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CERTIFICATE OF CHEMICAL ANALYSIS No 07 – 24

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

SPL LA-1D (PT 32/1E, ~ 99,75 % Fe)

CERTIFIED VALUES – Mass content in %wt.

Element	Value [%wt.]	Uncertainty [%wt.]
C	0.0148	0.0009
Mn	0.117	0.002
Si	0.0099	0.0006
P	0.0061	0.0005
S	0.0127	0.0004
Cu	0.0138	0.0004
Cr	0.046	0.001

Element	Value [%wt.]	Uncertainty [%wt.]
Ni	0.0112	0.0005
Al	0.0020	0.0005
Mo	0.0038	0.0003
W	0.0014	
Sn	0.0016	0.0004
B	0.0094	0.0004
N	0.0043	0.0003

PARTICIPATING LABORATORIES:

ARCELORMITTAL Avilés, Spain
ARCELORMITTAL Gijón, Spain
ARCELORMITTAL Poland S.A., Poland
COGNOR S.A. - Ferrostal Łabędy, Poland
ČEZ - JE Temelín, Czech Republic
DAIMLER TRUCK AG, Germany
DUNAFERR Labor Nonprofit, Hungary
ENVIFORM, Czech Republic
ESAB CZ, Czech Republic

IFAM, Germany
OCAS NV, Belgium
SSAB, Sweden
SVÚM, Czech Republic
TATA STEEL IJMUIDEN, Netherlands
TÜV NORD Czech, Czech Republic
VOESTALPINE STAHL, Austria
ZPS - SLÉVÁRNA, Czech Republic

LA-1D - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr
IR	0,0088*							AES	0,0102				
AES	0,0127							AES	0,0112				
AES	0,0128							AES	0,0116				
IR	0,0130							AES	0,0116				
AES	0,0131							AES	0,0117				
AES	0,0132							AES	0,0117				
IR	0,0133							IR	0,0118				
IR	0,0133							ICP	0,0120				
AES	0,0135	ICP	0,112			AES	0,0041	AES	0,0120	AES	0,0098*	ICP	0,040
IR	0,0139	AES	0,112			AES	0,0048	IR	0,0120	ICP	0,0118	ICP	0,041
IR	0,0141	AES	0,112	AES	0,0074	AES	0,0049	IR	0,0122	AES	0,0129	AES	0,044
AES	0,0142	AES	0,113	AES	0,0082	ICP	0,0051	AES	0,0122	AES	0,0130	AES	0,044
IR	0,0143	AES	0,113	AES	0,0087	ICP	0,0054	IR	0,0125	AES	0,0130	AES	0,045
AES	0,0144	AES	0,114	ICP	0,0088	AES	0,0054	AES	0,0126	AES	0,0133	AES	0,045
IR	0,0146	ICP	0,115	AES	0,0090	AES	0,0055	IR	0,0128	AES	0,0135	AES	0,045
IR	0,0148	AES	0,116	AES	0,0091	AES	0,0057	IR	0,0128	ICP	0,0135	AES	0,045
IR	0,0148	AES	0,117	AES	0,0092	ICP	0,0057	AES	0,0128	ICP	0,0136	AES	0,045
AES	0,0148	AES	0,117	AES	0,0095	AES	0,0058	IR	0,0129	ICP	0,0138	ICP	0,045
AES	0,0150	AES	0,117	AES	0,0096	AES	0,0058	AES	0,0129	ICP	0,0138	AES	0,046
AES	0,0151	AES	0,117	AES	0,0097	AES	0,0058	IR	0,0130	AES	0,0138	AES	0,046
AES	0,0153	ICP	0,118	AES	0,0098	AES	0,0060	IR	0,0131	AES	0,0140	AES	0,046
AES	0,0154	AES	0,118	AES	0,0099	AES	0,0060	AES	0,0132	AES	0,0140	ICP	0,047
IR	0,0158	AES	0,118	AES	0,0100	AES	0,0060	IR	0,0134	AES	0,0140	AES	0,047
AES	0,0159	AES	0,118	AES	0,0100	AES	0,0060	IR	0,0136	AES	0,0141	AES	0,047
AES	0,0159	AES	0,118	AES	0,0100	AES	0,0060	AES	0,0141	AES	0,0141	AES	0,048
IR	0,0160	AES	0,119	AES	0,0102	AES	0,0065	AES	0,0141	AES	0,0144	AES	0,048
AES	0,0161	AES	0,119	AES	0,0106	ICP	0,0072	AES	0,0142	AES	0,0145	AES	0,049
IR	0,0167	AES	0,120	ICP	0,0110	AES	0,0074	IR	0,0146	AES	0,0148	AES	0,049
IR	0,0167	ICP	0,122	ICP	0,0112	ICP	0,0081	AES	0,0146	AES	0,0148	AES	0,049
AES	0,0171	ICP	0,123	ICP	0,0124	AES	0,0083	AES	0,0148	AES	0,0149	AES	0,050
IR	0,0174	AES	0,126	AES	0,0130	AES	0,0087	IR	0,017*	AES	0,0150	ICP	0,051
C		Mn		Si		P		S		Cu		Cr	
Value	0,0148		0,117		0,0099		0,0061		0,0127		0,0138		0,046
S _M	0,0013		0,004		0,0013		0,0011		0,0011		0,0008		0,003
U	0,0009		0,002		0,0006		0,0005		0,0004		0,0004		0,001

