

JIS

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS B 8266 : 2003
(KHK/JSA)

**Alternative standard for construction
of pressure vessels**

ICS 23.020.30

Reference number : JIS B 8266 : 2003 (E)

PROTECTED BY COPYRIGHT

This is a preview. [Click here to purchase the full publication.](#)

206S

Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Health, Labour and Welfare, and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from The High Pressure Gas Safety Institute of Japan (KHK)/Japanese Standards Association (JSA), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

Attention shall be drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent right after opening to the public, utility model right, or application for registration of utility model after opening to the public which have technical properties. The Minister of Health, Labour and Welfare, the Minister of Economy, Trade and Industry, and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application of a patent right after opening to the public, utility model right, or application for registration of utility model after opening to the public which have the said technical properties.

The figures and tables marked with + in this Standard were adapted from the ASME Boiler and Pressure Vessels Code © 2001 by The American Society of Mechanical Engineers with the written consent of the ASME Codes & Standards Department. No additional translation or reproduction may be made of these materials without the prior written consent of ASME.

Date of Establishment: 2003-09-30

Date of Public Notice in Official Gazette: 2003-09-30

Investigated by: Japanese Industrial Standards Committee

Standards Board

Technical Committee on Industrial Machinery

JIS B 8266 : 2003, First English edition published in 2004-08

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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

© JSA 2004

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

M&T

PROTECTED BY COPYRIGHT

This is a preview. Click here to purchase the full publication.

Contents

	Page
1 Scope	1
1.1 Pressure vessels within the scope	1
1.2 Range of pressure vessels	2
2 Normative references	2
3 Definition	2
4 Clarification of application conditions	2
4.1 General matters	2
4.2 Design specifications prepared by users of pressure vessels	2
4.3 Design documents prepared by manufacturers of pressure vessels	3
5 Materials	3
5.1 Materials in general	3
5.2 Materials used for pressure vessels	5
5.3 Steel materials	6
5.4 Nonferrous metals	16
5.5 Bolts, nuts, and washers	18
6 Design	18
6.1 General design	18
6.2 Design-stress strength of the materials used for design, and tolerance limit of stress intensity	23
6.3 Several characteristics of the materials used for design	26
6.4 Stress analysis and fatigue analysis	27
6.5 Shell and head	33
6.6 Cover plate	35
6.7 Bolted flange	36
6.8 Rapid closing-motion lid apparatus	37
6.9 Hole	37
6.10 Tube sheet	40
6.11 Flat head supported by stay bolts	41

6.12	Expansion joint	41
6.13	Jacket	42
6.14	Noncircular shell	42
6.15	Attachments and support structure	42
6.16	Horizontal vessel of saddle support	42
7	Welded-joint Design	42
7.1	General weld joint	42
7.2	Weld joint in details and general	45
7.3	Non-destructive test	51
7.4	Heat treatment	51
8	Machining in general	51
8.1	Confirmation of material	51
8.2	Repair of material defect	52
8.3	Inspection before machining of material	52
8.4	Cutting of material, and finishing of cut surface	52
8.5	Test and inspection of cut surface	53
8.6	Fabrication of shell and head	53
8.7	Roundness of shell	54
8.8	Manufacturing tolerance of formed head	58
8.9	Special provision about machining of heat-treated high tensile strength steel	58
8.10	Special provision about machining of stainless clad steel	58
9	Welding	58
9.1	Welding in general	58
9.2	Non-destructive test of weld joint	65
9.3	Repair of defect of weld	67
9.4	Special provision about corrosion resistant clad and corrosion resistant cladding by welding or corrosion resistant lining	70
9.5	Special provision about welding with tube sheet and heat transfer tube	71
10	Heat treatment	72
10.1	Post weld heat treatment	72

