

# INTERNATIONAL STANDARD

**ISO**  
**9723**

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## 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.

# 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 imperfections.

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 <sup>2</sup>                                                |
| Proof stress ( $R_{p0,2}$ )                                             | Nearest 5 N/mm <sup>2</sup>                                                 |
| 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 <sup>1)</sup> |                    | Composition % (m/m) <sup>2)</sup> |                |              |                  |              |      |              |      |              |              |       |              |      | Density <sup>3)</sup> |            |                                                                        |                   |
|------------------------------------|--------------------|-----------------------------------|----------------|--------------|------------------|--------------|------|--------------|------|--------------|--------------|-------|--------------|------|-----------------------|------------|------------------------------------------------------------------------|-------------------|
| Number                             | Description        | Al                                | B              | C            | Co <sup>4)</sup> | Cr           | Cu   | Fe           | Mn   | Mo           | Ni           | P     | S            | Si   | Ti                    | W          | Others <sup>5)</sup>                                                   | g/cm <sup>3</sup> |
| 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<br>4,9                        | 0,003<br>0,010 | 0,12<br>0,17 | 18,0<br>22,0     | 14,0<br>15,7 | 0,2  | 1,0          | 1,0  | 4,5<br>5,5   | Remainder    |       | 0,015        | 1,0  | 0,9<br>1,5            |            | Ag: 0,0005(5)<br>Bi: 0,0001(1)<br>Pb: 0,0015(15)                       | 8,4               |
| NW7263                             | NiCo20Cr20Mo5Ti2Al | 0,3<br>0,6                        | 0,005          | 0,04<br>0,08 | 19,0<br>21,0     | 19,0<br>21,0 | 0,2  | 0,7          | 0,6  | 5,6<br>6,1   | Remainder    |       | 0,007<br>0,4 | 0,1  | 1,9<br>2,4            |            | Ag: 0,0005(5)<br>Bi: 0,0001(1)<br>Pb: 0,0020(20)<br>Ti+Al: 2,4 to 2,8  | 8,4               |
| NW7001                             | NiCr20Co13Mo4Ti3Al | 1,2<br>1,6                        | 0,003<br>0,010 | 0,02<br>0,10 | 12,0<br>15,0     | 18,0<br>21,0 | 0,10 | 2,0          | 1,0  | 3,5<br>5,0   | Remainder    | 0,015 | 0,015        | 0,1  | 2,8<br>3,3            |            | Ag: 0,0005(5)<br>Bi: 0,0005(0,5)<br>Pb: 0,0010(10)<br>Zr: 0,02 to 0,08 | 8,4               |
| NW7090                             | NiCr20Co18Ti3      | 1,0<br>2,0                        | 0,020          | 0,13         | 15,0<br>21,0     | 18,0<br>21,0 | 0,2  | 1,5          | 1,0  |              | Remainder    |       | 0,015        | 1,0  | 2,0<br>3,0            |            | Zr: 0,15                                                               | 8,2               |
| NW7750                             | NiCr15Fe7Ti2Al     | 0,4<br>1,0                        |                | 0,08         |                  | 14,0<br>17,0 | 0,5  | 5,0<br>9,0   | 1,0  |              | 70,0         |       | 0,015        | 0,5  | 2,2<br>2,8            |            | Nb+Ta: 0,7 to 1,2                                                      | 8,3               |
| NW6600                             | NiCr15Fe8          |                                   |                | 0,15         |                  | 14,0<br>17,0 | 0,5  | 6,0<br>10,0  | 1,0  |              | 72,0         |       | 0,015        | 0,5  |                       |            |                                                                        | 8,4               |
| NW6602                             | NiCr15Fe8-LC       |                                   |                | 0,02         |                  | 14,0<br>17,0 | 0,5  | 6,0<br>10,0  | 1,0  |              | 72,0         |       | 0,015        | 0,5  |                       |            |                                                                        | 8,4               |
| NW7718                             | NiCr19Fe19Nb5Mo3   | 0,2<br>0,8                        | 0,006          | 0,08         |                  | 17,0<br>21,0 | 0,3  | Remainder    | 0,4  | 2,8<br>3,3   | 50,0<br>55,0 | 0,015 | 0,015        | 0,4  | 0,6<br>1,2            |            | Nb+Ta: 4,7 to 5,5                                                      | 8,0               |
| NW6002                             | NiCr21Fe18Mo9      |                                   | 0,010          | 0,05<br>0,15 | 0,5<br>2,5       | 20,5<br>23,0 |      | 17,0<br>20,0 | 1,0  | 8,0<br>10,0  | Remainder    | 0,040 | 0,030        | 1,0  | 0,2<br>1,0            |            |                                                                        | 8,2               |
| NW6601                             | NiCr23Fe15Al       | 1,0<br>1,7                        |                | 0,10         |                  | 21,0<br>25,0 | 1,0  | Remainder    | 1,0  |              | 58,0<br>63,0 |       | 0,015        | 0,5  |                       |            |                                                                        | 8,0               |
| NW6333                             | NiCr26Fe20Co3Mo3W3 |                                   |                | 0,10         | 2,5<br>4,0       | 24,0<br>27,0 |      | Remainder    | 2,0  | 2,5<br>4,0   | 44,0<br>48,0 | 0,030 | 0,030        | 1,5  |                       | 2,5<br>4,0 |                                                                        |                   |
| NW6690                             | NiCr29Fe9          |                                   |                | 0,05         |                  | 27,0<br>31,0 | 0,5  | 7,0<br>11,0  | 0,5  |              | Remainder    |       | 0,015        | 0,5  |                       |            |                                                                        | 8,2               |
| NW6455                             | NiCr16Mo16Ti       |                                   |                | 0,015        | 2,0              | 14,0<br>18,0 |      | 3,0          | 1,0  | 14,0<br>17,0 | Remainder    | 0,040 | 0,030        | 0,08 | 0,7                   |            |                                                                        | 8,6               |
| NW6022                             | NiCr21Mo13Fe4W3    |                                   |                | 0,015        | 2,5              | 20,0<br>22,5 |      | 2,0<br>6,0   | 0,5  | 12,5<br>14,5 | Remainder    | 0,025 | 0,020        | 0,08 |                       | 2,5<br>3,5 | V: 0,35                                                                | 8,7               |
| NW6625                             | NiCr22Mo9Nb        | 0,40                              |                | 0,10         | 1,0              | 20,0<br>23,0 |      | 5,0          | 0,50 | 8,0<br>10,0  | 58,0         | 0,015 | 0,015        | 0,50 | 0,40                  |            | Nb+Ta: 3,15 to 4,15                                                    | 8,5               |

