0190	0.101	0.021	0.0154	0.0150	0.0023
4	3.104	1.138	0.760	0.0558	0.0190	0.101	0.022	0.0157	0.0172	0.0026
5	3.110	1.148	0.768	0.0560	0.0194	0.102	0.023	0.0166	0.0176	0.0036
6	3.119	1.163	0.771	0.0570	0.0196	0.102	0.023	0.0170	0.0180	
7	3.159	1.164	0.779	0.0576	0.0203	0.102	0.024	0.0177	0.0192	
8	3.180	1.173	0.779	0.0580	0.0204	0.102	0.025	0.0178	0.0193	
9	3.182	1.180	0.780	0.0585	0.0206	0.102	0.026	0.0180	0.0200	
10	3.184	1.190	0.782	0.0590	0.0208	0.104	0.028	0.0180	0.0210	
11	3.190	1.196	0.785	0.0598	0.0210	0.106	0.028	0.0180	0.0212	
12	3.195	1.200	0.798	0.0600	0.0222	0.110		0.0185	0.0236	
13		1.202	0.810	0.0605	0.0232	0.117		0.0190		
14		1.290	0.838	0.0647		0.120		0.0190		
15				0.0658						
M(M)	3.142	1.161	0.779	0.0582	0.0199	0.105	0.024	0.0171	0.0184	0.0023
s(M)	0.043	0.065	0.025	0.0038	0.0019	0.007	0.003	0.0015	0.0030	0.0009
CH011	C	Si	Mn	P	S	Cr	Ni	Ti	Cu	V
1	3.234	1.590	1.530	0.396	0.0280	0.030	0.035	0.0200	0.097	0.0180
2	3.244	1.594	1.554	0.400	0.0290	0.030	0.038	0.0215	0.101	0.0196
3	3.299	1.620	1.558	0.402	0.0297	0.031	0.040	0.0224	0.101	0.0198
4	3.300	1.640	1.564	0.406	0.0318	0.031	0.040	0.0228	0.103	0.0204
5	3.313	1.649	1.567	0.406	0.0326	0.032	0.042	0.0230	0.105	0.0210
6	3.315	1.654	1.568	0.410	0.0351	0.032	0.042	0.0232	0.106	0.0223
7	3.315	1.656	1.570	0.413	0.0353	0.032	0.043	0.0234	0.107	0.0250
8	3.320	1.659	1.583	0.418	0.0360	0.032	0.044	0.0235	0.108	
9	3.326	1.664	1.583	0.423	0.0362	0.032	0.044	0.0236	0.109	
10	3.330	1.670	1.586	0.428	0.0386	0.033	0.046	0.0236	0.110	
11	3.334	1.670	1.586		0.0390	0.034	0.046	0.0237	0.120	
12	3.340	1.682	1.587		0.0408	0.034	0.050	0.0240		
13		1.720	1.610		0.0410	0.037		0.0240		
14			1.620		0.0410	0.044		0.0243		
M(M)	3.306	1.651	1.576	0.410	0.0353	0.033	0.043	0.0231	0.106	0.0209
s(M)	0.034	0.035	0.023	0.010	0.0045	0.004	0.004	0.0011	0.006	0.0022
CH012	C	Si	Mn	P	S	Cr	Ni	Ti	Cu	V
1	3.450	0.230	1.080	0.0840	0.0360	0.287	0.186	0.0280	0.310	0.0016
2	3.520	0.232	1.093	0.0876	0.0363	0.297	0.191	0.0281	0.317	0.0019
3	3.526	0.243	1.100	0.0890	0.0383	0.298	0.195	0.0285	0.325	0.0033
4	3.540	0.245	1.110	0.0920	0.0390	0.300	0.195	0.0286	0.325	0.0035
5	3.557	0.245	1.112	0.0956	0.0410	0.306	0.196	0.0292	0.326	0.0051
6	3.577	0.248	1.113	0.0978	0.0442	0.308	0.197	0.0293	0.328	0.007
7	3.580	0.252	1.120	0.0980	0.0448	0.308	0.199	0.0296	0.329	
8	3.583	0.255	1.122	0.1004	0.0462	0.309	0.199	0.0305	0.329	
9	3.587	0.257	1.125	0.1015	0.0480	0.311	0.201	0.0307	0.332	
10	3.596	0.259	1.130	0.1020	0.0485	0.311	0.202	0.0314	0.335	
11	3.615	0.262	1.140	0.1030	0.0505	0.311	0.206	0.0318	0.335	
12	3.618	0.263	1.148	0.1030	0.0540	0.324	0.206	0.0320	0.340	
13		0.266	1.150	0.1035	0.0568	0.330		0.0330		
14		0.268	1.170	0.1043	0.0580	0.330		0.0336		
M(M)	3.562	0.252	1.122	0.0973	0.0458	0.309	0.198	0.0303	0.328	0.0031
s(M)	0.048	0.012	0.024	0.0066	0.0073	0.012	0.006	0.0018	0.008	0.0014

M(M) - Mean of the intralaboratory means

s(M) - Standard deviation of the mean values of laboratories

PARTICIPATING LABORATORIES (Ukraine)

ArcelorMittal Kriviy Rig PJSC

Dniprospetsstal (DSS) PJSC

Dniprovsky Metallurgical Plant (DMZ) PJSC

Kremenchuk Steel Works JSC

Interpipe Steel LTD

Metal and Quality LLC

Motor PJSC

Zaporizhia Foundry and Mechanical Plant LLC

Zaporozhye Steel Works LLC

Zaporozhstal PJSC

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