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**Steel and iron castings — Visual
testing of surface quality**

*Pièces moulées en acier ou en fonte — Contrôle visuel de l'état de
surface*



Reference number
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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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 11, *Steel castings*.

This third edition cancels and replaces the second edition (ISO 11971:2008), which has been technically revised. The main changes compared to the previous edition are as follows:

- “Normative References” added as new [Clause 2](#) and “Terms and Definitions” added as new [Clause 3](#); subsequent Clauses were renumbered
- Correction in [Clause 5](#) (previously [Clause 3](#)) regarding the use of SCRATA comparators for iron castings
- Table 3 and Table 4 in the previous edition were moved to new [Annex A](#)

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The surface roughness of a casting is influenced by the manufacturing process (moulding, grinding, finishing, etc.), the moulding materials used (sand, coating, etc.), the equipment available and the alloy cast.

Since cast surfaces do not exhibit the same cyclic regularity as machined surfaces, it is difficult to evaluate their roughness using conventional mechanical, optical, or pneumatic devices.

The use of visual/tactile comparators is therefore preferred in these circumstances.

Moreover, in order to take account of the irregularities on as-cast surfaces, ground surfaces or other means of finishing of castings, comparators should have relatively large dimensions (greater than or equal to 15 000 mm²) in order to make them more reliable and their results repeatable and consistent.

Two sets of comparators¹⁾ are in widespread use:

1. *SCRATA or CTI comparators for the definition of surface quality of steel castings*, available from Castings Technology International (CTI), Advanced Manufacturing Park, Brunel Way, Rotherham, South Yorkshire, United Kingdom, info@castingstechnology.com;
2. BNIF 359, *Recommandation technique du Bureau de Normalisation des Industries de la Fonderie. Caractérisation d'états de surface des pièces moulées — Utilisation des échantillons types de 110 × 160 mm*, available from CTIF, 44 avenue de la Division Leclerc, 92310 Sèvres, France, www.ctif-editions.com.

1) This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these products.

Steel and iron castings — Visual testing of surface quality

1 Scope

1.1 This document covers the acceptance criteria for the visual testing of the surface of steel and iron castings.

1.2 Acceptance levels utilize Bureau de Normalisation des Industries de la Fonderie (BNIF) and Steel Castings Research and Trade Association (SCRATA) or Casting Technology International (CTI) reference comparators for the visual determination of surface roughness and surface discontinuities described as follows:

- surface roughness;
- thermal dressing;
- mechanical dressing;
- non-metallic inclusions;
- gas porosity;
- fusion discontinuities;
- expansion discontinuities;
- metal inserts.

2 Normative References

There are no normative references in this document.

3 Terms and Definitions

No terms and definitions are listed in this document.

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

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

4 Ordering information

The enquiry and order should specify the following information:

- a) the casting areas where the surface is to be tested should be clearly indicated on the drawing or solid model;
- b) the number of castings to be tested;
- c) the acceptance level: more than one acceptance level may be specified for different surfaces of the same casting;
- d) if any types of discontinuities are unacceptable.

5 Test method

The area to be tested shall be examined without optical aids exceeding 1 \times magnification.

The comparators define the worst or roughest condition for that acceptance level.

6 Acceptance criteria

- a) The SCRATA comparator set is used for steel or iron castings.
- b) The BNIF comparator set S1 and S2 categories can be used for all alloys. Category S3 is used for steel castings only.

[Table 1](#) lists BNIF and SCRATA comparators for surface roughness and gives the equivalency between BNIF and SCRATA comparators for surface roughness, mechanical dressing and thermal dressing.

[Table 2](#) lists the SCRATA surface-discontinuity comparators.

Levels of acceptance for surface roughness and discontinuities may be specified by the customer.

In [Annex A](#), [Table A.1](#) and [Table A.2](#) give guidance on optional roughness acceptance and surface discontinuity acceptance.