| Alloy identification <sup>1)</sup> |                   | Composition % (m/m) <sup>2)</sup> |                |              |                  |              |              |            |     |              |              |       |       |      |              | Density <sup>3)</sup><br>g/cm <sup>3</sup> |                                                  |     |
|------------------------------------|-------------------|-----------------------------------|----------------|--------------|------------------|--------------|--------------|------------|-----|--------------|--------------|-------|-------|------|--------------|--------------------------------------------|--------------------------------------------------|-----|
| Number                             | Description       | Al                                | B              | C            | Co <sup>4)</sup> | Cr           | Cu           | Fe         | Mn  | Mo           | Ni           | P     | S     | Si   | Ti           | W                                          | Others <sup>5)</sup>                             |     |
| NW6621                             | NiCr20Ti          |                                   |                | 0,08<br>0,15 | 5,0              | 18,0<br>21,0 | 0,5          | 5,0        | 1,0 |              | Remainder    |       | 0,020 | 1,0  | 0,20<br>0,60 |                                            | Pb: 0,0050(50)                                   | 8,4 |
| NW7080                             | NiCr20Ti2Al       | 1,0<br>1,8                        | 0,008          | 0,04<br>0,10 | 2,0              | 18,0<br>21,0 | 0,2          | 1,5        | 1,0 |              | Remainder    |       | 0,015 | 1,0  | 1,8<br>2,7   |                                            | Ag: 0,0005(5)<br>Bi: 0,0001(1)<br>Pb: 0,0020(20) | 8,2 |
| NW4400                             | NiCu30            |                                   |                | 0,30         |                  |              | 28,0<br>34,0 | 2,5        | 2,0 |              | 63,0         |       | 0,025 | 0,5  |              |                                            |                                                  | 8,8 |
| NW4402                             | NiCu30-LC         |                                   |                | 0,04         |                  |              | 28,0<br>34,0 | 2,5        | 2,0 |              | 63,0         |       | 0,025 | 0,5  |              |                                            |                                                  | 8,8 |
| NW5500                             | NiCu30Al3Ti       | 2,2<br>3,2                        |                | 0,25         |                  |              | 27,0<br>34,0 | 2,0        | 1,5 |              | Remainder    | 0,020 | 0,015 | 0,5  | 0,35<br>0,85 |                                            |                                                  | 8,5 |
| NW8825                             | NiFe30Cr21Mo3     | 0,2                               |                | 0,05         |                  | 19,5<br>23,5 | 1,5<br>3,0   | Remainder  | 1,0 | 2,5<br>3,5   | 38,0<br>46,0 |       | 0,015 | 0,5  | 0,6<br>1,2   |                                            |                                                  | 8,1 |
| NW9911                             | NiFe36Cr12Mo6Ti3  | 0,35                              | 0,010<br>0,020 | 0,06         |                  | 11,0<br>14,0 | 0,2          | Remainder  | 0,5 | 5,0<br>6,5   | 40,0<br>45,0 | 0,020 | 0,020 | 0,4  | 2,8<br>3,1   |                                            |                                                  | 8,2 |
| NW0276                             | NiMo16Cr15Fe6W4   |                                   |                | 0,010        | 2,5              | 14,5<br>16,5 |              | 4,0<br>7,0 | 1,0 | 15,0<br>17,0 | Remainder    | 0,040 | 0,030 | 0,08 |              | 3,0<br>4,5                                 |                                                  | 8,9 |
| NW0665                             | NiMo28            |                                   |                | 0,02         | 1,0              | 1,0          |              | 2,0        | 1,0 | 26,0<br>30,0 | Remainder    | 0,040 | 0,030 | 0,1  |              |                                            |                                                  | 9,2 |
| NW0001                             | NiMo30Fe5         |                                   |                | 0,05         | 2,5              | 1,0          |              | 4,0<br>6,0 | 1,0 | 26,0<br>30,0 | Remainder    | 0,040 | 0,030 | 1,0  |              |                                            | V: 0,2 to 0,4                                    | 9,2 |
| NW8800                             | FeNi32Cr21AlTi    | 0,15<br>0,60                      |                | 0,10         |                  | 19,0<br>23,0 | 0,7          | Remainder  | 1,5 |              | 30,0<br>35,0 |       | 0,015 | 1,0  | 0,15<br>0,60 |                                            |                                                  | 8,0 |
| NW8810                             | FeNi32Cr21AlTi-HC | 0,15<br>0,60                      |                | 0,05<br>0,10 |                  | 19,0<br>23,0 | 0,7          | Remainder  | 1,5 |              | 30,0<br>35,0 |       | 0,015 | 1,0  | 0,15<br>0,60 |                                            |                                                  | 8,0 |
| NW8811                             | FeNi32Cr21AlTi-HT | 0,25<br>0,60                      |                | 0,06<br>0,10 |                  | 19,0<br>23,0 | 0,7          | Remainder  | 1,5 |              | 30,0<br>35,0 |       | 0,015 | 1,0  | 0,25<br>0,60 |                                            | Al+Ti: 0,85 to 1,2                               | 8,0 |
| NW8801                             | FeNi32Cr21Ti      |                                   |                | 0,10         |                  | 19,0<br>22,0 | 0,5          | Remainder  | 1,5 |              | 30,0<br>34,0 |       | 0,015 | 1,0  | 0,7<br>1,5   |                                            |                                                  | 8,0 |
| NW8020                             | FeNi35Cr20Cu4Mo2  |                                   |                | 0,07         |                  | 19,0<br>21,0 | 3,0<br>4,0   | Remainder  | 2,0 | 2,0<br>3,0   | 32,0<br>38,0 | 0,040 | 0,030 | 1,0  |              |                                            | Nb+Ta: 8 x C to 1,0                              | 8,1 |

