

JIS

JAPANESE INDUSTRIAL STANDARD

**Construction of Pressure
Vessels for Refrigeration**

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

Construction of Pressure Vessels for Refrigeration

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JAPANESE INDUSTRIAL STANDARD

J I S

Construction of Pressure Vessels
for Refrigeration

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1. Scope

1.1 Specification Range This Japanese Industrial Standard specifies the pressure vessels ⁽²⁾, hereinafter referred to as the "pressure vessels", to be used for refrigerator ⁽¹⁾ using liquified gas of -150°C or over in boiling point as the refrigerant and the attachments.

Notes ⁽¹⁾ In this Standard, the refrigeration means the fact that the vapour compression type refrigeration, absorption type refrigeration or the action similar to these is carried out (including heat pump), and exclusively these in which the refrigerant circulates.

⁽²⁾ The pressure vessel includes the shells of fully closed type compressor having profile of the pressure vessel and refrigerant liquid pump.

Remarks 1. Even the items not specified in this Standard, exclusively where those correspond to the applicable ranges of the following Standards, respective standards may be applied, as appropriate.

JIS B 8243

JIS B 8201

However, exclusively the pressure vessel concerning generator.

2. The range of pressure vessel shall be the body of pressure vessel, and the part of pipe connecting with the apparatus other than pressure vessel until the joint nearest to the vessel.

3. The units and numerical values shown in { } in this Standard are based on the International System of Units (SI) and are appended for informative reference.

1.2 Excluding Application This Standard excludes application to the following:

(1) Those specified in the application ranges of other JISs ⁽³⁾.

Note ⁽³⁾ Example 1: Those according to JIS B 8243. However, pressure vessels other than those to be used for refrigerator in the applicable range of this Standard.

Example 2: Heat exchanger in accordance with JIS B 8249.

- (2) Those not less than 50 kgf/cm {5 MPa} ⁽⁴⁾ in design pressure.

Note ⁽⁴⁾ Even in the case of those not less than 50 kgf/cm {5 MPa} in design pressure, concerning the head, tube sheet, cover plate, nozzle neck, etc. when the construction relating to the high pressure is taken into consideration, these may be applied.

Further, from the restriction of design pressure, in the case of cylindrical shell, it becomes the thin thickness cylindrical shell of not more than 1/4 of inner diameter in thickness of shell plate, and therefore the content of reference is promised on this assumption.

- (3) Those of which the inner diameter of the shell is not more than 160 mm.
- (4) Those of rivet structure.
- (5) Those used for outer burning type generator to be used for absorption refrigerator of 132800 kcal/h {154.42 kW} in incident heat quantity and those to be used for refrigerator using strongly inflammable or toxic gas (Third class gas) as the refrigerant or absorption solution.

2. Definitions

- (1) pressure When not specially, clearly indicated, the gauge pressure.
- (2) high-pressure part The part to receive the condensation pressure due to action of compressor or generator (generator to be applied to absorption refrigerator, hereinafter referred to as the "generator".)
- (3) low pressure part The parts other than high pressure parts. However, the parts shown in the following are taken as the low pressure part.
- (a) In a tightly closed compressor built in with high pressure part, the part to receive the pressure of low pressure part.
- (b) Parts receiving discharge pressure of booster, the pressure of which becomes the pressure not more than the design pressure of low pressure part of refrigerator using the booster.
- (c) The parts to receive condensation pressure due to actuation of compressor or generator in multielement refrigerator, of which condensation temperature becomes not higher than -15°C under ordinary running condition.
- (4) allowable pressure (maximum working pressure) The maximum pressure allowable at the top after setting the pressure vessel at the specified temperature.
- (5) working pressure The pressure at actually using the pressure vessel. The maximum pressure at the top of pressure vessel allowable under the ordinary using condition, which is not more than the allowable pressure.

