INTERNATIONAL STANDARD

ISO 3452-2

Second edition
2006-08-15

Non-destructive testing — Penetrant testing —

Part 2: Testing of penetrant materials

Essais non destructifs — Examen par ressuage —

Partie 2: Essais des produits de ressuage

Reference number
ISO 3452-2:2006(E)

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Published in Switzerland

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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.

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 3452-2 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 138, *Non-destructive testing*, in collaboration with Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 2, *Surface methods*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 3452-2:2000), which has been technically revised.

ISO 3452 consists of the following parts, under the general title *Non-destructive testing — Penetrant testing*:

— *General principles*

— *Part 2: Testing of penetrant materials*

— *Part 3: Reference test blocks*

— *Part 4: Equipment*

Non-destructive testing — Penetrant testing —

Part 2:
Testing of penetrant materials

SAFETY PRECAUTIONS — The materials required by this part of ISO 3452 include chemicals which may be harmful, flammable and/or volatile. All necessary precautions shall be observed. All relevant International, national and local regulations pertaining to health and safety, environmental requirements, etc. shall be observed.

1 Scope

This part of ISO 3452 specifies the technical requirements and test procedures for penetrant materials for their type testing and batch testing. It also details on-site control tests and methods.

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 3059, *Non-destructive testing — Penetrant testing and magnetic particle testing — Viewing conditions*

ISO 3452-3, *Non-destructive testing — Penetrant testing — Part 3: Reference test blocks*

ISO 12706, *Non-destructive testing — Terminology — Terms used in penetrant testing*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

EN 571-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12706, EN 571-1 and the following apply.

3.1
batch
quantity of material produced at one operation having uniform properties throughout and with a unique identifying number or mark

3.2
candidate
sample of the testing product submitted for evaluation in accordance with this part of ISO 3452

4 Classification

4.1 Testing products

Penetrant testing products shall be classified by type, method and form in accordance with Table 1.

Table 1 — Testing products

Penetrant		Excess penetrant remover		Developer	
Type	**Denomination**	**Method**	**Denomination**	**Form**	**Denomination**
I	Fluorescent penetrant	A	Water	a	Dry
II	Colour contrast penetrant	B	Lipophilic emulsifier:	b	Water soluble
			1 Oil-based emulsifier		
			2 Rinsing with running water	c	Water suspendible
		C	Solvent (liquid):		
III	Dual-purpose (fluorescent colour contrast penetrant)		Class 1 Halogenated	d	Solvent-based (non-aqueous for Type I)
			Class 2 Non-halogenated		
			Class 3 Special application		
		D	Hydrophilic emulsifier:		
			1 Optional pre-rinse (water)	e	Solvent-based (non-aqueous for Types II and III)
			2 Emulsifier (water-diluted)		
			3 Final rise (water)		
		E	Water and solvent	f	Special application

4.2 Sensitivity levels

4.2.1 General

Sensitivity levels shall be defined separately for penetrant, excess penetrant remover and developer, and for product families.

4.2.2 Fluorescent product family

Sensitivity levels for this product family shall be defined by reference products:

— sensitivity level 1/2 (ultra-low);

— sensitivity level 1 (low);

— sensitivity level 2 (medium);

— sensitivity level 3 (high);

— sensitivity level 4 (ultra-high).

4.2.3 Colour contrast product family

Sensitivity levels for this product family shall be defined using the type 1 reference block in accordance with ISO 3452-3:

— sensitivity level 1 (normal);

— sensitivity level 2 (high).

4.2.4 Dual-purpose product family

There are no sensitivity levels for dual-purpose penetrants. Classification may be carried out as for colour contrast systems (see 4.2.3).

5 Testing of penetrant materials

5.1 Testing facilities

5.1.1 Type testing

Type testing shall be carried out on penetrant materials according to EN 571-1 to ensure their conformance to the requirements of this part of ISO 3452.

Type testing shall be carried out by a laboratory accredited in accordance with ISO/IEC 17025 for type testing of penetrant materials.

5.1.2 Batch testing

Batch testing to the requirements of this part of ISO 3452 shall be carried out on each production batch according to EN 571-1 to ensure the batch has the same properties as the corresponding type approval sample. In the case of penetrant material packed in spray cans, the content of sulfur and halogens shall be additionally determined according to 6.12.

Batch testing shall be carried out under a defined and maintained quality system. A system meeting the requirements of ISO 9001 is considered suitable.

5.1.3 Process control testing

Process control testing shall be carried out or commissioned by the user in accordance with EN 571-1 and ISO 3452-3.

5.2 Reporting

5.2.1 Type testing

The testing laboratory (see 5.1.1) shall provide a certificate of compliance with this part of ISO 3452 and a report that details the results obtained.