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

2) Single values are maximum limits, except for nickel where single values are minimum.

3) Density values are average values and are given for information only.

4) Where no limits are specified, cobalt up to a maximum of 1,5 % is allowed and counted as nickel. In this case, an indication of cobalt content is not required.

5) Values for Ag, Bi and Pb may be expressed in mass percentage [% (m/m)] or in parts per million (ppm).

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Table 2 — Tensile properties

| Alloy identification <sup>1)</sup> |                                  | Cross-section            | Temper                                                 | Diameter or width across flats or thickness |                        | Tensile strength<br>$R_m$ , min<br>N/mm <sup>2</sup> | 0,2 % proof stress<br>$R_{p0.2}$ , min<br>N/mm <sup>2</sup> | Minimum elongation <sup>2)</sup><br>$A_5/A_{50}$<br>% |
|------------------------------------|----------------------------------|--------------------------|--------------------------------------------------------|---------------------------------------------|------------------------|------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| Number                             | Description                      |                          |                                                        | over                                        | mm up to and including |                                                      |                                                             |                                                       |
| NW2200                             | Ni99,0                           | Round                    | Cold worked                                            | —                                           | 25                     | 550                                                  | 415                                                         | 10 <sup>3)</sup>                                      |
|                                    |                                  |                          |                                                        | 25                                          | 105                    | 520                                                  | 345                                                         | 15                                                    |
|                                    |                                  |                          |                                                        | All                                         |                        | 450                                                  | 275                                                         | 25 <sup>3)</sup>                                      |
| NW2201                             | Ni99,0-LC                        | Square Hexagon Rectangle | Cold worked                                            |                                             |                        |                                                      |                                                             |                                                       |
|                                    |                                  | All                      | Hot worked                                             | All                                         |                        | 410                                                  | 105                                                         | 35 <sup>4)</sup>                                      |
|                                    |                                  | All                      | Annealed                                               | All                                         |                        | 380                                                  | 105                                                         | 35 <sup>3)</sup>                                      |
|                                    |                                  | All                      | Hot worked                                             | All                                         |                        | 340                                                  | 65                                                          | 35 <sup>4)</sup>                                      |
|                                    |                                  | All                      | Annealed                                               | All                                         |                        | 340                                                  | 65                                                          | 35 <sup>3)</sup>                                      |
| NW3021                             | NiCo20Cr15Mo5Al4Ti               | All                      | Solution treated, stabilized and precipitation treated | All                                         |                        | —                                                    | —                                                           | —                                                     |
| NO7263                             | NiCo20Cr20Mo5Ti2Al <sup>5)</sup> | All                      | Solution and precipitation treated                     | All                                         |                        | 540 <sup>5)</sup>                                    | 400 <sup>5)</sup>                                           | 12 <sup>5)</sup>                                      |
| NW7001                             | NiCr20Co13Mo4Ti3Al               | All                      | Solution and precipitation treated                     | All                                         |                        | 1 100                                                | 755                                                         | 15                                                    |
| NO7090                             | NiCr20Co18Ti3                    | All                      | Solution and precipitation treated                     | All                                         |                        | 1 080                                                | 695                                                         | 25                                                    |
| NW7750                             | NiCr15Fe7Ti2Al                   | All                      | Solution and precipitation treated                     | —                                           | 65                     | 1 170                                                | 790                                                         | 18                                                    |
| NW6600                             | NiCr15Fe8                        | Round                    | Cold worked                                            | 65                                          | 100                    | 1 170                                                | 790                                                         | 15                                                    |
|                                    |                                  |                          |                                                        | —                                           | 12                     | 830                                                  | 620                                                         | 7 <sup>3)</sup>                                       |
|                                    |                                  |                          |                                                        | 12                                          | 25                     | 760                                                  | 585                                                         | 10                                                    |
|                                    |                                  |                          |                                                        | 25                                          | 65                     | 720                                                  | 550                                                         | 12                                                    |
|                                    |                                  |                          |                                                        | —                                           | 6                      | 690                                                  | 550                                                         | 5 <sup>3)</sup>                                       |
|                                    |                                  | Square Hexagon Rectangle | Cold worked                                            | 6                                           | 10                     | 650                                                  | 480                                                         | 7                                                     |
|                                    |                                  | Round                    | Hot worked                                             | > 6                                         | 12                     | 650                                                  | 310                                                         | 27                                                    |
|                                    |                                  |                          |                                                        | 12                                          | 75                     | 620                                                  | 275                                                         | 27                                                    |
|                                    |                                  |                          |                                                        | 75                                          | —                      | 590                                                  | 240                                                         | 27                                                    |
|                                    |                                  | All                      | Hot worked                                             | All                                         |                        | 590                                                  | 240                                                         | 27                                                    |
| NW6602                             | NiCr15Fe8-LC                     | All                      | Annealed                                               | All                                         |                        | 550                                                  | 240                                                         | 30                                                    |
|                                    |                                  | All                      | Annealed                                               | All                                         |                        | 550                                                  | 180                                                         | 30                                                    |

