



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 04 – 23

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

SPL CM-9C (PT 31/1C)

CERTIFIED VALUES – Mass content in %wt.

Element	Value [%wt.]	Uncertainty [%wt.]
C	0.205	0.002
Mn	2.259	0.017
Si	0.808	0.010
P	0.0171	0.0008
S	0.0088	0.0003
Cu	0.072	0.002
Cr	1.786	0.016
Ni	0.171	0.002
Al	0.0272	0.0008
Mo	0.060	0.002
W	0.0201	0.0016

Element	Value [%wt.]	Uncertainty [%wt.]
V	0.0293	0.0005
Ti	0.0152	0.0008
Co	0.0176	0.0005
As	0.0062	0.0005
Sn	0.0147	0.0004
B	0.0040	0.0002
Ca	0.0018	0.0002
Nb	0.312	0.005
Sb	0.0112	0.0029
Zr	0.0033	0.0008
N	0.0162	0.0003

PARTICIPATING LABORATORIES:

ARCELORMITTAL Warszawa, Poland
COGNOR S.A. - Ferrostal Łabędy, Poland
COMTES, Czech Republic
DUNAFERR Labor Nonprofit, Hungary
ENVIFORM, Czech Republic
ENVIROLAB MIKE, Greece
ESAB CZ, Czech Republic
FERONA, Czech Republic
OBLF, Germany

SSAB, Sweden
ŠKODA AUTO, Czech Republic
TATA STEEL IJMUIDEN, Netherlands
TAWESCO, Czech Republic
ÚJV Řež, Czech Republic
VOESTALPINE STAHL, Austria
VÚHŽ-Foundry, Czech Republic
ZPS - SLÉVÁRNA, Czech Republic

