

Specification for

# Nickel and nickel alloys: strip

UDC 669.24 – 122.2 – 418

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| Confirmed<br>May 2009 |
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# Cooperating organizations

The Non-Ferrous Metals Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following Government department and scientific and industrial organizations:

- Aluminium Federation
- Association of Bronze and Brass Founders
- BNF Metals Technology Centre\*
- British Electrical and Allied Manufacturers' Association
- British Lead Manufacturers' Association
- British Non-Ferrous Metals Federation
- Copper Development Association
- Electric Cable Makers' Confederation
- Institute of British Foundrymen
- Institution of Mechanical Engineers (Automobile Division)
- Institution of Mining and Metallurgy
- Institution of Production Engineers
- Institution of Structural Engineers
- Lead Development Association
- Light Metal Founders' Association
- London Metal Exchange
- Magnesium Industry Council
- Ministry of Defence\*
- National Brassfoundry Association
- Non-Ferrous Metal Stockists\*
- Royal Institute of British Architects
- Society of Motor Manufacturers and Traders Limited
- Tin Research Institute
- Zinc Development Association
- Individual manufacturer\*

The Government department and the scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- British Steel Industry
- Engineering Equipment Users' Association
- Oil Companies Materials Association
- Process Plant Association

## Amendments issued since publication

| Amd. No. | Date of issue | Comments                              |
|----------|---------------|---------------------------------------|
| 3467     | December 1980 |                                       |
| 4201     | March 1983    | Indicated by a sideline in the margin |
|          |               |                                       |
|          |               |                                       |

This British Standard, having been prepared under the direction of the Non-Ferrous Metals Standards Committee, was published under the authority of the Executive Board on 31 May 1977

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First published March 1959  
First revision December 1968  
Second revision May 1977

The following BSI references relate to the work on this standard:  
Committee reference NFE/10  
Draft for comment 76/74495 DC

ISBN 0 580 09692 0

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## Foreword

This British Standard is one of a series for nickel and nickel alloys in various forms intended for general engineering purposes. Others in the series are:

BS 3071, *Nickel-copper alloy castings*.

BS 3072, *Nickel and nickel alloys: sheet and plate*.

BS 3074, *Nickel and nickel alloys: tube*.

BS 3075, *Nickel and nickel alloys: wire*.

BS 3076, *Nickel and nickel alloys: rods and bar*.

All the alloys included in the previous edition have been retained although details for the specific requirements have been revised where necessary. One additional alloy has been added, alloy NA12, low-carbon nickel.

This standard is now fully metricated. Where material of deep drawing quality is required provision has now been made for it to be supplied to a recognized grain size number.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

# Section 1. General requirements

## 1 Scope

This British Standard specifies requirements for nickel and nickel alloys in the form of cold rolled strip in coil and flat lengths, in thicknesses over 0.05 mm up to and including 4.0 mm and in widths up to and including 300 mm.

## 2 References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

## 3 Definitions

For the purposes of this British Standard the following definitions apply.

### 3.1 strip

a rolled product of rectangular section

### 3.2 cast

the product of a furnace melt, or of a number of melts that are mixed prior to casting

### 3.3 batch

strip of the same thickness from the same cast produced in the same way and heat treated together or, in the case of continuous heat treatment, from a run of not more than 8 h

### 3.4 annealing

a heat treatment of alloys for the purpose of softening

### 3.5 solution treatment

the heat treatment of alloys at a suitable temperature for sufficient time to ensure adequate solution of a certain phase (or phases), followed by cooling at a suitable rate to ensure retention of the phase (or phases) in solution. The term is also associated with material in the softest condition

### 3.6 precipitation treatment

the heat treatment of alloys to promote precipitation in order to produce optimum creep, or stress rupture and/or tensile characteristics. It may be accompanied by a change in hardness

## 4 Information to be supplied by the purchaser

The purchaser shall state the following at the time of the enquiry and order:

- a) the number of this British Standard and the designation of the material required (as given for the relevant material in section 2);
- b) width, thickness, and mass or length of material required;
- c) whether coil, cut lengths or random straight lengths are required;
- d) when required whether 1.0 % proof stress values are to be determined in place of the 0.2 % proof stress values (see 9.1);
- e) whether a test certificate is required (see clause 10);
- f) whether the purchaser desires to witness tests or inspections, and, if so, which tests and/or inspections are to be witnessed (see clause 11);
- g) the nature and detail of any special requirements including finish required;
- h) the condition of the material (see section 2).

## 5 Freedom from defects

Cold rolled strip shall be clean, smooth and free from harmful defects.

## 6 Samples for chemical analysis

The chemical composition of each cast of material shall be determined on a sample that shall be representative of the cast.

