Eddy current examination of steel pipes and tubes by encircling coil technique

Introduction This Japanese Industrial Standard has been prepared based on **ISO 9302** *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Electromagnetic testing for verification of hydraulic leak-tightness* published in 1994 as the first edition and **ISO 9304** *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Eddy current testing for the detection of imperfections* published in 1989 as the first edition with some modifications of the technical contents.

Portions underlined with dots are the matters in which the contents of the original International Standards have been modified. A list of modifications with the explanations is given in annex 3 (informative).

1 Scope This Japanese Industrial Standard specifies the eddy current examination, using encircling coil, for the seamless steel pipes, welded steel pipes and forge welded steel pipes mainly of 4 mm to 180 mm in outside diameter and 0.7 mm to 20 mm in thickness.

The general matter other than requirements specified in this Standard shall be in accordance with **JIS G 0568**.

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

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**.

ISO 9302 : 1994 *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Electromagnetic testing for verification of hydraulic leak-tightness* (MOD)

ISO 9304 : 1989 *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Eddy current testing for the detection of imperfections* (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 G 0568 *Method for eddy current testing of steel products by encircling coil technique*

JIS Z 2300 *Terms and definitions of nondestructive testing*

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

JIS Z 2315 *Test methods for performance characteristics of eddy current flaw detecting system*

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

a) **marking apparatus** The apparatus to mark on the signal generating part of material to be inspected, when the height of signal exceeds the criterion.

b) **automatic alarm device** The apparatus to give a warning by light or sound, when the height of signal exceeds the criterion.

c) **straightener spiral mark** The spiral pattern produced on the inside and outside surface of pipe or tube.

d) **scratch** The flaw produced by scratching the surface of pipe or tube.

e) **light scratch** The flaw produced by scratching lightly the surface of pipe or tube.

f) **chattering marks** The bellows-shaped, uneven patterns in circumferential direction on both inside and outside surfaces of pipe or tube produced in drawing process of pipe or tube.

g) **chattering marks by cutting tool** The scraped trace by cutting tool remained continuously in wavy shape with narrow intervals produced in bead scraping process of electric resistance welded steel pipe or tube.

4 Inspection engineer The engineer engaged in an eddy current inspection of steel pipes and tubes shall acquire the basic technology on eddy current test and have the sufficient knowledge and experience on properties and inspection methods of steel pipes and tubes to be inspected.

In addition, **JIS G 0431**, **JIS Z 2305**, or the certification standard equivalent to those may apply in accordance with the agreement between the purchaser and the manufacturer.

5 Apparatus for flaw detection

5.1 Construction The apparatus for flaw detection shall be composed of a flaw detection device, a flaw detection coil, a feed device of tube (including flaw detection coil centering apparatus. This applies hereinafter.), a magnetic saturation apparatus, a marking apparatus, and an automatic alarm device or a recording device. However, a magnetic saturation apparatus may be omitted.

5.2 Flaw detection device The flaw detection device shall be composed of an oscillator, an electric apparatus for processing electric signals, an indication apparatus for signals of detects and shall comply with the following.

a) The type, frequency of flaw detection, marking system of signal and so on shall fit the purpose of test.

b) They shall work stably for a long time at 0 °C to 40 °C in ambient temperature and at ± 15 % in voltage variation of power source and shall be protected against electric noise from outside.

5.3 Flaw detection coil The flaw detection coil shall be mainly the differential coil technique. The marking of the type, system and dimensions of flaw detection coil shall comply with **JIS G 0568**.

5.4 Feed device of tube, magnetic saturation apparatus, marking apparatus, automatic alarm device and recording device The feed device of tube, magnetic saturation apparatus, marking apparatus, automatic alarm device and recording device shall provide the sufficient performance for flaw detection work and result judgment work.

5.5 Performance characteristics of apparatus for flaw detection The measurement of performance characteristics for apparatus for flaw detection shall be carried out according to **JIS Z 2315** at the time of periodical checking and as occasion demands, and the apparatus shall provide the sufficient performance for flaw detection work and result judgment work.

6 Reference test piece

6.1 Purpose for use The reference test piece shall be used for the setting of flaw detection condition and confirmation of sensitivity during flaw detection, and the setting of criterion and the confirmation of performance characteristics.

6.2 Material The material used for the reference test piece shall be equal to the tube to be inspected in properties, nominal dimensions, surface conditions and heat treatment conditions.

