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Jacket for pressure vessels

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Health, Labour and Welfare, and 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 High Pressure Gas Safety Institute of Japan (KHK)/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 8279:1993** is replaced with this Standard.

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Jacket for pressure vessels

1 Scope This Japanese Industrial Standard specifies the construction of the jacket for pressure vessels to be welded to the outside of the pressure vessel for the purpose expressed in remarks 1 (hereafter referred to as “jacket”). For the application, it shall be in accordance with **JIS B 8265** or **JIS B 8266** when there are any provision, and shall be as the agreement between the purchaser and the manufacture when there is no provisions.

Remarks 1 Jackets are assumed to be attached for one or more purposes such as:

- to heat the vessel and its contents;
 - to cool the vessel and its contents;
 - to provide sealed insulation chamber for the vessel.
- 2 The jacketed portion of the vessel is defined as the inner and outer walls, the closure devices, and all other penetrations or parts within the jacket which are subjected to pressure stresses. Parts such as nozzle closure members and stiffening or stay rings are included.
- 3 To weld the jacket made according to this Standard to the vessel designed and manufactured according to **JIS B 8266**, follow 5.2.2 and 6.13 of **JIS B 8266**.

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

JIS B 0190 *Glossary of terms used in construction of pressure vessels*

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

JIS B 8266 *Alternative standard for construction of pressure vessels*

JIS B 8277 *Expansion joint for pressure vessels*

JIS G 4304 *Hot rolled stainless steel plates, sheets and strip*

JIS G 4305 *Cold rolled stainless steel plates, sheets and strip*

JIS G 4317 *Hot rolled stainless steel equal leg angles*

JIS G 4320 *Cold-formed stainless equal leg angles*

3 Definitions For the purposes of this Standard, the definitions given in **JIS B 0190** apply.

4 Types of jacket The jacket shall be classified into the following five types according to the covering method of inner vessel as shown in figure 1.

- a) **Type 1** Jacket of any length confined entirely to cylindrical shell.
- b) **Type 2** Jacket covering a portion of cylindrical shell and one end plate.
- c) **Type 3** Jacket covering a portion of end plate.
- d) **Type 4** Jacket with addition of stay or equalizer rings to the cylindrical shell portion to reduce effective length.
- e) **Type 5** Jacket covering cylindrical shell and any portion of either end plate.

Jackets shall be circular in cross section. The use of any combination of the types shown is permitted on any one vessel provided the individual requirements for each are met.