If any changes are made to the penetrant material composition, then a new type test and product identity shall be required.

5.2.2 Batch testing

Manufacturers of penetrant materials shall provide certificates of compliance with this part of ISO 3452 (for example, see EN 10204).

5.2.3 Process and control testing

Results obtained shall be recorded (see Annex B).

5.3 Tests

5.3.1 Penetrants

Type and batch testing of penetrant properties shall be carried out in accordance with Table 2.

Table 2 — Properties of penetrants and required tests

Property	Test type	Use test method according to
Appearance	Batch	6.1
Sensitivity	Type and batch	6.2
Density	Type and batch	6.3
Viscosity	Type and batch	6.4
Flashpoint	Type and batch	6.5
Washability (Method A penetrants only)	Batch	6.6
Fluorescent brightness (Type I penetrants)	Type and batch	6.7
UV stability (Type I penetrants)	Type	6.8
Thermal stability (Type I penetrants)	Type	6.9
Water tolerance (Method A penetrants only)	Type	6.10
Corrosive properties	Type and batch	6.11
Content of sulfur and halogens [a]	Type and batch	6.12
Water content (Methods A and E)	Batch	6.20
Other contaminants on request (as required)	Batch	

[a] Only required for products designated “low in sulfur and halogens”.

5.3.2 Excess penetrant removers (excluding method A)

Type and batch testing of penetrant remover properties shall be carried out in accordance with Table 3.

Table 3 — Properties of excess penetrant removers and required tests

Property	Test type	Use test method according to
Appearance	Batch	6.1
Sensitivity	Type and batch	6.2
Density	Type and batch	6.3
Viscosity (for Methods B and D only)	Type and batch	6.4
Flashpoint	Type and batch	6.5
Water tolerance (Method B only)	Type and batch	6.10
Corrosive properties	Type and batch	6.11
Content of sulfur and halogens [a]	Type and batch	6.12
Residue on evaporation/solid content	Type and batch	6.13
Penetrant tolerance (Methods B and D only)	Type	6.14
Water content (Method B only)	Batch	6.20
Other contaminants on request (as required)	Batch	

[a] Only required for products designated “low in sulfur and halogens”.

5.3.3 Developers

Type and batch testing of developer properties shall be carried out in accordance with Table 4.

Table 4 — Properties of developers and required tests

Property	Test type	Use test method according to
Appearance	Batch	6.1
Sensitivity	Type and batch	6.2
Flashpoint (Form d only)	Type and batch	6.5
Corrosive properties (except Form a)	Type and batch	6.11
Content of sulfur and halogens [a]	Type and batch	6.12
Solid content (Form d only)	Type and batch	6.13
Developer performance (except Form e)	Type and batch	6.15
Re-dispersability (Forms c and d only)	Type and batch	6.16
Density (of carrier liquid) (Form d only)	Type and batch	6.17
Particle size distribution	Type	6.19
Other contaminants on request (as required)	Batch	

[a] Only required for products designated “low in sulfur and halogens”.

5.3.4 Batch tests for spray cans

Batch testing shall be carried out in accordance with the product performance test given in 6.18.

The first and last containers, and a container from the middle, of the batch shall be tested. Where testing for content of sulfur and halogens in accordance with 6.12 is appropriate, only the first container need be tested.

6 Test methods and requirements

6.1 Appearance

The appearance of the sample shall be the same as that of the type test sample.

6.2 Penetrant system sensitivity

6.2.1 Fluorescent penetrants (Type I)

6.2.1.1 Qualification provisions

6.2.1.1.1 Penetrants (Type I)

Method A (water washable) penetrants and Methods B and D (post-emulsifiable) penetrants/emulsifiers shall be qualified with the appropriate reference dry developer D-1. Method C penetrants shall be qualified either on the basis of their performance as Method A, B, or D materials, or, alternatively, with the appropriate reference remover R-1 and reference dry developer D-1 (see Table 5).

Table 5 — Reference material designation

Reference material	Designation	
	Method A	Methods B, C and D
Penetrant, Type I, Level ½	FP-1/2	
Penetrant, Type I, Level 1	FP-1W	FP-1PE
Penetrant, Type I, Level 2	FP-2W	FP-2PE
Penetrant, Type I, Level 3	FP-3W	FP-3PE
Penetrant, Type I, Level 4	FP-4W	FP-4PE
Penetrant, Type II, Level 1	VP-1W	VP-1PE
Penetrant, Type II, Level 2	VP-2W	VP-2PE
Emulsifier, Type I, Method B		FE-B
Emulsifier, Type I, Method D		FE-D
Emulsifier, Type II, Method B		VE-B
Removers, Class 1, Method C	R-1	R-1
Removers, Class 2, Method C	R-2	R-2
Developer, Form a	D-1	D-1
Developer, Form e	D-2	D-2

FP fluorescent penetrant
W water-washable
PE post emulsifiable
FE emulsifier for fluorescent penetrant
VP visible penetrant
VE emulsifier for visible penetrant

6.2.1.1.2 Developers

All developers, except Form f (specific application), intended for use with Type I (fluorescent) penetrant materials, shall be qualified with the reference level 4, Method B penetrant/emulsifier system FP-4PE/FE-B (see Table 6). Form f developers shall be qualified in accordance with 6.2.1.1.4.