6.3 Artificial flaw to be used for reference test piece

6.3.1 Types and cross-sectional shape of artificial flaw The types of artificial flaw used for reference test piece shall be of a square notch, a drilled hole or a filed notch, and the shape shall be as shown in figure 1.

In addition, the symbols of the type of artificial flaw shall be "N" for the square notch, "D" for the drilled hole and "F" for the filed notch.

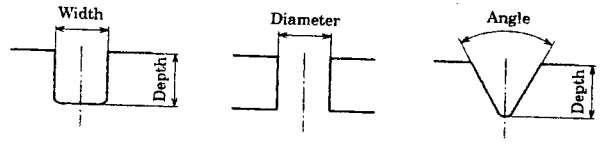

Figure 1 Types and cross-sectional shapes of artificial flaws

6.3.2 Dimensions and dimensional tolerances of artificial flaws The dimensions and dimensional tolerances of artificial flaws used for reference test piece shall comply with tables 1 to 3.

Table 1 Dimensions and dimensional tolerances of square notch

Designation	Depth	Tolerance on depth	Width	Length
N-15	15 % of nominal thickness	±15 % (The minimum value is ±0.05 mm.)	Any of smaller value, 1.5 mm max. or the triple value of depth	25 mm max.
N-20	20 % of nominal thickness			
N-25	25 % of nominal thickness			
N-30	30 % of nominal thickness			
N-40	40 % of nominal thickness			
N-50	50 % of nominal thickness			

Table 2 Dimensions and dimensional tolerances of drilled hole

Designation	Diameter of hole	Tolerance of diameter
D−0.5	0.5 mm	±0.1 mm max.
D−0.65	0.65 mm	
D−0.8	0.8 mm	
D−0.9	0.9 mm	
D−1.0	1.0 mm	
D−1.1	1.1 mm	±0.2 mm max.
D−1.2	1.2 mm	
D−1.4	1.4 mm	
D−1.6	1.6 mm	
D−1.7	1.7 mm	
D−1.8	1.8 mm	
D−2.0	2.0 mm	
D−2.2	2.2 mm	
D−2.5	2.5 mm	
D−2.7	2.7 mm	
D−3.2	3.2 mm	
D−3.7	3.7 mm	

Table 3 Dimensions and dimensional tolerances of filed notch

Designation	Depth	Tolerance on depth	Angle	Length
F-10	10 % of nominal thickness	±10 % (The minimum value is ±0.05 mm.)	60°	20 mm max.
F-12	12 % of nominal thickness			
F-15	15 % of nominal thickness			
F-20	20 % of nominal thickness			
F-25	25 % of nominal thickness			
F-30	30 % of nominal thickness			

6.4 Processing method of artificial flaws The processing method of artificial flaws shall be as follows:

a) Square notches shall be processed on the outside surface of the pipe in its axial direction by machine working or electric discharge process. In the case of square notches, even if some of them were made in "U" shape, these shall be regarded as equivalent to the square notches.

b) Drilled holes shall be bored through perpendicularly to the surface of the pipe.

c) Filed notches shall be processed by the triangular file in the circumferential direction of the pipe to the surface of the pipe.

7 Method for flaw detection

7.1 Frequency of flaw detection The frequency of flaw detection shall be selected from the range of 0.5 kHz to 512 kHz and be capable of sufficiently detecting the artificial flaw of reference test piece.

7.2 Flaw detection coil The flaw detection coil shall be capable of sufficiently detecting the artificial flaw of reference test piece used for setting sensitivity.

7.3 Setting of condition for flaw detection

7.3.1 Artificial flaw for setting of sensitivity of flaw detection For artificial flaw for setting of sensitivity of flaw detection, the classification in table 4 shall apply.

In addition, when the sensitivity classification L2 and L4 of annex 1, or annex 2 is designated according to the specification of product standard or the agreement between the purchaser and the manufacturer, it shall be followed.

Table 4 Artificial flaw for setting of sensitivity of flaw detection

Division	Outside diameter: 50.8 mm max.			Outside diameter: exceeding 50.8 mm		
	Square notch	Drilled hole	Filed notch	Square notch	Drilled hole	Filed notch
EU	N−15	D−1.0	F−10	N−20	D−1.2	F−12
EV	N−20	D−1.2	F−12	N−25	D−1.6	F−15
EW	N−25	D−1.6	F−15	N−30	D−2.0	F−20
EX	N−30	D−2.0	F−20	N−40	D−2.5	F−25
EY	N−40	D−2.5	F−25	N−50	D−3.2	F−30
EZ	N−50	D−3.2	F−30	N−50	D−3.2	F−30

Remarks 1 The minimum value of depth for square notch and filed notch shall be 0.3 mm for hot-worked seamless steel pipes, electric resistance welded steel pipes and forge welded steel pipes, and 0.2 mm for cold-worked seamless steel pipes and welded stainless steel pipes.

