



SPL-LABMAT s.r.o.

1.máje 432, CZ-735 31 Bohumín, Czech Republic
e-mail: info@spl-labmat.cz, www.spl-labmat.cz, phone: +420 596 014 627

CERTIFICATE OF CHEMICAL ANALYSIS No 05 – 22

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

SPL SST-5B (PT 30/1B)

CERTIFIED VALUES – Mass content in %wt.

Element	Value [%wt.]	Uncertainty [%wt.]
C	0.0173	0.0012
Mn	0.168	0.003
Si	3.653	0.045
P	0.0098	0.0007
S	0.0093	0.0005
Cu	0.0244	0.0010
Cr	0.103	0.003
Ni	0.069	0.001
Al	0.816	0.018
Mo	0.0135	0.0010
W	0.0110	0.0043
V	0.0180	0.0006

Element	Value [%wt.]	Uncertainty [%wt.]
Ti	0.0192	0.0006
Co	0.0124	0.0005
As	0.0052	0.0005
Sn	0.0061	0.0012
B	0.0043	0.0002
Nb	0.0146	0.0012
Sb	0.0029	0.0011
Pb	0.0076	0.0011
Zr	0.0045	0.0006
Zn	<i>0.0010</i>	
N	0.0063	0.0005

PARTICIPATING LABORATORIES:

COMTES, Czech Republic
DAIMLER TRUCK AG, Germany
DUNAFERR Labor Nonprofit, Hungary
FERROMET, Czech Republic
MM VÝZKUM, Czech Republic
OCAS NV, Belgium
SIJ METAL RAVNE, Slovenia

SSAB EMEA, Sweden
TATA STEEL IJMUIDEN, Netherlands
TÜV NORD Czech, Czech Republic
U. S. STEEL Košice - Labortest, Slovakia
VOESTALPINE, Austria
ZPS - SLÉVÁRNA, Czech Republic

SST-5B - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr	Method	Ni	Method	Al	
								IR	0,0072									
AES	0,0107							ICP	0,0079									
AES	0,0144	AES	0,151*					IR	0,0085	ICP	0,0213	AES	0,089					
IR	0,0146	ICP	0,152*			ICP	0,0076	AES	0,0085	ICP	0,0220	ICP	0,091	ICP	0,063			
AES	0,0150	AES	0,161			ICP	0,0076	IR	0,0087	ICP	0,0224	ICP	0,097	XRF	0,064			
AES	0,0152	AES	0,161		AES	3,192*	ICP	0,0078	IR	0,0088	AES	0,0225	AES-m.	0,099	ICP	0,066		
IR	0,0154	AES	0,162		ICP	3,325*	AES	0,0086	AES	0,0088	AES	0,0226	AES	0,099	ICP	0,067		
AES-m.	0,0166	AES	0,164		AES	3,501	AES	0,0087	IR	0,0091	AES	0,0228	AES	0,100	AES	0,067	ICP	0,465*
IR	0,0170	AES	0,165		AES	3,502	AES	0,0091	IR	0,0092	ICP	0,0228	AES	0,101	AES	0,068	ICP	0,763
IR	0,0170	AES-m.	0,166		AES	3,609	AES	0,0092	AES	0,0092	AES	0,0236	ICP	0,102	AES	0,068	AES	0,779
IR	0,0171	AES	0,167		AES	3,615	AES-m.	0,0093	IR	0,0094	AES	0,0237	AES	0,103	AES-m.	0,069	AES	0,787
IR	0,0180	AES	0,168		AES	3,640	AES	0,0098	ICP	0,0095	AES-m.	0,0242	AES	0,103	AES	0,069	AES-m.	0,807
AES	0,0183	AES	0,169	Gravim.	3,649	AES	0,0100	AES	0,0098	AES	0,0242	AES	0,103	AES	0,070	AES	0,808	
IR	0,0184	ICP	0,170	AES	3,654	AES	0,0101	AES	0,0098	AES	0,0254	ICP	0,104	AES	0,070	ICP	0,811	
AES	0,0184	AES	0,170	AES	3,665	AES	0,0101	AES-m.	0,0099	AES	0,0257	AES	0,104	AES	0,071	AES	0,811	
IR	0,0186	ICP	0,171	ICP	3,673	AES	0,0106	IR	0,0099	AES	0,0258	AES	0,108	AES	0,071	AES	0,826	
IR	0,0189	XRF	0,171	XRF	3,692	AES	0,0108	AES	0,0099	AES	0,0259	XRF	0,110	AES	0,071	AES	0,826	
ICP	0,0196	ICP	0,172	ICP	3,715	AES	0,0111	AES	0,0104	ICP	0,0261	AES	0,110	ICP	0,072	AES	0,838	
AES	0,0196	AES	0,174	AES	3,724	XRF	0,0112	AES	0,0105	AES	0,0262	AES	0,111	AES	0,072	AES	0,851	
AES	0,0202	AES	0,175	AES	3,736	AES	0,0120	AES	0,0116	AES	0,0263	AES	0,112	AES	0,072	AES	0,852	
AES	0,0228	ICP	0,177	AES	3,762	ICP	0,0125	AES	0,0134*	XRF	0,0292	ICP	0,113	AES	0,075	AES	0,853	
C		Mn		Si		P		S		Cu		Cr		Ni		Al		
Value	0,0173		0,168		3,653		0,0098		0,0093		0,0244		0,103		0,069		0,816	
S _M	0,0026		0,005		0,078		0,0014		0,0010		0,0020		0,007		0,003		0,029	
U	0,0012		0,003		0,045		0,0007		0,0005		0,0010		0,003		0,001		0,018	

