

## Ultrasonic examination for steel pipes and tubes

**Introduction** This Japanese Industrial Standard has been prepared based on each first edition of **ISO 9303**: 1989 *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Full peripheral ultrasonic testing for the detection of longitudinal imperfections*, **ISO 9764**: 1989 *Electric resistance and induction welded steel tubes for pressure purposes—Ultrasonic testing of the weld seam for the detection of longitudinal imperfections* and **ISO 10332**: 1994 *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Ultrasonic testing for the verification of hydraulic leak-tightness* with some modifications of the technical contents.

Portions underlined with dots are the matters not stated in the original International Standards. The list of modification with its explanation is given in annex 1 (informative).

**1 Scope** This Standard specifies angle beam ultrasonic examination mainly intended for the detection of longitudinal imperfections of the seamless steel tubes and weld seam of the electric resistance welded steel tubes with an outside diameter greater than or equal to 9.0 mm, with a thickness greater than or equal to 1.0 mm and with a thickness-to-outside diameter percentage (hereafter referred to as "*t/D*") smaller than or equal to 20%. This method does not apply to welded stainless steel tubes.

In the case of *t/D* exceeding 20%, where an ultrasonic examination is designated by the purchaser, the examination may be performed, by agreement between the purchaser and supplier, in accordance with the method specified in annex 1. Further, for general matters other than those specified in this Standard, **JIS Z 2344** shall apply.

**Remarks**: The International Standards corresponding to this Standard is as follows.

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

**ISO 9303**: 1989 *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Full peripheral ultrasonic testing for the detection of longitudinal imperfections* (MOD)

**ISO 9764**: 1989 *Electric resistance and induction welded steel tubes for pressure purposes—Ultrasonic testing of the weld seam for the detection of longitudinal imperfections* (MOD)

**ISO 10332**: 1994 *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Ultrasonic testing for the verification of hydraulic leak-tightness* (MOD)

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

**JIS G 0431** *Qualification and certification of non-destructive testing (NDT) personnel for steel products*

**JIS Z 2300** *Terms and definitions of nondestructive testing*

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

**JIS Z 2344** *General rule of ultrasonic testing of metals by pulse echo technique*

**JIS Z 2350** *Method for measurement of performance characteristics of ultrasonic probes*

**JIS Z 2352** *Method for assessing the overall performance characteristics of ultrasonic pulse echo testing instrument*

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

a) **automatic scanning ultrasonic equipment** An ultrasonic equipment capable of automatically adjusting the working sensitivity by inputted external information which is necessary for the examination.

b) **digital ultrasonic equipment** An ultrasonic equipment having a function of processing an output signal in digital manner.

### 4 General requirements

**4.1 Opportunity for examination** The ultrasonic examination specified in this Standard is preferably executed on the tubes after all the manufacturing processes (those to change the ultrasonic characteristics or shape of the tube, for example heat treatment, cold finishing, etc.) are completed.

**4.2 Condition of steel tube** The tube shall be free from a warp as may interfere with the effectiveness of the examination, and from adhesion of foreign substance as would interfere with the validity of the examination.

**4.3 Examination personnel** The person to take charge of the ultrasonic examination of steel pipes and tubes shall have acquired the fundamental techniques about the ultrasonic examination and shall possess adequate knowledge and experiences concerning the nature of and the ultrasonic examination method for the steel pipes and tubes he undertakes to investigate.

For this requirement **JIS G 0431**, **JIS Z 2305** or other certification standard equivalent thereto may apply by agreement between purchaser and supplier.

**6 Test instrument** The ultrasonic test instrument for automatic scanning comprises a scanning equipment, automatic alarm and marking device in addition to an ultrasonic equipment and probe. For the case of manual scanning, it comprises the ultrasonic equipment and probe.

**6.1 Ultrasonic equipment** The automatic scanning ultrasonic equipment stored in an air-conditioned room shall be checked once within three years, and other automatic scanning and manual scanning ultrasonic equipments shall be checked once within one year, and shall have the following performances.

