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**Non-destructive testing—Magnetic
particle testing—Part 2: Detection
media**

ICS 19.100

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Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Safety precautions	2
5 Classification	2
5.1 General	2
5.2 Magnetic particles	2
5.3 Detection media used for wet technique (magnetic inks)	2
5.4 Detection media used for dry technique (powders)	3
5.5 Contrast aid paints	3
6 Testing and test certificate	3
6.1 Type testing and batch testing	3
6.2 In-service testing	4
7 Requirements and test methods	4
7.1 Performance	4
7.2 Colour	4
7.3 Particle size	4
7.4 Temperature resistance	5
7.5 Fluorescent coefficient and fluorescent stability	5
7.6 Fluorescence of carrier liquid	7
7.7 Flash point	7
7.8 Corrosion induced by detection media	7
7.9 Viscosity of the carrier liquid	7
7.10 Mechanical stability	7
7.11 Foaming	8
7.12 pH	8
7.13 Storage stability	8
7.14 Solids content	8
7.15 Sulfur and halogen content	9
8 Testing requirements	9
9 Test report	9
10 Packaging and labelling	9
Annex A (normative) Procedure for type, batch and in-service testing	12

Annex B (normative)	Reference blocks	14
Annex C (normative)	Corrosion testing of steel and cast iron	19
Annex JA (normative)	Procedure of in-service testing (when using standard test piece Type A etc.)	23
Annex JB (normative)	Measurement of particle size distribution by microscopic method	24
Annex JC (informative)	Comparison table between JIS and corresponding International Standard	26

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japanese Society for Non-Destructive Inspection (JSNDI)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS Z 2320-2:2007** is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

JIS Z 2320 series consists of the following 3 parts under the general title “*Non-destructive testing—Magnetic particle testing*”:

Part 1: General principles

Part 2: Detection media

Part 3: Equipment

Non-destructive testing—Magnetic particle testing—Part 2: Detection media

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 9934-2:2015**, Edition 2, with some modifications of the technical contents so that it is applicable in Japan.

The vertical lines on both sides and dotted underlines indicate addition to the corresponding International Standard. A list of modifications with the explanations is given in Annex JC.

1 Scope

This Standard specifies the significant properties of magnetic particle testing products (including detection media, magnetic particle, carrier liquid, contrast aid paints) and the methods for checking their properties.

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 9934-2:2015 *Non-destructive testing—Magnetic particle testing—Part 2: Detection media* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 8313 *End suction centrifugal pumps*

JIS G 0415 *Steel and steel products—Inspection documents*

JIS G 4051 *Carbon steels for machine structural use*

JIS G 5501 *Grey iron castings*

JIS K 2203 *Kerosine*

JIS K 2246 *Rust preventive oils*

JIS K 2283 *Crude petroleum and petroleum products—Determination of kinematic viscosity and calculation of viscosity index from kinematic viscosity*

NOTE : Corresponding International Standard: ISO 3104 *Petroleum products—Transparent and opaque liquids—Determination of kinematic viscosity and calculation of dynamic viscosity* (MOD)

JIS K 2513 *Petroleum products—Corrosiveness to copper—Copper strip test*

NOTE : Corresponding International Standard: ISO 2160 *Petroleum products—Corrosiveness to copper—Copper strip test* (MOD)

JIS R 3503 *Glass apparatus for chemical analysis*

JIS Z 2300 *Terms and definitions of nondestructive testing*

JIS Z 2320-1 *Non-destructive testing—Magnetic particle testing—Part 1: General principles*

NOTE : Corresponding International Standard: ISO 9934-1 *Non-destructive testing—Magnetic particle testing—Part 1: General principles* (MOD)

JIS Z 2320-3 *Non-destructive testing—Magnetic particle testing—Part 3: Equipment*

NOTE : Corresponding International Standard: ISO 9934-3 *Non-destructive testing—Magnetic particle testing—Part 3: Equipment* (MOD)

JIS Z 2323 *Non-destructive testing—Penetrant testing and magnetic particle testing—Viewing conditions*

NOTE : Corresponding International Standard: ISO 3059 *Non-destructive testing—Penetrant testing and magnetic particle testing—Viewing conditions* (IDT)

JIS Z 8802 *Methods for determination of pH of aqueous solutions*

JIS Z 8803 *Methods for viscosity measurement of liquid*

JIS Z 8815 *Test sieving—General requirements*

NOTE : Corresponding International Standard: ISO 2591-1 *Test sieving—Part 1: Methods using test sieves of woven wire cloth and perforated metal plate* (MOD)

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in **JIS Z 2300** apply.

4 Safety precautions

The safety precautions shall be as given in clause 5 of **JIS Z 2320-1**.

5 Classification

5.1 General

The magnetic particle testing materials shall be classified as follows.

5.2 Magnetic particles

The magnetic particles shall be classified into a dry type and a wet type according to the difference of carrier liquids at the time of application, and further classified into fluorescent magnetic particles and coloured magnetic particles according to the viewing method.