CM-9C - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr	Method	Ni	Method	Al	Method	Mo	Method	W	
IR	0,196																					
AES	0,198							AES-m.	0,0010*													
AES	0,198							AES	0,0059*													
AES	0,198							IR	0,0076													
AES	0,200							AES	0,0076													
IR	0,202							IR	0,0079	XRF	0,066											
AES	0,202	AES	1,900*	ICP	0,715*			AES	0,0080	ICP	0,068											
IR	0,202	AES-m.	2,171	Gravim.	0,720*	AES	0,0084*	AES	0,0082	XRF-m.	0,068	XRF	1,664*	AES-m.	0,160	AES				0,054		
AES	0,202	ICP	2,221	AES	0,753	AES-m.	0,0126	AES	0,0082	AES	0,069	ICP	1,670*	AES	0,163	AES	0,0234	AES	0,055			
AES	0,203	AES	2,225	AES	0,762	ICP	0,0137	IR	0,0083	AES	0,069	ICP	1,694	AES	0,164	ICP	0,0248	AES	0,056			
AES	0,204	AES	2,225	AES	0,778	ICP	0,0149	IR	0,0085	ICP	0,070	AES	1,745	AES	0,165	AES	0,0250	AES	0,057			
IR	0,204	AES	2,234	AES	0,785	AES	0,0155	AES	0,0085	AES	0,070	XRF-m.	1,758	AES	0,165	ICP	0,0254	AES	0,058	AES	0,0134	
IR	0,204	AES	2,235	AES	0,793	AES	0,0159	AES	0,0086	ICP	0,070	AES	1,760	AES	0,168	AES	0,0254	AES	0,058	AES-m.	0,0148	
IR	0,205	AES	2,236	AES	0,800	AES	0,0159	AES	0,0086	AES	0,071	AES	1,761	AES	0,170	AES	0,0255	AES	0,058	ICP	0,0167	
AES	0,205	AES	2,243	AES-m.	0,801	AES	0,0162	IR	0,0086	AES	0,071	AES	1,761	AES	0,171	AES	0,0259	XRF-m.	0,058	AES	0,0184	
IR	0,205	AES	2,244	AES	0,802	AES	0,0166	AES	0,0086	AES	0,072	AES	1,771	AES	0,171	XRF	0,0262	ICP	0,058	AES	0,0187	
AES	0,205	AES	2,244	AES	0,807	AES	0,0167	IR	0,0086	AES	0,072	ICP	1,773	ICP	0,171	AES	0,0266	ICP	0,059	AES	0,0188	
AES	0,206	AES	2,246	AES	0,808	AES	0,0168	IR	0,0087	AES	0,073	AES	1,779	AES	0,172	AES	0,0268	AES	0,059	AES	0,0188	
AES	0,206	XRF-m.	2,247	AES	0,809	AES	0,0169	IR	0,0088	AES	0,073	AES	1,779	AES	0,172	AES	0,0268	AES	0,059	XRF	0,0190	
AES	0,206	AES	2,263	AES	0,811	AES	0,0170	IR	0,0089	AES	0,073	AES-m.	1,783	XRF-m.	0,173	AES	0,0270	AES	0,060	AES	0,0192	
AES	0,206	XRF	2,266	AES	0,812	AES	0,0171	AES	0,0091	AES	0,073	AES	1,786	AES	0,173	AES	0,0271	AES	0,060	AES	0,0193	
IR	0,207	ICP	2,274	AES	0,812	AES	0,0171	AES	0,0091	AES	0,073	AES	1,790	AES	0,173	AES	0,0274	AES	0,060	AES	0,0202	
AES	0,207	AES	2,276	AES	0,816	AES	0,0173	IR	0,0092	ICP	0,073	AES	1,797	AES	0,173	AES	0,0280	XRF	0,060	AES	0,0203	
IR	0,207	AES	2,285	AES	0,816	AES	0,0174	AES	0,0093	AES	0,074	AES	1,798	AES	0,173	AES	0,0286	AES	0,061	AES	0,0218	
IR	0,208	AES	2,287	AES	0,824	AES	0,0178	IR	0,0093	AES	0,075	AES	1,807	AES	0,174	AES	0,0288	AES	0,061	AES	0,0221	
AES	0,208	AES	2,289	AES	0,826	AES	0,0180	AES	0,0097	AES	0,075	XRF	1,809	AES	0,174	AES	0,0292	AES	0,062	AES	0,0224	
IR	0,208	AES	2,294	XRF	0,831	AES	0,0187	AES	0,0099	AES	0,075	AES	1,809	AES	0,175	AES	0,0292	AES	0,062	AES	0,0230	
IR	0,208	AES	2,300	XRF-m.	0,834	ICP	0,0197	AES	0,0099	AES	0,075	AES	1,816	AES	0,175	AES	0,0294	AES	0,064	AES	0,0250	
AES	0,208	ICP	2,309	ICP	0,834	AES	0,0200	AES	0,0099	AES	0,079	AES	1,840	ICP	0,175	AES	0,0296	AES	0,065	AES	0,0254	
IR	0,209	ICP	2,337	AES	0,839	XRF	0,0201	AES	0,0103	AES	0,080	AES	1,840	ICP	0,175	AES	0,0313	AES-m.	0,067	AES	0,0255	
AES-m.	0,212	AES	2,344	AES	0,840	AES	0,0204	XRF	0,0136*	AES-m.	0,090*	AES	1,846	XRF	0,176	AES-m.	0,0358*	AES	0,069	AES	0,0368*	
Value		0,205		0,259		0,808		0,0171		0,0088		0,072		1,786		0,171		0,0272		0,060		0,0201
Su		0,004		0,042		0,023		0,0019		0,0007		0,003		0,035		0,005		0,0019		0,004		0,0033
U		0,002		0,017		0,010		0,0008		0,0003		0,002		0,016		0,002		0,0008		0,002		0,0016

