Metal and Quality LLC

CERTIFICATE OF ANALYSIS

DSZU LG53d

High Manganese Steel

INFORMATION Certified Reference Material LG53d is intended for calibration of measuring instruments at definition of chemical composition of high manganese steels by using of Optical Emission Spectrometry method

MANUFACTURER Metal and Quality, LLC

CERTIFIED	**C**	**Si**	**Mn**	**P**	**S**	**Cr**	**Ni**	**Cu**	**Mo**	**V**	**Al**	**Nb**	**N**
Mass fraction in % M(M)	**1.11**	**0.292**	**13.09**	**0.091**	**0.0080**	**0.105**	**0.092**	**0.118**	**0.012**	**0.016**	**0.022**	*0.013*	*0.014*
Uncertainty C(95%)	**0.02**	**0.005**	**0.04**	**0.002**	**0.0006**	**0.006**	**0.003**	**0.003**	**0.001**	**0.006**	**0.004**	-	-

Italics - approximate values

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)

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

SPECIFICATION Reference material is made of forged steel in the form of cylinders diameter of 40 mm, height 20 mm.

HOMOGENEITY The homogeneity was evaluated according ISO Guide 35:2017 - Reference materials - Guidance for characterization and assessment of homogeneity and stability. This reference material was tested for homogeneity using OES method and found acceptable

TRACEABILITY The traceability of LG53d established in accordance with ISO Guide 30-35. The metrological characteristics of LG53d were obtained on the basis of multiple comparative measurements with the CRM LG53 by optical emission method followed by an inter-laboratory experiment. At analyses applied standardized and certified methods of analysis, certified reference materials were used

RM VALIDITY Shelf life of CRM: unlimited. 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)

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DELIVERY CRM, packed into a box and certificate

SAFETY A Safety Data Sheet (SDS) is not required for LG53d. Reference Material LG53d 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 %

n	C	Si	Mn	P	S	Cr	Ni	Cu	Mo	V	Al	Nb	N
1	1.059	0.282	13.02	0.0860	0.0065	0.0913	0.084	0.112	0.0093	0.0130	0.0175	0.0093	0.014
2	1.081	0.283	13.04	0.0884	0.0073	0.0970	0.089	0.113	0.0106	0.0131	0.0190	0.0120	
3	1.082	0.284	13.04	0.0885	0.0074	0.0990	0.089	0.115	0.0117	0.0135	0.0195	0.0180	
4	1.100	0.286	13.05	0.0885	0.0076	0.1026	0.089	0.118	0.0124	0.0145	0.0200		
5	1.107	0.289	13.08	0.0890	0.0076	0.1050	0.089	0.118	0.0126	0.0148	0.0225		
6	1.110	0.292	13.09	0.0898	0.0081	0.1080	0.093	0.120	0.0129	0.0154	0.0225		
7	1.122	0.294	13.09	0.0927	0.0083	0.1081	0.093	0.120		0.0156	0.0226		
8	1.125	0.296	13.10	0.0930	0.0086	0.1120	0.094	0.120		0.0173	0.0250		
9	1.128	0.297	13.16	0.0942	0.0090	0.1140	0.099	0.123		0.0180	0.0330		
10	1.132	0.301	13.21	0.0970	0.0096	0.1158	0.099	0.123		0.0220			
11	1.132	0.306											
12	1.137												
M(M)	**1.110**	**0.292**	**13.09**	**0.0907**	**0.0080**	**0.1053**	**0.092**	**0.118**	**0.0116**	**0.0157**	**0.0224**	*0.0131*	*0.014*
s(M)	0.025	0.008	0.059	0.0034	0.0009	0.0079	0.005	0.004	0.0014	0.0028	0.0046	*0.0045*	-

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

PARTICIPATING LABORATORIES

ArcelorMittal Krivy Rig PJSC
Dneprospetsstal (DSS) JSC
Dnepropress Steel LTD
Dnieper Railway Switch Plant JSC
Dniprovsky metallurgical plant (DMZ) JSC
Interpipe Steel (Dniprostal) LTD
Metal and Quality LLC
Motor Sich PJSC
Zaporozhye Steel Works LTD
Zaporizhstal PJSC

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