| Alloy identification <sup>1)</sup> |                    | Cross-section                  | Temper                                     | Diameter or width across flats or thickness |                        | Tensile strength<br>$R_m$ , min<br>N/mm <sup>2</sup> | 0,2 % proof stress<br>$R_{p0.2}$ , min<br>N/mm <sup>2</sup> | Minimum elongation <sup>2)</sup><br>$A_5/A_{50}$<br>% |
|------------------------------------|--------------------|--------------------------------|--------------------------------------------|---------------------------------------------|------------------------|------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| Number                             | Description        |                                |                                            | mm over                                     | mm up to and including |                                                      |                                                             |                                                       |
| NW7718                             | NiCr19Fe19Nb5Mo3   | All                            | Solution and precipitation treated         | —                                           | 100                    | 1 270                                                | 1 030                                                       | 12                                                    |
| NW6002                             | NiCr21Fe18Mo9      | Round                          | Annealed                                   | All                                         | All                    | 660                                                  | 240                                                         | 30                                                    |
| NW6601                             | NiCr23Fe15Al       | All                            | Annealed                                   | All                                         | All                    | 550                                                  | 205                                                         | 30                                                    |
| NW6333                             | NiCr26Fe20Co3Mo3W3 | Round                          | Solution treated                           | All                                         | All                    | 690                                                  | 280                                                         | 35                                                    |
| NW6690                             | NiCr29Fe9          | Round                          | Annealed                                   | All                                         | All                    | 590                                                  | 240                                                         | 30                                                    |
| NW6455                             | NiCr16Mo16Ti       | Round                          | Solution treated                           | All                                         | All                    | 690                                                  | 275                                                         | 35                                                    |
| NW6022                             | NiCr21Mo13Fe4W3    | All                            | Solution treated                           | All                                         | All                    | 690                                                  | 310                                                         | 45                                                    |
| NW6625                             | NiCr22Mo9Nb        | All                            | Annealed                                   | 100                                         | 100                    | 830                                                  | 415                                                         | 30                                                    |
|                                    |                    |                                |                                            | 250                                         | 250                    | 760                                                  | 345                                                         | 25                                                    |
|                                    |                    |                                |                                            | All                                         | All                    | 690                                                  | 275                                                         | 30                                                    |
| NW6621                             | NiCr20Ti           | All                            | Annealed                                   | All                                         | All                    | 640                                                  | 230                                                         | 30                                                    |
| NW7080                             | NiCr20Ti2Al        | All                            | Solution treated and precipitation treated | All                                         | All                    | No tensile test required                             |                                                             |                                                       |
| NW4400                             | NiCu30             | Round                          | Cold worked                                | —                                           | 15                     | 760                                                  | 585                                                         | 83)                                                   |
|                                    |                    | Square Hexagon Rectangle       | Cold worked                                | —                                           | 15                     | 580                                                  | 375                                                         | 103)                                                  |
|                                    |                    | Round                          | Cold worked and stress relieved            | —                                           | 15                     | 580                                                  | 340                                                         | 103)                                                  |
|                                    |                    |                                |                                            | 15                                          | 40                     | 600                                                  | 415                                                         | 20                                                    |
|                                    |                    |                                |                                            | 40                                          | 100                    | 580                                                  | 380                                                         | 20                                                    |
|                                    |                    | Square Hexagon Rectangle       | Cold worked and stress relieved            | All                                         | All                    | 580                                                  | 345                                                         | 203)                                                  |
|                                    |                    | Round Square Rectangle Hexagon | Hot worked                                 | All                                         | All                    | 550                                                  | 275                                                         | 276)                                                  |
|                                    |                    |                                |                                            | —                                           | 55                     | 550                                                  | 275                                                         | 276)                                                  |
|                                    |                    |                                |                                            | 55                                          | —                      | 520                                                  | 205                                                         | 27                                                    |
|                                    |                    | Round                          | Hot worked and stress relieved             | 100                                         | 300                    | 550                                                  | 275                                                         | 27                                                    |
|                                    |                    |                                |                                            | 300                                         | —                      | 520                                                  | 275                                                         | 27                                                    |
|                                    |                    | All                            | Annealed                                   | All                                         | All                    | 480                                                  | 170                                                         | 35                                                    |