Method	Ni	Method	Al	Method	Mo	Method	W	Method	Sn	Method	B	Method	N
ICP	0,0084			AES	0,0025								
ICP	0,0099			AES	0,0029							AES	0,0036
AES	0,0099			AES	0,0029							TCM	0,0037
AES	0,0104			AES	0,0031			AES	0,0011	ICP	0,0075	TCM	0,0039
AES	0,0108			AES	0,0033			ICP	0,0013	ICP	0,0085	AES	0,0040
AES	0,0109	ICP	0,0010	AES	0,0033			AES	0,0014	AES	0,0088	TCM	0,0041
AES	0,0109	AES	0,0010	AES	0,0034			AES	0,0015	AES	0,0090	IR	0,0041
AES	0,0111	AES	0,0011	AES	0,0036			AES	0,0015	AES	0,0090	TCM	0,0042
ICP	0,0111	AES	0,0012	AES	0,0037			AES	0,0016	AES	0,0091	TCM	0,0042
AES	0,0111	AES	0,0012	ICP	0,0037			ICP	0,0016	AES	0,0092	TCM	0,0042
AES	0,0112	ICP	0,0015	AES	0,0037			ICP	0,0016	AES	0,0094	AES	0,0042
AES	0,0113	AES	0,0017	AES	0,0039			AES	0,0017	AES	0,0095	AES	0,0043
ICP	0,0113	AES	0,0020	ICP	0,0039			AES	0,0017	AES	0,0095	AES	0,0044
AES	0,0116	AES	0,0021	AES	0,0040			AES	0,0017	AES	0,0097	TCM	0,0044
AES	0,0118	AES	0,0022	AES	0,0041			AES	0,0018	AES	0,0097	AES	0,0045
AES	0,0121	AES	0,0024	ICP	0,0041			AES	0,0019	AES	0,0098	AES	0,0046
AES	0,0124	AES	0,0025	ICP	0,0042			AES	0,0020	AES	0,0099	AES	0,0046
AES	0,0125	ICP	0,0026	ICP	0,0043			AES	0,0023	AES	0,0099	TCM	0,0050
AES	0,0126	AES	0,0026	AES	0,0043	AES	0,0004	ICP	0,0025	AES	0,0100	AES	0,0051
AES	0,0129	AES	0,0027	AES	0,0044	AES	0,0011	AES	0,0027	AES	0,0104	AES	0,0052
ICP	0,0164*	AES	0,0029	AES	0,0047	AES	0,0016	AES	0,0032	AES	0,0104	AES	0,0052
AES	0,0167*	AES	0,0032	AES	0,0047	ICP	0,0023	AES	0,0032	AES	0,0110	AES	0,0060
Ni		Al		Mo		W		Sn		B		N	
Value	0,0112		0,0020		0,0038		0,0014		0,0016		0,0094		0,0043
S _M	0,0011		0,0007		0,0006				0,0006		0,0008		0,0006
U	0,0005		0,0005		0,0003				0,0004		0,0004		0,0003

COMMENTS:

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

U – Uncertainty of the reference value $U \geq \pm \frac{t_{5;0,05}}{\sqrt{n}} \cdot s_M$ 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 17034 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 results from SPL proficiency test **PT 32/1E** - laboratories by various spectrometric methods (AES spark, glow discharge, XRF) and alternative methods (combustion, thermoevolution, wet-way) standard methods, with measurements metrological traceable to adequate CRM (CZ 2001, 2003 - 2008, 2015-2024, BAS, Brammer Standard). Identity of PT participating laboratories is confidential.

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.

Produced by: SPL-LABMAT s.r.o.

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