- a) **Automatic scanning ultrasonic equipment** The amplitude linearity of an automatic scanning ultrasonic equipment shall be obtained from an ideal valve and the absolute value of the sum of a maximum plus/minus deviation of measured values after setting the back wall echo of calibration or reference test piece or an electrical false signal at a suitable level according to 5 (1) of JIS Z 2352 and taking the ideal value as the basis. The value of this sum shall be 2.5 dB or less for an automatic scanning digital test equipment and 8 % or less for an automatic scanning equipment with A-scan display.
- b) **Manual scanning ultrasonic equipment** The amplitude linearity and the far surface resolution of a manual scanning ultrasonic equipment shall be as follows:
  - 1) The amplitude linearity, when measured by the same way as a) according to 5 (1) of JIS Z 2352, shall be 8 % or less in sum of the absolute values of the plus and minus maximum deviations.
  - 2) The far surface resolution shall be 9 mm or finer in a measurement according to 4.4 of JIS Z 2352 by using RB-RA test piece or 7 mm or finer according to 4.8 of JIS Z 2352 by using RB-RD test piece.

**6.2 Probe**

**6.2.1 Performance of probe** Probes shall have a performance capable of detecting clearly an artificial discontinuity on the reference test piece.

**6.2.2 Size of transducer** The nominal size of angle probe shall usually be 25 mm or less in length parallel to the tube axis and the nominal size of the transducer of normal probe used for immersion technique shall usually be 25 mm or less in diameter (including a triangle of almost the same area as that).

**6.2.3 Frequency** The nominal frequency shall generally be 15 MHz or less. In the case of, however, using a frequency less than or equal to 1 MHz, it shall be subjected to agreement between purchaser and supplier.

**6.2.4 Angle of refraction** The angle of refraction shall be as follows:

- a) For using an angle probe, the probe used shall be suitable to detect clearly artificial discontinuities on the outside and inside surfaces of reference test piece.  
 Information : Those having a nominal angle of refraction given in table 1 are recommended in general.
- b) For the case of angle beam scanning by using a normal probe, adjustment shall be made by referring to table 1 and obtaining suitable angle of refraction to detect clearly artificial discontinuities on the outside and inside surfaces of reference test piece.

**Table 1 Nominal angle of refraction of angle probe**

t/D	Nominal angle of refraction
2.3 % max.	70° 60° 45° 40°
Over 2.3 % up to and incl. 5.8 %	60° 45° 40°
Over 5.8 % up to and incl. 13 %	45° 40°
Over 13 % up to and incl. 20 %	40° 35°

Remarks : The angle of refraction of angle probe shall be measured in accordance with JIS Z 2350.

**6.3 Scanning equipment** The scanning equipment shall have a device whereby the tube and/or the probe can move relatively to detect mainly longitudinal imperfections.

**6.4 Automatic alarm and recording devices** The automatic alarm device and the recording device shall have sufficient performance for the works of scanning and judgement of the results.

**7 Reference test piece**

**7.1 Material** The material used for the reference test piece shall have an outside diameter and thickness and also ultrasonic characteristics equivalent to the pipe or tube to be examined.

**7.2 Classification and shape and dimensions of reference notches and holes**

**7.2.1 Classification** The reference notches and holes, which are artificial discontinuities such as square notch, V notch and drilled hole, shall be classified according to the designation of the discontinuity and the notch depth or hole diameter as given in table 2.

**Table 2 Classification of reference notches and holes**

Designation	Square notch	V notch		Drilled hole	
	Notch depth	Designation	Notch depth	Designation	Hole diameter
N-3	3 % of nominal thickness	V-3	3 % of nominal thickness	D-3.2	3.2 mm
N-5	5 % of nominal thickness	V-5	5 % of nominal thickness	D-5.0	5.0 mm
N-8	8 % of nominal thickness	V-8	8 % of nominal thickness		
N-10	10 % of nominal thickness	V-10	10 % of nominal thickness		
N-12.5	12.5 % of nominal thickness	V-12.5	12.5 % of nominal thickness		
N-15	15 % of nominal thickness	V-15	15 % of nominal thickness		

Remarks 1 The minimum value of square and V notches shall be 0.3 mm for hot-finished seamless steel tubes and electric resistance weld steel tubes, and 0.2 mm for cold-finished seamless steel tubes.

- 2 The maximum value of square notch depth shall be 1.5 mm. In the case of tubes with a thickness in excess of 50 mm, it may be extended up to 3.0 mm by agreement between purchaser and supplier.
- 3 The V notch can be used only in the case of the notch depth less than or equal to 0.5 mm.