| Alloy identification <sup>1)</sup> |                                | Cross-section | Temper                                                 | Diameter or width across flats or thickness |                        | Tensile strength<br>$R_m$ , min<br>N/mm <sup>2</sup> | 0,2 % proof stress<br>$R_{p0,2}$ , min<br>N/mm <sup>2</sup> | Minimum elongation <sup>2)</sup><br>$A_5/A_{50}$<br>% |
|------------------------------------|--------------------------------|---------------|--------------------------------------------------------|---------------------------------------------|------------------------|------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------|
| Number                             | Description                    |               |                                                        | over                                        | mm up to and including |                                                      |                                                             |                                                       |
| NW4402                             | NiCu30-LC                      | All           | Annealed                                               | —                                           | All                    | 430                                                  | 160                                                         | 35                                                    |
| NW5500                             | NiCu30Al3Ti                    | All           | Hot worked and precipitation treated                   | —                                           | 100                    | 970                                                  | 690                                                         | 15                                                    |
|                                    |                                |               |                                                        | 100                                         | —                      | 830                                                  | 550                                                         | 15                                                    |
|                                    |                                | Round         | Cold worked and precipitation treated                  | 6                                           | 25                     | 1 000                                                | 755                                                         | 14                                                    |
|                                    |                                |               |                                                        | 25                                          | 75                     | 970                                                  | 690                                                         | 16                                                    |
|                                    |                                |               |                                                        | 75                                          | 100                    | 930                                                  | 655                                                         | 20                                                    |
|                                    |                                | Hexagon       | Cold worked and precipitation treated                  | 6                                           | 25                     | 970                                                  | 585                                                         | 15                                                    |
| NW8825                             | NiFe30Cr21Mo3                  | All           | Solution and precipitation treated                     | —                                           | 25                     | 900                                                  | 620                                                         | 20                                                    |
|                                    |                                |               |                                                        | 25                                          | 100                    | 900                                                  | 585                                                         | 20                                                    |
|                                    |                                |               |                                                        | 100                                         | 300                    | 830                                                  | 500                                                         | 15                                                    |
|                                    |                                |               |                                                        |                                             | All                    | 590                                                  | 240                                                         | 30 <sup>4)</sup>                                      |
| NW9911                             | NiFe36Cr14Mo6Ti3 <sup>7)</sup> | All           | Solution treated, stabilized and precipitation treated |                                             | All                    | 960 <sup>7)</sup>                                    | 690 <sup>7)</sup>                                           | 8 <sup>7)</sup>                                       |
| NW0276                             | NiMo16Cr15Fe6W4                | All           | Solution treated                                       |                                             | All                    | 690                                                  | 275                                                         | 40                                                    |
| NW0665                             | NiMo28                         | Round         | Solution treated                                       | 7                                           | 90                     | 780                                                  | 350                                                         | 35                                                    |
| NW0001                             | NiMo30Fe5                      | Round         | Solution treated                                       | 7                                           | 40                     | 790                                                  | 315                                                         | 30                                                    |
|                                    |                                |               |                                                        | 40                                          | 90                     | 690                                                  | 315                                                         | 27                                                    |

| Alloy identification <sup>1)</sup> |                  | Cross-section | Temper     | Diameter or width across flats or thickness |                        | Tensile strength               | 0,2 % proof stress                  | Minimum elongation <sup>2)</sup> |
|------------------------------------|------------------|---------------|------------|---------------------------------------------|------------------------|--------------------------------|-------------------------------------|----------------------------------|
| Number                             | Description      |               |            | mm over                                     | mm up to and including | $R_m$ min<br>N/mm <sup>2</sup> | $R_{p0.2}$ min<br>N/mm <sup>2</sup> | $A_5/A_{50}$<br>%                |
| NW8800                             | FeNi32Cr2AlTi    | All           | Hot worked |                                             | All                    | 550                            | 240                                 | 25 <sup>3)</sup>                 |
|                                    |                  | All           | Annealed   |                                             | All                    | 520                            | 205                                 | 30                               |
| NW8810                             | FeNi32Cr21AlTi   | All           | Annealed   |                                             | All                    | 450                            | 170                                 | 30                               |
| NW8811                             | FeNi32Cr21AlTi4  | All           | Annealed   |                                             | All                    | 450                            | 170                                 | 30                               |
| NW8801                             | FeNi32Cr20Ti     | All           | Annealed   |                                             | All                    | 450                            | 170                                 | 30                               |
| NW8020                             | FeNi35Cr20Cu4Mo2 | All           | Annealed   |                                             | All                    | 550                            | 240                                 | 27 <sup>6)</sup>                 |

