



**SPL-LABMAT s.r.o.**

1.máje 432, CZ-735 31 Bohumín, Czech Republic  
e-mail: [info@spl-labmat.cz](mailto:info@spl-labmat.cz), [www.spl-labmat.cz](http://www.spl-labmat.cz), phone: +420 596 014 627

**CERTIFICATE OF CHEMICAL ANALYSIS No 07 – 22**

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

**SPL CM-27A (PT 30/1D)**

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

<b>Element</b>	<b>Value [%wt.]</b>	<b>Uncertainty [%wt.]</b>
<b>C</b>	<b>0.339</b>	0.005
<b>Mn</b>	<b>0.308</b>	0.004
<b>Si</b>	<b>0.128</b>	0.003
<b>P</b>	<b>0.0165</b>	0.0007
<b>S</b>	<b>0.0171</b>	0.0003
<b>Cu</b>	<b>0.0408</b>	0.0013
<b>Cr</b>	<b>1.641</b>	0.011
<b>Ni</b>	<b>1.089</b>	0.012
<b>Al</b>	<b>1.051</b>	0.033
<b>Mo</b>	<b>0.218</b>	0.004
<b>W</b>	<b>0.0197</b>	0.0036

<b>Element</b>	<b>Value [%wt.]</b>	<b>Uncertainty [%wt.]</b>
<b>V</b>	<b>0.0206</b>	0.0010
<b>Ti</b>	<b>0.0230</b>	0.0004
<b>Co</b>	<b>0.0145</b>	0.0003
<b>As</b>	<b>0.0046</b>	0.0003
<b>Sn</b>	<b>0.0108</b>	0.0004
<b>B</b>	<b>0.0038</b>	0.0002
<b>Nb</b>	<b>0.0173</b>	0.0015
<b>Sb</b>	<b>0.0136</b>	0.0011
<b>Pb</b>	<b>0.0162</b>	0.0016
<b>N</b>	<b>0.0077</b>	0.0007

**PARTICIPATING LABORATORIES:**

AIMEN, Spain  
COMTES, Czech Republic  
ČEZ - JE Temelín, Czech Republic  
DAIMLER TRUCK AG, Germany  
DUNAFERR Labor Nonprofit, Hungary  
INSTYTUT METALURGII ŻELAZA, Poland  
JSC Moldova Steel Works, Moldova  
MM VÝZKUM, Czech Republic  
OCAS NV, Belgium

ORLEN UNIPETROL RPA, Czech Republic  
SIJ METAL RAVNE, Slovenia  
SSAB EMEA, Sweden  
TATA STEEL IJMUIDEN, Netherlands  
U. S. STEEL Košice - Labortest, Slovakia  
VÚHŽ, Czech Republic  
ZPS - SLÉVÁRNA, Czech Republic  
ŽĎAS, Czech Republic