**7.2.2 Shape and dimensions** The reference notches and holes shall be shaped in square or V notch or drilled hole shown in figure 1 with the following dimensions and tolerances.

a) **Square notch**

- 1) To be less than or equal to 1.5 mm in width.
- 2) To be of a convenient length selected by the manufacturer for calibration and checking purposes. It shall be less than or equal to 50.8 mm.
- 3) The tolerance on depth is to be  $\pm 15\%$  or  $\pm 0.05$  mm, whichever is the larger.

b) **V notch**

- 1) To be  $60^\circ$  in angle.
- 2) To be of a convenient length selected by the manufacturer for calibration and checking purposes. It shall be less than or equal to 50.8 mm.
- 3) The tolerance on depth is to be  $\pm 15\%$  or  $\pm 0.05$  mm, whichever is the larger.

c) **Drilled hole**

- 1) To be a through hole.
- 2) The hole diameter is to be as given in table 2 with the tolerance of  $\pm 0.2$  mm.

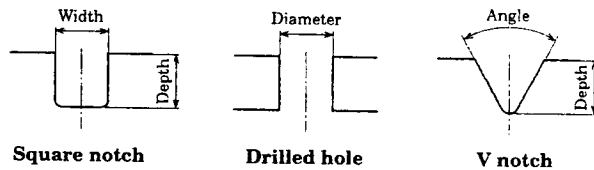


Figure 1 Sectional shapes of reference notches and holes

**7.3 Interval of reference notches or holes** Where plural number of reference notches or holes are processed, they shall be sufficiently separated from each other so that clearly distinguishable signal indications are obtained.

**7.4 Processing of reference notches and holes** The square and V notches shall be formed on the external and internal surfaces in parallel to the major axis of the tube by machining or spark erosion process. In the case of application to a tube of internal diameter less than or equal to 15 mm, these shall be formed only on the external surface. Square notches shaped in U-bottom shall be treated equally. The drilled hole shall be formed normal to the tube surface.

**7.5 Dimensional measurement of reference notches and holes** The dimensions (length and depth) of processed reference notches and holes shall be verified by such a suitable technique as using vernier calipers and depth gauge with the tolerance given in 7.2.2.

**8 Method of test**

**8.1 Method of test** Tubes shall be examined for longitudinal imperfections with scanning in two opposing circumferential directions (clockwise and counterclockwise). Scanning in one circumferential direction shall be subject to agreement between the purchaser and supplier. The scanning technique shall be immersion method (including local immersion technique), gap scanning or contact scanning. It is recognizable that there is short length at both ends which may not be able to be tested.

**8.2 Couplant** The couplant shall generally be water.

**8.3 Scanning pitch** The scanning pitch in the case of rotating tube or rotating probe shall generally be as that the ultrasonic beam covers the whole tube surface.

**8.4 Calibration of working sensitivity** The calibration of working sensitivity shall be as follows:

- a) The acceptance levels for calibration of working sensitivity, given in table 3, shall be applied according to the manufacturer's product standard or agreement between purchaser and supplier.
- b) For the calibration of working sensitivity, which shall be performed at the start of production run and whenever any tube dimension or reference notch is changed or other case, the equipment shall be adjusted to produce, to enable the judgement, clearly identifiable signals from both the external and internal reference notches or from the external reference notch. Where the signals from the external and internal reference notches are different, the acceptance level shall be set at the lesser of the two signals or acceptance level shall be set for each separately.
- c) For the calibration, such dynamic technique is preferable as scanning the reference test piece processed with reference notch(es) or hole at a speed equivalent to the production test. Where the equivalent dynamic technique is impractical, other calibration technique may be used in the conditions as near as possible with any necessary adjustment to sensitivity made.

**Table 3 Working sensitivity**

Division	Type of reference notches and holes used		
	Square notch	V notch	Drilled hole
UO	N-3	V-3	—
UA	N-5	V-5	—
UB	N-8	V-8	—
UC	N-10	V-10	D-3.2
UD	N-12.5	V-12.5	D-3.2
UE	N-15	V-15	D-5.0

Remarks 1 In the case where the depth of square notch is less than or equal to 0.5 mm, V notch may be used in place of the square notch.

