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(PLA/JSA)

**Inspection method and evaluation
method for lining material
delamination by ultrasonic testing**

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Contents

	Page
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Test personnel	2
5 Principle	2
5.1 General	2
5.2 Difference in the echo height based on the state of the boundary	2
5.3 Outline of the determination methods	4
6 Equipment and materials	5
6.1 Ultrasonic test instrument	5
6.2 Probe	5
6.3 Couplant	5
7 Adjustment of ultrasonic test instrument	5
7.1 Test piece for adjustment	5
7.2 Selection of the number of reflections	6
7.3 Setting of the specified sensitivity	8
7.4 Adjustment of time axis	9
8 Test	9
8.1 Preparation	9
8.2 Measurement	10
9 Evaluation of measurement results	10
9.1 Determination of sound area	10
9.2 Determination of delamination area	10
9.3 Determination of noted area	10
9.4 Measurement of spread range	10
10 Test report	11

Foreword

This Japanese Industrial Standard has been established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by Plastics Lining Association (PLA)/Japanese Standards Association (JSA) with a draft prepared from the association standard (PLA-R-110-16) being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act.

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No. 5735706	Lamination peel test method and peel inspection apparatus	Name: Mitsubishi Kakoki Kaisha, Ltd. Address: 2-1 Ohkawa-cho, Kawasaki-ku, Kawasaki-shi, Kanagawa, Japan Name: Non-Destructive Inspection Company Limited. Address: 1-18-14 Kitahorie, Nishi-ku, Osaka-shi, Osaka, Japan	23 April 2033

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NOTE Based on Article 9 of the Supplementary Provisions to the Unfair Competition Prevention Act etc., any submission of proposal, or employment of procedures such as deliberation by the Japanese Industrial Standards Committee under the previous Industrial Standardization Act shall be deemed to have been conducted pursuant to the provision of Article 12, paragraph (1) of the revised Industrial Standardization Act.

Inspection method and evaluation method for lining material delamination by ultrasonic testing

1 Scope

This standard specifies inspection method and evaluation method for lining material delamination by ultrasonic testing for equipment in which lining material is lined or coated (hereafter referred to as lining) on one side of parent metal whose inner surface and outer surface are parallel and whose thickness does not change. The lined equipment includes instruments, piping and tanks.

The lining materials shall be resin or rubber of organic material, or a composite material thereof.

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 G 0801 *Ultrasonic testing of steel plates for pressure vessels*

JIS Z 2300 *Terms and definitions of nondestructive testing*

JIS Z 2305 *Non-destructive testing—Qualification and certification of NDT personnel*

JIS Z 2345-3 *Standard test blocks for ultrasonic testing—Part 3: Standard test blocks for normal ultrasonic testing*

3 Terms and definitions

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

3.1

parent metal

metal on which a lining material is lined

3.2

adhesive

material that adheres a lining material to a parent metal, e.g. glue, adhesive sheet and primer

3.3

sound area

portions where there is no gap at the boundary between the parent metal and the lining material (including adhesive)

3.4

delamination area

portions where there is a gap at the boundary between the parent metal and the lining material (including adhesive)

3.5

noted area

portions where reflected signal of ultrasonic wave notably decreases and which cannot be distinguished clearly into the sound area and the delamination area

3.6

Distance Amplitude Correction Curve (DAC)

curve that connects respective peak positions of multiple reflection echoes

NOTE It should be noted that the definition is different from that in **JIS Z 2300**.

4 Test personnel

The test personnel shall be an individual certified to Level 1 or higher of the ultrasonic testing specified in **JIS Z 2305**, and have sufficient knowledge on the properties of test objects. The test carried out by Level 1 personnel shall be supervised by Level 2 or Level 3 personnel.

5 Principle

5.1 General

In the case of ultrasonic wave incident from the outer surface of a test object with the lined inner surface using an ultrasonic test instrument, the echo height of reflected signal varies depending on the state of boundary (e.g. sound area, delamination area and corrosion area) between the parent metal and lining material. By repetitive reflection of the ultrasonic wave signal, the reflected signal attenuates. Difference arises in the amount of attenuation based on the state of the boundary. This difference shall be detected to determine the occurrence of delamination between the parent metal and lining material.

5.2 Difference in the echo height based on the state of the boundary

5.2.1 Sound area and delamination area

The reflection of ultrasonic wave in the sound area and the delamination area is shown in Figure 1 a). In the case of the sound area, the reflected signal is obtained from boundary ①, boundary ② and the inner surface, and in the case of the delamination area, the reflected signal is obtained only from boundary ①. Figure 1 b) shows respective first reflected signals.

The attenuation rate of the reflected signal in the sound area is high compared to the delamination area. For this reason, when ultrasonic wave signal is repeatedly incident in the sound area and the delamination area of boundary ①, the difference in the intensity of reflected signal (echo height) becomes greater as the number of reflections increases (see Figure 1 c).