- Remarks 1. The allowable pressure shall be calculated concerning each part of pressure vessel by excluding the thickness and corrosion allowance required for load other than pressure.
2. In the case where it is confirmed that it is manufactured same as design pressure, the design pressure may be taken as the allowable pressure, without calculation of allowable pressure (inverse calculation from the plate thickness, or the like).
3. In the case where the pressure vessel consists of two or more chambers and the pressures acting respective chambers are different, the design pressure and the allowable pressure of the pressure vessel may be determined on respective chambers.
4. In the case where from the working conditions of the pressure vessel, the design temperatures are different in some cases, the allowable pressures relative to respective design temperature shall be determined.
- (6) design pressure The pressure to be used for determination of calculation thickness or mechanical strength concerning each part in design of pressure vessel, and shall be in accordance with Table 1.

Table 1. Design Pressure

Kind of refrigerant	High pressure part: (kgf/cm ²)(MPa)					Low temperature part (kgf/cm ²)(MPa)
	Reference condensation temperature (°C)					
	43	50	55	60	65	
Ethylene (°)	92 {9.2 }	—	—	—	—	68 {6.8 }
Ethane (°)	68 {6.8 }	—	—	—	—	40 {4.0 }
Flon 13 13	40 {4.0 }	—	—	—	—	40 {4.0 }
Flon 13B1 B1	24 {2.4 }	28 {2.8 }	31 {3.1 }	34.3 {3.43}	38 {3.8 }	21 {2.1 }
Flon 502 12	17 {1.7 }	20 {2.0 }	23 {2.3 }	26 {2.6 }	29 {2.9 }	14 {1.4 }
Ammonia	16 {1.6 }	20 {2.0 }	23 {2.3 }	26 {2.6 }	—	12.8 {1.28}
Flon 22 22	16 {1.6 }	19 {1.9 }	22 {2.2 }	25 {2.5 }	28 {2.8 }	13 {1.3 }
Propane	16 {1.6 }	18 {1.8 }	20 {2.0 }	22 {2.2 }	—	12 {1.2 }
Flon 500 100	11.5 {1.15}	14 {1.4 }	16 {1.6 }	18 {1.8 }	20 {2.0 }	9.2 {0.92}
Flon 12 12	9.6 {0.96}	11.5 {1.15}	13 {1.3 }	15 {1.5 }	16 {1.6 }	8 {0.8 }
Isobutane	5 {0.5 }	6 {0.6 }	7 {0.7 }	8 {0.8 }	9 {0.9 }	4.2 {0.42}
Flon C318 318	4.5 {0.45}	5.8 {0.58}	6.8 {0.68}	7.8 {0.78}	9 {0.9 }	4 {0.4 }
Normal butane	3.3 {0.33}	4 {0.4 }	4.8 {0.48}	5.6 {0.56}	6.5 {0.65}	3 {0.3 }
Flon 114 114	2.8 {0.28}	4 {0.4 }	4.8 {0.48}	5.5 {0.55}	6.2 {0.62}	2.8 {0.28}
Flon 21 21	2.3 {0.23}	3 {0.3 }	3.6 {0.36}	4.3 {0.43}	5 {0.5 }	2.4 {0.24}
Flon 11 11	1.5 {0.15}	1.5 {0.15}	1.8 {0.18}	2.2 {0.22}	2.7 {0.27}	1.5 {0.15}
Flon 113 113	1.5 {0.15}	1.5 {0.15}	1.5 {0.15}	1.5 {0.15}	1.5 {0.15}	1.5 {0.15}
Other refrigerant	The pressure equal to saturated vapour pressure at each reference condensation temperature. However, its minimum value shall be 1.5 {0.15}.					Pressure equal to saturated vapour pressure at 38°C in temperature.

Note ⁽⁵⁾ This value is the reference value.