2 The division UO applies only to such a case as that it is a special purpose seamless steel tube with very fine surface properties and agreed by the purchaser and supplier.

**8.5 Checking** The working sensitivity shall be checked as follows:

- a) The sensitivity shall be checked at completion of the examination work and at least every 8 h to confirm that it is kept within -3 dB from the specified sensitivity.

The frequency of checking the calibration shall be at least every 4 h or once every 10 production tubes tested, whichever is the longer time period.

- b) If the checking sensitivity of a) confirmed drop exceeding 3 dB beyond the specified sensitivity, all tubes tested since the previous check shall be retested after the equipment has been recalibrated.
- c) Retesting shall not be necessary even after a drop in test sensitivity of more than 3 dB, provided that suitable recordings from individually identifiable tubes are available. Where accurate classification of individual tubes is permitted into suspect and acceptable categories, the tubes in acceptance shall only be re-examined.

**9 Acceptance** The judgement on the result scanned shall be as any of the following:

- a) Any tube producing signals lower than the signal level from the reference notch or hole on the reference test piece shall be deemed to have passed this test.
- b) Any tube producing signals greater than or equal to the signal level from the reference notch or hole shall be subjected to any of the following actions.
  - 1) After the suspect area is exposed by dressing, the tube shall be retested.
  - 2) After the suspect area is cropped off, the tube is deemed to have passed this test.
  - 3) The tube shall be deemed not to have passed this test.

**10 Record** In making record of examination, the following information shall be contained.

- a) Date of examination
- b) Type symbol and size of the steel pipe or tube
- c) Type of ultrasonic equipment
- d) Nominal frequency
- e) Type symbol of probe
- f) Scanning technique (distinction of immersion method, gap technique and contact technique)
- g) Acceptance level and reference test piece used
- h) Couplant
- i) Name of examination personnel
- j) Results of examination

**Annex 1 (normative)**

**Ultrasonic examination of steel tubes having a thickness-to-diameter percentage ( $t/D$ ) exceeding 20 %**

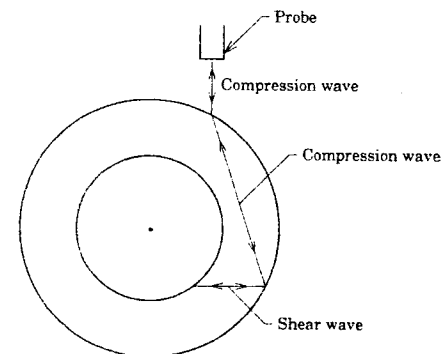
**1 Scope** The ultrasonic examination of steel tubes with a  $t/D$  exceeding 20 % is specified here. This shall be applied by agreement between purchaser and supplier.

**2 Scanning** The scanning technique shall be as follows:

- a) In the case of  $t/D$  over 20 % but less than or equal to 25 %
  - 1) The internal longitudinal notch or hole depth shall be increased in relation to the external notch or hole depth as given in annex 1 table 1.
  - 2) For the angle of refraction in test object, the probe used shall be suitable to detect clearly the reference notches or holes on the external and internal surfaces of the reference test piece.
  - 3) For detecting the reference notch or hole clearly, the mode-transformation technique defined in b) may be used as required.
- b) In the case of  $t/D$  over 25 %
  - 1) For the angle of refraction in test object, the probe used shall be suitable to detect clearly the reference notches or holes on the external and internal surfaces of the reference test piece.
  - 2) For application of angle beam scanning by using mode-transformation technique (see annex 1 figure 1), the ratio of internal to external reference notch or hole depth shall be by agreement between purchaser and supplier, but not be greater than the relevant ratios given in annex 1 table 1.

**Annex 1 Table 1 Percentage of tube thickness-to-outside diameter ( $t/D$ ) and ratio of internal to external reference notch depth**

$t/D$	Ratio of internal to external reference notch depth
Over 20 % up to and incl. 21 %	1.6
Over 21 % up to and incl. 22 %	1.9
Over 22 % up to and incl. 23.5 %	2.2
Over 23.5 % up to and incl. 25 %	2.5



