
Nickel and nickel alloy forgings

Pièces forgées en nickel et alliages de nickel

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Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Alloy identification	1
5 Information to be supplied by the purchaser	1
6 Requirements	2
6.1 Requirements for forgings heat treated by the manufacturer	2
6.1.1 General	2
6.1.2 Composition	2
6.1.3 Tensile properties	2
6.1.4 Heat treatment	2
6.1.5 Grain size	3
6.1.6 Creep or stress rupture properties	3
6.1.7 Hardness	3
6.1.8 Dimensional tolerances	3
6.1.9 Surface condition	3
6.2 Requirements for forgings to be heat treated by purchaser	3
6.2.1 Composition	3
6.2.2 Temper	3
6.2.3 Precipitation-hardenable alloys	3
6.2.4 Dimensional tolerances	3
6.2.5 Surface condition	3
7 Sampling	3
7.1 Chemical analysis	3
7.2 Tensile, creep or stress rupture test	4
7.3 Heat treatment of test samples	4
7.3.1 Forgings supplied in hot-worked temper	4
7.3.2 Forgings supplied in heat-treated temper	4
8 Number of tests	4
8.1 Determination of the chemical composition	4
8.2 Forgings heat treated by the manufacturer	4
8.3 Forgings to be heat treated by the purchaser	4
9 Test procedures	5
9.1 Determination of the chemical composition	5
9.2 Tensile tests	5
9.3 Creep and stress rupture tensile	5
9.4 Grain size determination	5
9.5 Rounding of results	5
9.6 Retests	5
10 Marking	6
11 Purchaser or third part inspection	6
12 Declaration of conformity	6
Annex A (normative) Rules for nickel and nickel alloys identification based on chemical symbols	15
Bibliography	17

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 155, *Nickel and nickel alloys*.

This second edition cancels and replaces the first edition (ISO 9725:1992), [Clause 2](#) and [Table 2](#) of which have been technically revised.

Nickel and nickel alloy forgings

1 Scope

This document specifies requirements for nickel and nickel alloy forgings for general purposes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 204, *Metallic materials — Uniaxial creep testing in tension — Method of test*

ISO 6372, *Nickel and nickel alloys — Terms and definitions*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature*

ASTM E112, *Standard test methods for determining average grain size*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6372 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

heat

molten metal poured from a single furnace or molten metal from two or more furnaces poured into a single ladle

3.2

lot

forgings of the same cross-sectional dimensions, from the same *heat* (3.1), heat treated together or sequentially heat treated in a continuous furnace, but in no case for no longer than 16 h of production

Note 1 to entry: For forgings not identified by heat, the lot either consists of one piece or is less than 500 kg.

4 Alloy identification

For the purposes of this document, the principles for alloy identification are given in [Annex A](#).

5 Information to be supplied by the purchaser

The purchaser shall give clear information in the enquiry and order, in particular, on the following:

- a) the number of this document, i.e. ISO 9725;
- b) quantity (mass or number of pieces) of forgings required;

- c) alloy name or alloy number of the material of which the forgings are made (see [Table 1](#));
- d) alloy temper (see [Table 2](#));
- e) the forgings dimensions or the drawing number(s) containing the dimensions, tolerances on dimensions, shape and surface finish, to which the forgings shall conform;
- f) if the purchaser will heat treat the product;
- g) optional requirements:
 - 1) samples for the finished product analysis (see [7.1.2](#));
 - 2) type of test sample for mechanical tests (see [7.2](#));
 - 3) determination of 1 % proof stress (see [9.2.3](#));
 - 4) hardness as acceptance test (see [6.1.7](#));
 - 5) surface condition (see [6.1.9](#) Note);
 - 6) individual forging marking (see [10.2](#));
 - 7) purchaser or third party inspection (see [Clause 11](#));
 - 8) declaration of conformity (see [Clause 12](#));
 - 9) any other special requirements, e.g. alloy making process, hot working process and degree of hot working, information on the forging procedure and the calculated forging reduction, greater tolerance to chemical composition, etc.

6 Requirements

6.1 Requirements for forgings heat treated by the manufacturer

6.1.1 General

Unless required in the hot-finished temper, forgings shall be supplied in the annealed, solution treated or solution and precipitation-treated temper.

Unless otherwise specified, precipitation-hardenable alloy forgings shall be supplied in the solution-treated temper.

6.1.2 Composition

The composition shall meet the composition limits specified in [Table 1](#).

The composition limits do not exclude the possible presence of other elements that are not specified. If the purchaser's requirements necessitate limits for 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 %.

6.1.3 Tensile properties

Forgings shall have the tensile properties specified in [Table 2](#).

6.1.4 Heat treatment

Precipitation-hardenable alloy forgings shall be heat treated in accordance to the information given in [Table 3](#) to the condition as ordered.

6.1.5 Grain size

Forgings of alloys NW8810 (FeNi32Cr21AlTi-HC) and NW8811 (FeNi32Cr21AlTi-HT) shall have a grain size ASTM n°5 as coarser (average diameter 0,06 mm maximum).

6.1.6 Creep or stress rupture properties

Where applicable, forgings of precipitation-hardenable alloys shall meet the creep or stress rupture requirements shown in [Table 4](#).

6.1.7 Hardness

If it is required that qualification and acceptance of forgings be based on hardness instead of tensile properties, the hardness values to be met and the hardness test to be used shall be specified on the order or drawing.

6.1.8 Dimensional tolerances

Dimensions and tolerances shall be as specified on the order or drawing.

6.1.9 Surface condition

Forgings shall be clean and free from detrimental surface imperfections.

NOTE Where appropriate, the acceptance criteria are agreed between the purchaser and the supplier.

6.2 Requirements for forgings to be heat treated by purchaser

6.2.1 Composition

The specifications of [6.1.2](#) apply.

6.2.2 Temper

Unless otherwise specified, forgings to be heat treated by the purchaser shall be supplied in the hot-worked temper.

6.2.3 Precipitation-hardenable alloys

The supplier of precipitation-hardenable alloy forgings shall demonstrate the capacity 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 Dimensional tolerances

The specifications of [6.1.8](#) apply.

6.2.5 Surface condition

The specifications of [6.1.9](#) apply.

7 Sampling

7.1 Chemical analysis

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