Surface discontinuities not covered by this document shall be a matter of agreement between the purchaser and manufacturer.

Table 1 — BNIF and SCRATA surface roughness and dressing comparators

	Roughness		Mechanical dressing		Thermal dressing	
	BNIF	SCRATA	BNIF	SCRATA	BNIF	SCRATA
Smoothest ↑	3/0S1	—	1/0S2	—	—	G1
	2/0S1	—	1S2	—	1S3	G2
	1/0S1	—	5S2	H1	2S3	G3
	1S1	A1	—	H3	3S3	G5
	2S1	A2	—	H4	—	—
	3S1	A3	—	H5	—	—
	4S1	—	—	—	—	—
	5S1	—	—	—	—	—
	6S1	A4	—	—	—	—
	7S1	—	—	—	—	—
Roughest ↓	8S1	A5	—	—	—	—

Table 2 — SCRATA surface-discontinuity comparators

	Reducing		Increasing	
Inclusions	B1	B2	B4	B5
Gas porosity	C2	C1	C3	C4
Fusion discontinuities	D1	D2	D3	D5
Expansion discontinuities	E3	E5	—	—
Inserts	F1	F3	—	—
Welds	J1	J2	J3	J5

7 Test report

The manufacturer shall, if requested by the purchaser at the time of enquiry and order, keep a record of the test results and provide a test report.

The records of the manufacturer shall contain the following:

- a) the identification of the castings;
- b) the name and qualification of the person undertaking the testing;
- c) the reference of the comparator used;
- d) the designated category and level of each area tested for the surface condition;
- e) date of the testing.

Annex A

(informative)

Table A.1 — Optional roughness acceptance levels

Classification	Surface comparator	
	Nominal	Not worse than
Level 1	—	3/0S1 ^a
Level 2	—	2/0S1 ^a
Level 3	1/0S1 ^a	1S1 ^a or A1 ^b
Level 4	2S1 ^a or A2 ^b	3S1 ^a or A3 ^b
Level 5	4S1 ^a , 5S1 ^a	6S1 ^a or A4 ^b
Level 6	7S1 ^a	8S1 ^a or A5 ^b

^a BNIF.
^b SCRATA.

Table A.2 — Optional surface-discontinuity acceptance levels

Surface discontinuity	Surface comparator — Classification					
	00	0	1	2	3	4
Inclusions	—	—	B1 ^b	B2 ^b	B4 ^b	B5 ^b
Gas porosity	—	—	C2 ^b	C1 ^b	C3 ^b	C4 ^b
Fusion discontinuities	—	—	—	D1 ^b	D2 ^b	D5 ^b
Expansion discontinuities	—	—	—	—	E3 ^b	E5 ^b
Inserts	—	—	—	—	F1 ^b	F3 ^b
Metal removal marks						
Thermal	—	—	G1 ^b or 1S3 ^a	G2 ^b or 2S3 ^a	G3 ^b or 3S3 ^a	G5 ^b
Mechanical	— 1/0S2 ^a	— 1S2 ^a	H1 ^b or 5S2 ^a	H3 ^b —	H4 ^b —	H5 ^b —
Welds	—	—	J1 ^b	J2 ^b	J3 ^b	J5 ^b

NOTE Class 0 and class 00 are available for special casting processes.

^a BNIF.
^b SCRATA.

Bibliography

- [1] *SCRATA or CTI comparators for the definition of surface quality of steel castings*, available from Castings Technology International (CTI), Advanced Manufacturing Park, Brunel Way, Rotherham, South Yorkshire, United Kingdom, info@castingstechnology.com
- [2] BNIF 359 — *Recommandation technique du Bureau de Normalisation des Industries de la Fonderie — Caractérisation d'états de surface des pièces moulées — Utilisation des échantillons types de 110 × 160 mm*, available from CTIF, 44 avenue de la Division Leclerc, 92310 Sèvres, France; www.ctif-editions.com

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