

Metal and Quality, LLC
CERTIFICATE OF ANALYSIS
DSZU C017a
Stainless Steel



INFORMATION Certified Reference Material DSZU C017a is intended for calibration of measuring instruments when determining the chemical composition of stainless steels AISI 316Ti (EN 1.4571, DIN X6CrNiMoTi17-12-2) and similar ones using spark atomic emission spectrometry, glow discharge atomic emission spectrometry and X-ray emission and fluorescence methods

MANUFACTURER Metal and Quality, LLC

CERTIFIED VALUES (mass fraction in %)

	C	Si	Mn	P	S	Cr	Ni	Mo	Ti	Al	Cu	W	V	Co	As	Sn	B	N
Certified M(M)	0.039	0.417	1.748	0.048	0.0124	16.73	10.94	2.046	0.317	0.074	0.255	0.052	0.048	0.119	0.0078	0.0090	0.0023	0.016
Uncertainty C(95%)	0.001	0.005	0.013	0.001	0.0005	0.04	0.04	0.013	0.006	0.003	0.005	0.003	0.002	0.004	0.0007	0.0008	0.0003	0.002

Uncertainty C(95%) estimated as the half-width confidence interval of Student's t-distribution, when n is the number of laboratory means (see next page)

$$C(95\%) = \frac{t \cdot s(M)}{\sqrt{n}}$$

SPECIFICATION The steel for this reference material was smelted and hot-rolled into rods weighing approximately 90 kg at the Dneprospeysstal Electrometallurgical Works. One of rods was subsequently reformed on a press to a diameter of 42 mm and subjected to heat treatment at 1050 °C, followed by water quenching. After turning and cutting this rod, the final diameter of reference material discs is 40 mm and the thickness is 25 mm

HOMOGENEITY The spark atomic emission method was used to assess homogeneity in one laboratory. The homogeneity was found to be acceptable

TRACEABILITY The characterization of CRM C017a was achieved through an inter-laboratory experiment. Chemical analyses were performed by participating laboratories on both monolithic samples and chips derived from them. All laboratories adhered to the requirements of ISO 17025 and employed standardized analytical methods. To validate the analytical results, the following certified reference materials were used: DSZU C017, DSZU C015, DSZU C016, DSZU C018; ICRM LG36/2, ICRM UG92, ICRM UG46/1, ICRM C9/4; BS 316F, BS 304 B, BS 304 C, BS 316 D, BS 321 D, BS 316A, BS 85D, BS-CA316-2; IMZ 504, IMZ 1.21/1, IMZ 138, IMZ 132; BCS 337, BCS 265/2; MBH 316; JSS 652-13

RM VALIDITY This reference material has no expiration date. The working surface of these samples should be purified before use. The reference material remain stable if not exposed to excessive heat (e.g., during surface preparation)

DATE OF ISSUE June 2025

DELIVERY The CRM C017a is supplied in a cardboard box with its certificate

SAFETY A Safety Data Sheet (SDS) is not required for this reference material. Material and packing does not contain hazardous chemicals, explosives and radioactive substances and substances which might influence health and the environment