A reference sample of each product shall be retained for comparison purposes and designated in accordance with Tables 5 and 6. The manufacturer, manufacturer's reference and the batch number shall be recorded.

NOTE A list of reference products is available from qualified laboratories (e.g. MPA-Hannover, Germany).

6.2.1.1.3 Solvent removers

Classes 1 and 2 solvent removers shall be qualified with reference penetrant FP-4PE and reference developer D-1. Class 3 solvent remover shall be qualified in accordance with 6.2.1.1.4.

6.2.1.1.4 Specific application — Developer/removers

Form f developers and Class 3 removers shall be qualified with materials as specified by the manufacturer and approval shall be specific to those materials.

6.2.1.1.5 Product family

While individual testing products are to be qualified, product families as defined by the manufacturer may be specified as meeting the requirements defined in this part of ISO 3452 (e.g. Type I, Level 2, Method D; Form a).

6.2.1.2 Sensitivity

6.2.1.2.1 General

Sensitivity of type I penetrant systems shall be determined by comparing results of candidate materials, and standard reference products using a set of test panels.

6.2.1.2.2 Test panels

A suitable test panel should be used, e. g. a type 1 reference block, see ISO 3452-3.

Test panels according to ISO 3452-3 have chromium-nickel plating with thicknesses of 10 µm, 20 µm, 30 µm and 50 µm. For each thickness there is a pair of panels with similar cracks. The test panels should be used either for fluorescent or for colour contrast penetrants. The same panels should not be used for the two systems.

Table 6 — Sensitivity and removability matrix

Candidate material	Materials for processing candidates			Reference materials		
Penetrant systems						
Type I, Method A, Level ½			D-1	FP-1/2		D-1
Type I, Method A, Level 1			D-1	FP-1W		D-1
Type I, Method B, Level 1			D-1	FP-1PE	FE-B	D-1
Type I, Method C, Level 1			D-1	FP-1PE	R-1	D-1
Type I, Method D, Level 1			D-1	FP-1PE	FE-D	D-1
Type I, Method A, Level 2			D-1	FP-2W		D-1
Type I, Method B, Level 2			D-1	FP-2PE	FE-B	D-1
Type I, Method C, Level 2			D-1	FP-2PE	R-1	D-1
Type I, Method D, Level 2			D-1	FP-2PE	FE-D	D-1
Type I, Method A, Level 3			D-1	FP-3W		D-1
Type I, Method B, Level 3			D-1	FP-3W	FE-B	D-1
Type I, Method C, Level 3			D-1	FP-3PE	R-1	D-1
Type I, Method D, Level 3			D-1	FP-3PE	FE-D	D-1
Type I, Method A, Level 4			D-1	FP-4W		D-1
Type I, Method B, Level 4			D-1	FP-4PE	FE-B	D-1
Type I, Method C, Level 4			D-1	FP-4PE	R-1	D-1
Type I, Method D, Level 4			D-1	FP-4PE	FE-D	D-1
Type II, Method A, Level 1			D-2	VP-1PE	VE-B	D-2
Type II, Method B, Level 1			D-2	VP-1PE	VE-B	D-2
Type II, Method C, Level 1			D-2	VP-1PE	R-2	D-2
Type II, Method D, Level 1			D-2	VP-1PE	VE-B	D-2
Type II, Method A, Level 2			D-2	VP-2PE	VE-B	D-2
Type II, Method B, Level 2			D-2	VP-2PE	VE-B	D-2
Type II, Method C, Level 2			D-2	VP-2PE	R-2	D-2
Type II, Method D, Level 2			D-2	VP-2PE	VE-B	D-2
Removers						
Class 1	FP-4PE		D-1	FP-4PE	R-1	D-1
Class 2	FP-4PE		D-1	FP-4PE	R-2	D-1
Developers						
Form a	FP-4PE	FE-B		FP-4PE	FE-B	D-1
From b	FP-4PE	FE-B		FP-4PE	FE-B	D-1
Form c	FP-4PE	FE-B		FP-4PE	FE-B	D-1
Form d	FP-4PE	FE-B		FP-4PE	FE-B	D-1
Form e	VP-2PE	VE-B		VP-2PE	VE-B	D-2