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

2) The elongation values listed are based on either:

- a proportional gauge length of  $5,65 \sqrt{S_0}$  where  $S_0$  is the original cross-sectional area, or
- a fixed gauge length of 50 mm =  $A_{50}$

3) Elongation is not applicable to diameters, width across flats or thicknesses under 2,5 mm.

4) Elongation shall be a minimum of 25 % for rectangles with thicknesses up to and including 8 mm.

5) For alloy NW7263/NiCo20Cr20Mo5Ti2Al, the tensile test shall be carried out at 780 °C.

6) Elongation shall be 20 % minimum for rectangles with thicknesses up to and including 8 mm.

7) For alloy NW9911/NiFe36Cr12Mo8Ti3, the tensile test shall be carried out at 575 °C.

8) Elongation shall be 15 % minimum for cold-worked and annealed bars.

Table 3 — Heat treatment of precipitation-hardenable alloys

| Alloy identification <sup>1)</sup>                                                                          |                    | Solution or annealing treatment <sup>2)</sup>  | Stabilizing and/or precipitation treatment                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number                                                                                                      | Description        |                                                |                                                                                                                                                                                                     |
| NW3021                                                                                                      | NiCo20Cr15Mo5Al4Ti | (1 150 ± 10) °C, 4 h, air cool.                | 1 050 °C, 16 h, air cool + 850 °C, 16 h, air cool.                                                                                                                                                  |
| NW7263                                                                                                      | NiCo20Cr20Mo5Ti2Al | 1 150 °C, air cool or faster.                  | 800 °C, 8 h, air cool.                                                                                                                                                                              |
| NW7001                                                                                                      | NiCr20Co13Mo4Ti3Al | 995 °C to 1 040 °C, 4 h, oil or water quench.  | 845 °C, 4 h, air cool + 760 °C, 16 h, air cool or furnace cool.                                                                                                                                     |
| NW7090                                                                                                      | NiCr20Co18Ti3      | 1 050 °C to 1 100 °C, 8 h, air cool or faster. | 700 °C, 16 h, air cool.                                                                                                                                                                             |
| NW7750                                                                                                      | NiCr15Fe7Ti2Al     | 980 °C to 1 100 °C, air cool or faster.        | 730 °C, 8 h, cool at 55 °C/h to 620 °C, hold at 620 °C for 8 h, air cool. Alternatively, cool to 620 °C at any speed and hold at 620 °C to give a total precipitation treatment time of 18 h.       |
| NW7718                                                                                                      | NiCr19Fe19Nb5Mo3   | 940 °C to 1 060 °C, air cool or faster.        | 720 °C, 8 h, cool at 55 °C/h to 620 °C, hold at 620 °C for 8 h, air cool. Alternatively, cool to 620 °C at any rate and hold at 620 °C to give a total precipitation treatment time of 18 h.        |
| NW7080                                                                                                      | NiCr20Ti2Al        | 1 050 °C to 1 100 °C, 8 h, air cool or faster. | 700 °C, 16 h, air cool.                                                                                                                                                                             |
| NW5500                                                                                                      | NiCu30Al3Ti        | 980 °C minimum, water quench.                  | 590 °C, 8 h to 16 h, furnace cool to 480 °C at between 8 °C/h and 15 °C/h, air cool. Alternatively, furnace cool to 535 °C, hold at 535 °C for 6 h, furnace cool to 480 °C, hold for 8 h, air cool. |
| NW9911                                                                                                      | NiFe36Cr12Mo6Ti3   | 1 090 °C, air cool.                            | 770 °C, 2 h to 4 h, air cool + 700 °C, 24 h, air cool.                                                                                                                                              |
| 1) For alloy identification either the number or the description may be used.                               |                    |                                                |                                                                                                                                                                                                     |
| 2) The tolerance on the selected temperature shall be within ± 15 °C, unless stated otherwise in the table. |                    |                                                |                                                                                                                                                                                                     |

