SLOVENSKI STANDARD
SIST ISO 9723:1996

01-avgust-1996

Palice iz niklja in nikljevih zlitin

Nickel and nickel alloy bars

Barres en nickel et alliages de nickel

Ta slovenski standard je istoveten z: **ISO 9723:1992**

ICS:

77.150.40	Nikljevi in kromovi izdelki	Nickel and chromium products

SIST ISO 9723:1996 **en**

INTERNATIONAL STANDARD

ISO 9723

First edition
1992-12-01

Nickel and nickel alloy bars

Barres en nickel et alliages de nickel

Reference number
ISO 9723:1992(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9723 was prepared by Technical Committee ISO/TC 155, *Nickel and nickel alloys*, Sub-Committee SC 2, *Wrought and cast nickel and nickel alloys*.

Annex A forms an integral part of this International Standard.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Nickel and nickel alloy bars

1 Scope

This International Standard specifies requirements for nickel and nickel alloy bars in the finished condition and for further working in the following size ranges:

— cold-worked bars up to and including 65 mm diameter or width across flats

— hot-worked bars up to and including 315 mm diameter or width across flats.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/R 204:1961, *Non-interrupted creep testing of steel at elevated temperatures.*

ISO/R 206:1961, *Creep stress rupture testing of steel at elevated temperatures.*

ISO 6372-1:1989, *Nickel and nickel alloys — Terms and definitions — Part 1: Materials.*

ISO 6372-3:1989, *Nickel and nickel alloys — Terms and definitions — Part 3: Wrought products and castings.*

ISO 6892:1984, *Metallic materials — Tensile testing.*

ISO 7003:1990, *Unified format for the designation of metals.*

ISO/TR 9721:1992, *Nickel and nickel alloys — Rules for material description based on chemical symbols.*

ISO 9722:1992, *Nickel and nickel alloys — Composition and forms of wrought products.*

ASTM E 112:1988, *Standard methods for determining average grain size.*

3 Definitions

For the purposes of this International Standard, the following definitions and those for nickel and nickel alloys in ISO 6372-1 and for bars in ISO 6372-3 apply.

3.1 heat: The product of a furnace melt or a number of melts that are mixed prior to casting.

3.2 lot: Bars of the same cross-sectional dimensions, from the same heat, heat treated together or sequentially heat treated in a continuous furnace, but in no case for longer than 16 h of production. For bars not identified by heat, the lot shall be either one piece of the forging or 500 kg, whichever is larger.

4 Alloy identification

For the purposes of this International Standard, the principles for alloy identification in ISO/TR 7003 and ISO/TR 9721 apply.

5 Ordering information

Orders for bars according to this International Standard shall include the following information.

5.1 The number of this International Standard.

5.2 Quantity (mass or number of bars).

5.3 Alloy identification (see table 1).

NOTE 1 For alloy identification, either the number or the description may be used.

5.4 Alloy temper, for finished bars only (see table 2).

5.5 Dimensions: diameter, width across flats, thickness, width, length.

5.6 Specify whether the purchaser will hot work the product.

5.7 Optional requirements:

a) tolerances for bars to be hot worked by the purchaser;

b) samples for product analysis (see 7.1.2);

c) determination of 1 % proof stress (see 9.2.3);

d) surface condition (see 6.1.8 or 6.2.4);

e) marking (see clause 10);

f) purchaser or third party inspection (see clause 11);

g) declaration of conformity (see clause 12).

6 Requirements

6.1 Requirements for bars supplied in a finished condition

6.1.1 Composition

Heat analysis shall meet the composition limits specified in table 1.

The composition limits do not preclude the possible presence of other elements that are not specified. If the purchaser's requirements necessitate limits for any other element that is not specified, these shall be agreed between the purchaser and the supplier. The percentage content of elements shown as "remainder" shall be calculated by difference from 100 %.

6.1.2 Temper

Unless otherwise specified, bars of precipitation-hardenable alloys shall be supplied in the solution-treated temper.

6.1.3 Tensile properties

Bars shall have the tensile properties specified in table 2.

6.1.4 Heat treatment

Precipitation-hardenable alloy bars shall be heat treated in accordance with table 3 to the condition as ordered.

6.1.5 Grain size

Bars of alloys NW8810 (FeNi32Cr21AlTi-HC) and NW8811 (FeNi32Cr21AlTi-HT) shall have a grain size ASTM No. 5 or coarser (average diameter 0,06 mm or greater).

6.1.6 Creep or stress rupture properties

Bars of precipitation-hardenable alloys shall meet the creep or stress rupture properties specified in table 4.

6.1.7 Dimensional tolerances

6.1.7.1 Diameter, thickness or width across flats

The tolerances for cross-sectional dimensions shall be as specified in tables 5 to 7.

6.1.7.2 Length

The length tolerance of hot-worked and cold-worked bars shall be as specified in table 8.

6.1.7.3 Straightness

The maximum curvature (depth of chord) shall not exceed 4 mm multiplied by the length in metres. Bars shall be free of sharp bends and kinks.

