
**Visual examination of surface quality of
steel castings**

Examen visuel de l'état de surface des pièces moulées en acier

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11971 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 11, *Steel castings*.

Annex A of this International Standard is for information only.

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Visual examination of surface quality of steel castings

1 Scope

1.1 This International Standard covers the acceptance criteria for the surface inspection of steel castings by visual examination.

1.2 Acceptance levels utilize Bureau de Normalisation des Industries de la Fonderie (BNIF)¹⁾ and Steel Castings Research and Trade Association (SCRATA)²⁾ reference comparators for the visual determination of surface roughness, and surface discontinuities described as follows:

- surface roughness
- thermal dressing
- mechanical dressing
- nonmetallic inclusions
- gas porosity
- fusion discontinuities
- expansion discontinuities
- metal inserts

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1.3 Description of terms related to casting discontinuities are given in annex A.

2 Ordering information

The inquiry and order should specify the following information:

- extent of casting surfaces to be examined;
- number of castings to be examined;
- acceptance level — More than one acceptance level may be specified for different surfaces of the same casting;
- if any types of discontinuities are unacceptable.

1) BNIF reference comparators may be purchased from:

Éditions Techniques des Industries de la Fonderie, 44, avenue de la Division Leclerc, 92310 Sèvres Cedex, BP 78, France or from
Steel Founders' Society of America, 455 State street, Des Plaines, IL 60016, USA.

2) SCRATA reference comparators may be purchased from:

Castings Development Centre, 7 East Bank Road, Sheffield, S2 3PT, United Kingdom, or from
Steel Founders' Society of America, 455 State street, Des Plaines, IL 60016, USA.

3 Acceptance standards

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. Tables 3 and 4 may be used by the customer when guidance is required.

Surface discontinuities not covered by this International Standard 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 ^ ↑ ↓ V Roughest	3/0S1	—	1/0S2	—	—	G1
	2/0S1	—	1S2	—	1S3	G2
	1/0S1	—	5S2	H1	2S3	G3
	1 S1	A1		H3	3S3	G5
	2 S1	A2		H4		
	3 S1	A3		H5		
	4 S1	—				
	5 S1	—				
	6 S1	A4				
7 S1	—					
8 S1	A5					

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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

Table 3 — Optional roughness acceptance standards

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

1) BNIF
2) SCRATA

Table 4 — Optional surface discontinuity acceptance standards

Surface discontinuity	Surface comparator — Classification					
	00	0	1	2	3	4
Inclusions	—	—	B1 ¹⁾	B2 ¹⁾	B4 ¹⁾	B5 ¹⁾
Gas porosity	—	—	C2 ¹⁾	C1 ¹⁾	C3 ¹⁾	C4 ¹⁾
Fusion discontinuities	—	—	—	D1 ¹⁾	D2 ¹⁾	D5 ¹⁾
Expansion discontinuities	—	—	—	—	E3 ¹⁾	E5 ¹⁾
Inserts	—	—	—	—	F1 ¹⁾	F3 ¹⁾
Metal removal marks						
Thermal	—	—	G1 ¹⁾ or 1S3 ²⁾	G2 ¹⁾ or 2S3 ²⁾	G3 ¹⁾ or 3S3 ²⁾	G5 ¹⁾
Mechanical	—	—	H1 ¹⁾ or 5S2 ²⁾	H3 ¹⁾	H4 ¹⁾	H5 ¹⁾
	1/0S2 ²⁾	1S2 ²⁾		—	—	—
Welds	—	—	J1 ¹⁾	J2 ¹⁾	J3 ¹⁾	J5 ¹⁾
NOTE — Class 0 and class 00 are available with special casting processes.						
1) SCRATA						
2) BNIF						

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Annex A (informative)

Description of terms specific to this International Standard

Surface roughness — the cast surface roughness produced by and replicating the mold. Surface roughness may also be as a result of the removal of gates, risers etc. by thermal or mechanical cutting methods.

Expansion discontinuities — surface effects caused by the thermal effect of the molten metal as it fills the mold.

External chills — metal or graphite blocks that are incorporated into the mold to locally increase the rate of heat removal during solidification. External chills may produce flat spots and edges (raised areas or depressions) on the casting surface.

Fusion discontinuities — usually associated with pouring temperature and premature solidification.

Gas porosity — due to evolution of gas, either from solidifying metal or mold.

Inserts — either chaplets or internal chills used to maintain casting dimensions and enhance directional solidification.

Metal removal marks — flame cutting and air carbon-arc cutting produce parallel grooves in the cut-off area. Finer marks are produced with the abrasive cut-off wheel and grinding.

Non-metallic inclusions — casting surface inclusions such as ceroxides, slag or sand.

Welding — an integral part of steel casting production.

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