Table 4 — Creep or stress rupture test requirements

| Alloy Identification <sup>1)</sup>                                                                                                                                                                                                                                                                                                           |                    | Thickness | Temperature | Stress            | Minimum time to rupture | Elongation at rupture on 50 mm | Duration | Total plastic strain |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------|-------------|-------------------|-------------------------|--------------------------------|----------|----------------------|
| Number                                                                                                                                                                                                                                                                                                                                       | Description        | mm        | °C          | N/mm <sup>2</sup> | h                       | %                              | h        | %                    |
| NW3021                                                                                                                                                                                                                                                                                                                                       | NiCo20Cr15Mo5Al4Ti | All       | 815         | 360 <sup>2)</sup> | 30                      | —                              | —        | —                    |
| NW7263                                                                                                                                                                                                                                                                                                                                       | NiCo20Cr20Mo5Ti2Al | All       | 780         | 120               | —                       | —                              | 50       | 0,10                 |
| NW7001                                                                                                                                                                                                                                                                                                                                       | NiCr20Co13Mo4Ti3Al | All       | 730         | 550 <sup>2)</sup> | 23                      | 5                              | —        | —                    |
| NW7090                                                                                                                                                                                                                                                                                                                                       | NiCr20Co18Ti3      | All       | 870         | 140 <sup>2)</sup> | 30                      | —                              | —        | —                    |
| NW7718                                                                                                                                                                                                                                                                                                                                       | NiCr19Fe19Nb5Mo3   | max. 100  | 650         | 690 <sup>2)</sup> | 23                      | 5                              | —        | —                    |
| NW7080                                                                                                                                                                                                                                                                                                                                       | NiCr20Ti2Al        | All       | 750         | 340 <sup>2)</sup> | 30                      | —                              | —        | —                    |
| NW9911                                                                                                                                                                                                                                                                                                                                       | NiFe36Cr12Mo6Ti3   | All       | 575         | 590               | —                       | —                              | 100      | 0,10                 |
| 1) For alloy identification either the number or the description may be used.                                                                                                                                                                                                                                                                |                    |           |             |                   |                         |                                |          |                      |
| 2) An initially higher stress may be used but shall not be changed while the test is in progress. Specified time to rupture and elongation requirements have to be met. Alternatively, stress may be increased after the minimum rupture life has been met at the specified stress; however, the specified minimum elongation has to be met. |                    |           |             |                   |                         |                                |          |                      |

**Table 5 — Tolerances for cold-worked bars  
(including cold-worked, heat-treated and descaled bars)**

Values in millimetres

| Specified dimension <sup>1)</sup>                                                                                                                                                                                                                                                                                 |      |                     | Tolerance      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------|----------------|
| Cross-section                                                                                                                                                                                                                                                                                                     | over | up to and including |                |
| Round                                                                                                                                                                                                                                                                                                             | —    | 10                  | +0,03<br>-0,08 |
|                                                                                                                                                                                                                                                                                                                   | 10   | 25                  | +0,03<br>-0,11 |
|                                                                                                                                                                                                                                                                                                                   | 25   | 65                  | +0,05<br>-0,13 |
| Square<br>Hexagon<br>Rectangle                                                                                                                                                                                                                                                                                    | —    | 10                  | +0,03<br>-0,08 |
| <p>1) The following dimensions and tolerances apply.</p> <p>a) Round bars: diameter.<br/>The circularity tolerance is half the total diameter tolerance and shall be within the diameter tolerance.</p> <p>b) Square and hexagonal bars: width across flats.</p> <p>c) Rectangular bars: thickness and width.</p> |      |                     |                |

**Table 6 — Tolerances for hot-worked bars (including hot-worked, heat-treated and descaled bars)**

Dimensions in millimetres

| Specified dimensions <sup>1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                |                     | Hot rolled | Tolerance <sup>1)</sup>                          |                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------|--------------------------------------------------|-----------------------------------|
| over                                                                                                                                                                                                                                                                                                                                                                                                                              | up to and including |            | Forged<br>up to and including 3 500 mm in length | Forged<br>over 3 500 mm in length |
|                                                                                                                                                                                                                                                                                                                                                                                                                                   | 25                  | ± 0,5      | ± 0,9                                            | ± 2,6                             |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                | 50                  | ± 0,8      | ± 1,1                                            | ± 2,9                             |
| 50                                                                                                                                                                                                                                                                                                                                                                                                                                | 100                 | ± 1,3      | ± 1,7                                            | ± 3,6                             |
| 100                                                                                                                                                                                                                                                                                                                                                                                                                               | 150                 | ± 1,8      | ± 2,3                                            | ± 4,6                             |
| 150                                                                                                                                                                                                                                                                                                                                                                                                                               | (315)               | —          | ± 4,2                                            | ± 7                               |
| <p>1) The following dimensions and tolerances apply.</p> <p>a) Round bars: diameter.<br/>The circularity tolerance for bars<br/>— up to and including 15 mm is the total diameter tolerance;<br/>— over 15 mm is half the total diameter tolerance.<br/>The circularity tolerance is within the diameter tolerance.</p> <p>b) Square and hexagonal bars: width across flats.</p> <p>c) Rectangular bars: thickness and width.</p> |                     |            |                                                  |                                   |

**Table 7 — Tolerances on diameter for hot-worked and machined round bars (including hot-worked and rough turned or ground bars)**

Dimensions in millimetres

| Specified diameter |                     | Tolerances   |
|--------------------|---------------------|--------------|
| over               | up to and including |              |
| —                  | 50                  | $+0,8$<br>0  |
| 50                 | 75                  | $+1,0$<br>0  |
| 75                 | 100                 | $+1,5$<br>0  |
| 100                | —                   | By agreement |

