

Metal and Quality, LLC
CERTIFICATE OF ANALYSIS
DSZU C010 – DSZU C013
High Manganese Steel



INFORMATION Certified Reference Materials of High Manganese Steel DSZU C010 - DSZU C013 is intended for calibration of measuring instruments at definition of chemical composition of high manganese steels by using of Optical Emission and X-ray Spectrometry methods

MANUFACTURER Metal and Quality, LLC

CERTIFIED VALUES (BOLD) AND UNCERTAINTIES

Mass fraction in %	C	Si	Mn	P	S	Cr	Ni	Cu	Mo	Al	Nb	V	N
C010	1.19	0.49	12.25	0.082	0.0037	0.187	0.108	0.120	0.01	0.006	-	-	0.017
	0.01	0.01	0.08	0.003	0.0007	0.007	0.008	0.003					
C011	0.44	0.41	16.09	0.031	0.0093	0.30	0.058	0.105	0.01	2.6	-	-	0.010
	0.01	0.01	0.08	0.001	0.0007	0.01	0.006	0.006					
C012	0.39	0.31	20.9	0.021	0.0072	0.17	0.103	0.087	0.03	2.9	-	1.14	0.013
	0.01	0.01	0.1	0.001	0.0013	0.01	0.006	0.005					
C013	0.89	0.29	28.8	0.025	0.002	0.14	0.20	0.108	0.44	8.6	0.46	0.1	0.002
	0.01	0.01	0.1	0.002	-	0.02	0.02	0.009	0.03				

Uncertainty C(95%) estimated as the half-width confidence interval of Student's t-distribution, when n is the number of laboratory means (see next page)

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

Italics - approximate values

SPECIFICATION CRMs are made from forged and heat-treated steels in cylinders form, 38-40 mm in diameter and 20-25 mm thick

HOMOGENEITY The homogeneity was evaluated according to ISO Guide 35:2006 (7.7 Evaluating a homogeneity study) and DSTU GOST 8.531:2002 "Reference materials of composition of solid and disperse materials. Ways of homogeneity assessment"

TRACEABILITY The traceability of CRMs DSZU C010 – DSZU C013 established in accordance with ISO Guide 30-35. The characterization of CRMs was achieved through an interlaboratory experiment. Average results of chemical methods have been obtained by two analysts, from 3 to 6 measurements by each. Average results of spectral methods have been obtained from 10 measurements. At analyses used standardized and certified methods of analysis: combustion coulometric and infrared, potentiometric, titrimetric, photometric, ICP-OES, F-AAS, Spark-OES, JDS-OES, XRF. At analysis reference materials were used: ICRM CRM C51g, BAM ECRM 235-1, BAS SS-CRM 491/2, BAS SS-CRM 491/2, SS-CRM 493/2, BAS SS-CRM 494/2, BAS SS-CRM 495/3, BAS SS-CRM 495/4, MBH CRM 14XMN1 – 14XMN5, Brammer BS18A

CRM VALIDITY The shelf life of samples is unlimited subject to the conditions of storage and use. 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 October 2010

DELIVERY CRM, packed into a box and a certificate of analysis

SAFETY A Safety Data Sheet (SDS) is not required for CRMs C010 - C013. Material and packing does not contain hazardous chemical, explosives and radioactive substances and substances which might influence health and the environment

PARTICIPATING LABORATORIES

Dnepropetsstal (DSS) OJSC, Ukraine; Ilyich Iron and Steel Works OJSC, Ukraine; Kerch Switch Plant Ltd., Ukraine; Dnepropetrovsk Pointer Factory OJSC, Ukraine; Ukrainian Special Steels Institute SE; MECHTEL OJSC, RU; UralSteel OJSC Metalinvest, RU; Alchevsk Iron & Steel Works OJSC, Ukraine; REGOM OJSC Ukraine; Mountain Equipment Works CJSC, Ukraine; Federal Institute for Materials Research and Testing (BAM), Germany

CONTACTS 37 Nezalezhnoi Ukrain Street, Zaporozhye City 69019, Ukraine
 Tel/fax: +380 61 7171800
rm@rm.co.ua
<https://rm.co.ua>

Revised March 2026

LABORATORY MEANS, mass fraction in % by weight
C010

n	C	Si	Mn	P	S	Cr	Ni	Cu
1	1.148	0.441	11.99	0.0785	0.0020	0.150	0.070	0.110
2	1.150	0.443	12.04	0.0790	0.0020	0.167	0.086	0.110
3	1.160	0.470	12.07	0.0800	0.0028	0.178	0.095	0.110
4	1.190	0.470	12.12	0.0802	0.0030	0.178	0.096	0.116
5	1.190	0.490	12.14	0.0805	0.0030	0.179	0.099	0.118
6	1.190	0.490	12.15	0.0808	0.0031	0.180	0.099	0.118
7	1.190	0.490	12.17	0.0810	0.0032	0.184	0.109	0.119
8	1.194	0.492	12.20	0.0810	0.0039	0.190	0.110	0.120
9	1.195	0.493	12.21	0.0831	0.0040	0.190	0.113	0.120
10	1.202	0.500	12.23	0.0859	0.0040	0.190	0.114	0.122
11	1.203	0.500	12.25	0.0870	0.0040	0.194	0.119	0.123
12	1.208	0.503	12.27	0.0890	0.0040	0.194	0.120	0.123
13	1.210	0.510	12.28	0.0913	0.0050	0.195	0.120	0.124
14	1.211	0.513	12.30		0.0071	0.198	0.120	0.124
15	1.215	0.521	12.36			0.200	0.125	0.128
16	1.229		12.37			0.203	0.127	0.130
17			12.37			0.210		0.130
18			12.39					
19			12.42					
20			12.67					
M(M)	1.193	0.488	12.25	0.0829	0.0037	0.187	0.108	0.120
s(M)	0.023	0.023	0.16	0.0041	0.0013	0.014	0.016	0.006