## CM-27A - ANALYTICAL DATA:

Method	C	Method	Mn	Method	Si	Method	P	Method	S	Method	Cu	Method	Cr	Method	Ni	Method	Al
AES	0,309							AES-m.	0,0144*								
AES	0,322							ICP	0,0146*								
AES	0,325							AES	0,0162								
IR	0,331							IR	0,0163								
IR	0,334	AES	0,291	ICP	0,114	AES	0,0095*	AES	0,0164				XRF	1,032			
AES	0,335	AES	0,292	AES	0,119	ICP	0,0135	IR	0,0165	ICP	0,0346		AES	1,050			
IR	0,337	ICP	0,302	Gravim.	0,121	ICP	0,0138	IR	0,0165	AES	0,0374	AES	1,518*	ICP	1,062		
IR	0,338	XRF	0,303	ICP	0,123	AES	0,0141	AES	0,0165	AES	0,0383	AES	1,535*	ICP	1,066		
IR	0,338	AES-m.	0,303	XRF	0,124	XRF	0,0154	AES	0,0166	AES	0,0384	AES	1,598	AES	1,072		
IR	0,338	AES	0,304	AES	0,124	AES-m.	0,0156	AES	0,0167	AES-m.	0,0391	AES	1,607	AES-m.	1,080	AES	0,917
IR	0,338	AES	0,305	AES	0,127	AES	0,0160	IR	0,0168	AES	0,0392	XRF	1,627	AES	1,083	AES	0,986
IR	0,338	AES	0,305	AES	0,127	AES	0,0160	IR	0,0169	ICP	0,0396	AES	1,630	AES	1,086	AES	0,995
IR	0,338	AES	0,306	AES	0,129	AES	0,0162	AES	0,0169	AES	0,0397	AES-m.	1,631	AES	1,088	ICP	1,016
AES-m.	0,339	ICP	0,307	AES-m.	0,129	AES	0,0164	IR	0,0171	AES	0,0399	AES	1,634	ICP	1,089	AES	1,019
IR	0,339	AES	0,307	AES	0,129	XRF	0,0168	AES	0,0172	AES	0,0403	AES	1,637	AES	1,093	AES-m.	1,038
IR	0,343	AES	0,307	XRF	0,130	AES	0,0169	IR	0,0172	AES	0,0410	AES	1,642	AES	1,094	ICP	1,041
AES	0,343	AES	0,310	AES	0,130	AES	0,0169	AES	0,0176	AES	0,0417	XRF	1,644	AES	1,095	AES	1,060
AES	0,343	AES	0,311	AES	0,130	AES	0,0170	IR	0,0177	AES	0,0420	AES	1,646	XRF	1,097	AES	1,068
AES	0,343	XRF	0,312	AES	0,131	AES	0,0170	AES	0,0178	ICP	0,0422	AES	1,651	AES	1,098	AES	1,070
AES	0,343	AES	0,312	AES	0,133	AES	0,0173	IR	0,0179	XRF	0,0430	AES	1,652	AES	1,099	AES	1,078
AES	0,346	AES	0,313	AES	0,133	AES	0,0180	AES	0,0184	AES	0,0437	AES	1,653	AES	1,100	AES	1,085
AES	0,347	AES	0,317	AES	0,133	AES	0,0181	AES	0,0184	AES	0,0442	AES	1,654	AES	1,126	AES	1,129
AES	0,359	ICP	0,320	AES	0,135	AES	0,0184	AES	0,0209*	AES	0,0450	ICP	1,670	AES	1,134	AES	1,130
AES	0,362	AES	0,327	AES	0,141	ICP	0,0192	XRF	0,0214*	XRF	0,0455	ICP	1,676	AES	1,139	AES	1,136
<b>C Mn Si P S Cu Cr Ni Al</b>																	
Value	0,339		0,308		0,128		0,0165		0,0171		0,0408		1,641		1,089		1,051
s <sub>M</sub>	0,011		0,008		0,006		0,0015		0,0007		0,0028		0,020		0,026		0,060
U	0,005		0,004		0,003		0,0007		0,0003		0,0013		0,011		0,012		0,033