**Annex 1 Figure 1 Angle scanning by using mode-transformation**

**Annex 2 (informative)**

**Comparison table between JIS and corresponding International Standards**

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
<p><b>JIS G 0582:2004</b> <i>Ultrasonic examination for steel pipes and tubes</i></p> <p><b>ISO 9303:1989</b> <i>Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Full peripheral ultrasonic testing for the detection of longitudinal imperfections</i></p> <p><b>ISO 9764:1989</b> <i>Electric resistance and induction welded steel tubes for pressure purposes—Ultrasonic testing of the weld seam for the detection of longitudinal imperfections</i></p> <p><b>ISO 10332:1994</b> <i>Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Ultrasonic testing for the verification of hydraulic leak-tightness</i></p>							
1 Scope	1) Imperfection detected: Longitudinal imperfections of seamless steel tubes and weld seam of electric resistance weld steel tubes	ISO 9303	1	Longitudinal imperfections of seamless or welded tubes for pressure purposes	MOD/alteration		On account of user's convenience integrated 3 ISO Standards. There are no actual differences.
		ISO 9764	1	Longitudinal imperfections of weld seam of electric resistance and induction welded steel tubes			

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
1 Scope (concluded)		ISO 10332	1	Requirements for ultrasonic testing of seamless and welded steel tubes for pressure purposes for verification of hydraulic leak-tightness			
	2) Test method and acceptance level, angle beam ultrasonic examination, 6 acceptance levels (in 8.4)	ISO 9303	1	Full peripheral ultrasonic shear wave testing by 4 acceptance levels	MOD/addition	JIS adds acceptance levels UB and UE.	Reflecting actual situation of commercial transactions.
		ISO 9764	1	Ultrasonic testing by 2 acceptance levels			
	3) Applicable sizes Outside diam.: 9 mm min. Thickness: 1 mm min. $t/D$ : 20 % max. For $t/D$ over 20 %, annex 1 may apply by agreement.	ISO 9303	1	Outside diam.: 9 mm min. $D/t$ : 5 min. For $D/t$ less than 5, annex A may apply by agreement.	MOD/addition	JIS adds range of thickness.	To clarify the range of applicable sizes.
		ISO 10332	1	Outside diam.: 168.3 mm min. Lesser tubes are by agreement. $D/t$ : 5 min.			

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
2 Normative references	JIS G 0431 JIS Z 2300 JIS Z 2305 JIS Z 2344 JIS Z 2350 JIS Z 2352	ISO 10332	2	ISO 235 ISO 286-1 ISO 9302 ISO 11484	MOD/ addition	JIS adds reference standards for terms, general rule and performance of equipments which are not adopted in ISO.	Following the adoption of requirements which are not in ISO, the normative references relating to performance of equipments are added.
3 Definitions	In addition to application of JIS Z 2300, defines 2 items.		—	No item of definition.	MOD/ addition	JIS adds definition of terms.	To clarify the definition of instruments and classification of imperfections.
4 General requirements	Opportunity of examination: To be desirable to perform on the tubes after completion of all the production processes (heat-treatment, cold-finishing, etc.).	ISO 9303 ISO 9764 ISO 10332	2	Inspections shall usually be conducted on the tubes after completion of all the production processes.	MOD/ addition	JIS adds specification of examination period.	JIS specifies clearly the inspection period.
	Properties of steel tubes: To be free from warp and sticky foreign matters on the surface as would interfere with effectiveness of the examination.	ISO 9303 ISO 9764 ISO 10332	2	Identical with JIS.	IDT		

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
5 Examination personnel	A person having sufficient knowledge and experiences. JIS G 0431, JIS Z 2305 or other equivalent certification standards may apply by agreement between purchaser and supplier.	ISO 9303 ISO 9764	2.1	To be carried out by suitably trained operators and be supervised by competent personnel nominated by the manufacturer.	MOD/ addition	Certification standards of JIS G 0431 and JIS Z 2305 are added to JIS.	JIS allows application of JIS G 0431 and JIS Z 2305 established in 2001 or any other standard equivalent to these for the certification standard.
		ISO 10332	3.1	To be carried out by personnel certificated according to ISO 11484, as nominated by the manufacturer.			
6 Test instrument	6.1 Ultrasonic equipment Specifies periodic checking cycle and items (including performance)	ISO 9303 ISO 9764 ISO 10332		—	MOD/ addition	Adds the specification of functional performance of test instrument.	The former JIS is followed, as it is necessary for correct testing to clarify the performance of instruments.
	6.2 Probe Performance of probe: To be capable of detecting clearly reference notches.	ISO 9303 ISO 9764 ISO 10332		—			
	6.3 Scanning equipment						
	6.4 Automatic alarm and recording devices						

