CERTIFIED REFERENCE MATERIAL
CERTIFICATE OF CHEMICAL ANALYSIS

REFERENCE – MRC N° **TL-1100**
Steel 36NiCrMo16-DIN 1.6773
LABORATORY MEANS (2 values) – Mass content %

Line n°	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	N	Sn	Co
1	0,3390	0,2770	0,6058	0,0105	0,0035	1,627	0,3067	3,645	0,1701	0,0107	0,0080	0,0248
2	0,3400	0,2770	0,6061	0,0115	0,0039	1,642	0,3100	3,689	0,1720	0,0110	0,0082	0,0268
3	0,3450	0,2815	0,6100	0,0116	0,0042	1,645	0,3205	3,711	0,1735	0,0111	0,0083	0,0270
4	0,3473	0,2815	0,6158	0,0119	0,0043	1,648	0,3299	3,716	0,1742	0,0115	0,0085	0,0279
5	0,3475	0,2840	0,6235	0,0126	0,0047	1,650	0,3340	3,730	0,1744	0,0116	0,0085	0,0282
6	0,3482	0,2850	0,6250	0,0127	0,0049	1,655	0,3360	3,739	0,1760	0,0116		0,0295
7	0,3489	0,2900	0,6275	0,0130	0,0049	1,658	0,3376	3,753	0,1769	0,0121		0,0300
8	0,3495	0,2956	0,6295	0,0130	0,0050	1,667	0,3400	3,756	0,1779	0,0122		0,0300
9	0,3498		0,6400	0,0131	0,0051	1,686	0,3410	3,761	0,1784	0,0130		0,0304
10	0,3505		0,6425	0,0141	0,0052	1,686	0,3466	3,765	0,1790			
11	0,3520		0,6500		0,0054	1,692	0,3574		0,1835			
12	0,3530		0,6658		0,0056	1,715	0,3590		0,1850			
13	0,3550				0,0057							
14	0,3558				0,0060							
M_M	0,3487	0,2839	0,6284	0,0124	0,0049	1,664	0,3349	3,727	0,1767	0,0116	0,0083	0,0283
s_M	0,0049	0,0063	0,0185	0,0010	0,0007	0,02 6	0,0163	0,038	0,0044	0,0007	0,0002	0,0019
s_W	0,0028	0,0059	0,0033	0,0004	0,0003	0,014	0,0044	0,017	0,0030	0,0003	0,0003	0,0003

Line n°	Al
1	0,0345
2	0,0348
3	0,0355
4	0,0355
5	0,0377
6	0,0380
7	0,0395
8	0,0400
9	0,0413
10	
M_M	0,0374
s_M	0,0025
s_W	0,0007

As	*Ti*	*V*	*W*
0,0050	*0,0018*	*0,0038*	*0,0185*
0,0067	*0,0019*	*0,0039*	*0,0261*
0,0075	*0,0021*	*0,0039*	*0,0293*
0,0079	*0,0031*	*0,0041*	*0,0352*
0,0081	*0,0036*	*0,0045*	*0,0370*
0,0091	*0,0042*	*0,0051*	
0,0091		*0,0057*	
0,0095		*0,0062*	
0,0105			
0,0106			
0,0084	*0,0028*	*0,0046*	*0,0292*
0,0017	*0,0010*	*0,0009*	*0,0074*
0,0003	*0,00002*	*0,0002*	*0,0023*

M_M : Mean of intralaboratory means
s_M : Standard deviation of intralaboratory means
s_W : Intralaboratory standard deviation

The laboratory mean values have been examined statistically with the Cochran and Grubbs Test to eliminate outlying values.

Values given in italic are for information only and are not certified.

Additional values for information: B ~ 2 ppm, Ca ~ 25 ppm, Mg ~ 5 ppm, Nb ~ 20 ppm, Zr ~ 15 ppm

CERTIFIED VALUES – Mass content in %

Element	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	N
M_M	0,3487	0,2839	0,6284	0,0124	0,0049	1,664	0,3349	3,727	0,1767	0,0116
C (95%)	0,0029	0,0054	0,0118	0,0008	0,0004	0,017	0,0104	0,027	0,0028	0,0006

Element	Sn	Co	Al
M_M	0,0083	0,0283	0,0374
C (95%)	0,0003	0,0015	0,0019

C(95%) : half-width confidence interval = $\frac{t \times s_M}{\sqrt{n}}$ where t is the appropriate Student's t value and n is the number of acceptable mean values
For further information regarding the confidence interval for the certified value see ISO Guide 35 : 2006 sections 6.1 et 10.5.2.

METHODS USED

Element	Line n°	Methods
C	1,2,3,4,5,6,8,9,10,11,12,13,14 7	Combustion + Infrared (Comb/IR) Reduction fusion + Thermal conductivity (Fusion/Cond th)
Si	1,2,3,4,5,6,7,8	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)
Mn	1,2,3,4,5,6,7,8,9,11,12 10	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
P	1,2,3,5,6,7,8,9,10 4	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
S	1,2,4,5,6,7,8,9,10,12,13,14 3,11	Combustion + Infrared (Comb/IR) Reduction fusion + Thermal conductivity (Fusion/Cond th)
Cr	1,2,3,4,5,6,8,9,10,11,12 7	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Titration (Titr)
Mo	1,2,3,4,5,6,7,8,9,10,11,12	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)
Ni	1,2,3,5,6,7,8,9,10 4	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
Cu	1,2,4,5,6,7,8,9,10,11,12 3	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Molecular Absorption Spectrometry (MAS)
N	2,3,4,5,6,7,8,9 1	Reduction fusion + Thermal conductivity (Fusion/Cond th) Combustion + Infrared (Comb/IR)
Sn	2,3,4,5 1	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES) Atomic Absorption Spectrometry (AAS)
Co	1,2,3,4,5,6,7,8,9	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)
Al	1,2,3,4,5,6,7,8,9	Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)

As	*1,2,4,6,7,8,9,10* *3* *5*	*Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)* *Atomic Absorption Spectrometry (AAS)* *Inductively Coupled Plasma + Mass Spectrometry (ICP/MS)*
Ti	*1,2,3,4,5,6*	*Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)*
V	*1,2,3,4,5,6,7,8*	*Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)*
W	*1,2,4,5* *3*	*Inductively Coupled Plasma + Optical Emission Spectrometry (ICP/OES)* *Inductively Coupled Plasma + Mass Spectrometry (ICP/MS)*

DESCRIPTION OF THE SAMPLE

The steel TL-1100 is a disc of 20 mm high and 40 mm diameter.

