भारतीय मानक
Indian Standard

IS 19056 : 2024
ISO 16048 : 2003

जंगरोधी इस्पात के फास्टनर्स का पैसिवेशन

Passivation of Corrosion-Resistant Stainless-Steel Fasteners

ICS 21.060.01

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General Engineering and Fasteners Standards Sectional Committee, PGD 37

NATIONAL FOREWORD

This Indian Standard which is identical to ISO 16048 : 2003 ‘Passivation of corrosion-resistant stainless-steel fasteners’ issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the General Engineering and Fasteners Standards Sectional Committee and approval of the Production and General Engineering Division Council.

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words ‘International Standard’ appear referring to this standard, they should be read as ‘Indian Standard’; and

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 3506-1 : 1997 Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 1: Bolts, screws and studs	IS 1367 (Part 14/Sec 1) : 2023/ ISO 3506-1 : 2020 Technical supply conditions for threaded steel fasteners: Part 14 Mechanical properties of corrosion-resistant stainless steel fasteners, Section 1 Bolts screws and studs with specified grades and property classes (*fifth revision*)	Identical
ISO 3506-2 : 1997 Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 2: Nuts	IS 1367 (Part 14/Sec 2) : 2023/ ISO 3506-2 : 2020 Technical supply conditions for threaded steel fasteners: Part 14 Mechanical properties of corrosion-resistant stainless steel fasteners, Section 2 Nuts with specified grades and property classes (*fifth revision*)	Identical
ISO 3506-3 : 1997 Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 3: Set screws and similar fasteners not under tensile stress	IS 1367 (Part 14/Sec 3) : 2018/ ISO 3506-3 : 2009 Technical supply conditions for threaded steel fasteners: Part 14 Mechanical properties of corrosion-resistant stainless steel fasteners, Section 3 Set screws and similar fasteners not under tensile stress (*fourth revision*)	Identical

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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.

Indian Standard

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_2SO_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_2SO_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	$HNO_3 + Na_2Cr_2O_7 \cdot 2H_2O$[c]	15 to 25		
C4	$HNO_3 + Na_2Cr_2O_7 \cdot 2H_2O$[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 $Na_2Cr_2O_7 \cdot 2H_2O$ may be used to minimize the discoloration or etching of high carbon and free-cutting stainless steels.

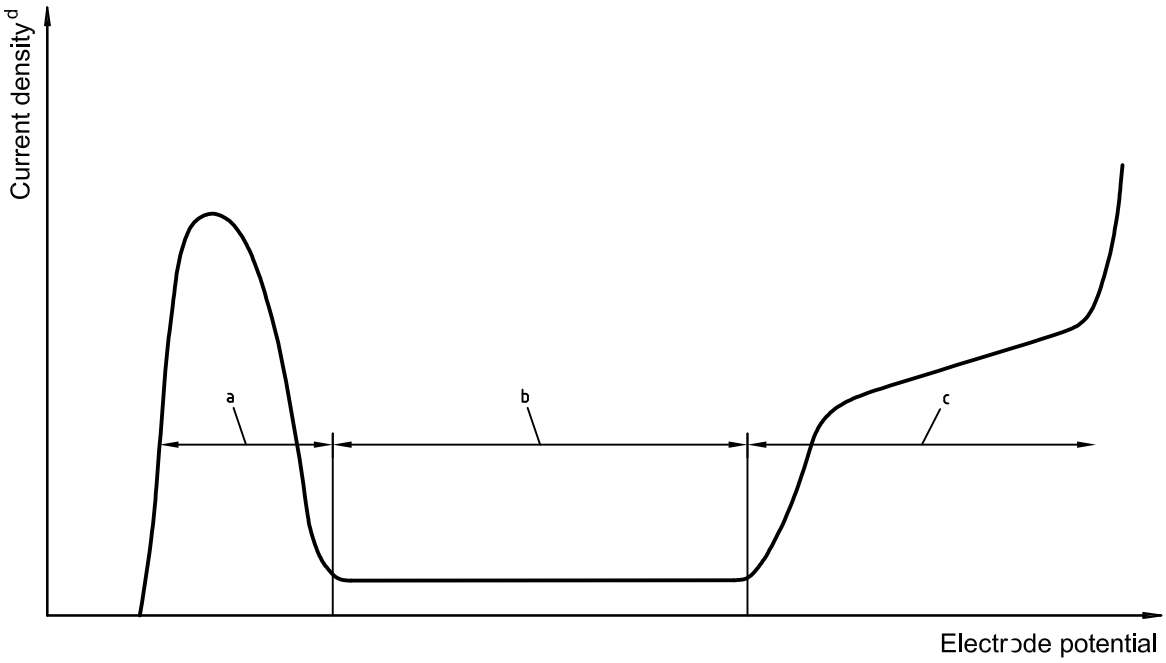
5 Verification of passivation

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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International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 3506-4 Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 4: Tapping screws	IS 1367 (Part 14/Sec 4) : 2023/ ISO 3506-4 : 2009 Technical supply conditions for threaded steel fasteners: Part 14 Mechanical properties of corrosion resistant stainless steel fasteners, Section 4 Tapping screws	Identical

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*).’

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: PGD 37 (25490).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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