INTERNATIONAL STANDARD

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Steel and iron castings — Visual examination of surface quality

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

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

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

This second edition cancels and replaces the first edition (ISO 11971:1997), which has been technically revised.

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 character 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 mm^2) in order to make them more reliable and their results repeatable and consistent.

Two sets of comparators are in widespread use:

— *SCRATA comparators for the definition of surface quality of steel castings*, available from Steel Castings Technology International, 7 East Bank Road, Sheffield S2 3PT, United Kingdom;

— 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 Editions Techniques des Industries de la Fonderie, 44 avenue de la Division Leclerc, 92310 Sèvres, France.

Steel and iron castings — Visual examination of surface quality

1 Scope

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

1.2 Acceptance levels utilize Bureau de Normalisation des Industries de la Fonderie (BNIF) and Steel Castings Research and Trade Association (SCRATA) 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.

2 Ordering information

The enquiry and order should specify the following information:

— the casting areas where the surface is to be examined should be clearly indicated on the drawing;

— the number of castings to be examined;

— the acceptance level: more than one acceptance level may be specified for different surfaces of the same casting;

— if any types of discontinuities are unacceptable.

3 Acceptance standards

The SCRATA comparator set may be used for steel castings only.

The BNIF comparator set S1 and S2 categories may be used for all alloys. Category S3 may be 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. 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.

4 Determination of compliance

The area to be inspected shall be examined without optical aids.

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

5 Documentation

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

The records of the manufacturer shall contain the following:

— the identification of the casting;

— the name and qualification of the person undertaking the inspection;

— the reference of the comparator used;

— the designated category and level of each area checked for the surface condition.

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

Table 3 — Optional roughness acceptance standards

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 4 — Optional surface-discontinuity acceptance standards

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	—	—	H1 [b] or 5S2 [a]	H3 [b]	H4 [b]	H5 [b]
	1/0S2 [a]	1S2 [a]		—	—	—
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

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