**Table 8 — Tolerance on length**

| Length                                                | Tolerance                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Random mill lengths:<br>Hot worked<br><br>Cold worked | Lengths between 1 800 mm and 7 800 mm, with short lengths of not more than 25 % of mass between 1 800 mm and 2 750 mm <sup>1)</sup><br><br>Lengths between 1 800 mm and 6 100 mm, with short lengths of not more than 25 % of mass between 1 800 mm and 3 000 mm               |
| Multiple lengths                                      | Furnished in multiples of a specified unit length, in lengths between 1 800 mm and 7 300 mm. For each multiple the cutting tolerance is $+7$ <sub>0</sub> mm, unless otherwise specified.<br>At the manufacturer's option, individual specified unit lengths may be furnished. |
| Nominal lengths                                       | Specified lengths of minimum 600 mm with no shorter length allowed. <sup>2)</sup>                                                                                                                                                                                              |
| Cut lengths                                           | Specified lengths to which all bars are cut with the following tolerances, for cross-sectional dimensions<br>— up to and including 200 mm : $+4$ <sub>0</sub> mm;<br>— over 200 mm : $+7$ <sub>0</sub> mm                                                                      |

1) For hot-worked bars weighing over 35 kg/m and for smooth forged bars with all cross-sections, short lengths down to 600 mm may be supplied.

2) For cold-worked bars with cross-sections up to and including 15 mm, ordered to nominal or stock lengths with a 600 mm range, at least 93 % of such bars shall be within the range specified. The remainder may be in shorter lengths, but in no case less than 1 200 mm.

## Annex A (normative)

### List of ISO methods of analysis

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| <p>[1] ISO 6351:1985, <i>Nickel — Determination of silver, bismuth, cadmium, cobalt, copper, iron, manganese, lead and zinc contents — Flame atomic absorption spectrometric method.</i></p> <p>[2] ISO 7523:1985, <i>Nickel — Determination of silver, arsenic, bismuth, cadmium, lead, antimony, selenium, tin, tellurium and thallium contents — Electrothermal atomic absorption spectrometric method.</i></p> <p>[3] ISO 7524:1985, <i>Nickel, ferronickel and nickel alloys — Determination of carbon content — Infra-red absorption method after induction furnace combustion.</i></p> <p>[4] ISO 7525:1985, <i>Nickel — Determination of sulfur content — Methylene blue molecular absorption spectrometric method after generation of hydrogen sulfide.</i></p> <p>[5] ISO 7526:1985, <i>Nickel, ferronickel and nickel alloys — Determination of sulfur content — Infra-red absorption method after induction furnace combustion.</i></p> <p>[6] ISO 7527:1985, <i>Nickel, ferronickel and nickel alloys — Determination of sulfur content — Iodimetric titration method after induction furnace combustion.</i></p> <p>[7] ISO 7528:1989, <i>Nickel alloys — Determination of iron content — Titrimetric method with potassium dichromate.</i></p> <p>[8] ISO 7529:1989, <i>Nickel alloys — Determination of chromium content — Potentiometric titration method with ammonium iron(II) sulfate.</i></p> <p>[9] ISO 7530-1:1990, <i>Nickel alloys — Flame atomic absorption spectrometric analysis — Part 1: General requirements and sample dissolution.</i></p> | <p>[10] ISO 7530-2:1990, <i>Nickel alloys — Flame atomic absorption spectrometric analysis — Part 2: Determination of cobalt content.</i></p> <p>[11] ISO 7530-3:1990, <i>Nickel alloys — Flame atomic absorption spectrometric analysis — Part 3: Determination of chromium content.</i></p> <p>[12] ISO 7530-4:1990, <i>Nickel alloys — Flame atomic absorption spectrometric analysis — Part 4: Determination of copper content.</i></p> <p>[13] ISO 7530-5:1990, <i>Nickel alloys — Flame atomic absorption spectrometric analysis — Part 5: Determination of iron content.</i></p> <p>[14] ISO 7530-6:1990, <i>Nickel alloys — Flame atomic absorption spectrometric analysis — Part 6: Determination of manganese content.</i></p> <p>[15] ISO 7530-7:1992, <i>Nickel alloys — Flame atomic absorption spectrometric analysis — Part 7: Determination of aluminium content.</i></p> <p>[16] ISO 7530-8:1992, <i>Nickel alloys — Flame atomic absorption spectrometric analysis — Part 8: Determination of silicon content.</i></p> <p>[17] ISO 7530-9:—<sup>1)</sup>, <i>Nickel alloys — Flame atomic absorption spectrometric analysis — Part 9: Determination of vanadium content.</i></p> <p>[18] ISO 9388:1992, <i>Nickel alloys — Determination of phosphorus content — Molybdenum blue molecular absorption spectrometric method.</i></p> <p>[19] ISO 9389:1989, <i>Nickel alloys — Determination of cobalt content — Potentiometric titration method with potassium hexacyanoferrate(III).</i></p> |
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1) To be published.