

Passivation of corrosion-resistant stainless-steel fasteners

The European Standard EN ISO 16048:2003 has the status of a
British Standard

ICS 21.060.01

National foreword

This British Standard is the official English language version of EN ISO 16048:2003. It is identical with ISO 16048:2003.

The UK participation in its preparation was entrusted to Technical Committee FME/9, Bolts, nuts and accessories (+QA and hose clamps), which has the responsibility to:

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Summary of pages

This document comprises a front cover, an inside front cover, the EN ISO title page, the EN ISO foreword page, the ISO title page, pages ii to iv, pages 1 to 4, and inside back cover and a back cover.

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Amendments issued since publication

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ICS 21.060.01

English version

Passivation of corrosion-resistant stainless-steel fasteners (ISO 16048:2003)

Passivation des éléments de fixation en acier inoxydable résistant à la corrosion (ISO 16048:2003)

Passivierung von Verbindungselementen aus nichtrostenden Stählen (ISO 16048:2003)

This European Standard was approved by CEN on 2 January 2003.

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Foreword

This document (EN ISO 16048:2003) has been prepared by Technical Committee ISO/TC 2 "Fasteners" in collaboration with Technical Committee CEN/TC 185 "Threaded and non-threaded mechanical fasteners and accessories", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2003, and conflicting national standards shall be withdrawn at the latest by August 2003.

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NOTE FROM CMC The foreword is susceptible to be amended on reception of the German language version. The confirmed or amended foreword, and when appropriate, the normative annex ZA for the references to international publications with their relevant European publications will be circulated with the German version.

Endorsement notice

The text of ISO 16048:2003 has been approved by CEN as EN ISO 16048:2003 without any modifications.

INTERNATIONAL
STANDARD

ISO
16048

First edition
2003-02-01

**Passivation of corrosion-resistant
stainless-steel fasteners**

*Passivation des éléments de fixation en acier inoxydable résistant à la
corrosion*



Reference number
ISO 16048:2003(E)

Foreword

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ISO 16048 was prepared by Technical Committee ISO/TC 2, *Fasteners*, Subcommittee SC 1, *Mechanical properties of fasteners*.

Introduction

In the preparation of this International Standard special attention has been given to the fundamental fact that a surface film of chromium oxide is immediately formed when producing stainless steel or products made of stainless steel. It is this very thin oxide film which can be thickened by passivation. The thickness of the layer is about 0,002 μm .

Passivation of corrosion-resistant stainless-steel fasteners

1 Scope

This International Standard specifies the methods most often used for passivation of corrosion-resistant stainless steel fasteners.

Typical anodic dissolution behaviour of an active-passive-transpassive metal is given in Annex A.

2 Normative references

The following referenced documents are indispensable for the application 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 3506-1:1997, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 1: Bolts, screws and studs*

ISO 3506-2:1997, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 2: Nuts*

ISO 3506-3:1997, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 3: Set screws and similar fasteners not under tensile stress*

ISO 3506-4:—¹⁾, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 4: Tapping screws*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

passivation

chemical treatment that increases the thickness of the naturally occurring chromium rich oxide film present on all types of stainless-steel surfaces

3.2

passivity

chemically inactive surface condition of stainless steels

1) To be published.

4 Passivation

4.1 Pickling prior to passivation

Before passivation, a pickling treatment in a bath selected from those listed in Table 1 is recommended.

Before pickling, the fasteners shall be degreased and rinsed.

Table 1 — Pickling baths

Steel grade ^a	Chemicals	Concentration ^c volume %	Temperature ^c °C	Exposure time for fresh bath ^c min
A2 A3 A4 A5 C3 ^b F1	HNO ₃	20 to 30	20 to 60	10 to 30
	H ₂ SO ₄	8 to 11	60 to 80	5 to 30
A1 C1 ^b C4 ^b	HNO ₃	10 to 15	20 to 60	10 to 30
	H ₂ SO ₄	8 to 11	60 to 80	5 to 30

^a Steel grades in accordance with ISO 3506-1, ISO 3506-2, ISO 3506-3 and ISO 3506-4.

^b Prior to pickling, hot forged C1, C3 and C4 fasteners shall be soft annealed to the softest condition and shot-peened in order to reduce the risk of hydrogen embrittlement. For fasteners manufactured from soft annealed and ground C1, C3 and C4 raw material only a shot peening may be necessary.