2 The artificial flaw to be used shall be the square notch as the standard, and unless otherwise specified by the purchaser, the drilled hole or the filed notch equivalent to the square notch may be used.

7.3.2 Adjustment of flaw detection device

a) The adjustment of flaw detection device shall be carried out by using the reference test piece of the classification selected from table 4.

b) The sensitivity of flaw detection device shall be adjusted so that the signal from the artificial flaw of reference test piece comes to the requisite size for judgment.

7.3.3 Adjustment of marking apparatus, automatic alarm device or recording device The marking apparatus, automatic alarm device or recording device shall be adjusted so that the indication from artificial flaw comes in the normal working range in the running condition of reference test piece.

7.3.4 Adjustment of centering apparatus of flaw detection coil The adjustment of centering apparatus of flaw detection coil shall be carried out so that the signal from artificial flaw can be adjusted when the pipes are made to pass in flaw detection coil: the ways are as follows; when the artificial flaw of the reference test piece is one, change the positions of the flaw to 0°, 90°, 180° and 270°, and when the flaws are three at each 120° on the pipe circumference or four at each 90°, the positions of the flaws shall remain.

7.4 Setting of criterion For the setting of criterion, the minimum signal of signals from artificial flaw shall be used when the reference test piece having the artificial flaw for setting of sensitivity of flaw detection passes through a flaw detection coil according to **7.3.4**.

7.5 Confirmation of sensitivity The confirmation of sensitivity shall be carried out as follows:

a) The confirmation of sensitivity shall be carried out at the completion time of inspection work and at least every 8 h, and it shall be confirmed that the sensitivity is maintained at least within −3 dB from the standard sensitivity.

In addition, according to the agreement between the purchaser and the manufacturer, the confirmation of sensitivity may be carried out every 4 h or every 10 pieces, whichever is the longer.

b) When the fall of exceeding −3 dB from the standard sensitivity is confirmed based on the confirmation of sensitivity in **a)**, the retest of all pipes and tubes which were inspected after the previous adjustment shall be performed after readjusting the sensitivity of flaw detection. Even if the sensitivity of flaw detection has fallen by exceeding −3 dB from the standard sensitivity, when the judgment of individual pipes and tubes is made possible by utilizing the suitable records, etc., the retest may not be required. When only the distinction of acceptance and rejection of individual pipes and tubes is classified, the retest of only the pipes and tubes which were judged to be acceptable may be required.

7.6 Time for flaw detection The eddy current examination specified in this Standard of pipes and tubes which completed all the manufacturing process (for example, the process which changes the eddy current characteristic and the shape of pipes and tubes such as heat treatment, temper rolling) should be performed.

8 Judgment of results Those pipes, from which no signal equal to or more than that from the artificial flaws of the reference test piece may be detected, shall be regarded as acceptance.

Those pipes, from which signals equal to or more than that from the artificial flaws of the reference test piece may be detected, shall be treated by any of the following:

a) For the pipes supposed to show a false signal and the pipes after corrected or mended, the pipes, from which no signal equal to or more that from the artificial flaws is detected when redetecting flaws under the previously set condition, shall be regarded as acceptance. The retest by other non-destructive tests or test methods may be allowed.

b) The confirmation may be performed by a visual observation and by a signal-generating condition. Those pipes, which have the signals caused by the flaws listed below and are judged not to be practically detrimental under the responsibility of the manufacturer, may be regarded as acceptance unless otherwise specified specially by the specification of product standard or by the agreement between the purchaser and the manufacturer.

1) Straightener spiral mark
2) Scratch and light scratch
3) Chattering marks
4) Chattering marks by cutting tool
5) Other similar flaws

c) The portion, from which the signal equal or more than that from the artificial flaws may be detected, shall be cut off.

d) Rejected

9 Records In the records of test results, the following information shall be described:

a) Date of inspection

b) Inspection engineer

c) Type symbol of pipe

d) Dimension of pipe

e) Apparatus for flaw detection

f) Division of sensitivity of flaw detection and reference test piece used

g) Flaw detection coil

h) Flaw detection frequency

i) Method for flaw detection, flaw detection condition (flaw detection speed, sensitivity of flaw detection, phase, etc.)

j) Inspection result

Annex 1 (normative)

Artificial flaws of acceptance level, L2 and L4 specified in ISO 9304

1 Scope This annex specifies the artificial flaws specified in **ISO 9304**. When the acceptance level, L2 and L4 specified in **ISO 9304** or the acceptance level, L2 and L4 in annex 1 table 1 of this Standard is specified in accordance with the specification of product standard or the agreement between the purchaser and the manufacturer, this annex 1 applies.

