



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 09 – 24

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

SPL SL-3B (PT 32/6A - grade AISI 310S, DIN 1.4845)

CERTIFIED VALUES – Mass content in %wt.

Element	Value [%wt.]	Uncertainty [%wt.]
C	0.0437	0.0019
Mn	1.626	0.016
Si	0.375	0.007
P	0.0269	0.0011
S	0.0021	0.0005
Cu	0.186	0.002
Cr	24.88	0.09
Ni	19.17	0.07
Al	0.0055	0.0010
Mo	0.207	0.003

Element	Value [%wt.]	Uncertainty [%wt.]
W	0.027	0.003
V	0.142	0.002
Ti	0.0060	0.0007
Co	0.283	0.004
Sn	0.0061	0.0003
B	0.0030	0.0002
Ca	0.0010	0.0002
Nb	<i>0.013</i>	
Zr	<i>0.007</i>	
N	0.0224	0.0015

PARTICIPATING LABORATORIES:

ARCELORMITTAL Poland S.A., Poland
CASTINGS TECH. INT'L., United Kingdom
COGNOR S.A. - Ferrostal Łabędy, Poland
ČEZ - JE Temelín, Czech Republic
ČZ, Czech Republic
DAIMLER TRUCK AG, Germany
DUNAFERR Labor Nonprofit, Hungary
ENVIFORM, Czech Republic

LIBERTY Ostrava, Czech Republic
OCAS NV, Belgium
PCS, Czech Republic
SVÚM, Czech Republic
TÜV NORD Czech, Czech Republic
VOESTALPINE STAHL, Austria
ZPS - SLÉVÁRNA, Czech Republic
ŽDAS, Czech Republic

SL-3B - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr
AES	0,0350												
AES	0,0363	ICP	1,542									AES	23,86*
AES	0,0379	XRF-m.	1,567	AES	0,352			IR	0,0008			AES	24,43
AES	0,0383	XRF	1,601	ICP	0,354	AES	0,0212	AES	0,0010			ICP	24,52
AES	0,0384	AES	1,602	XRF-m.	0,355	AES	0,0231	IR	0,0012	ICP	0,124*	ICP	24,54
AES	0,0390	AES	1,606	AES	0,357	AES	0,0240	IR	0,0013	AES	0,147*	XRF	24,60
AES	0,0428	ICP	1,606	AES	0,358	AES	0,0241	IR	0,0013	AES	0,149*	AES	24,70
IR	0,0429	AES	1,611	AES	0,359	AES	0,0250	IR	0,0013	AES	0,177	AES	24,83
IR	0,0430	AES	1,611	AES	0,360	XRF	0,0262	IR	0,0014	ICP	0,178	AES	24,84
IR	0,0430	XRF	1,617	AES	0,369	AES	0,0262	IR	0,0015	AES	0,178	AES	24,84
AES	0,0430	AES	1,618	XRF	0,370	AES	0,0262	IR	0,0016	AES	0,180	AES	24,85
IR	0,0430	AES	1,619	Gravim.	0,372	AES	0,0263	IR	0,0017	AES	0,181	AES	24,86
AES	0,0432	AES	1,626	AES	0,375	AES	0,0264	AES	0,0018	AES	0,186	AES	24,87
IR	0,0437	ICP	1,626	AES	0,376	ICP	0,0265	AES-m.	0,0020	XRF-m.	0,186	AES	24,88
IR	0,0439	AES	1,628	AES	0,378	AES	0,0268	IR	0,0021	AES	0,186	AES	24,88
AES	0,0441	AES	1,629	XRF	0,379	AES	0,0269	AES	0,0024	ICP	0,186	AES	24,91
AES	0,0442	AES	1,636	AES	0,380	AES	0,0271	AES	0,0029	AES	0,187	XRF-m.	24,98
IR	0,0443	AES	1,648	ICP	0,381	AES	0,0272	AES	0,0030	AES	0,187	AES	24,99
AES	0,0446	AES	1,650	AES	0,385	XRF	0,0276	AES	0,0031	XRF	0,187	AES	25,00
IR	0,0455	AES	1,650	AES	0,386	AES	0,0276	XRF	0,0034	AES	0,188	Titrimetric	25,00
IR	0,0470	ICP	1,652	AES	0,388	AES	0,0278	AES	0,0036	AES	0,189	AES	25,06
AES	0,0480	AES	1,660	ICP	0,391	ICP	0,0283	AES	0,0036	XRF	0,190	XRF	25,06
IR	0,0488	AES	1,672	ICP	0,392	Photom.	0,0291	AES	0,0040	AES	0,190	AES	25,11
AES	0,0489	ICP	1,728	AES	0,404	AES-m.	0,0309	AES	0,0042	ICP	0,194	ICP	25,24
IR	0,0514	AES	1,758*	AES	0,405	ICP	0,0312	AES	0,0044	ICP	0,197	AES-m.	25,25
AES-m.	0,0557	AES-m.	1,766*	AES-m.	0,449*	AES	0,0332	IR	0,0045	AES-m.	0,228*	ICP	25,76*
C Mn Si P S Cu Cr													
Value	0,0437		1,626		0,375		0,0269		0,0021		0,186		24,88
s _M	0,0046		0,036		0,016		0,0026		0,0012		0,005		0,21
U	0,0019		0,016		0,007		0,0011		0,0005		0,002		0,09