10.2	Heat treatment of pressure vessel manufactured using heat-treated high tensile strength steel	72
10.3	Post weld heat treatment of pressure vessel manufactured using nonferrous metals	72
10.4	Post weld heat treatment of pressure vessel manufactured using stainless clad steel	72
11	Test and inspection	72
11.1	Test and inspection in general	72
11.2	Mechanical test of weld joints	75
11.3	Method for non-destructive test, and evaluation of result	76
11.4	Non-destructive test engineer	77
11.5	Retest of non-destructive tests	78
11.6	Pressure test	78
11.7	Leakage test	81
12	Auxiliaries	81
12.1	Pressure relief device	81
12.2	Pressure gauge	86
12.3	Thermometer	86
12.4	Liquid level indicator	86
13	Marking	86
Annex 1 (normative)	Shells and heads of pressure vessels	140
Annex 2 (normative)	Hole reinforcement of pressure vessel	193
Annex 3 (normative)	Bolted flange of pressure vessel	206
Annex 4 (normative)	Flat face flange using a whole surface type non-metallic gasket	225
Annex 5 (normative)	Metallic-surface contacting flanges	229
Annex 6 (normative)	Reverse flange	248
Annex 7 (normative)	Cover plate of pressure vessel	252
Annex 8 (normative)	Stress analysis and fatigue analysis of pressure vessels	254
Annex 9 (normative)	Setting criteria of design-stress strength	337
Annex 10 (normative)	Property and performance qualification test method for material	341

Annex 11 (normative)	Attachments and support structure	345
Annex 12 (normative)	Machining of heat-treated high tensile strength steel	349
Annex 13 (normative)	Machining of stainless clad steel	353
Annex 14 (normative)	Postweld heat treatment	359
Annex 15 (normative)	Impact test rule	371
Annex 16 (normative)	Mechanical test of weld joint of pressure vessel	391
Annex 17 (normative)	Pressure test and leakage test of pressure vessel	496
Annex 18 (informative)	Preheating	402

Alternative standard for construction of pressure vessels

1 Scope

1.1 Pressure vessels within the scope This Japanese Industrial Standard applies to vessels whose design pressure is less than 100 MPa, whose design temperature is within the creep range, and that holds pressure exceeding the atmospheric pressure, or pressure vessels that experience external pressure (hereafter referred to as “pressure vessels”). This Standard does not include the following pressure vessels.

- a) Those that are included in the scope of other Japanese Industrial Standards⁽¹⁾
- b) Those that are nonmetallic
- c) Those that are related to atomic power
- d) Those that riveted or brazed
- e) Those that are exposed to direct fire
- f) Those that have special structures and uses⁽²⁾

Notes ⁽¹⁾ Examples are shown as follows.

Examples	JIS B 8201	<i>Stationary steel boilers —Construction⁽³⁾</i>
	JIS B 8240	<i>Construction of pressure vessels for refrigeration</i>
	JIS B 8241	<i>Seamless steel gas cylinders</i>
	JIS B 8265	<i>Construction of pressure vessel—General principles</i>
	JIS B 8501	<i>Welded steel tanks for oil storage</i>

⁽²⁾ Pressure compartments of rotating machines or reciprocating machines such as hydraulic machines, hydraulic presses, pumps, compressors, turbines, internal combustion engines, hydraulic cylinders, pneumatic cylinders.

⁽³⁾ Waste heat boilers are included in the scope of JIS B 8201 and are outside this Standard.

Remarks : This Standard include pressure vessels whose design pressure is less than 100 MPa, but it may be applied to those whose design pressure is 100 MPa or more, if special technical consideration is given to the following matters: materials used, internal and external surface finish (roughness) of pressure vessels, screws, non-destructive test, etc.

1.2 Range of pressure vessels

- a) The main body of pressure vessels (shells, heads, and nozzles that are directly connected thereto, etc.) and the following items 1) to 3) shall be included in the range to be considered as pressure vessels.
 - 1) At the connection to external pipes.
 - 1.1) As far as the first circumferential joint of weld joint (the groove face shall be included, but the weld joint is not included).
 - 1.2) As far as the first screw joint of the screw joint.
 - 1.3) As far as the first flange face of the bolted flange face.
 - 2) As far as the weld joint when attachments are directly welded to the pressure parts.
 - 3) For manholes, hand holes, etc, the cover plates, welded joints, bolts, nuts and gaskets that withstand pressure shall be included.
- b) Auxiliaries such as attachments, safety valves, etc. that are directly mounted to pressure parts are not included in the scope of pressure vessels, but they shall satisfy the corresponding provisions.