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
6 Test instrument (concluded)	6.2 Probe Size of transducer: 25 mm max. in parallel to tube axis, and 25 mm max. in diameter for normal probe at using for immersion method.	ISO 9303	3.4	Max. width of each individual transducer is 25 mm in parallel to tube axis. For a tube of outside diameter less than or equal to 50 mm in L1, L2 categories, width of transducer unit is restricted to 12.5 mm max.	MOD/ deletion	Deletes the proviso for restriction of transducer width related to L1, L2 category tubes of outside diameter 50 mm max.	Deleted as the basis for such restriction is unclear and poor in rationality.
			ISO 9764 ISO 10332	3.4 4.4			
7 Reference test piece	7.1 Material To be equivalent to the tube to be examined in outside diameter, thickness and ultrasonic characteristics.	ISO 9303 ISO 9764 ISO 10332	4.3 4.3 5.3	Identical with JIS.	IDT		

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures																					
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation																						
7 Reference test piece (continued)	7.2.1 Classification of reference notches and holes Shape of reference notch and hole: To be square or V notch or drilled hole. <table border="1"> <tr> <td>Square notch</td> <td>V notch</td> <td>Drilled hole</td> </tr> <tr> <td>3 %</td> <td>3 %</td> <td>3.2 mm</td> </tr> <tr> <td>5 %</td> <td>5 %</td> <td>5.0 mm</td> </tr> <tr> <td>8 %</td> <td>8 %</td> <td></td> </tr> <tr> <td>10 %</td> <td>10 %</td> <td></td> </tr> <tr> <td>12.5 %</td> <td>12.5 %</td> <td></td> </tr> <tr> <td>15 %</td> <td>15 %</td> <td></td> </tr> </table> Min. depth: Min. depth of square and V notches: Heat-finished seamless and ERW tubes: 0.3 mm Cold-finished seamless tubes: 0.2 mm	Square notch	V notch	Drilled hole	3 %	3 %	3.2 mm	5 %	5 %	5.0 mm	8 %	8 %		10 %	10 %		12.5 %	12.5 %		15 %	15 %		ISO 9303	4.2 5.2	Classification of "N" type notches: Acceptance level N notch L1 3 % L2 5 % L3 10 % L4 12.5 %	Classification of reference notches: MOD/ addition	Classification of notches: JIS adds 8 % and 15 % notch depths and 5.0 mm drilled hole.	Classification of reference notches and holes: Reflecting actual situation of commercial transaction. 15 % notch and 5.0 mm hole are to be applied to ordinary piping purpose pipes which are out of the scope of application of ISO.
		Square notch	V notch	Drilled hole																								
3 %	3 %	3.2 mm																										
5 %	5 %	5.0 mm																										
8 %	8 %																											
10 %	10 %																											
12.5 %	12.5 %																											
15 %	15 %																											
	Min. depth: Specifies by every sub-category. Sub- cate- gory A 0.1 mm Cold-finished or machined B 0.2 mm ditto C 0.3 mm Other finish than the above D 0.5 mm ditto	Min. depth: MOD/ deletion	Min. depth: JIS adopts categories B and C in ISO for the min. depth (no adoption of A and D)	Min. depth: JIS deleted categories A and D as these are not actually used.																								

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
7 Reference test piece (continued)	Max. depth: 1.5 mm Max. depth of square notch: 1.5 mm Except for tube thickness over 50 mm, in which case the notch depth may increase to 3.0 mm by agreement. V notch may be used in notch depth 0.5 mm or less.	ISO 9303	4.2	Max. depth: 1.5 mm	Max. depth: IDT		
			5.2	Except for tube thickness over 50 mm, in which case it may increase to 3.0 mm by agreement.			
			4.5	For notch depth 0.5 mm or less, V notch may be used.			
		ISO 9764	4.2	To calibrate equipment by using N notch.			
			5.2	Use of reference hole by agreement is permitted, provided equivalency to N notch is verified. Level N notch min. max. L3 10% 0.3 mm 1.5 mm L4 12.5% 0.5 mm 1.5 mm			
		4.5	In the case of notch depth 0.5 mm or less, V notch may also be used.				
ISO 10332	5.2	To calibrate by external notch or reference hole (through). "N" type notch Hole 12.5% 3.2 mm Min. depth of N type notch 0.5 mm Max. depth of N type notch 1.5 mm					
	6						

