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JAPANESE INDUSTRIAL STANDARD

Methods of radiographic examination for titanium welds by X-ray

JIS Z 3107—1993

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Methods of radiographic examination for
titanium welds by X-ray

Z 3107-1993

1. Scope This Japanese Industrial Standard specifies the methods of radiographic examination for welds of titanium plates and pipes where the transmission thickness is 25 mm or less (hereafter referred to as "material thickness") by the direct photographing method using the X-ray film for industrial use.

Remarks 1. When the radiographic examination by X-ray is carried out, it is necessary to observe the requirements of the "Industrial Safety and Health Law" and the like, and to pay sufficient attention to the prevention of radiographic exposure.

2. The standards cited in this Standard are shown below.

JIS K 7605 Method for determining photographic density

JIS K 7652 Photography - Density measurements - Part 2:
Geometric conditions for transmission density
(ISO 5-2:1985)

JIS K 7653 Photography - Density measurements - Part 3:
Spectral conditions (ISO 5-3:1984)

JIS Z 2300 Glossary of terms used in nondestructive testing

JIS Z 2306 Radiographic image quality indicators for
non-destructive testing

JIS Z 4561 Viewing illuminators for industrial radiograph

JIS Z 4606 Industrial X-ray apparatus for radiographic
testing

2. Definition The terms used in this Standard shall comply with JIS Z 2300 together with the definition as follows:

- (1) thickness of base metal Nominal thickness of titanium plates and pipes to be used. In the case where the thickness of the base metal is different on both sides of the weld, the smaller thickness shall be used.
- (2) test part A part including the weld metal and the heat-affected zone.
- (3) effective length of test part The length in the weld line on the surface of the test part on the focus side, and in the range where the requirements on the penetrometer and the density are satisfied on the radiograph.
- (4) focus The focus of X-ray tube.

3. General matters

3.1 Test engineers The engineer who undertakes the X-ray test shall have sufficient knowledge on the welding of titanium, and sufficient techniques and experience on the X-ray testing methods including X-ray equipment, shielding of X-rays and the method of radiographic examination including the photographic processes, and the classifying method of the defect images.

3.2 Matters to be deliberated The photographing area of the weld to be tested and the allowable classifying method of defect images shall preferably be fixed, upon deliberation between the parties concerned on the use, the design and the specifications of the weld.

4. X-ray radiographic devices, photo-sensitive materials, and observing devices

4.1 X-ray radiographic devices The X-ray radiographic device shall be a device specified in JIS Z 4606 as a rule.

4.2 Photo-sensitive materials The photo-sensitive materials shall be the X-ray film for industrial use of non-screen and ultrafine particle type or of fine particle type. When the intensifying screen is used, it shall be the lead foil type intensifying screen of 0.03 mm in thickness. However, the intensifying screen shall not be used in the case of photography with the tube voltage less than 80 kV.

4.3 Observing devices The observing device shall be one specified in JIS Z 4561.

4.4 Densitometer The densitometer shall be one specified in JIS K 7652 and JIS K 7653.

5. Photographing method of radiographs

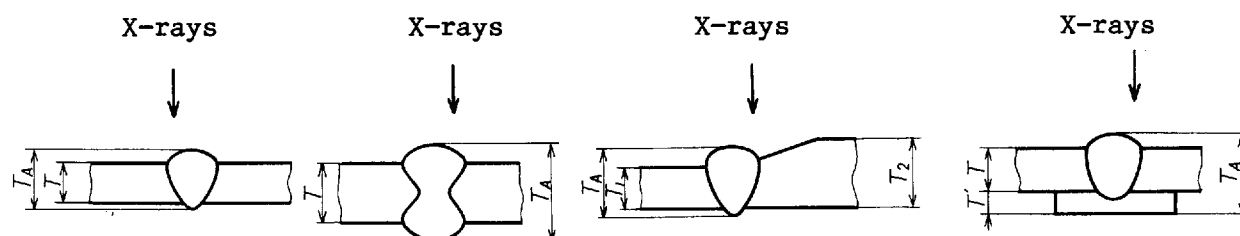
5.1 Irradiating direction of X-ray Radiographs shall be photographed by irradiating X-rays from the direction where the material thickness of the test part may be the minimum as a rule. However, when it is impossible or inappropriate to achieve photographing, X-ray may be irradiated from the direction appropriate for the respective photographing.

5.2 Thickness of base metal and material thickness

5.2.1 In a case where measurement of the dimensions of the respective parts is possible When measurement of the dimensions of the respective parts is possible, they shall be measured as shown in Fig. 1.

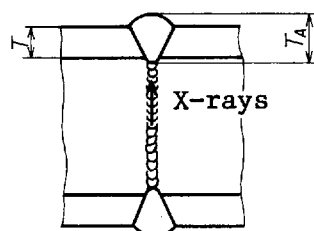
Fig. 1. Thickness of base metal and material thickness in various types of weld joints (in the case where the respective dimensions can be measured)

(1) Photographing of the weld of plates

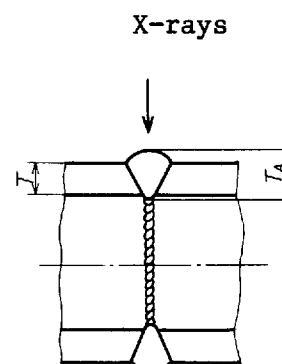


(2) Photographing of single wall at the pipe circumferential welds

Photographing method by radiation source inside

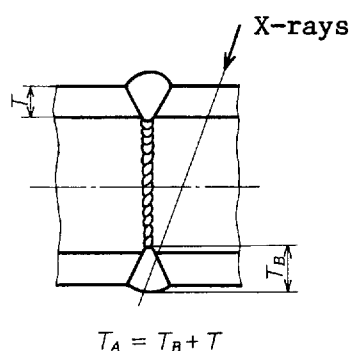


Photographing method by inside film

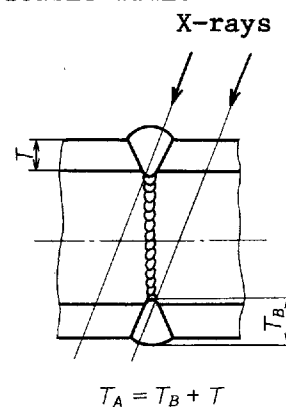


(3) Photographing of double walls at the pipe circumferential welds

Photographing method of single image of double walls

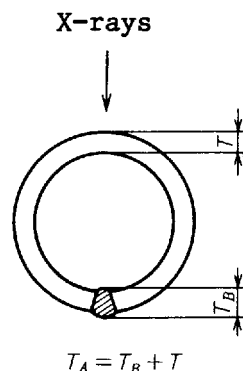


Photographing method of double images of double walls



(4) Photographing method of double walls at the pipe longitudinal welds

Photographing method of single
image of double walls



Remarks T_A : material thickness

T, T_1, T_2 : thickness of base metal

T' : thickness of backing metal

T_B : thickness of base metal added by the reinforcement of weld in the photographing method of single image of double walls and the photographing method of double images of double walls in the case of pipe.

5.2.2 In a case where measurement of the dimensions of the respective parts is difficult When measurement of the dimensions of the respective parts is difficult, they shall be measured as follows.

- (1) The thickness of the base metal shall be the nominal thickness of the plate or the pipe wall to be used.
- (2) The material thickness shall be the value specified in Table 1 for the various types of weld joints.