2 Normative references The standards mentioned in attached table 1.1 or parts thereof contain provisions which, through reference in this Standard, constitute provisions of this Standard. In addition to these normative references, attached table 1.2 shows, as reference standards, those standards that are not applied to this Standard but are related to construction of pressure vessels.

3 Definitions For the major terms used in this Standard, the definitions given in JIS B 0190 apply.

4 Clarification of application conditions

4.1 General matters When using this Standard, users and manufacturers shall consider the intended use, environment and design conditions of pressure vessels, conform to the following provisions of 4.2 and 4.3, and clarify that they comply with the application conditions of this Standard for pressure vessels within the respective range of responsibility.

4.2 Design specifications prepared by users of pressure vessels Users of pressure vessels (including agents who have been delegated by users) shall clarify the application conditions of this Standard, prepare the design specifications of users on their responsibility, and present them to manufacturers of pressure vessels.

These design specifications shall include the following items.

- a) The planned operating conditions⁽⁴⁾ or design conditions⁽⁴⁾ that become appropriate

basic data for selection of materials, design, machining, and test and inspection

- b) Presence or absence of corrosion or erosion, and values of corrosion allowance
- c) Indication whether lethal substances are handled or not
- d) Basic shape, basic dimensions, etc. of pressure vessels⁽⁵⁾
- e) Whether fatigue analysis is necessary or not (basic data to judge whether fatigue analysis is necessary or not, such as the result of such judgment or experiential data)
- f) Operating environment conditions
- g) Other informative items such as operating experience data

Notes ⁽⁴⁾ The planned operating conditions shall include the conditions to determine 6.1.1, heat transmission conditions, contents and their values of physical properties. The design conditions shall include the 6.1.2 Design pressure and 6.1.3 a) Design temperature (high-temperature side and low-temperature side).

⁽⁵⁾ They shall include dimensions such as diameter, length, etc., mounting positions and supporting methods of manholes, nozzles and measuring equipment, and other basic shape and dimensions.

4.3 Design documents prepared by manufacturers of pressure vessels Design documents prepared by manufacturers shall be as follows.

- a) Manufacturers of pressure vessels shall confirm that the users' design specifications meet the provisions of 4.2, prepare the design documents on their responsibility based on the user's design specification according to this Standard, and obtain users' approval.

Remarks : The design documents shall include specifications, drawings and design calculation sheets.

- b) The design documents shall include, in addition to calculation of wall thickness, evaluation by stress analysis and fatigue analysis mentioned in annex 8. However, if it is exempted by provisions of 6.4.2 or 6.4.3, then, such evaluation is not included.

5 Materials

5.1 Materials in general Materials of pressure parts used for pressure vessels based on this Standard shall be as follows.

- a) **Standard materials** The standard materials stipulated in this Standard shall be such materials as specified in JIS mentioned in attached table 2.1, attached table 2.2, attached table 3.1, and attached table 3.2.
- b) **Equivalent materials** If any materials are compared with the standard materials specified in attached table 2.1, attached table 2.2, attached table 3.1, and attached table 3.2, and if they meet either of the following items, then, they may be regarded

as the materials equivalent to the standard materials.

