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**CERTIFICATE OF CHEMICAL ANALYSIS No 12 – 20**

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

**SPL SL-6B** (PT 28/6)

**CERTIFIED VALUES – Mass content in %wt.**

Element	Value [%wt.]	Uncertainty [%wt.]
<b>C</b>	<b>0.139</b>	0.004
<b>Mn</b>	<b>0.411</b>	0.009
<b>Si</b>	<b>0.322</b>	0.012
<b>P</b>	<b>0.0200</b>	0.0019
<b>S</b>	<b>0.0256</b>	0.0013
<b>Cu</b>	<b>0.306</b>	0.010
<b>Cr</b>	<b>6.72</b>	0.09

Element	Value [%wt.]	Uncertainty [%wt.]
<b>Ni</b>	<b>33.40</b>	0.14
<b>Al</b>	<b>0.252</b>	0.014
<b>Mo</b>	<b>0.190</b>	0.005
<b>W</b>	<b>1.775</b>	0.077
<b>V</b>	<b>0.164</b>	0.008
<b>Ti</b>	<b>1.706</b>	0.027
<b>Co</b>	<b>0.816</b>	0.023

Element	Value [%wt.]	Uncertainty [%wt.]
<b>As</b>	<b>0.0102</b>	0.0035
<b>Sn</b>	<b>0.0202</b>	0.0014
<b>B</b>	<b>0.0032</b>	0.0004
<b>Nb</b>	<b>0.537</b>	0.014
<b>Sb</b>	<i>0.015</i>	
<b>Zr</b>	<i>0.0097</i>	
<b>N</b>	<i>0.0042</i>	

**PARTICIPATING LABORATORIES:**

AZTERLAN, Spain	OCAS NV, Belgium
COGNOR S.A. - Ferrostal Łabędy, Poland	SSAB EMEA, Sweden
COMTES, Czech Republic	ŠKODA AUTO, Czech Republic
DUNAFERR Labor Nonprofit, Hungary	TEDIKO, Czech Republic
ENVIFORM, Czech Republic	ÚJV ŘEŽ, Czech Republic
HORN&CO. ANALYTICS, Germany	VÍTKOVICE TESTING CENTER, Czech Republic
MATERIÁLOVÉ LAB. CHOMUTOV, Czech Republic	VÚHŽ, Czech Republic
MS UTILITIES & SERVICES, Czech Republic	ZPS - SLÉVÁRNA, Czech Republic

# SL-6B – ANALYTICAL DATA

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr	Method	Ni	Method	Al	Method	Mo	Method	W
AES	0,125	AES	0,375							AES	0,266	AES	6,36	AES	31,67*			AES	0,163		
IR	0,128	AES	0,390						AES	0,279	AES	6,50	AES	32,12*			AES	0,175			
AES	0,129	XRF	0,390	AES	0,269			AES	0,0203	ICP	0,279	AES	6,50	AES	32,12*			AES	0,175		
AES	0,132	AES	0,392	AES	0,280	XRF	0,0153	IR	0,0232	XRF	0,282	AES	6,56	AES	32,98	AES	0,200	AES	0,181	AES	1,490
IR	0,133	XRF	0,397	AES	0,284	AES	0,0156	IR	0,0235	XRF	0,285	AES	6,57	AES	33,08	XRF	0,209	AES	0,184	ICP	1,494
AES	0,136	AES	0,397	AES	0,308	AES	0,0171	AES	0,0242	AES	0,286	AES	6,57	AES	33,17	AES	0,229	AES	0,189	AES	1,610
AES	0,137	AES	0,401	AES	0,317	ICP	0,0176	AES	0,0245	ICP	0,298	AES	6,59	ICP	33,30	AES	0,232	AES	0,189	AES	1,699
IR	0,138	AES	0,408	ICP	0,319	AES	0,0180	XRF	0,0248	AES	0,307	AES	6,60	AES	33,36	AES	0,239	XRF	0,190	XRF	1,747
IR	0,138	AES	0,410	ICP	0,321	XRF	0,0180	IR	0,0249	AES	0,308	AES	6,61	AES	33,37	AES	0,251	ICP	0,191	AES	1,761
IR	0,139	ICP	0,412	AES	0,323	AES	0,0180	AES	0,0252	AES	0,311	XRF	6,78	XRF	33,38	AES	0,252	AES	0,192	AES	1,774
AES	0,139	AES	0,413	AES	0,326	AES	0,0182	AES	0,0255	AES	0,316	AES	6,79	AES	33,43	AES	0,254	XRF	0,192	XRF	1,775
IR	0,140	AES	0,413	AES	0,327	AES	0,0187	AES	0,0256	AES	0,317	AES	6,83	AES	33,46	AES	0,255	AES	0,193	XRF	1,791
IR	0,142	AES	0,423	AES	0,330	AES	0,0196	IR	0,0258	XRF	0,320	AES	6,85	AES	33,53	ICP	0,255	AES	0,193	AES	1,808
AES	0,144	AES	0,424	XRF	0,340	AES	0,0214	ICP	0,0262	AES	0,320	ICP	6,88	AES	33,60	AES	0,262	AES	0,195	AES	1,853
AES	0,144	AES	0,426	AES	0,340	AES	0,0216	AES	0,0265	AES	0,322	XRF	6,88	AES	33,62	ICP	0,262	AES	0,197	ICP	1,870
AES	0,144	XRF	0,430	AES	0,341	ICP	0,0237	IR	0,0270	AES	0,324	AES	6,88	AES	33,62	AES	0,267	AES	0,201	AES	1,881
AES	0,147	ICP	0,432	AES	0,345	AES	0,0242	AES	0,0284	AES	0,327	XRF	6,94	ICP	33,64	AES	0,269	AES	0,203	AES	1,901
AES	0,157	AES	0,434	XRF	0,348	AES	0,0247	IR	0,0309	AES	0,328	AES	6,97	AES	33,65	AES	0,288	XRF	0,204	AES	1,938
AES	0,158	AES	0,437	AES	0,354	AES	0,0278	AES	0,0310	AES	0,334	ICP	6,98	XRF	33,79	AES	0,307	AES	0,206	AES	2,003