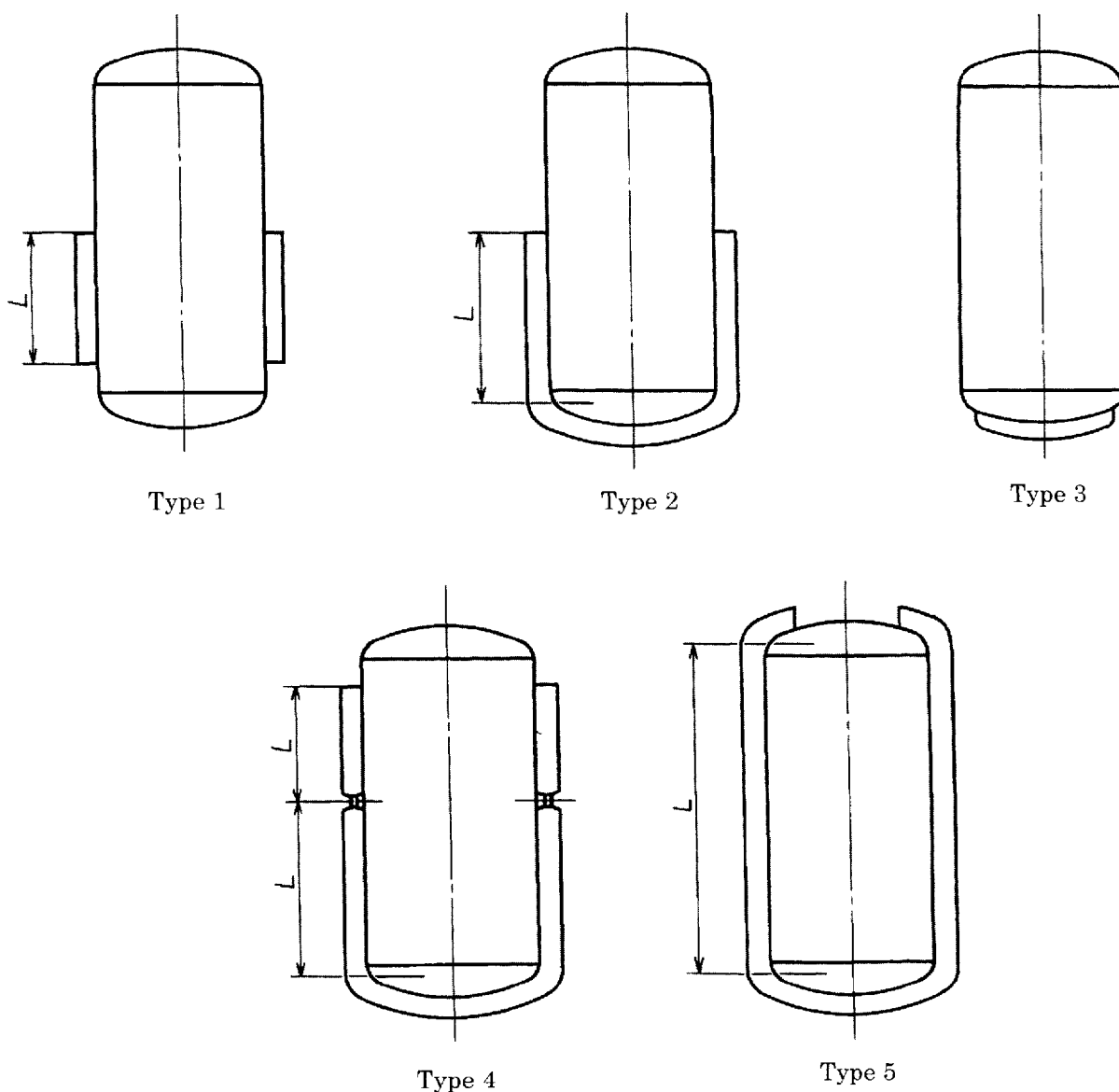


Figure 1 Types of jacket[†]

5 Materials The materials used in the fabrication of jackets shall be as follows:

- a) The materials of the jacket shall be as specified in attached table 2.1.1 and attached table 2.2 of **JIS B 8265**. However, the materials of the jacket designed and manufactured according to **JIS B 8266** shall be as specified in attached table 2.1 and attached table 2.2 of **JIS B 8266**.
- b) The following materials can be used for the section stainless steel in addition to a).
 - 1) **JIS G 4317**
 - 2) **JIS G 4320**

For the allowable tensile stress at the design temperature of materials of 1) and 2), the allowable tensile stress of **JIS G 4304** and **JIS G 4305**, as shown in the type column of attached table 2.1.1 of **JIS B 8265**, according to the types of materials.

6 Meaning of symbols The meaning of symbols used in this Standard shall be as follows:

- t_s : thickness of inner vessel wall (mm)
- t_{rj} : calculated thickness of outer jacket wall (mm)
- t_{rc} : calculated thickness of jacket closure member (mm)
- t_c : thickness of jacket closure member (mm)
- t_j : thickness of outer jacket wall (mm)
- t_n : nominal thickness of nozzle neck (mm)
- r : corner radius of torus closures (mm)
- η : weld joint efficiency
- R_s : outside radius of inner vessel (mm)
- R_j : inside radius of jacket (mm)
- R_p : radius of opening in the jacket at the jacket penetration (mm)
- P : internal design pressure in jacket chamber (MPa)
- p : stay pitch (mm)
- σ_a : allowable tensile stress at design temperature of material (N/mm²)
- j : jacket space (inside radius of jacket minus outside radius of inner vessel) (mm)
- a, b, c, Y and Z : minimum weld dimensions for attachment of closure member to inner vessel measured as shown in figure 3 and figure 4 (mm)

7 Classification by position of jacket weld joint The classification by position of the

jacket weld joint subjected to pressure shall be according to the provisions of 6.1.3 of JIS B 8265 and as follows.

- a) **Classification A** The following weld joints shall be the joint of classification A.
 - 1) The longitudinal joint at the positions where subjected to the pressure such as outer jacket wall, jacket mould closure, jacket penetration closure (see figure 4).
 - 2) All the weld joint at jacket mould end plate and plane closure, except for those specified in the following b) to d).
- b) **Classification B** The following weld joints shall be the joint of classification B.
 - 1) The peripheral joint at the positions where subjected to the pressure such as outer jacket wall, jacket mould closure, jacket penetration closure, except for those specified in the following c) and d).
 - 2) The peripheral joint to attach jacket mould closure over outside surface of inner vessel [see figure 3 a-1), a-2) and a-3)].
 - 3) The peripheral joint to attach outer jacket over peripheral rim of jacket closure made of plane plate or section steel [see figure 3 d-1), e-1), g-4), g-5) and g-6)].
 - 4) The peripheral joint to attach of mould end plate type jacket over outside surface of inner vessel [see figure 3 i-2)].
- c) **Classification C** The following weld joints shall be the joint of classification C.
 - 1) The peripheral joint to attach the moulded-, plane plate- or section steel jacket closure by full penetration weld or fillet weld on both sides over inner vessel [see figure 3 b-1), b-2), b-3), c), d-1), d-2), e-1), e-2), f-1), f-2) and f-3)].
 - 2) The weld joint at corner part which attaches plane plate jacket closure to outer jacket wall at right angle so that they make L-shape or T-shape [see figure 3 d-2), g-1), g-2), and g-3)].
 - 3) The joint to attach jacket of mould end plate type over outside surface of inner vessel by full penetration welding [see figure 3 i-1a) and i-1b)].
 - 4) The weld joint to attach jacket penetration closure member over inner vessel [see remarks 2 of figure 4 b), c), d), e-1), e-2) and f)].
- d) **Classification D** The following weld joint shall be the joint of classification D.
All the weld joint at opening in the jacket except for the weld joint specified in c) 4).