Method	Mo	Method	W	Method	V	Method	Ti	Method	Co	Method	As	Method	Sn	Method	B	Method	Nb	
AES	0,205																	
AES-m.	0,207				AES-m.	0,0159	XRF	0,0186*										
ICP	0,210				AES	0,0172	ICP	0,0210										
AES	0,210				AES	0,0190	AES	0,0220	ICP	0,0135						AES	0,0125	
AES	0,213				ICP	0,0193	AES	0,0220	AES	0,0136		AES	0,0087			AES	0,0140	
XRF	0,213				AES	0,0194	AES	0,0220	AES	0,0137		XRF	0,0102			AES	0,0150	
AES	0,214				ICP	0,0196	AES	0,0223	AES	0,0140		AES	0,0102			AES	0,0150	
AES	0,214				AES	0,0198	AES	0,0226	AES-m.	0,0141	ICP	0,0037	AES	0,0104	AES	0,0024*	AES	0,0150
AES	0,214				AES	0,0200	AES	0,0227	AES	0,0143	AES	0,0037	AES	0,0104	ICP	0,0029*	XRF	0,0155
ICP	0,216	XRF	0,0136	XRF	0,0200	AES	0,0228	AES	0,0144	ICP	0,0039	ICP	0,0106	AES	0,0035	AES	0,0158	
AES	0,217	AES	0,0144	XRF	0,0202	AES	0,0228	ICP	0,0145	AES	0,0041	AES	0,0107	AES-m.	0,0035	AES	0,0162	
AES	0,219	ICP	0,0150	AES	0,0208	AES	0,0230	AES	0,0146	AES	0,0045	AES	0,0107	AES	0,0036	AES	0,0164	
AES	0,219	AES	0,0155	AES	0,0211	AES	0,0232	AES	0,0148	AES	0,0047	XRF	0,0108	AES	0,0036	AES-m.	0,0164	
AES	0,220	AES	0,0156	AES	0,0214	AES	0,0233	AES	0,0149	AES-m.	0,0047	AES	0,0108	AES	0,0037	ICP	0,0173	
AES	0,220	AES	0,0164	AES	0,0214	AES-m.	0,0235	ICP	0,0150	AES	0,0047	AES-m.	0,0108	AES	0,0038	AES	0,0174	
XRF	0,220	AES	0,0180	AES	0,0217	AES	0,0239	AES	0,0150	AES	0,0048	ICP	0,0111	AES	0,0038	AES	0,0186	
AES	0,224	XRF	0,0235	AES	0,0217	AES	0,0239	AES	0,0152	AES	0,0048	AES	0,0113	AES	0,0038	AES	0,0190	
AES	0,226	AES	0,0242	AES	0,0220	AES	0,0239	XRF	0,0152	XRF	0,0049	AES	0,0114	AES	0,0039	AES	0,0203	
ICP	0,228	AES	0,0244	AES	0,0220	ICP	0,0241	AES	0,0166*	AES	0,0051	AES	0,0116	AES	0,0039	AES	0,0210	
AES	0,231	AES	0,0262	AES	0,0240	ICP	0,0244	XRF	0,0167*	AES	0,0052	AES	0,0119	AES	0,0040	ICP	0,0221	
AES	0,234	AES	0,0300	ICP	0,0251	XRF	0,0245	AES	0,0186*	AES	0,0060	AES	0,0124	AES	0,0040	XRF	0,0236	
<b>Mo W V Ti Co As Sn B Nb</b>																		
Value	0,218		0,0197		0,0206		0,0230		0,0145		0,0046		0,0108		0,0038		0,0173	
s <sub>M</sub>	0,008		0,0056		0,0021		0,0009		0,0006		0,0006		0,0008		0,0002		0,0030	
U	0,004		0,0036		0,0010		0,0004		0,0003		0,0003		0,0004		0,0002		0,0015	

Method	Sb	Method	Pb	Method	N
				AES	0,0054
		AES	0,005*	TCM	0,0067
		AES	0,0126	TCM	0,0068
		ICP	0,0129	AES	0,0070
		AES	0,0140	TCM	0,0073
ICP	0,0116	AES	0,0146	TCM	0,0074
AES	0,0118	AES	0,0149	AES	0,0074
AES	0,0123	AES	0,0159	AES	0,0075
AES	0,0132	AES	0,0159	TCM	0,0076
XRF	0,0140	AES	0,0177	TCM	0,0077
AES	0,0146	AES	0,0178	AES	0,0080
ICP	0,0147	AES	0,0180	AES	0,0085
AES	0,0150	ICP	0,0187	AES	0,0099
AES	0,0151	AES	0,0208	AES	0,0102
<b>Sb Pb N</b>					
Value	0,0136		0,0162		0,0077
s <sub>M</sub>	0,0014		0,0025		0,0012
U	0,0011		0,0016		0,0007

## COMMENTS:

**Value** – reference value, **s<sub>M</sub>** – 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 30/1D** - 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