5.3 Detection media used for wet technique (magnetic inks)

The detection media used for wet technique shall be as follows.

- a) Magnetic inks shall consist of finely-divided coloured or fluorescent magnetic particles in a suitable carrier liquid. They shall form a uniform suspension when agitated.

Magnetic inks can be produced from products supplied as concentrates, including paste and powders, or ready for use.

- b) For the wet technique, organic suspension ready for use using organic carrier liquid such as kerosine specified in **JIS K 2203**, or aqueous suspension ready for use in which rust inhibitor and surface-active agents (or dispersing agents) have been added as necessary, using water as carrier liquid shall be employed. The properties of detection media prepared beforehand by the manufacturer shall be presented according to **7.1, 7.3, 7.6, 7.7, 7.9, 7.12** and **7.15**.
- c) The solids content in the detection media shall be expressed by mass (g) of magnetic particles contained in unit volume (1 L) of detection media at the location where the application is actually performed, or by precipitate volume (ml) of magnetic particles contained in unit volume (100 ml) of detection media, and shall be set in consideration of the type and particle size of magnetic particles. For detection media prepared beforehand by the manufacturer, the solids content (g/L) or precipitate volume (ml) shall be presented according to **7.14**.

5.4 Detection media used for dry technique (powders)

Powders for the dry technique shall consist of finely-divided coloured or fluorescent magnetic particles in air.

5.5 Contrast aid paints

Contrast aid paints shall be white or near white. They shall be applied to a test face, and immediately dried. The paints shall be insoluble in the carrier liquid of detection media, excellent in wettability, and easily removable from the test face after testing.

6 Testing and test certificate

6.1 Type testing and batch testing

Type testing and batch testing of magnetic particle materials shall be carried out in accordance with the requirements of **JIS Z 2320-1**, **JIS Z 2320-3** and this Standard.

Type testing is carried out in order to demonstrate suitability of a product for the intended use. Batch testing is carried out in order to demonstrate conformity of the characteristics of a batch to the product type specified.

The supplier or manufacturer shall provide a test certificate showing compliance with this Standard. This certificate shall include results obtained and tolerances allowed.

If any changes are made to the design of magnetic particle testing materials or production line, etc., then a new type test shall be performed.

NOTE 1 Type testing is performed in order to check the properties given in this Standard and determine the specific type (specification) of products for every product identification supplied by the supplier or manufacturer.

NOTE 2 Batch testing is performed by the manufacturer in terms of quality control in order to check that the properties of a production batch (lot) conform to the type (specification) of each product which has been determined by type testing.

NOTE 3 The supplier refers to a direct seller and deliverer to the customer including the manufacturer, such as trading company, sales agency and retailer.

6.2 In-service testing

In-service testing is carried out to demonstrate the continued performance of the detection media.

7 Requirements and test methods

7.1 Performance

7.1.1 Type testing and batch testing

Type testing and batch testing shall be carried out according to Annex A using the reference blocks Type 1 or Type 2 as described in Annex B.

7.1.2 In-service testing

In-service testing shall be carried out according to Annex A using one of the reference blocks Type 1 or Type 2 as described in Annex B or a test block which exhibits similar discontinuities to those normally found in components typically processed in the equipment.

When the test block having such discontinuities cannot be used, the testing may be performed using standard test pieces Type A or C specified in Annex JA of **JIS Z 2320-1**, or using reference blocks Type B specified in Annex JA of **JIS Z 2320-1**, in accordance with the procedures in Annex JA.

7.1.3 Contrast aid paints

Type testing and batch testing shall be carried out according to **7.1.1** after having applied the paint in accordance with the manufacturer instructions and using a type test approved, compatible magnetic ink.

7.2 Colour

The colour of magnetic particles detection media under working conditions shall be stated by the supplier or manufacturer. The shown colour shall not differ from the colour of the type test sample when visually compared.

The colour of the batch test sample shall not differ from the colour of the type test sample when visually compared.

7.3 Particle size

7.3.1 Method

The method for determination of particle size is dependent on the range of the particle size distribution.

For magnetic inks, the particle size distribution can be determined by the Coulter Method ¹⁾, microscopic method specified in Annex JB or an equivalent method.

Note ¹⁾ See **BS 3406-5** *Methods for determination of particle size distribution. Recommendations for electrical sensing zone method (the Coulter principle)*.

7.3.2 Definition of the particle size

The range of particle size shall be as follows:

- lower diameter, d_l : no more than 10 % of the particles shall be smaller than d_l ;
- average diameter, d_a : 50 % of the particles shall be larger and 50 % by volume smaller than d_a ;
- upper diameter, d_u : no more than 10 % by volume of the particles shall be larger than d_u .

Either of the followings shall be reported.

- lower diameter d_l , upper diameter d_u , and average diameter d_a ;
- particle diameters of 10 % and 90 % in the cumulative distribution based on sieving method, and average diameter d_a .