Method	V	Method	Ti	Method	Co	Method	As	Method	Sn	Method	B	Method	Ca	Method	Nb	Method	Sb	Method	Zr	Method	N	
ICP	0,0175*																					
AES	0,0220*																					
AES-m.	0,0240*																					
ICP	0,0275																					
ICP	0,0276	AES	0,0114	ICP	0,0148																	
AES	0,0280	AES	0,0120	AES	0,0164																	
AES	0,0281	AES	0,0121	XRF	0,0168																	
XRF-m.	0,0284	AES	0,0123	ICP	0,0168	XRF	0,0045	XRF	0,0141	AES	0,0034											
AES	0,0285	AES-m.	0,0142	AES	0,0169	ICP	0,0046	AES	0,0142	XRF	0,0036	AES	0,0013									
AES	0,0286	ICP	0,0148	AES	0,0170	AES	0,0050	AES	0,0142	AES	0,0036	XRF	0,0015	AES	0,307							
AES	0,0287	XRF	0,0149	ICP	0,0171	AES	0,0052	AES	0,0144	AES	0,0037	AES	0,0015	AES	0,308							
AES	0,0287	AES	0,0152	AES	0,0172	AES	0,0054	AES	0,0144	AES	0,0038	AES	0,0015	AES	0,309							
XRF	0,0288	AES	0,0152	AES	0,0176	AES	0,0057	ICP	0,0145	AES	0,0038	AES	0,0016	AES	0,310	AES	0,0026	AES	0,0012	AES	0,0159	
AES	0,0289	AES	0,0153	AES	0,0176	AES	0,0059	AES	0,0146	AES	0,0039	AES	0,0016	AES	0,310	AES	0,0047	AES	0,0019	AES	0,0159	
AES	0,0290	AES	0,0158	AES	0,0177	ICP	0,0060	AES	0,0146	AES-m.	0,0040	AES	0,0016	AES	0,311	AES	0,0064	AES	0,0023	AES	0,0160	
AES	0,0290	AES	0,0158	AES	0,0177	AES	0,0061	AES	0,0146	AES	0,0040	AES	0,0016	AES	0,313	AES	0,0075	AES	0,0028	AES	0,0161	
AES	0,0292	AES	0,0159	AES	0,0178	AES	0,0061	AES	0,0148	AES	0,0041	ICP	0,0017	AES	0,314	AES	0,0086	AES	0,0028	AES	0,0161	
AES	0,0298	ICP	0,0159	AES	0,0180	AES	0,0062	AES	0,0150	AES	0,0042	AES	0,0017	AES	0,315	AES	0,0107	AES	0,0029	TCM	0,0163	
ICP	0,0300	AES	0,0159	AES	0,0182	AES	0,0063	AES	0,0154	AES	0,0043	AES	0,0019	AES	0,317	AES	0,0108	AES	0,0029	TCM	0,0163	
AES	0,0302	AES	0,0160	AES	0,0182	AES	0,0066	AES	0,0154	AES	0,0044	AES	0,0019	AES-m.	0,317	AES	0,0121	AES	0,0031	TCM	0,0164	
AES	0,0305	AES	0,0161	AES	0,0187	AES	0,0071	AES	0,0157	AES	0,0044	AES	0,0019	AES	0,317	AES	0,0130	AES	0,0033	AES	0,0166	
AES	0,0306	AES	0,0169	AES	0,0188	AES	0,0071	AES	0,0158	AES	0,0044	AES	0,0019	AES	0,321	AES	0,0139	AES	0,0040	AES	0,0166	
AES	0,0306	AES	0,0170	AES	0,0188	AES	0,0072	AES	0,0158	AES	0,0046	AES	0,0020	ICP	0,323	AES	0,0139	AES	0,0053	AES	0,0171	
AES	0,0308	AES	0,0174	AES	0,0191	AES	0,0073	AES	0,0160	AES	0,0048	AES	0,0021	AES	0,327	AES	0,0142	AES	0,0054	AES	0,0172	
AES	0,0310	AES	0,0174	AES	0,0204	AES	0,0074	XRF-m.	0,0167	AES	0,0050	AES	0,0022	XRF-m.	0,330	AES	0,0160	AES	0,0060	AES	0,0172	
AES	0,0325	AES	0,0176	AES-m.	0,0470*	AES	0,0076	AES-m.	0,0244*	AES	0,0058*	AES	0,0022	AES	0,365*	ICP	0,0220	AES	0,0063	TCM	0,0173	
Value		0,0293		0,0152		0,0176		0,0062		0,0147		0,0040		0,0018		0,312		0,0112		0,0033		0,0162
Su		0,0012		0,0018		0,0012		0,0010		0,0009		0,0005		0,0003		0,010		0,0050		0,0016		0,0007
U		0,0005		0,0008		0,0005		0,0005		0,0004		0,0002		0,0002		0,005		0,0029		0,0008		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 31/1C** - 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

Issued in Bohumín in May 2023

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