2 Type of artificial flaws The type of artificial flaws to be used for the reference test piece shall be the drilled hole.

3 Dimension of artificial flaws for setting of sensitivity of flaw detection The dimension of artificial flaws shall be that of the drilled holes given in annex 1 table 1.

Annex 1 Table 1 Dimension of artificial flaws for setting of sensitivity of flaw detection

Acceptance level, L2		Acceptance level, L4	
Pipe outside diameter (mm)	Designation	Pipe outside diameter (mm)	Designation
$D \leqq 6$	D−0.5	$D \leqq 26.9$	D−1.2
$6 < D \leqq 19$	D−0.65	$26.9 < D \leqq 48.3$	D−1.7
$19 < D \leqq 25.4$	D−0.8	$48.3 < D \leqq 63.5$	D−2.2
$25.4 < D \leqq 31.8$	D−0.9	$63.5 < D \leqq 114.3$	D−2.7
$31.8 < D \leqq 42.4$	D−1.1	$114.3 < D \leqq 139.7$	D−3.2
$42.4 < D \leqq 60.3$	D−1.4	$139.7 < D \leqq 177.8$	D−3.7
$60.3 < D \leqq 76.1$	D−1.8		
$76.1 < D \leqq 114.3$	D−2.2		
$114.3 < D \leqq 152.4$	D−2.7		
$152.4 < D \leqq 177.8$	D−3.2		

Annex 2 (normative)

Artificial flaws specified in ISO 9302

1 Scope This annex specifies the artificial flaws specified in **ISO 9302**. When the artificial flaws specified in **ISO 9302** or in annex 2 of this Standard are specified in accordance with the specification of product standard or the agreement between the purchaser and the manufacturer, this annex 2 applies.

2 Type of artificial flaws The type of artificial flaws to be used for the reference test piece shall be the drilled hole.

3 Dimension of artificial flaw for setting of sensitivity of flaw detection The dimension of artificial flaws shall be that of the drilled holes given in annex 2 table 1.

Annex 2 Table 1 Dimension of artificial flaws for setting of sensitivity of flaw detection

Pipe outside diameter (mm)	Designation
$D \leqq 26.9$	D−1.2
$26.9 < D \leqq 48.3$	D−1.7
$48.3 < D \leqq 63.5$	D−2.2
$63.5 < D \leqq 114.3$	D−2.7
$114.3 < D \leqq 139.7$	D−3.2
$139.7 < D \leqq 177.8$	D−3.7

Annex 3 (informative)

Comparison table between JIS and corresponding International Standards

JIS G 0583: 2004 *Eddy current examination of steel pipes and tubes by encircling coil technique*									**ISO 9304**: 1989 *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Eddy current testing for the detection of imperfections* **ISO 9302**: 1994 *Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes—Electromagnetic testing for verification of hydraulic leak-tightness*		
(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	MOD/ alteration/ deletion	Detail of technical deviation		
1 Scope	Method for flaw detection: Only the encircling coil technique is specified. Outside diameter: 4 mm to 180 mm Thickness: 0.7 mm to 20 mm Category: Seamless steel pipes, welded steel pipes, forge welded steel pipes		**ISO 9304** **ISO 9302**	1	Method for flaw detection: Concentric coil technique (177.8 mm or under), pancake coil technique, segment coil technique Outside diameter: 4 mm or over Category: Seamless steel pipes, welded steel pipes (excluding SAW)				In **JIS** only the encircling coil technique is specified. Requirements for outside diameter and thickness are also added.		Method for flaw detection: Since the domestic usage track records of techniques other than the encircling coil technique are few, only the encircling coil technique is specified. In the future, if the domestic usage and request increase, the pancake coil technique and segment coil technique will be studied.