For dry powders, d_l is generally $\geq 40 \mu\text{m}$.

7.4 Temperature resistance

There shall be no degradation of the product after 5 min heating at the maximum temperature specified by the supplier.

This shall be verified by repeating the performance test as specified in 7.1.1.

7.5 Fluorescent coefficient and fluorescent stability

To carry out these tests, it is necessary to use a dry sample of the particles.

7.5.1 Type testing

7.5.1.1 Test methods

The fluorescent coefficient β in cd/W is defined as given in Formula (1):

$$\beta = L/E_c \dots\dots\dots (1)$$

where, β : fluorescent coefficient (cd/W)

L : luminance in cd/m² of a plane powder surface

E_c : level of UV-irradiance in W/m² at the surface of the powder

The arrangement of the apparatus used is shown in Figure 1.

The powder surface shall be evenly irradiated with UV-A specified in **JIS Z 2320-3** at an angle of $45^\circ \pm 5^\circ$. Luminance shall be measured with a suitable meter with an accuracy of $\pm 10 \%$ or better. It shall measure the luminance from the powder surface and be unaffected by areas outside of the target area. The level of irradiance shall be measured with a meter (UV-A irradiation meter) conforming to **JIS Z 2323** with its UV sensor replacing the centre (measurement point of the irradiance) of the powder surface.

The recommended arrangement is using a luminance meter with a 200 cd/m² range and a viewing angle (α) of 20° placed 80 mm above the plane powder surface, diameter 40 mm. UV-A lamps are placed so as to give an even irradiance at the powder surface, with E_e between 10 W/m² and 15 W/m².

NOTE : Figure 1 is an example of measurement and can be referred to for the positioning of the measurement equipment.

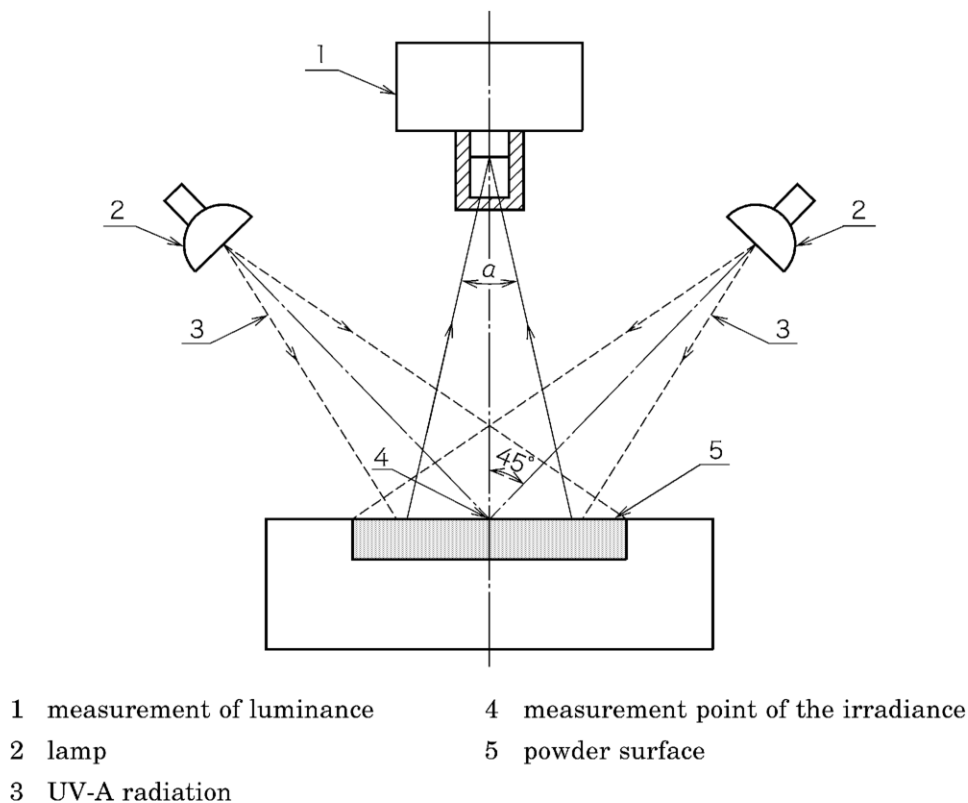


Figure 1 Determination of the fluorescent coefficient, β , for magnetic particles

7.5.1.2 Requirements

The fluorescent coefficient (β) should be greater than 1.5 cd/W.

7.5.1.3 Fluorescence stability

The sample shall first be tested according to the method described in 7.5.1.1.

The sample shall then be exposed and re-tested as described in 7.5.1.1 after 30 min of exposure to UV-A irradiance of 20 W/m² (minimum). The fluorescent coefficient shall not decrease more than 5 %.

7.5.2 Batch testing

Batch testing shall be carried out according to 7.5.1.1.

The fluorescent coefficient shall be within ± 10 % of the type test value.