C011

n	C	Si	Mn	P	S	Cr	Ni	Cu
1	0.400	0.379	15.77	0.0257	0.0070	0.270	0.040	0.090
2	0.404	0.379	15.91	0.0280	0.0072	0.276	0.050	0.090
3	0.419	0.383	15.94	0.0300	0.0089	0.277	0.051	0.095
4	0.423	0.389	15.96	0.0300	0.0090	0.280	0.053	0.098
5	0.430	0.390	15.98	0.0304	0.0090	0.290	0.055	0.099
6	0.432	0.397	16.01	0.0304	0.0090	0.292	0.055	0.100
7	0.433	0.410	16.04	0.0310	0.0090	0.295	0.060	0.100
8	0.437	0.411	16.05	0.0310	0.0090	0.300	0.062	0.103
9	0.439	0.420	16.11	0.0313	0.0096	0.300	0.067	0.110
10	0.440	0.420	16.11	0.0320	0.0099	0.303	0.070	0.110
11	0.441	0.420	16.12	0.0325	0.0100	0.310	0.070	0.111
12	0.442	0.420	16.14	0.0327	0.0106	0.310	-	0.115
13	0.450	0.420	16.18	0.0330	0.0106	0.310	-	0.115
14	0.460	0.428	16.22	0.0331	-	0.319	-	0.120
15	0.460	0.430	16.28	0.0340	-	0.328	-	0.126
16	0.473	0.434	16.31	0.0340	-	0.329	-	-
17	0.495	0.440	16.41	-	-	0.330	-	-
M(M)	0.440	0.410	16.09	0.0310	0.0093	0.300	0.058	0.105
s(M)	0.024	0.020	0.16	0.0022	0.0011	0.019	0.009	0.011

C012

n	C	Si	Mn	P	S	Cr	Ni	Cu
1	0.353	0.290	20.55	0.0160	0.0030	0.148	0.089	0.076
2	0.359	0.293	20.74	0.0170	0.0040	0.154	0.095	0.080
3	0.379	0.293	20.75	0.0194	0.0049	0.160	0.098	0.080
4	0.380	0.296	20.78	0.0195	0.0060	0.169	0.098	0.080
5	0.380	0.298	20.78	0.0197	0.0067	0.169	0.100	0.083
6	0.385	0.302	20.82	0.0203	0.0069	0.170	0.100	0.083
7	0.390	0.302	20.85	0.0210	0.0070	0.170	0.101	0.087
8	0.390	0.303	20.89	0.0210	0.0070	0.172	0.103	0.090
9	0.391	0.303	20.90	0.0210	0.0070	0.178	0.105	0.090
10	0.398	0.306	20.97	0.0213	0.0080	0.180	0.110	0.097
11	0.400	0.306	21.00	0.0215	0.0080	0.190	0.117	0.100
12	0.405	0.310	21.04	0.0215	0.0102	-	0.120	0.100
13	0.409	0.320	21.28	0.0218	0.0106	-	-	-
14	0.410	0.320	21.32	0.0220	0.0110	-	-	-
15	0.410	0.320	-	0.0220	-	-	-	-
16	0.416	0.330	-	0.0230	-	-	-	-
M(M)	0.390	0.310	20.90	0.0210	0.0072	0.170	0.103	0.087
s(M)	0.018	0.012	0.21	0.0019	0.0023	0.012	0.009	0.008

C013

n	C	Si	Mn	P	Cr	Ni	Cu	Mo
1	0.840	0.273	28.41	0.0211	0.107	0.150	0.077	0.402
2	0.858	0.280	28.50	0.0222	0.112	0.153	0.090	0.410
3	0.870	0.281	28.59	0.0225	0.119	0.157	0.101	0.415
4	0.880	0.287	28.65	0.0230	0.120	0.164	0.105	0.430
5	0.891	0.288	28.65	0.0239	0.122	0.169	0.107	0.430
6	0.893	0.289	28.79	0.0240	0.130	0.200	0.108	0.454
7	0.896	0.290	28.86	0.0240	0.134	0.202	0.110	0.470
8	0.900	0.293	28.88	0.0245	0.140	0.220	0.110	0.480
9	0.900	0.295	28.88	0.0257	0.145	0.230	0.118	0.500
10	0.908	0.297	28.90	0.0289	0.170	0.230	0.120	-
11	0.910	0.300	29.05	0.0290	0.170	0.230	0.120	-
12	0.913	0.320	29.07	0.0308	0.178	0.240	0.132	-
13	0.920	0.350	29.07	-	-	-	-	-
14	-	0.350	-	-	-	-	-	-
M(M)	0.890	0.290	28.80	0.0250	0.137	0.195	0.108	0.443
s(M)	0.024	0.024	0.22	0.0031	0.024	0.035	0.015	0.034

M(M) - Mean of intralaboratory means

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