

**Metal and Quality LLC**  
**CERTIFICATE OF ANALYSIS**  
**DSZU LG56**  
**High Manganese Steel**



**INFORMATION** Certified Reference Material LG56 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

| <b>CERTIFIED</b>               | <b>C</b>    | <b>Si</b>   | <b>Mn</b>    | <b>P</b>     | <b>S</b>      | <b>Cr</b>   | <b>Ni</b>    | <b>Cu</b>    | <b>Mo</b>    | <b>V</b>    | <b>Al</b>    | <b>Nb</b>    | <b>N</b>    |
|--------------------------------|-------------|-------------|--------------|--------------|---------------|-------------|--------------|--------------|--------------|-------------|--------------|--------------|-------------|
| <b>Mass fraction in % M(M)</b> | <b>1.19</b> | <b>0.86</b> | <b>18.62</b> | <b>0.088</b> | <b>0.0069</b> | <b>2.65</b> | <b>0.473</b> | <b>0.184</b> | <b>0.049</b> | <b>0.19</b> | <i>0.008</i> | <i>0.017</i> | <i>0.08</i> |
| <b>Uncertainty C(95%)</b>      | <b>0.02</b> | <b>0.03</b> | <b>0.06</b>  | <b>0.005</b> | <b>0.0009</b> | <b>0.04</b> | <b>0.010</b> | <b>0.007</b> | <b>0.003</b> | <b>0.01</b> | -            | -            | -           |

*Italics - approximate value*

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 LG56 established in accordance with ISO Guide 30-35. The metrological characteristics of LG56 were obtained using 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 LG56. Reference Material LG56 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    | 1.110        | 0.774        | 18.50        | 0.0770        | 0.0055        | 2.565        | 0.454        | 0.170        | 0.0428        | 0.159        | 0.0036        | 0.0106        | 0.066        |
| 2    | 1.170        | 0.815        | 18.50        | 0.0780        | 0.0058        | 2.600        | 0.456        | 0.173        | 0.0440        | 0.179        | 0.0047        | 0.0135        | 0.097        |
| 3    | 1.175        | 0.857        | 18.51        | 0.0805        | 0.0062        | 2.602        | 0.465        | 0.179        | 0.0460        | 0.185        | 0.0055        | 0.0175        |              |
| 4    | 1.178        | 0.861        | 18.60        | 0.0833        | 0.0064        | 2.635        | 0.467        | 0.181        | 0.0467        | 0.185        | 0.0060        | 0.0180        |              |
| 5    | 1.181        | 0.866        | 18.61        | 0.0881        | 0.0070        | 2.643        | 0.473        | 0.185        | 0.0500        | 0.188        | 0.0067        | 0.0203        |              |
| 6    | 1.194        | 0.869        | 18.65        | 0.0890        | 0.0073        | 2.650        | 0.479        | 0.185        | 0.0518        | 0.188        | 0.0070        | 0.0235        |              |
| 7    | 1.200        | 0.872        | 18.67        | 0.0928        | 0.0080        | 2.660        | 0.485        | 0.186        | 0.0535        | 0.189        | 0.0100        |               |              |
| 8    | 1.205        | 0.876        | 18.67        | 0.0928        | 0.0089        | 2.695        | 0.486        | 0.187        | 0.0538        | 0.194        | 0.0125        |               |              |
| 9    | 1.207        | 0.881        | 18.68        | 0.0948        |               | 2.727        | 0.492        | 0.193        |               | 0.200        | 0.0176        |               |              |
| 10   | 1.210        | 0.943        | 18.68        | 0.0969        |               | 2.765        |              | 0.203        |               | 0.220        |               |               |              |
| 11   | 1.212        |              | 18.75        | 0.0970        |               |              |              |              |               |              |               |               |              |
| 12   | 1.213        |              |              |               |               |              |              |              |               |              |               |               |              |
| 13   | 1.217        |              |              |               |               |              |              |              |               |              |               |               |              |
| M(M) | <b>1.190</b> | <b>0.861</b> | <b>18.62</b> | <b>0.0882</b> | <b>0.0069</b> | <b>2.654</b> | <b>0.473</b> | <b>0.184</b> | <b>0.0486</b> | <b>0.189</b> | <i>0.0082</i> | <i>0.0172</i> | <i>0.081</i> |
| s(M) | 0.029        | 0.044        | 0.08         | 0.0074        | 0.0012        | 0.061        | 0.014        | 0.009        | 0.0043        | 0.015        | <i>0.0045</i> | <i>0.0046</i> | <i>0.022</i> |

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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