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CERTIFICATE OF CHEMICAL ANALYSIS No 05 – 19

LOW ALLOY STEEL for solid sample spectrometry, combustion and wet-way methods

SPL LA-3G

CERTIFIED VALUES – Mass content in %wt.

Element	Value [%wt.]	Uncertainty [%wt.]
C	0.626	0.004
Mn	0.687	0.010
Si	1.296	0.011
P	0.0472	0.0010
S	0.0351	0.0011
Cu	0.236	0.004
Cr	1.377	0.007
Ni	1.019	0.010
Al	0.047	0.002
Mo	0.326	0.005
W	0.105	0.004
V	0.232	0.002

Element	Value [%wt.]	Uncertainty [%wt.]
Ti	0.143	0.004
Co	0.127	0.003
As	0.051	0.004
Sn	0.031	0.001
B	0.0039	0.0002
Nb	0.0711	0.0015
Pb	0.0098	0.0005
Sb	0.0242	0.0036
Zr	0.068	0.003
Ca	0.0016	0.0002
N	0.0115	0.0010

PARTICIPATING LABORATORIES:

ARCELORMITTAL, Ostrava, Czech Republic

DUNAFERR LABOR NONPROFIT, Dunaújváros, Hungary

ENVIFORM, Třinec, Czech Republic

GO STEEL, Frýdek-Místek, Czech Republic

INSTITUTE FOR CRM (ICRM), Yekaterinburg, Russia

SES INSPEKT, Tlmače, Slovakia

ŠKODA AUTO, Mladá Boleslav, Czech Republic

U. S. STEEL KOŠICE – LABORTEST, Košice, Slovakia

VÍTKOVICE TESTING CENTER, Ostrava, Czech Republic

VOESTALPINE STAHL DONAWITZ, Leoben-Donawitz, Austria

ŽĐAS, Žďár nad Sázavou, Czech Republic

LA-3G - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr	Method	Ni	Method	Al
AES	0,615							AES	0,0290								
AES	0,618							AES	0,0314								
AES	0,619							AES	0,0316								
IR+TCM	0,619							IR+TCM	0,0336								
AES	0,619							IR+TCM	0,0339								
IR+TCM	0,620							IR+TCM	0,0339								
AES	0,621							AES	0,0343								
AES	0,621	AES	0,663	ICP	1,227*	AES	0,0370*	AES	0,0344	ICP	0,218*	AES	1,362	AES	0,948*	ICP	0,044
IR+TCM	0,623	AES	0,672	AES	1,228*	AES	0,0452	AES	0,0347	AES	0,228	AES	1,367	AES	0,999	AES	0,044
IR+TCM	0,625	AES	0,675	AES	1,267	AES	0,0455	IR+TCM	0,0349	AES	0,230	AES	1,368	AES	1,002	AES	0,045
IR	0,627	AES	0,679	AES	1,280	AES	0,0458	AES	0,0354	AES	0,233	AES	1,370	ICP	1,009	AES	0,046
IR+TCM	0,628	AES	0,680	AES	1,284	ICP	0,0460	AES	0,0354	AES	0,233	ICP	1,371	AES	1,012	AES	0,046
AES	0,628	AES	0,684	AES	1,290	AES	0,0460	AES	0,0355	AES	0,235	AES	1,372	AES	1,016	AES	0,046
IR+TCM	0,629	AES	0,686	AES	1,297	AES	0,0474	AES	0,0356	AES	0,236	AES	1,375	AES	1,017	AES	0,047
AES	0,630	AES	0,689	AES	1,298	AES	0,0478	IR+TCM	0,0358	AES	0,237	AES	1,377	AES	1,021	AES	0,048
IR+TCM	0,633	AES	0,690	AES	1,306	AES	0,0481	IR+TCM	0,0365	AES	0,239	AES	1,380	AES	1,023	AES	0,049
IR+TCM	0,637	AES	0,696	AES	1,308	AES	0,0484	IR+TCM	0,0372	AES	0,240	AES	1,390	AES	1,029	AES	0,049
AES	0,638	AES	0,711	AES	1,310	AES	0,0490	IR+TCM	0,0375	AES	0,240	AES	1,391	AES	1,042	AES	0,049
AES	0,643	ICP	0,713	AES	1,315	AES	0,0496	IR	0,0380	AES	0,243	AES	1,395	AES	1,042	AES	0,050
C		Mn		Si		P		S		Cu		Cr		Ni		Al	
Value	0,626		0,687		1,296		0,0472		0,0351		0,236		1,377		1,019		0,047
s_M	0,008		0,015		0,015		0,0015		0,0022		0,005		0,011		0,014		0,002
U	0,004		0,010		0,011		0,0010		0,0011		0,004		0,007		0,010		0,002

