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Bellows type expansion joints

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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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 Society of Piping Engineers of Japan (JSPE)/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 B 2352**:2005 is replaced with this Standard.

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.

Bellows type expansion joints

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 15348** published in 2002, with some modifications of the technical contents to fit them to the actual situation in Japan.

Annex JC contains instruction notes and installation regulations for the design and execution of piping using the bellows type expansion joints. The portions given continuous sidelines or dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JE.

1 Scope

This Standard specifies characteristics of bellows type expansion joints (hereafter referred to as "expansion joints").

It applies to metal expansion joints equipped with one or more corrugated bellows of circular cross-section.

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

ISO 15348 : 2002 *Pipework—Metal bellows expansion joints—General* (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 0151 *Iron and steel pipe fittings—Vocabulary*

JIS B 0202 *Parallel pipe threads*

NOTE : Corresponding International Standard: ISO 228-1 : 1994 *Pipe threads where pressure-tight joints are not made on the threads—Part 1: Dimensions, tolerances and designation* (MOD)

JIS B 0203 *Taper pipe threads*

NOTE : Corresponding International Standard: ISO 7-1 : 1994 *Pipe threads where pressure-tight joints are made on the threads—Part 1: Dimensions, tolerances and designation* (MOD)

JIS B 2220 *Steel pipe flanges*

JIS B 2311 *Steel butt-welding pipe fittings for ordinary use*

JIS B 2312 *Steel butt-welding pipe fittings*

JIS B 2313 *Steel plate butt-welding pipe fittings*

JIS B 8265 *Construction of pressure vessel—General principles*

JIS G 4305 *Cold-rolled stainless steel plate, sheet and strip*

JIS G 4902 *Corrosion-resisting and heat-resisting superalloy plates and sheets*

ISO 7268 *Pipe components—Definition of nominal pressure*

ISO 9328-5 *Steel flat products for pressure purposes—Technical delivery conditions—Part 5: Weldable fine grain steels, thermomechanically rolled*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in the following and **JIS B 0151** apply.

3.1 expansion joint

pipe joint used to absorb axial, angular, lateral and/or other movements by means of expansion, contraction and/or bend of one or more bellows (see **4201** of **JIS B 0151**)

3.2 corrugation

element of the bellows to flexibly expand, contract and bend

3.3 bellows

expansion element made from one or more plies, with one or more corrugations/convolutions and with or without end cuffs

NOTE : It can be reinforced with rings.

3.4 ply

constituent element of the wall of the bellows

NOTE : The wall can be made from one or more plies.

3.5 cuff

cylindrical section situated at one or both of the ends of the bellows integrated with the corrugations

To be used for the portion of welding attachment.

3.6 cuff reinforcement collar

ring placed around the cuff to reinforce it against the effect of internal pressure and hence reduce deformation

3.7 root-reinforcing ring

element fitted outside or inside a bellows in a corrugation/convolution root, conforming to the shape of the root, to prevent its deformation under internal or external pressure

NOTE 1 When placed between two corrugation/convolutions, it is called an intermediate reinforcing ring. When placed at the end, it is called an end corrugation/convolution-reinforcing ring.

NOTE 2 The adjusting ring mentioned in **JB.3.4.4** is also included in root-reinforcing rings.

3.8 welding ring

ring placed around the cuff to facilitate welding

NOTE 1 Where the bellows has a thickness sufficient for welding, it is not required to be provided with welding rings.

NOTE 2 Although this term is not used in this Standard, the definition is given here for conformity with the corresponding International Standard.

3.9 internal sleeve

element which allows a satisfactory flow of medium and protects the bellows from erosion and flow-induced vibrations

NOTE : It is designed so that it does not restrict the movement of the expansion joint.

3.10 pressure thrust

axial force arising from internal pressure (see F_s in **JC.2**)

3.11 end fittings

fittings (usually weld ends or flanged ends) by means of which expansion joints are connected to the piping system or to equipment

For expansion joints for small size pipes, threaded fittings may be used as end fittings.