- 1) The standard material, chemical composition and mechanical property are the same. But, the tolerance of sheet thickness is slightly different.
 - 2) The standard material, chemical composition and mechanical property are the same. But, the manufacturing method or the shape is different.
 - 3) The standard material, chemical composition, mechanical property, test method and sampling method are very similar. The standard material and the said material are very similar in terms of properties.
- c) **Special certified materials** Even when materials are not specified in JIS, if they have been tested according to annex 10, and specially certified as appropriate as pressure vessel materials of this Standard by an agreement between the parties concerned with delivery; and even when materials are not specified in JIS mentioned in a) but are specified in ISO or other standards, if they have been confirmed and specially certified as having properties at least equivalent to the standard mentioned in a) by an agreement between the parties concerned with delivery; then, they may be used for pressure parts of pressure vessels.
- d) **Tolerance of material thickness** The tolerance of material thickness shall be as follows.
- 1) The material thickness shall be equal to or more than the design thickness.
 - 2) The sheet material may be used if the negative tolerance of thickness is 0.3 mm or 6 % of nominal thickness whichever is smaller.
 - 3) When pipes are used for pressure parts, the negative tolerance of thickness specified in JIS material standards shall be included in the count.
- e) **Working temperature range of materials** The standard materials specified in attached table 2.1, attached table 2.2, attached table 3.1, and attached table 3.2 shall not be used exceeding the maximum temperatures for which those tables show the design stress strength and allowable tensile stress. On one hand, the low-temperature working limit shall be as specified in 5.3.5 for steel and 5.4.1 for nonferrous metals.
- f) **Fatigue characteristics of materials** Design of pressure vessels shall consider fatigue characteristics of materials. When exemption of fatigue analysis in 6.4.3 is not applicable, only the materials whose fatigue characteristics curves are shown in annex 8 may be used. However, if sufficient data are available to draw the design fatigue curves, then, this provision does not apply.
- g) **Addition of inspection to JIS material standards** Some JIS material standards specify non-destructive test and special additional inspection that are designated by orderers. Manufacturers of pressure vessels shall comply with provisions of 5.3.4, 5.3.5 and 5.4.4 of this Standard, designate additional inspection, and order materials. Furthermore, the material certificate issued by material manufacturers shall show that the materials meet the provisions of applicable material standards

and other provisions including the additional inspection. This material certificate includes evidence of numerical results of all the necessary tests.

- h) **Limitation of materials used concerning contents** The materials used for pressure vessels holding corrosive substances shall be selected by considering, in advance, resistance to the contents.
- i) **Material classification** Material classification and group number in this Standard shall be as specified in JIS B 8285, attached table 1.
- j) **Heat-treated high tensile strength steel** This refers to such a steel that is heat-treated according to the process 3510 in JIS G 0203, has the property as high tensile strength, and whose minimum tensile strength is specified as 620 N/mm² or more.

Remarks : The examples of JIS standard materials that correspond to this heat-treated high tensile strength steel as follows.

SQV1B, SQV2B and SQV3B of JIS G 3120

SL5N590, SL9N520 and SL9N590 of JIS G 3127

SFVQ1B, SFVQ2B and SFVQ3 of JIS G 3204

STPL690 of JIS G 3460

STBL690 of JIS G 3464

5.2 Materials used for pressure vessels

5.2.1 Materials used for main body of pressure vessel The materials used for main body of pressure vessel shall be the steel materials mentioned in attached table 2.1, the nonferrous metal standard materials mentioned in attached table 2.2, the materials equivalent to these and specified in 5.1 b), or the special certified materials specified in 5.1 c).

5.2.2 Materials used for attachments and support structures Jackets, support structures, attachments and other parts that are directly welded to the main body of pressure vessel may be the standard materials mentioned in JIS B 8265, attached table 2.1.1 and attached table 2.2, or the materials that are equivalent to these, or the special certified materials. However, those welding materials used for welding to the main body shall be compatible with the material of pressure part of main body of pressure vessel. The weld joint shall meet the provision of this Standard.

5.2.3 Materials used for steel bolts If flanges, bolted cover plates and tube sheets are designed by stress analysis, then, the materials for steel bolts shall be the standard materials mentioned in attached table 3.1. If flanges are designed by annex 3, annex 4, annex 5 and annex 6, and if bolted cover plates are designed by annex 7, then, the materials for steel bolts shall be the standard materials mentioned in attached table 3.2. In both cases, the materials for steel bolts may be the materials that are equivalent to these and that are specified in 5.1 b).