(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 G 0568** **JIS Z 2300** **JIS Z 2305** **JIS Z 2315**	**ISO 9304**	2	Three relevant standards are referred to. **ISO 235** **ISO 286-2** **ISO 4200**	MOD/ addition	In **JIS**, **JIS G 0431** and **JIS Z 2305** are added as the certification standard. Furthermore, the standards related to terms, apparatus, performance and certification which are not specified in **ISO** Standard are added.	**JIS G 0431** and **JIS Z 2305** established in 2001 as the certification standard were adopted. The standards related to apparatus and performance which are not specified in **ISO** Standard were added, and simultaneously the relative standards were added.
		ISO 9302	2	**ISO 235** **ISO 286-2** **ISO 4200** **ISO 11484**			
3 Definitions	As definitions of main terms, those given in **JIS Z 2300** and 7 terms [**a**) to **g**)] are specified.	**ISO 9304** **ISO 9302**	—	Not specified.	MOD/ addition	In **JIS** terms to be defined are added.	The definitions of apparatus and kinds of flaws were made more specific.
4 Inspection engineer	The engineer having sufficient knowledge and experience. In addition, **JIS G 0431**, **JIS Z 2305**, or the certification standard equivalent to those may apply in accordance with the agreement between the purchaser and the manufacturer.	**ISO 9304**	3	The inspection shall be carried out by suitable trained operators and supervised by competent personnel nominated by the manufacturer. In the case of third-party inspection, this shall be agreed between the purchaser and manufacturer.	MOD/ addition	The certification standards, **JIS G 0431** and **JIS Z 2305** were added.	**JIS G 0431** and **JIS Z 2305** established in 2001 as the certification standard, or also the certification standard equivalent to those were made applicable.

(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	
4 Inspection engineer (concluded)		**ISO 9302**	3	The inspection shall be carried out by personnel certificated in accordance with **ISO 11484**, as nominated by the manufacturer. In the case of third-party inspection, this shall be agreed between the purchaser and manufacturer.			
5 Apparatus for flaw detection	The construction of apparatus, the performance of flaw detection device and peripheral device, and the performance characteristics, etc. are described. Flaw detection coil: in accordance with **JIS G 0568**. Performance characteristics: in accordance with **JIS Z 2315**.	**ISO 9304**	4.3	No requirements other than those described below are specially specified. The equipment for automatic testing shall be capable of differentiating between acceptable and suspect tubes by means of an automatic trigger/ alarm level combined with a marking and/or sorting system.	MOD/ addition	The requirement for the performance of apparatus for flaw detection were added.	It is necessary for performing the flaw detection exactly to specify the requirement for the performance of apparatus for flaw detection, which follows the conventional **JIS**.

(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 Apparatus for flaw detection (concluded)		ISO 9302	4.2	No requirements other than those described below are specially specified. The equipment for automatic testing shall be capable of differentiating between acceptable and suspect tubes by means of an automatic trigger/alarm level combined with a marking and/or sorting system.			
6 Reference test piece	Dimensions and dimensional tolerances of artificial flaws • Square notch Depth: ± 15% (the minimum value is ± 0.05 mm.) Width: Any of smaller value, 1.5 mm max. or the triple value of depth Length: 25 mm max. • Drilled hole less than φ1.1 mm: ± 0.1 mm max. not less than φ1.1 mm: ± 0.2 mm max.	ISO 9304	5	• Drilled hole less than φ1.1 mm: ± 0.1 mm max. not less than φ1.1 mm: ± 0.2 mm max.	Square notch MOD/addition Drilled hole IDT Filed notch MOD/addition	In JIS the square notch and filed notch are added.	The square notch was taken to be the standard as the flaws to be detected, and since at the same time the drilled hole and filed notch corresponding to this were made applicable, the square notch and filed notch were added.
		ISO 9302	5	• Drilled hole ± 0.2 mm max. (the diameter is not less than φ1.2 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	
6 Reference test piece (concluded)	• Filed notch Depth: ± 10 % (the minimum value is ± 0.05 mm.) Angle: 60° Length: 20 mm max.						
7 Method for flaw detection	7.1 Frequency of flaw detection: Limited to 0.5 kHz to 512 kHz	ISO 9304 ISO 9302	4	—	MOD/addition	In JIS the frequency of flaw detection is specified.	The frequency of flaw detection was concretely specified so that an appropriate flaw detection can be performed.
	7.3.1 Artificial flaw for setting of sensitivity of flaw detection: The artificial flaw of square notch, drilled hole, filed notch, each is classified into 6 divisions by the sensitivity, and 2 divisions by the pipe diameter. Annex 1: Drilled hole (dimensions in ISO 9304) Annex 2: Drilled hole (dimensions in ISO 9302)	ISO 9304	5	For the concentric coil technique, only the drilled hole is specified. L2: 10 levels of dimensions L4: 6 levels of dimensions Drill diameter is specified according to pipe diameter.	MOD/addition	In ISO Standard only the drilled hole is specified. In JIS the square notch, drilled hole, and filed notch are specified.	The square notch was taken to be the standard as the flaws to be detected, and the drilled hole and filed notch corresponding to this were also made applicable. However, in annex, the drilled hole specified in ISO Standard was made applicable to conform to the ISO Standard.
		ISO 9302	5	For the concentric coil technique, only the drilled hole is specified. 6 levels of dimensions Drill diameter is specified according to pipe diameter.			