3.12 restraining components

mechanical components (tie-rods, tie-bars, hinges, gimbal rings, etc.) designed to resist pressure thrust and external loads

NOTE : They are attached to end fittings with carrier flanges, brackets or reinforcing gussets.

3.13 guide elements

components used for maintaining coaxiality during movement

3.14 external shroud

cover around the bellows, which provide limited protection of the bellows against mechanical shock, and spark or spatter of welding

3.15 stroke indicator

device that, in normal service, indicates the movement of the bellows

NOTE 1 If the design movement is exceeded, the device may distort permanently to indicate that an abnormal function of the system has occurred.

NOTE 2 Although this term is not used in this Standard, the definition is given here for conformity with the corresponding International Standard.

3.16 movement distributor

device mounted on an expansion joint containing several bellows that limits each of them to work within their designed movements

NOTE : Although this term is not used in this Standard, the definition is given here for conformity with the corresponding International Standard.

3.17 adjusting device

device to enable the bellows to be pre-set to given dimensions, or to meet special installation requirements

NOTE : It may also serve as shipping bars.

3.18 shipping bar

device that secures the expansion joint in a position determined by the manufacturer, so that the face-to-face length does not change during the period of shipment, handling and installation

3.19 movements

3.19.1 axial movement

movement causing axial extension (expressed in positive number) or compression (expressed in negative number) of an expansion joint

Its magnitude is regarded as the quantity of axial movement (see x_e and x_c in **JB.3.2**).

3.19.2 angular movement

movement causing bending of axis of an expansion joint in positive (expressed in negative number) or reverse (expressed in positive number) side

Its magnitude is regarded as the quantity of angular movement (see θ_n and θ_o in **JB.3.2**).

3.19.3 lateral movement

movement normal to the axis of an expansion joint in positive (expressed in negative number) or reverse (expressed in positive number) side

Its magnitude is regarded as the quantity of lateral movement (see y_n and y_o in **JB.3.2**).

3.20 spring rate

force, axial, angular or lateral in nature, or moment necessary to produce a unit deflection (1 mm or 1 rad) of the expansion joint

NOTE : For the calculation of reaction force and reaction bending moment of expansion joints, the spring rate per convolution of bellows is to be used (see **JB.3.4.1.3**).

3.21 cycle

full movement, from an initial position to the given working position and back, under the working conditions specified

NOTE : The number of the full movements cycled under the designated working conditions is regarded as the cycle life.

3.22 width of bellows convolution

outer width of convolution at the mean diameter of bellows

3.23 tie rod

part that serves as a guide to allow expansion or contraction in the axial direction, serves the role of self-weight receptacle, prevents joint damage due to anchor failure, or serves the role in charge of thrust caused by internal pressure

4 Types of expansion joints

4.1 General

There are four principal types of expansion joint, which are designated according to the movements absorbed (see **4.2** to **4.5** and table 1).

4.2 Axial expansion joint

This type mainly absorbs axial movement. Pressure thrust will act for the loading onto main anchor.

When pressure-balanced, it restrains pressure thrust.

4.3 Angular expansion joint

This type absorbs angular movement. When fitted with hinges, it allows movement in a single plane and normally be used in a set of two or three joints. When fitted with gimbal rings, it allows movement in any plane.

These restrain pressure thrust.

NOTE : Normally used in a set of two gimbal and single hinged expansion joints.

4.4 Lateral expansion joint

This type absorbs lateral movement. An angular movement is also permissible when the joint is fitted with two tie rods.

The tie-rod fitted expansion joint restrains pressure thrust.

NOTE : Those fitted with three or more tie rods allow lateral movement, with its two end faces capable of shifting in parallel.

4.5 Universal expansion joint

This type absorbs movements in all planes. Pressure thrust acts on main anchor. In the case of pressure-balanced expansion joint, it does not act on main anchor.