INTENDED USE - STABILITY

The solid (disc) sample TL-1100 is intended for establishing and checking the calibration of instruments, such as Optical Emission Spectrometers and X-ray Spectrometers, for the analysis of samples of similar materials.
For best analytical results, use the same method for preparing the analytical surface on all reference materials as you use for production specimens.
The entire thickness of the disc can be used. It is recommended to avoid overheating the sample during surface preparation.

If the sample is stored and / or used in a normal environment [protected from heat, corrosive atmosphere, excessive humidity ...], the chemical composition of this sample does not undergo any evolution, whatever the duration of storage.

SAFETY NOTICE

A Material Safety Data Sheet (MSDS) is not required for this material. This material will not release or otherwise result in exposure to a hazardous chemical, under normal conditions of use.

TRACEABILITY

The traceability of CRM TL-1100 has been established in accordance with the ISO Guides 30-35 and the International vocabulary of basic and general terms in metrology.

The assigned values for each material are achieved by inter-laboratory characterization, each laboratory using the method of their choice, details of which are given above. These methods are either stoichiometric analytical techniques or methods which are calibrated against pure metals or stoichiometric compounds. Most methods used were either international or national standard methods or methods which are technically equivalent.

PARTICIPATING LABORATORIES

A2M INDUSTRIE	FR- 42490 FRAISSES
ACCIAIERIE BERTOLI SAFAU	FR- 57070 METZ
ACIERIE ET FONDERIE DE LA HAUTE SAMBRE	FR- 59145 BERLAIMONT
ACIERIES HACHETTE ET DRIOUT	FR- 52115 SAINT DIZIER Cedex
AMETEK	FR- 78990 ELANCOURT
APAVE SUDEUROPE SAS	FR- 69160 TASSIN LA DEMI LUNE
ARCELORMITTAL ATLANTIQUE ET LORRAINE DUNKERQUE	FR- 59760 GRANDE SYNTHE
ARCELORMITTAL MEDITERRANEE	FR- 13776 FOS-SUR-MER Cedex
ARCELORMITTAL RESEARCH	FR- 57283 MAIZIERES LES METZ
ASCOMETAL FOS SUR MER	FR- 13270 FOS-SUR-MER
ASCOVAL	FR- 59880 SAINT SAULVE
AUBERT ET DUVAL FIRMINY	FR- 42704 FIRMINY
AUBERT ET DUVAL LES ANCIZES	FR- 63770 LES ANCIZES
BRAMMER STANDARD	US- 77069 HOUSTON
BUREAU VERITAS LABORATOIRES	FR- 95310 SAINT-OUEN L'AUMONE
CEA Saclay	FR- 91191 GIF SUR YVETTE
CETIM NANTES	FR- 44308 NANTES Cedex 3
CETIM SAINT-ETIENNE	FR- 42952 SAINT-ETIENNE Cedex 1
CRITT-MDTS	FR- 08000 CHARLEVILLE-MEZIERES
ENVIFORM a.s.	CZ- 73961 TRINEC
EVANS ANALYTICAL GROUP	FR- 31170 TOURNEFEUILLE
FRAMATOME-CENTRE TECHNIQUE LE CREUSOT	FR- 71205 LE CREUSOT
FONDERIE ET ACIERIE DE DENAIN	FR- 59220 DENAIN
INDUSTEEL BELGIUM	BE- 6030 CHARLEROI
INDUSTEEL FRANCE LE CREUSOT	FR- 71201 LE CREUSOT CEDEX
INDUSTEEL FRANCE RIVE DE GIER	FR- 42803 RIVE-DE-GIER CEDEX
INSTITUTE FOR CERTIFIED REFERENCE MATERIALS (ICRM)	RU- 620057 EKATERINBURG
INSTYTUT METALURGII ZELAZA (IMZ)	PL - 44100 GLIWICE
LABORATOIRE METALLURGIQUE DE L'EST	FR- 54340 POMPEY
LABORATOIRES POURQUERY	FR- 69354 LYON CEDEX 07
LES BRONZES INDUSTRIES	FR- 57360 AMNEVILLE
LUXCONTROL	LU- 4004 ESCH SUR ALZETTE
METALCONTROL	FR- 77100 MEAUX
TECHLAB	FR- 57072 METZ CEDEX 3

REFERENCES

- ISO 5725-2 : Accuracy (trueness and precision) of measurement methods and results – Part 2 : Basic method for the determination of repeatability and reproducibility of a standard measurement method
- ISO GUIDE 35 : Reference Materials – General and statistical principles for certification
- E826-85 : Standard practice for testing homogeneity of Materials for the Development of Reference Materials

TECHLAB
Pascal BODO and Sabine POIREL
4C La Tannerie
57070 St Julien-les-Metz
☏ **(33) 3 87 75 54 29**
🖷 (33) 3 87 36 23 20
www.techlab.fr
techlab@techlab.fr

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