Method	Mo	Method	W	Method	V	Method	Ti	Method	Co	Method	As	Method	Sn	Method	B	Method	Nb
				AES	0,0155												
AES	0,0091			ICP	0,0162	ICP	0,0149*										
AES	0,0113			AES	0,0170	AES	0,0172										
AES	0,0121			ICP	0,0172	AES	0,0179										
ICP	0,0125			AES	0,0175	AES	0,0180										
AES-m.	0,0126			AES-m.	0,0176	AES	0,0183	AES	0,0105	AES-m.	0,0037	ICP	0,0010				
AES	0,0127			AES	0,0176	AES	0,0189	ICP	0,0109	AES	0,0044	AES	0,0040				
AES	0,0130			AES	0,0178	AES-m.	0,0189	AES	0,0118	AES	0,0048	ICP	0,0046				
XRF	0,0131			ICP	0,0178	ICP	0,0189	ICP	0,0122	AES	0,0050	AES	0,0048	ICP	0,0038	AES	0,0143
ICP	0,0131			XRF	0,0180	AES	0,0190	XRF	0,0123	AES	0,0054	ICP	0,0049	AES	0,0039	AES	0,0145
AES	0,0132			ICP	0,0181	ICP	0,0190	AES-m.	0,0123	AES	0,0054	AES-m.	0,0058	AES-m.	0,0042	AES	0,0146
ICP	0,0133	AES	0,0057	AES	0,0181	AES	0,0191	AES	0,0125	AES	0,0055	AES	0,0063	AES	0,0042	AES	0,0147
AES	0,0140	AES	0,0057	AES	0,0182	AES	0,0191	ICP	0,0125	AES	0,0056	AES	0,0073	AES	0,0043	AES	0,0152
ICP	0,0150	ICP	0,0071	AES	0,0187	AES	0,0196	ICP	0,0128	AES	0,0056	ICP	0,0073	AES	0,0044	AES-m.	0,0154
AES	0,0150	ICP	0,0094	AES	0,0188	ICP	0,0200	AES	0,0129	ICP	0,0062	XRF	0,0077	AES	0,0045	AES	0,0155
AES	0,0152	ICP	0,0114	AES	0,0191	AES	0,0200	AES	0,0130	AES	0,0063	AES	0,0078	AES	0,0045	XRF	0,0155
AES	0,0164	AES	0,0129	AES	0,0204	XRF	0,0207	AES	0,0130	ICP	0,0074*	AES	0,0080	AES	0,0045	AES	0,0176
AES	0,0176	AES	0,0152	AES	0,0210	ICP	0,0208	AES	0,0135	XRF	0,0088*	AES	0,0082	AES	0,0046	ICP	0,0182
AES	0,025*	AES	0,0204	ICP	0,0251*	AES	0,0211	AES	0,0136	ICP	0,0123*	AES	0,0090	AES	0,0048	ICP	0,0282*
Mo		W		V		Ti		Co		As		Sn		B		Nb	
Value	0,0135		0,0110		0,0180		0,0192		0,0124		0,0052		0,0061		0,0043		0,0146
S _M	0,0020		0,0051		0,0013		0,0011		0,0009		0,0008		0,0021		0,0003		0,0020
U	0,0010		0,0043		0,0006		0,0006		0,0005		0,0005		0,0012		0,0002		0,0012

Method	Sb	Method	Pb	Method	Zr	Method	Zn	Method	N
				AES	0,0030				
				AES	0,0034			AES	0,0044
		ICP	0,0044	ICP	0,0035			AES	0,0049
		AES	0,0050	AES	0,0038			AES	0,0051
ICP	0,0005	AES	0,0062	ICP	0,0042			TCM	0,0053
ICP	0,0007	ICP	0,0070	AES-m.	0,0043			AES	0,0054
AES	0,0017	ICP	0,0072	ICP	0,0044	ICP	0,0005	TCM	0,0056
AES	0,0030	AES	0,0074	AES	0,0044	AES	0,0007	TCM	0,0063
AES	0,0031	AES	0,0082	AES	0,0044	AES	0,0007	TCM	0,0066
XRF	0,0034	AES	0,0083	AES	0,0045	AES	0,0008	TCM	0,0067
AES	0,0034	ICP	0,0088	AES	0,0048	AES	0,0010	TCM	0,0067
ICP	0,0040	AES	0,0093	ICP	0,0058	AES	0,0015	TCM	0,0067
AES	0,0042	AES	0,0094	AES	0,0061	AES	0,0020	AES	0,0068
ICP	0,0050	AES	0,0098	AES	0,0067	ICP	0,0039*	TCM	0,0069
Sb		Pb		Zr		Zn		N	
Value	0,0029		0,0076		0,0045		0,0010		0,0063
S _M	0,0015		0,0017		0,0010				0,0009
U	0,0011		0,0011		0,0006				0,0005

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 30/1B** - 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.

Responsible person: Martin Bogumský

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SPL-LABMAT s.r.o.
1. máje 432
735 31 Bohumín, CZ
IČO: 06480870, DIČ: CZ06480870
www.spl-labmat.cz
e-mail: info@spl-labmat.cz