(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 Method for flaw detection (continued)	7.3.4 Adjustment of centering apparatus of flaw detection coil Any of the following methods: 1) Signals of one artificial flaw of which the positions are changed to 0°, 90°, 180° and 270°. 2) Signals of three artificial flaws at each 120° on the pipe circumference. 3) Signals of four artificial flaws at each 90° on the pipe circumference. For the setting of criterion, the minimum signal is used.	**ISO 9304** **ISO 9302**	5.4	The adjustment of centering apparatus of flaw detection coil shall be performed by any of the following methods: 1) Signals of one artificial flaw of which the positions are changed to 0°, 90°, 180° and 270°. 2) Signals of three artificial flaws at each 120° on the pipe circumference. For the setting of criterion, the minimum signal is used.	MOD/ selection	In **JIS** signals of four artificial flaws at each 90° on the pipe circumference were added so that they can be selected.	The conventional **JIS** is followed in addition to the **ISO** Standard.
	7.5 Confirmation of sensitivity At the completion time of inspection work and at least every 8 h, every 4 h or every 10 pieces, whichever is the longer according to the agreement.	**ISO 9304** **ISO 9302**	7.3	Confirmation of sensitivity At the start and end of flaw detection, at the time of change of operators, At least every 4 h, The 4 h maximum period may be extended by the agreement between the purchaser and the manufacturer	MOD/ addition	In **JIS** 8 h is also made applicable.	In **JIS** the conventional every 8 h is reliably accepted, but even the frequency specified in **ISO** Standard was made applicable to conform to the **ISO** Standard.

(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 Method for flaw detection (concluded)	7.6 Time for flaw detection At the completion time of all the manufacturing process (for example, the process which changes the eddy current characteristic and the shape of pipes and tubes such as heat treatment, cold finishing)	**ISO 9304** **ISO 9302**	3.1	Time for flaw detection After completion of all the production process operations	MOD/ addition	In **JIS** the specific time is added.	The specific time of examination was specified.
	The relative speed of movement during calibration is not specified.	**ISO 9304** **ISO 9302**	7.2	Relative speed of movement during calibration: The relative speed of movement between the test piece and the test coils shall be the same as that to be used during the production test.	MOD/ deletion	In **JIS** the relative speed of movement between the test piece and the test coils is not specified.	It is desirable that the relative speed of movement between the test piece and the test coils agrees between **JIS** and **ISO** Standard, but the conventional **JIS** was followed taking the conventional usage track records into consideration.

(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 Judgment of results	Treatment of pipes designated: a) The retest of pipes supposed to show a false signal and pipes after corrected or mended. The retest by other NDT or test methods b) The confirmation may be performed by a visual observation and by a signal-generating condition. Those pipes, which have the signals caused by the flaws listed below and are judged not to be practically detrimental under the responsibility of the manufacturer, may be regarded as acceptance unless otherwise specified specially by the specification of product standard or by the agreement between the purchaser and the manufacturer. c) To be cut off d) To be rejected	**ISO 9304** **ISO 9302**	8.4	Treatment of pipes designated: a) The retest of pipes supposed to show a false signal and pipes after corrected or mended, The retest by other NDT or test methods by the agreement between the purchaser and the manufacturer b) To be cut off c) To be rejected	MOD/ addition	In **JIS** "pipes judged not to be practically detrimental, may be regarded as acceptance" was added.	Taking the conventional usage track records and working into consideration, the conventional **JIS** was followed.

(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	
9 Records	10 items are specified.	**ISO 9304** **ISO 9302**	9	7 items are specified.	MOD/ addition	In **JIS** the requirements for apparatus for flaw detection, inspection engineer, flaw detection condition are added.	Taking the conventional usage track records and working into consideration, the conventional **JIS** was followed.

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.

— MOD/selection: Parallel requirement(s) for specification content(s).

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.