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
7 Reference test piece (continued)	7.2.2 Shape and dimensions of reference notches and holes Square notch: Width: 1.5 mm max. Length: 50.8 mm max. Tolerance on depth: ±15% of nominal value or ±0.05 mm, whichever is the larger V notch: Angle: 60° Length (the same as square notch) Tolerance on depth (the same as square notch) Tolerance on drilled hole: Nominal value ±0.2 mm	ISO 9303	5	"N" type notch: Width: 1.5 mm max. Length: Convenient length for calibration, except that it is to be 12.5 mm max. for L1 and L2 category tubes with an outside diameter 50 mm or less and where a transducer width exceeds 12.5 mm. Tolerance on depth: ±15% of notch depth or ±0.05 mm, whichever is the larger	MOD/ addition in length MOD/ deletion of proviso in length	JIS adds 50.8 mm in length. JIS deletes the proviso.	To define twice the upper limit of transducer 25.4 mm to clarify the requirement content. To delete the proviso as the basis is unclear.
			ISO 9764	5			
		ISO 10332	6	"N" type notch: Width: 1.5 mm max. Length: Convenient length for calibration Tolerance on depth: ±15% of notch depth or ±0.05 mm, whichever is the larger Tolerance on reference hole: Nominal diameter + 0.2 mm			

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
7 Reference test piece (concluded)	7.3 Reference notch interval Omitted	ISO 9303 ISO 9764 ISO 10332	4.4	Identical with JIS.	IDT		
			4.4				
			5.4)				
	7.4 Processing of reference notches and holes Omitted	ISO 9303 ISO 9764 ISO 10332	4.6	Identical with JIS.	IDT		
			4.6)				
			5.6				
	7.5 Dimension measurement of reference notches and holes Omitted	ISO 9303 ISO 9764 ISO 10332	5.4	Identical with JIS.	IDT		
			5.4				
			6.1.5				
8 Method of test	8.1 Method of test Scanning direction: Scanning in 2 opposing circumferential directions for detecting longitudinal imperfections Scanning technique: Immersion method, gap scanning or contact scanning No scanned parts at both tube ends. To be recognized	ISO 9303 ISO 9764 ISO 10332	3	Scanning direction: Scanning in 2 opposing circumferential directions No scanned part at both tube ends: Recognized	MOD/ addition	JIS adds scanning technique and couplant.	To clarify the requirement content.
			3				
			4				
	8.2 Couplant To usually be water						