## 7 Dimensional tolerances

**7.1 Thickness.** The thickness of cold rolled strip shall not differ from the specified thickness at any point by more than the appropriate tolerance specified in Table 1 and Table 2. For material supplied with the surface pickled clean, the tolerances shall be increased by 0.012 mm.

**7.2 Width.** The width of sheared strip shall not differ from that specified by more than the appropriate tolerance specified in Table 3.

**7.3 Length.** Strip ordered to a specified length shall not differ from that length by more than the appropriate tolerance specified in Table 4.

**7.4 Straightness (edge curvature).** The edge curvature (depth of arc), when the strip is flat, shall not exceed 15 mm in any 2 m length.

## 8 Selection of samples for mechanical test

Strip shall be grouped into batches. One test sample shall be cut to provide one tensile and one grain size and/or hardness test piece from each batch.

Before test samples are cut they shall be marked to identify them with the batch they represent. Test samples shall be taken from material as supplied and, except in certain cases for alloy NA18, shall be tested in that condition.

When alloy NA18 is supplied in other than the finally heat treated condition the hardness shall be determined on material in the condition as supplied, but the sample for the tensile test shall be precipitation treated using the conditions recommended by the supplier which shall be within the ranges given in Appendix A.

**Table 1 — Tolerances on thickness of cold rolled strip (alloys NA11, NA12 and NA13)**

| Thickness |                     | Tolerance (plus and minus)      |
|-----------|---------------------|---------------------------------|
| Over      | Up to and including | Up to and including 200 mm wide |
| mm        | mm                  | mm                              |
| 0.05      | 0.15                | 0.013                           |
| 0.15      | 0.70                | 0.025                           |
| 0.70      | 1.0                 | 0.04                            |
| 1.0       | 1.6                 | 0.05                            |
| 1.6       | 2.5                 | 0.06                            |
| 2.5       | 4.0                 | 0.08                            |

## 9 Tests

**9.1 Tensile test.** For the tensile test, test pieces shall be prepared and the test carried out in accordance with the requirements of BS 18-1.

When strip is less than 50 mm wide tensile test pieces may be of the full width of the strip.

Test pieces shall be of the full thickness of the strip and shall normally be cut parallel to the direction of rolling, but where this is impracticable they may be cut transversely.

Values of 0.2 % proof stress are normally determined for acceptance purposes, but 1.0 % proof stress values may be determined if required by the purchaser and agreed at the time of the enquiry and order.

**9.2 Hardness test.** Vickers hardness tests shall be determined in accordance with the requirements of BS 427-1. The test load used should be reasonably large having regard to the condition of the test piece and the value should be included in the report of the test result.

**9.3 Grain size.** When estimation of grain size is required, the method used and the rules for expressing average grain size shall be as given in ASTM E112-81.<sup>1)</sup>

**Table 2 — Tolerances on thickness of cold rolled strip (alloys NA14, NA15, NA16, NA17 and NA18)**

| Thickness |                     | Materials NA14, NA15, NA16, NA17 and NA18 | Materials NA14 and NA15                     |
|-----------|---------------------|-------------------------------------------|---------------------------------------------|
|           |                     | Tolerance (plus and minus)                | Tolerance (plus and minus)                  |
| Over      | Up to and including | Up to and including 200 mm wide           | Over 200 mm up to and including 300 mm wide |
| mm        | mm                  | mm                                        | mm                                          |
| 0.05      | 0.15                | 0.013                                     | 0.013                                       |
| 0.15      | 0.25                | 0.025                                     | 0.025                                       |
| 0.25      | 0.45                | 0.04                                      | 0.04                                        |
| 0.45      | 0.70                | 0.05                                      | 0.05                                        |
| 0.70      | 1.0                 | 0.06                                      | 0.06                                        |
| 1.0       | 1.6                 | 0.08                                      | 0.08                                        |
| 1.6       | 2.5                 | 0.09                                      | 0.10                                        |
| 2.5       | 4.0                 | 0.10                                      | 0.13                                        |

**9.4 Retests.** If any one of the test pieces first selected fails to pass the tests, two further samples from the same batch shall be selected for testing, one of which shall be from the strip from which the original test sample was taken, unless that strip has been withdrawn by the supplier.

If the test pieces from both these additional sample pass, the batch represented by the test samples shall be deemed to comply with the requirements of this standard. If the test pieces from either of these additional samples fail, the batch represented by these samples shall be deemed not to comply with the requirements of this standard.

<sup>1)</sup> Copies of this specification are obtainable from American Technical Publishers Ltd., 68a Wilbury Way, Hitchin, Herts. SG4 0TP.