6.1.8 Surface condition

Bars shall be clean and free from detrimental surface imperfections.

NOTE 2 Where appropriate, the acceptance criteria should be agreed between the purchaser and the supplier.

6.1.9 Finish

Bars may be supplied in one of the following finishes:

a) hot worked;

b) cold drawn;

c) descaled;

d) machined;

e) ground.

6.2 Requirements for bars to be further worked by the purchaser

6.2.1 Composition

Heat analysis shall meet the composition limits specified in table 1, as in ISO 9722.

The composition limits do not preclude the possible presence of other elements that are not specified. If the purchaser's requirements necessitate limits for any other element that is not specified, these shall be agreed between the purchaser and the supplier. The percentage content of elements shown as "remainder" shall be calculated by difference from 100 %.

6.2.2 Temper

Unless otherwise specified, bars to be further worked by the purchaser shall be supplied in the hot-worked temper, without specified mechanical properties.

6.2.3 Precipitation-hardenable alloys

The supplier of precipitation-hardenable alloy bars shall demonstrate the capability of meeting the requirements specified in table 2 and/or table 4, by testing samples heat treated in accordance with table 3.

6.2.4 Surface condition

Bars shall be clean and free from detrimental surface inperfections.

Unless otherwise agreed between the purchaser and the supplier, bars shall be supplied with a machined surface.

NOTE 3 Where appropriate, the acceptance criteria should be agreed between the purchaser and the supplier.

7 Sampling

7.1 Chemical analysis

7.1.1 Representative heat analysis samples shall be taken during pouring or subsequent processing.

7.1.2 Product analysis samples shall be taken from the finished product.

7.2 Tensile and creep or stress rupture test

Tensile and creep or stress rupture test samples shall be taken from material in the final heat-treated condition and tested in the longitudinal direction.

Samples from products to be supplied in other than the fully heat-treated condition shall be heat treated in accordance with table 3 before testing.

8 Number of tests

8.1 Chemical analysis, one test per heat.

8.2 Tensile test, one test per lot.

8.3 Creep or stress rupture test, one test per lot.

8.4 Grain size determination, one test per lot.

9 Test procedures

9.1 Chemical analysis

9.1.1 The method of chemical analysis shall be at the option of the supplier, however, in cases of dispute the method specified in the relevant International Standard shall be used.

If no International Standard exists, an analytical method that can be calibrated to a reference standard agreed upon by the purchaser and the supplier shall be used.

9.1.2 For a list of ISO analytical standards, see annex A.

9.2 Tensile testing

9.2.1 Testing shall be carried out in accordance with ISO 6892.

9.2.2 Bars shall be tested over their total cross-section, if possible. When a test over the total cross-section cannot be performed, the largest possible round specimen, not exceeding 15 mm in diameter on the gauge length, shall be used.

Longitudinal strip specimens shall be prepared for rectangular bars, with thicknesses up to and including 15 mm, which are too wide to be tested in full cross-section.

See annexes C and D of ISO 6892.

9.2.3 The offset method shall be used for the determination of proof stress. An offset of 0,2 % ($R_{p0,2}$) shall be standard. However, a 1 % proof stress ($R_{p1,0}$) shall be determined and reported for information when requested by the purchaser.

9.3 Creep and stress rupture testing

9.3.1 Creep tests shall be carried out in accordance with ISO/R 204, except that only the final total plastic strain need be reported.

9.3.2 Stress rupture tests shall be carried out in accordance with ISO/R 206.

9.4 Grain size determination

A transverse sample representative of the full thickness shall be examined in accordance with ASTM E 112.

9.5 Rounding-off

For the purpose of determining compliance with the specified limits of the properties listed below, an observed value or a calculated value shall be rounded as follows.

When the figure immediately after the last figure to be retained is lower than 5, the last figure to be retained remains unchanged.

When the figure immediately after the last figure to be retained is 5 or greater, the last figure to be retained is increased by one.

Composition, creep, stress rupture, grain size, hardness and dimensions	Nearest unit to the last right-hand place of figures of the specified limit
Tensile strength (R_m)	Nearest 10 N/mm ^{2}
Proof stress ($R_{p0,2}$)	Nearest 5 N/mm ^{2}
Elongation (A)	Nearest 1 %

9.6 Retests

If any one of the test pieces first selected fails to pass the specified tests, two further samples from the same lot shall be selected for testing, one of which shall be from the original bar tested, unless that bar has been withdrawn by the supplier. If the test pieces from both these additional samples pass, the lot represented by the test samples shall be deemed to comply with the requirements of this International Standard. If the test pieces from either of these additional samples fail, the lot represented by these samples shall be deemed not to comply with the requirements of this International Standard.

10 Marking

10.1 Each bundle or shipping container shall be marked with the number of this International Standard, the alloy identification (either the number or the description), the heat number, heat-treated condition, the size, the gross, tare and net weight, the consignor and consignee address, contract or order number, and any other information requested in the contract or order.