LABORATORY MEANS, mass fraction in % by weight

n	C	Si	Mn	P	S	Cr	Ni	Mo	Ti	Al	Cu	W	V	Co	As	Sn	B	N
1	0.0335	0.400	1.700	0.0420	0.0100	16.57	10.76	1.990	0.300	0.0670	0.2370	0.0430	0.0380	0.100	0.0060	0.0060	0.0016	0.0128
2	0.0360	0.400	1.710	0.0460	0.0100	16.58	10.78	2.004	0.300	0.0670	0.2410	0.0465	0.0410	0.106	0.0070	0.0080	0.0017	0.0132
3	0.0380	0.408	1.716	0.0465	0.0110	16.62	10.81	2.010	0.308	0.0675	0.2430	0.0470	0.0447	0.110	0.0070	0.0080	0.0018	0.0141
4	0.0380	0.408	1.724	0.0470	0.0117	16.65	10.86	2.019	0.310	0.0680	0.2460	0.0480	0.0458	0.113	0.0070	0.0080	0.0020	0.0146
5	0.0383	0.410	1.724	0.0474	0.0118	16.66	10.87	2.020	0.310	0.0690	0.2500	0.0480	0.0460	0.113	0.0071	0.0081	0.0020	0.0147
6	0.0386	0.410	1.726	0.0478	0.0120	16.67	10.90	2.026	0.310	0.0698	0.2502	0.0500	0.0460	0.120	0.0072	0.0082	0.0022	0.0150
7	0.0388	0.412	1.731	0.0480	0.0120	16.68	10.93	2.038	0.312	0.0700	0.2524	0.0502	0.0460	0.120	0.0078	0.0090	0.0024	0.0153
8	0.0398	0.414	1.734	0.0480	0.0124	16.69	10.93	2.040	0.312	0.0720	0.2525	0.0510	0.0486	0.121	0.0078	0.0090	0.0025	0.0173
9	0.0400	0.415	1.738	0.0480	0.0125	16.70	10.94	2.040	0.315	0.0730	0.2530	0.0514	0.0490	0.121	0.0080	0.0094	0.0025	0.0180
10	0.0400	0.420	1.740	0.0485	0.0125	16.73	10.95	2.042	0.316	0.0730	0.2550	0.0516	0.0498	0.121	0.0082	0.0095	0.0025	0.0180
11	0.0403	0.422	1.747	0.0485	0.0127	16.73	10.95	2.048	0.316	0.0750	0.2580	0.0520	0.0500	0.122	0.0088	0.0096	0.0026	0.0190
12	0.0403	0.424	1.750	0.0490	0.0128	16.73	10.96	2.050	0.320	0.0760	0.2600	0.0530	0.0500	0.123	0.0093	0.0105	0.0030	
13	0.0410	0.424	1.760	0.0496	0.0130	16.74	10.96	2.050	0.320	0.0780	0.2600	0.0540	0.0500	0.123	0.0100	0.0110	0.0032	
14	0.0412	0.425	1.777	0.0501	0.0130	16.76	10.97	2.052	0.322	0.0780	0.2600	0.0540	0.0500	0.124		0.0110		
15	0.0413	0.426	1.777	0.0510	0.0130	16.76	10.97	2.053	0.325	0.0790	0.2670	0.0600	0.0518	0.125				
16	0.0414	0.426	1.778	0.0510	0.0130	16.79	10.99	2.060	0.327	0.0800	0.2700	0.0600	0.0560	0.125				
17		0.429	1.779		0.0133	16.80	11.00	2.070	0.339	0.0810	0.2754	0.0655		0.129				
18		0.433	1.780		0.0137	16.81	11.01	2.072	0.350	0.0890				0.130				
19			1.780		0.0137	16.83	11.01	2.075										
20			1.790		0.0138	16.84	11.08	2.098										
21						16.89	11.08	2.100										
M(M)	0.0392	0.417	1.748	0.0480	0.0124	16.73	10.94	2.046	0.317	0.0740	0.2547	0.0521	0.0477	0.119	0.0078	0.0090	0.0023	0.0156
s(M)	0.0021	0.010	0.028	0.0022	0.0011	0.08	0.09	0.028	0.012	0.0060	0.0102	0.0056	0.0043	0.008	0.0011	0.0014	0.0005	0.0021

M(M) - Mean of laboratory means

s(M) - Standard deviation of the laboratory means

PARTICIPATING LABORATORIES

ArcelorMittal Kryvyi Rih PJSC, Ukraine
Dnepropress Steel LLC, Ukraine
Dneprospetsstal (DSS) PJSC, Ukraine
ENVIFORM a.s., Czech Republic
Luvak Inc., USA
Górnosławski Instytut Technologiczny, Poland
Metal and Quality LLC, Ukraine
Oy NAREMA, Finland
TCR Engineering Services, India
VÍTKOVICE TESTING, Czech Republic
Zaporizhstal PJSC, Ukraine
Zaporozhye Steel Works LLC, Ukraine
Zaporizhia Foundry and Mechanical Plant LLC, Ukraine

ANALYTICAL METHODS USED**Carbon (C), Sulfur (S):** AES, Infrared Absorption, Coulometric Titration**Silicon (Si):** Photometric, ICP-AES, DCP-AES, AES, XRF**Nickel (Ni):** Photometric, Gravimetric, ICP-AES, AAS, DCP-AES, AES, XRF**Chromium (Cr):** Titrimetric, ICP-AES, DCP-AES, AES, XRF**Manganese (Mn), Molybdenum (Mo):** Photometric, ICP-AES, DCP-AES, AES, XRF**Phosphorus (P), Titanium (Ti), Copper (Cu), Cobalt (Co), Aluminum (Al), Vanadium (V), Tungsten (W):** ICP-AES, DSP-AES, AES, XRF**Boron (B):** ICP-AES, DCP-AES, AES**Arsenic (As), Tin (Sn):** ICP-AES, DSP-AES, AAS**Nitrogen (N):** AES, Inert Gas Fusion**CONTACT INFORMATION****Metal and Quality, LLC**

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