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures																											
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation																												
8 Method of test (continued)	8.3 Scanning pitch For rotation scanning, to usually be such a pitch as that the ultrasonic wave beam covers the whole tube surface.	ISO 9303 ISO 10332	3	To allow tube and transducer assembly to move relative to each other so that scanning the whole tube surface is possible.	IDT																													
			4																															
	8.4 Calibration of working sensitivity a To perform the calibration at the start of production run, changing tube sizes, changing reference notch and other cases.	ISO 9303 ISO 9764 ISO 10332	6.4	Identical with JIS.	IDT																													
	6.4																																	
	7.4																																	
	b For calibration of working sensitivity, to usually be according to production standard, or apply the following divisions by agreement between purchaser and supplier.	ISO 9303 ISO 9764 ISO 10332	5.2	Level N notch or drilled hole L1 3 % L2 5 % (equivalent to N notch) L3 10 % L4 12.5 %	MOD/ addition	JIS adds acceptance levels UB and UE.	Reflecting actual situation of commercial transactions. Level UE applies to pipes for ordinary piping which are out of ISO scope.																											
			5.2																															
			6.1.2 6.2.1					N notch 12.5 %	Drilled hole 3.2 mm																									
	<table border="0"> <tr> <td>Division</td> <td>Square notch</td> <td>V notch</td> <td>Drilled hole</td> </tr> <tr> <td>UO</td> <td>N-3</td> <td>V-3</td> <td></td> </tr> <tr> <td>UA</td> <td>N-5</td> <td>V-5</td> <td></td> </tr> <tr> <td>UB</td> <td>N-8</td> <td>V-8</td> <td></td> </tr> <tr> <td>UC</td> <td>N-10</td> <td>V-10</td> <td>D-3.2</td> </tr> <tr> <td>UD</td> <td>N-12.5</td> <td>V-12.5</td> <td>D-3.2</td> </tr> <tr> <td>UE</td> <td>N-15</td> <td>V-15</td> <td>D-5.0</td> </tr> </table>	Division	Square notch	V notch	Drilled hole	UO	N-3	V-3		UA	N-5	V-5		UB	N-8	V-8		UC	N-10	V-10	D-3.2	UD	N-12.5	V-12.5	D-3.2	UE	N-15	V-15	D-5.0					
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(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
Clause	Content		Clause	Content	Classification by clause	Detail of technical deviation	
8 Method of test (continued)	c To perform calibration of working sensitivity by a dynamic technique equivalent to production scanning speed. If not, by other technique similar to that and correction made as required.	ISO 9303 ISO 9764 ISO 10332	6.2	Identical with JIS.	IDT		
	6.2 7.2						
	8.5 Checking a Checking period: To be checked at completion of examination works and at least every 8 h. It may be altered by agreement to every 4 h or once every 10 production tubes whichever is the longer.	ISO 9303 ISO 9764 ISO 10332	6.3 6.3 7.3	To be every 4 h or once every 10 production tubes whichever is the longer time period, but also to perform at the time of operator change-over and at the start and end of production run. Where a production run continues from one shift to the next, the 4 h max. period may be extended by agreement between purchaser and supplier.	MOD/ addition	JIS permits also 8 h frequency.	Although JIS has defined the period of every 8 h, with the reliability obtained, for the purpose of conformity, permits the same frequency as ISO based on the agreement.

(I) Requirements in JIS		(II) International Standard number	(III) Requirements in International Standard		(IV) Classification and details of technical deviation between JIS and the International Standard by clause Location of deviation: text Indication method: dotted underlines		(V) Justification for the technical deviation and future measures
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8 Method of test (concluded)	b Treatment for fluctuation in checking: In the case of sensitivity drop exceeding 3 dB, to retest all tubes tested since the previous check. Even after a drop exceeding 3 dB, if capable of judgement on the individual tubes separately by suitable recording, etc., retest is not necessary.	ISO 9303 ISO 9764 ISO 10332	6.5 6.5 7.5	Identical with JIS.	IDT		
9 Acceptance	a Acceptance: Any tube producing signals lower than signal levels from the reference notch is deemed to have passed.	ISO 9303 ISO 9764 ISO 10332	7.1 7.1 8.1	Identical with JIS.	IDT		
	b Treatment for tubes exceeding the specified level: • To retest the tube after dressing the suspect part. • Cropping off the suspect part. • To deem the tube not to have passed.	ISO 9303 ISO 9764	7.2, 7.3, 7.4 7.2, 7.3, 7.4	To deem to be suspect or retest by the same conditions. Treatment of suspect tubes: • To retest after dressing. • Cropping off suspect area. • To deem not to have passed.	IDT		
		ISO 10332	8.2, 8.3, 8.4 (pass or fail)	Specifies below in addition to the above • To apply a hydraulic leak-tightness test according to the product standard.			

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10 Record	Specifies the items to be recorded	ISO 9303 ISO 9764 ISO 10332	8 8 9	Identical with JIS.	MOD/ addition	JIS adds the items to be recorded which are type of ultrasonic equipment, nominal frequency, type symbol of probe, couplant and name of examination personnel.	The said items are indispensable for the JIS standard of ultrasonic examination.
Annex 1 (normative)		ISO 9303	Annex A		IDT		

Designated degree of correspondence between JIS and International Standards: MOD

Remarks 1 Symbols in sub-columns of classification by clause in the above table indicate as follows:

- IDT: Identical in technical contents.
- MOD/deletion: Deletes specification item(s) or content(s) of International Standards.
- MOD/addition: Adds specification item(s) or content(s) not included in International Standards.
- MOD/alteration: Alters the specification content(s) included in International Standards.

2 Symbol in column of designated degree of correspondence between JIS and International Standards in the above table indicates as follows:

- MOD: Modifies International Standards.