10.2 If agreed between the purchaser and supplier, the supplier shall mark each bar with the number of this International Standard, the alloy identification, the heat number and the manufacturer's name. The method of marking will be at the option of the supplier, unless otherwise agreed. Marking shall not result in harmful contamination.

11 Purchaser or third party inspection

On-site inspection of bars by the purchaser or third parties shall be in accordance with agreements made between the purchaser and the supplier as part of the purchase contract.

12 Declaration of conformity

When requested by the purchaser in the contract or order, the supplier shall certify that the bars were manufactured and tested in accordance with this International Standard. The declaration of conformity shall detail the results of all tests required by this International Standard and the order.

Table 1 — Composition and density of wrought nickel and nickel alloys (selected from table 1 of ISO 9722:1992)

Alloy identification[1)]		Composition % (m/m)[2)]															Density[3)]
Number	Description	Al	B	C	Co[4)]	Cr	Cu	Fe	Mn	Mo	Ni	P	S	Si	Ti	W	Others[5)]	g/cm[3]
NW2200	Ni99,0			0,15			0,2	0,4	0,3		99,0		0,010	0,3				8,9
NW2201	Ni99,0-LC			0,02			0,2	0,4	0,3		99,0		0,010	0,3				8,9
NW3021	NiCo20Cr15Mo5Al4Ti	4,5 4,9	0,003 0,010	0,12 0,17	18,0 22,0	14,0 15,7	0,2	1,0	1,0	4,5 5,5	Remainder		0,015	1,0	0,9 1,5		Ag: 0,0005(5) Bi: 0,0001(1) Pb: 0,0015(15)	8,4
NW7263	NiCo20Cr20Mo5Ti2Al	0,3 0,6	0,005	0,04 0,08	19,0 21,0	19,0 21,0	0,2	0,7	0,6	5,6 6,1	Remainder		0,007	0,4	1,9 2,4		Ag: 0,0005(5) Bi: 0,0001(1) Pb: 0,0020(20) Ti+Al: 2,4 to 2,8	8,4
NW7001	NiCr20Co13Mo4Ti3Al	1,2 1,6	0,003 0,010	0,02 0,10	12,0 15,0	18,0 21,0	0,10	2,0	1,0	3,5 5,0	Remainder	0,015	0,015	0,1	2,8 3,3		Ag: 0,0005(5) Bi: 0,0005(0,5) Pb: 0,0010(10) Zr: 0,02 to 0,08	8,4
NW7090	NiCr20Co18Ti3	1,0 2,0	0,020	0,13	15,0 21,0	18,0 21,0	0,2	1,5	1,0		Remainder		0,015	1,0	2,0 3,0		Zr: 0,15	8,2
NW7750	NiCr15Fe7Ti2Al	0,4 1,0		0,08		14,0 17,0	0,5	5,0 9,0	1,0		70,0		0,015	0,5	2,2 2,8		Nb+Ta: 0,7 to 1,2	8,3
NW6600	NiCr15Fe8			0,15		14,0 17,0	0,5	6,0 10,0	1,0		72,0		0,015	0,5				8,4
NW6602	NiCr15Fe8-LC			0,02		14,0 17,0	0,5	6,0 10,0	1,0		72,0		0,015	0,5				8,4
NW7718	NiCr19Fe19Nb5Mo3	0,2 0,8	0,006	0,08		17,0 21,0	0,3	Remainder	0,4	2,8 3,3	50,0 55,0	0,015	0,015	0,4	0,6 1,2		Nb+Ta: 4,7 to 5,5	8,0
NW6002	NiCr21Fe18Mo9		0,010	0,05 0,15	0,5 2,5	20,5 23,0		17,0 20,0	1,0	8,0 10,0	Remainder	0,040	0,030	1,0		0,2 1,0		8,2
NW6601	NiCr23Fe15Al	1,0 1,7		0,10		21,0 25,0	1,0	Remainder	1,0		58,0 63,0		0,015	0,5				8,0
NW6333	NiCr26Fe20Co3Mo3W3			0,10	2,5 4,0	24,0 27,0		Remainder	2,0	2,5 4,0	44,0 48,0	0,030	0,030	1,5		2,5 4,0		
NW6690	NiCr29Fe9			0,05		27,0 31,0	0,5	7,0 11,0	0,5		Remainder		0,015	0,5				8,2
NW6455	NiCr16Mo16Ti			0,015	2,0	14,0 18,0		3,0	1,0	14,0 17,0	Remainder	0,040	0,030	0,08	0,7			8,6
NW6022	NiCr21Mo13Fe4W3			0,015	2,5	20,0 22,5		2,0 6,0	0,5	12,5 14,5	Remainder	0,025	0,020	0,08		2,5 3,5	V: 0,35	8,7
NW6625	NiCr22Mo9Nb	0,40		0,10	1,0	20,0 23,0		5,0	0,50	8,0 10,0	58,0	0,015	0,015	0,50	0,40		Nb+Ta: 3,15 to 4,15	8,5