  

	C	Mn	Si	P	S	Cu	Cr	Ni	Al	Mo	W
Value	0,139	0,411	0,322	0,0200	0,0256	0,306	6,72	33,40	0,252	0,190	1,775
S <sub>M</sub>	0,009	0,018	0,024	0,0036	0,0027	0,020	0,18	0,27	0,027	0,011	0,145
U	0,004	0,009	0,012	0,0019	0,0013	0,010	0,09	0,14	0,014	0,005	0,077

Method	V	Method	Ti	Method	Co	Method	As	Method	Sn	Method	B	Method	Nb	Method	Sb	Method	Zr	Method	N
AES	0,102*																		
AES	0,144	XRF	1,601									AES	0,382*						
AES	0,146	AES	1,622	AES	0,740							ICP	0,501						
AES	0,148	AES	1,670	XRF	0,756							ICP	0,507						
AES	0,148	AES	1,672	ICP	0,761							XRF	0,512						
AES	0,150	AES	1,673	ICP	0,768			AES	0,0151	AES	0,0021	XRF	0,513					AES	0,0035
ICP	0,155	ICP	1,676	ICP	0,794			AES	0,0171	AES	0,0023	AES	0,518					TCM	0,0039
AES	0,156	AES	1,681	AES	0,795			AES	0,0182	AES	0,0026	AES	0,522			AES	0,0031	TCM	0,0039
AES	0,156	AES	1,685	XRF	0,801			AES	0,0190	AES	0,0029	AES	0,523			ICP	0,0036	AES	0,0041
ICP	0,157	ICP	1,697	AES	0,821			AES	0,0193	AES	0,0032	AES	0,529			ICP	0,0057	TCM	0,0042
AES	0,159	AES	1,705	AES	0,823	AES	0,0035	AES	0,0194	AES	0,0032	AES	0,531			ICP	0,0066	TCM	0,0043
XRF	0,165	AES	1,709	AES	0,825	AES	0,0039	ICP	0,0196	AES	0,0032	AES	0,535	ICP	0,001	AES	0,0080	TCM	0,0043
AES	0,165	AES	1,724	AES	0,828	AES	0,0072	ICP	0,0206	AES	0,0033	XRF	0,536	AES	0,002	AES	0,0084	AES	0,0076
AES	0,174	AES	1,731	AES	0,836	AES	0,0089	AES	0,0214	AES	0,0035	AES	0,543	AES	0,006	AES	0,0106	AES	0,0082
XRF	0,176	XRF	1,747	XRF	0,836	AES	0,0110	XRF	0,0216	AES	0,0037	AES	0,556	AES	0,010	AES	0,0124	AES	0,0082
XRF	0,177	XRF	1,753	AES	0,870	AES	0,0124	AES	0,0222	AES	0,0039	XRF	0,569	AES	0,013	AES	0,0134	AES	0,0087
AES	0,184	AES	1,771	AES	0,870	AES	0,0140	AES	0,0226	AES	0,0039	AES	0,572	AES	0,019	AES	0,0140	AES	0,0134
AES	0,188	AES	1,784	AES	0,872	AES	0,0147	AES	0,0235	AES	0,0043	AES	0,583	ICP	0,027	AES	0,0150	AES	0,0137
AES	0,196	AES	1,808	AES	0,884	AES	0,0160	AES	0,0237	ICP	0,0075*	AES	0,587	AES	0,043	AES	0,0150	AES	0,0137

  

	V	Ti	Co	As	Sn	B	Nb	Sb	Zr	N
Value	0,164	1,706	0,816	0,0102	0,0202	0,0032	0,537	0,015	0,0097	0,0042
S <sub>M</sub>	0,016	0,054	0,044	0,0046	0,0025	0,0007	0,027	0,015	0,0097	0,0042
U	0,008	0,027	0,023	0,0035	0,0014	0,0004	0,014	0,015	0,0097	0,0042

## COMMENTS:

**Value** – reference value, **S<sub>M</sub>** – 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 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 28/6** - 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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