Method	Mo	Method	W	Method	V	Method	Ti	Method	Co	Method	As	Method	Sn	Method	B	Method	Nb
AES	0,313				AES	0,230	AES	0,131									
AES	0,320				AES	0,231	AES	0,139								AES	0,0682
AES	0,322				AES	0,231	AES	0,140								AES	0,0686
AES	0,323				ICP	0,232	AES	0,140								AES	0,0702
AES	0,323	AES	0,098	AES	0,232	AES	0,141	AES	0,122	AES	0,046	AES	0,029	AES	0,0025*	AES	0,0704
ICP	0,325	AES	0,103	AES	0,233	AES	0,141	AES	0,125	AES	0,047	ICP	0,030	AES	0,0035	AES	0,0706
AES	0,325	AES	0,105	AES	0,233	AES	0,142	AES	0,126	ICP	0,047	AES	0,031	AES	0,0037	AES	0,0720
AES	0,332	AES	0,106	AES	0,234	ICP	0,142	AES	0,128	AES	0,050	AES	0,031	AES	0,0039	AES	0,0728
AES	0,332	AES	0,108	AES	0,235	AES	0,146	AES	0,128	AES	0,051	AES	0,031	AES	0,0040	AES	0,0730
AES	0,336	AES	0,108	AES	0,237*	AES	0,148	AES	0,128	AES	0,053	AES	0,031	AES	0,0040	AES	0,0742
AES	0,337	AES	0,109	AES	0,241*	AES	0,150	AES	0,129	AES	0,054	AES	0,032	AES	0,0042	ICP	0,0914*
AES	0,362*	AES	0,124*	AES	0,254*	AES	0,154	ICP	0,130	AES	0,057	AES	0,033	ICP	0,0097*	AES	0,0959*
Mo		W		V		Ti		Co		As		Sn		B		Nb	
Value	0,326		0,105		0,232		0,143		0,127		0,051		0,031		0,0039		0,0711
s_M	0,007		0,004		0,002		0,006		0,003		0,004		0,001		0,0002		0,0020
U	0,005		0,004		0,002		0,004		0,003		0,004		0,001		0,0002		0,0015

Method	Pb	Method	Sb	Method	Zr	Method	Ca	Method	N
AES	0,0092	AES	0,0175			AES	0,0015	AES	0,0104
AES	0,0092	AES	0,0224	AES	0,067	AES	0,0015	IR+TCM	0,0105
AES	0,0097	AES	0,0232	AES	0,067	AES	0,0015	AES	0,0109
AES	0,0100	AES	0,0248	AES	0,068	AES	0,0016	IR+TCM	0,0112
AES	0,0100	AES	0,0252	AES	0,068	AES	0,0017	IR+TCM	0,0113
AES	0,0101	ICP	0,0264	AES	0,071	AES	0,0017	AES	0,0116
AES	0,0105	AES	0,0302	ICP	0,140*	AES	0,0021*	AES	0,0125
								IR+TCM	0,0133
Pb		Sb		Zr		Ca		N	
Value	0,0098		0,0242		0,068		0,0016		0,0115
s_M	0,0005		0,0039		0,002		0,0001		0,0010
U	0,0005		0,0036		0,003		0,0002		0,0010

Value – reference value, **s_M** – standard deviation of intralaboratory means, (* - result excluded as outlier)

U – Uncertainty of the reference value $U = \pm \frac{t_{5;0,05}}{\sqrt{n}} \cdot s_M$ in the sense of the ISO Guide to the Expression of the Uncertainty of Measurement (1993), dependent on the standard deviation of the laboratory results.

Certified fully compliant with the ISO Guide 35 definition of Reference Material – with the characterization for determining the property values and their associated uncertainties.

Intended for calibration, matrix-match verification and statistical process control of low alloy steel spectrometric analysis from a plane of solid sample. They may not substitute CRM in a statement of metrological traceability, method validation. A single analysis area of at least 4 mm in diameter defines the minimum sample intake. They may be used for combustion and wet-way methods too.

Manufactured by casting to a special ingot with discarding of the parts, which have been suspected inhomogenous and the rest has been machined to the samples of the ultimate size.

Supplied as discs 37 mm in diameter and 25 mm of standard height.

Homogeneity (random and trend, within- and between- samples) was tested by various analytical techniques of adequate repeatability. Its uncertainty contribution, when statistically significant, was combined to the ultimate uncertainty statement. The RM are stable by a nature of material.

Characterised by inter-laboratory study of the expert laboratories listed below by spectrometric methods and alternative methods (combustion, thermoevolution, wet-way) standard methods, with measurements metrological **traceable** to adequate CRMs.

Certified values in % m/m, tabulated below in bold, are robust means of a minimum five accepted laboratory means. They are rounded to the same digit as their uncertainty statement.

Uncertainty is expressed as a \pm half width interval combined from the standard uncertainty, expanded by the coverage factor $k = 2$ (corresponding to 95% level of confidence). It does not exceed 1,5 multiple of the typical uncertainty of the matching CRM.

Non-certified values in regular without the uncertainty statement do not meet the requirements for certification and are intended for the matrix information.

User instruction: the surface of the specimens and RM should be prepared in a similar manner in accordance with manufacturer's instructions of spectrometers. It is recommended to storage of RM in dry and non-corrosive conditions.

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