Method	Ni	Method	Al	Method	Mo	Method	W	Method	V	Method	Ti	Method	Co
AES				AES	0,189			AES-m.	0,094*				
AES	18,92			ICP	0,199			AES	0,123*				
XRF	18,92			ICP	0,200			AES	0,131				
AES	19,00			AES	0,202			AES	0,132		AES-m.	0,077*	
AES	19,01			AES	0,202			AES	0,133		AES	0,262	
AES	19,03			AES	0,202	AES	0,017	AES	0,137		XRF	0,267	
AES	19,05	AES	0,0023	AES	0,202	AES	0,018	AES	0,138	AES	0,0030	AES	0,272
AES-m.	19,05	AES	0,0031	AES	0,203	XRF	0,019	AES	0,138	ICP	0,0032	AES	0,277
XRF-m.	19,06	AES	0,0038	AES	0,204	AES	0,021	AES	0,139	AES	0,0046	AES	0,278
AES	19,10	AES	0,0039	XRF	0,204	AES	0,021	ICP	0,141	AES	0,0051	AES	0,279
ICP	19,12	ICP	0,0046	AES	0,205	ICP	0,023	ICP	0,143	AES	0,0051	AES	0,280
AES	19,13	AES	0,0051	XRF-m.	0,206	ICP	0,024	AES	0,143	AES	0,0053	AES	0,281
ICP	19,21	AES	0,0054	AES	0,207	AES	0,024	XRF-m.	0,143	AES	0,0053	AES	0,282
AES	19,25	AES	0,0054	AES	0,207	AES	0,026	AES	0,144	AES	0,0056	ICP	0,282
AES	19,25	AES	0,0059	ICP	0,207	AES	0,028	AES	0,144	AES	0,0057	AES	0,285
AES	19,26	ICP	0,0061	AES	0,210	AES	0,029	AES	0,144	AES	0,0062	AES	0,286
AES	19,32	AES	0,0063	XRF	0,211	ICP	0,030	ICP	0,144	AES	0,0066	ICP	0,289
AES	19,33	AES	0,0072	ICP	0,212	ICP	0,030	XRF	0,145	AES	0,0070	AES	0,290
AES	19,34	ICP	0,0072	AES	0,215	XRF	0,030	ICP	0,145	AES	0,0072	AES	0,290
XRF	19,35	AES	0,0080	AES	0,217	AES	0,030	AES	0,146	ICP	0,0073	AES	0,290
AES	19,35	AES	0,0087	AES	0,218	AES	0,033	AES	0,146	XRF	0,0074	AES	0,291
AES	19,47	AES	0,0167*	ICP	0,220	AES	0,034	AES	0,146	AES	0,0076	XRF-m.	0,291
AES	20,13*	AES-m.	0,0187*	AES	0,223	AES	0,041	XRF	0,146	AES-m.	0,0078	XRF	0,293
ICP	20,66*	AES	0,0261*	AES-m.	0,44*	AES-m.	0,05*	AES	0,149	AES	0,0080	AES	0,293
								ICP	0,151	ICP	0,0081	ICP	0,294
Ni Al Mo W V Ti Co													
Value	19,17		0,0055		0,207		0,027		0,142		0,0060		0,283
s _M	0,16		0,0018		0,008		0,006		0,005		0,0015		0,009
U	0,07		0,0010		0,003		0,003		0,002		0,0007		0,004

Method	Sn	Method	B	Method	Ca	Method	Nb	Method	Zr	Method	N
AES-m.	0,0020*										
ICP	0,0048									AES	0,0182
ICP	0,0053									TCM	0,0206
AES	0,0054									TCM	0,0207
AES	0,0056	AES	0,0022							TCM	0,0213
AES	0,0056	AES	0,0023							TCM	0,0214
AES	0,0056	AES	0,0024		AES	0,0101				TCM	0,0214
AES	0,0058	AES	0,0025	AES	0,0005	AES	0,0102			AES	0,0216
AES	0,0060	AES	0,0028	AES	0,0005	XRF	0,0112			TCM	0,0217
AES	0,0060	AES	0,0029	AES	0,0007	AES	0,0112			AES	0,0219
AES	0,0060	AES	0,0030	AES	0,0008	XRF-m.	0,0119			AES	0,0224
AES	0,0060	AES	0,0030	AES	0,0009	AES	0,0121			AES	0,0226
AES	0,0060	AES	0,0032	AES	0,0009	AES	0,0128			AES	0,0231
ICP	0,0061	AES	0,0033	AES	0,0010	ICP	0,0133	AES	0,0011	AES	0,0231
AES	0,0061	AES	0,0033	AES	0,0010	AES	0,0133	AES	0,0013	AES	0,0255
AES	0,0070	AES	0,0033	AES	0,0010	AES	0,0217	AES	0,0044	AES	0,0264
AES	0,0070	AES	0,0034	AES	0,0012	AES	0,0267	AES	0,0078	AES	0,0266
AES	0,0070	AES	0,0034	AES	0,0012	AES	0,0325	AES	0,0084	TCM	0,0274
AES	0,0070	AES	0,0034	AES	0,0015	AES	0,0351	AES	0,0120	AES	0,0278
AES	0,0078	AES-m.	0,0036	AES	0,0015	AES-m.	0,0395	AES	0,0130	AES	0,0282
Sn B Ca Nb Zr N											
Value	0,0061		0,0030		0,0010		0,013		0,007		0,0224
s _M	0,0007		0,0004		0,0003						0,0030
U	0,0003		0,0002		0,0002		0,0000		0,0000		0,0015

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 32/6A** - 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