8 Design of jacket

8.1 Design length of cylindrical shell used for calculation of external pressure of inner vessel The design length of cylindrical shell used for calculation of external pressure of inner vessel shall be as follows.

- a) When stiffening ring is not mounted on the part where the external pressure by jacket side pressure of inner vessel is applied, dimension L (mm) as shown in fig-

ure 1 shall be the design length of cylindrical shell.

- b) For type 2, type 4 and type 5 of figure 1, L (mm) shall include the length of 1/3 of the depth measured from tangent line of end plate of inner vessel to inner surface of this end plate.
- c) The stiffening ring specified in 4.6 of JIS B 8265 annex 1, or 4.6 of JIS B 8266 annex 1 may also serve as jacket closure provided it satisfies the provisions of 8.4. When stiffening rings or jacket closures are located next to each other, the distance between each attached point shall be the design length of cylindrical shell L (mm) (see type 4 of figure 1).
- d) In a) to c), the design length L (mm) of cylindrical shell shall be measured parallel to the axis of inner vessel. In this case, for the closure as shown in a-1) to c), dimension L (mm) shall extend to the welded part of inner vessel.

8.2 Shell and end plate of jacket The shell and the end plate of jacket shall be as follows.

- a) The thickness of shell and end plate shall be equal or more the value of the calculated thickness specified in clause 2 and clause 3 of JIS B 8265 annex 1 plus corrosion allowance.
- b) When the tensile stress or compression stress generated on shell of inner vessel or shell of jacket by the temperature difference or pressure difference in use of the inner vessel and jacket exceeds the allowable tensile stress or the allowable compression stress of material at the design temperature, the expansion joint specified in JIS B 8277 shall be installed. And to prevent restriction by welding at the point where the nozzle of inner vessel side penetrates jacket, those construction as shown e-1), e-2) or f) in figure 4 shall be used.
- c) To attach the supporting structure of pressure vessel to the jacket, investigate the strength of jacket and reinforcement member such as rib, stay and so on shall be attached to jacket space in consideration of transmitting method of supporting load of inner vessel and its content as appropriate.
- d) For jacket, inspection hole specified in 5.1.2 of JIS B 8265 shall be provided. However, for pressure vessel of every diameter, the maximum diameter of inspection hole is not necessary to surpass tube calibre of 2B.

Remarks : For the vapour condensing agency such as steam vapour, it is recommended to install obstruction plate or buffering plate at the inlet nozzle of jacket to prevent the corrosion of inner vessel wall. And measures against evacuation air from the jacket by the vapour condensing shall be taken or the jacket which can bear in vacuum shall be designed.

8.3 Design of jacket of welded stayed construction The design of jacket of welded stayed construction shall be as follows.

- a) The jacket may be designed using a stayed plate specified in annex 9 of JIS B 8265. In this case, plates composing jacket shall be in accordance with the provisions of

clause 4 of JIS B 8265 annex 9 and shall meet the requirements of clause 2 and clause 3 of JIS B 8265 annex 1.

b) The welded stay as shown in figure 2 may be applied to jacket which satisfies the following conditions:

- 1) The design pressure of jacket is not more than 2.1 MPa
- 2) The calculated thickness of jacket is not more than 12.7 mm
- 3) When jacket is welded to stay by slot welds or plug welds, the fillet size shall be not less than jacket thickness, and the strength of welded part shall be the product of the minimum fillet size and circumferential length of hole of jacket multiplied with allowable tensile stress and weld joint efficiency (in this case $\eta = 0.55$).
- 4) In the case of using slot welds or plug welds, the shape of joint connected with jacket shall be as indicated in figure 2.
- 5) The maximum spacing of stays shall be determined by the following formula:

$$p = t \sqrt{\frac{\sigma_a C}{P}} \text{ (mm)}$$

Where, p , σ_a and P shall be as indicated in clause 6.

t : calculated thickness of plate (mm)

C : constant and shall be as follows:

$C = 2.1$ if either jacket or stay is not over 11 mm thick

$C = 2.2$ if both jacket and stay are over 11 mm thick

- 6) Before sealing with jacket plate, the welded stayed part shall be subjected to non-destructive test specified for welded attachment of inner vessel.