^c If necessary, values outside the specified ranges are permitted in adjusting the acid concentration, temperature and exposure time.

4.2 Passivation process

After pickling, the fastener shall be passivated in a bath selected from those listed in Table 2.

Table 2 — Passivation baths

Steel grade ^a	Chemicals	Concentration volume %	Temperature °C	Typical exposure time min
A2, A3, A4, A5 C1 F1	HNO ₃	20 to 50	20 to 40	10 to 30
A1 C4	HNO ₃ ^b	25 to 35	15 to 40	
A1	HNO ₃ + Na ₂ Cr ₂ O ₇ ·2H ₂ O ^c	15 to 25		
C4	HNO ₃ + Na ₂ Cr ₂ O ₇ ·2H ₂ O ^c	2 to 6		
^a Steel grades in accordance with ISO 3506-1, ISO 3506-2, ISO 3506-3 and ISO 3506-4. ^b Use preferably this bath. ^c The addition of Na ₂ Cr ₂ O ₇ ·2H ₂ O may be used to minimize the discoloration or etching of high carbon and free-cutting stainless steels.				

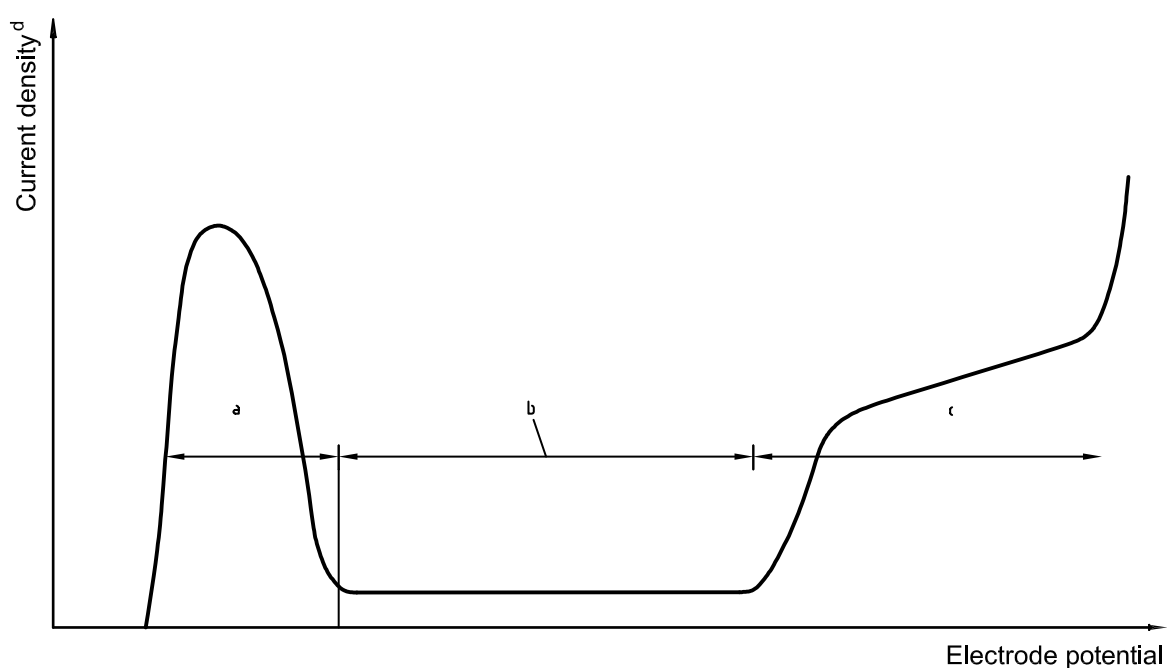
5 Verification of passivation

Passivation shall be verified by the manufacturer's quality assurance system. There is no known referee test method for passivation.

Annex A (informative)

Passivity

Figure A.1 schematically illustrates the typical behaviour of an active-passive-transpassive metal. The metal initially demonstrates behaviour similar to non-passivating metals, i.e., as the electrode potential is made more positive, the metal follows typical Tafel behaviour, and dissolution rate increases exponentially. This is the active region. At more noble potentials, dissolution rate decreases to a very small value and remains essentially independent of potential over a considerable potential region. This is termed the passive region. Finally, at very noble potentials, dissolution rate again increases with increasing potential in the transpassive region.



- a Active
- b Passive
- c Transpassive
- d Logarithmic scale

Figure A.1 — Typical anodic dissolution behaviour of an active-passive-transpassive metal

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