- Remarks 1. In case where the condensation temperature of refrigerator is other than the reference condensation temperature shown in Table 1, the pressure corresponding to the nearest upper temperature shall be taken as the design pressure of the pressure vessel to be used for high pressure part of the refrigerant facility.
2. For the design pressure of the pressure vessel to be used for high pressure part of refrigerator of which condensation temperature exceeds 65°C at the normal running condition or the design pressure of pressure vessel to be used for low pressure part of refrigerator (crane cab cooler, and the like) exceeding always 38°C in environmental temperature of refrigerant facility, the pressure not less than the saturated vapour pressure of the refrigerant at respective maximum working temperature shall be taken as the design pressure of the pressure vessel.
3. In case where the value of design pressure of Table 1 is not adequate such as in the case of pressure vessel and the like for refrigerator designed so that the definite pressure value is not exceeded by restriction of filling amount of refrigerant, the design pressure may not be in accordance with the table.
4. The design pressure of the part where the internal part of pressure vessel is at not more than atmospheric pressure at the ordinary working condition, shall be 1 kgf/cm² {0.1 MPa} in outer pressure. In this case where outer pressures such as liquid head pressure, pump pressure, etc. are applied, these shall be taken into consideration.
5. For inside and outside of pressure vessel or pressure vessel consisting of not less than two chambers, the maximum pressure difference between them shall be taken into consideration.
- (7) design temperature (highest or lowest temperature) In design of pressure vessel, the temperature determined from ordinary working conditions concerning its each part.
- Remarks 1. The design temperature shall be a temperature not lower than the average temperature in plate thickness direction of material (in the case where the design temperature is not higher than 0°C, not higher than 0°C). However, the surface temperature of material under the ordinary working condition shall not exceed the working restriction temperature or the temperature specified in allowable stress table.
2. In case where respective different temperatures are expected on each part of pressure vessel, the design temperature concerning each part may be determined.
- (8) refrigerant The working fluid in refrigeration cycle circulating in refrigerant facility of refrigerator.
- (9) secondaty refrigerant In indirect type refrigerator, the fluid to be heat medium to cool the substance to be cooled by circulating with cooling by refrigerant.

- (10) absorption solution The working fluid to absorb refrigerant and to generate by circulating in the refrigerant facilities of absorption refrigerator.
- (11) division of refrigerants and absorption solution by violence The violence (degree of combustibility and toxicity) of refrigerant and absorption solution to be put in the pressure vessel divided as given in Table 2.

Table 2. Division of Refrigerants and Absorption Solutions by Violence (Degree of Combustibility and Toxicity)

Division	Reference of division	Example of division
Class 1-A	Refrigerant or its solution of non-combustibility and non-toxicity, of less than 2 kgf/cm ² {0.2 MPa} in saturated vapour pressure at 35°C in temperature.	Fleon 11, fleon 21, fleon 113, water or those similar thereto.
Class 1-B	Refrigerant or its solution of non-combustibility and non-toxicity of 2 kgf/cm ² {0.2 MPa} up to and including 30 kgf/cm ² {3 MPa} in saturated vapour pressure at 35°C in temperature. However, it contains fleon 114.	Fleon 114, fleon 115, fleon 12, fleon 22, fleon 500, fleon 502, fleon C 318 or those similar thereto.
Class 1-C	Refrigerant or its solution of non-combustibility, exceeding 30 kgf/cm ² {3 MPa} in saturated vapour pressure at 35°C in temperature. However, in the case where the highest working pressure does not exceed 30 kgf/cm ² {3 MPa} according to restricted filling, it may be handled as Class 1-B gas.	Fleon 13, fleon 13B1, fleon 14, or those similar thereto.
Class 2	Refrigerant or its solution having combustibility or toxicity.	Ammonia or those similar thereto.
Class 3	Refrigerant or its concentrate solution having strong combustibility or strong toxicity	Normalbutane, isobutane, propane, ethane, ethylene or those similar thereto.

Further, concerning the secondary refrigerant this division applies depending upon the characteristics. However, concerning the thin concentrate water solution, it may be divided depending upon violence.

- (12) refrigerator The system composing the refrigeration cycle by compressor for refrigeration (in absorption refrigerator, the generator), condenser, liquid receiver, evaporator, refrigerant pump, piping, etc. and means the system of equipment for refrigeration containing compressor, refrigerant pump, absorption solution pump and motors driving these, automatic control appliances to control directly the refrigerant (including secondary refrigerant) and absorption solution and including refrigerant and absorption solution and includes the heat pump apparatus.
- (13) refrigerant facilities The parts of refrigerator where the refrigerant or absorption solution passes through and receive the pressure of refrigerant.
- Further these include the lubricating oil system receiving the pressure of refrigerant.
- (14) piping The generic term of pipe, valves, pipe joints, flexible pipes, etc. of piping system through which refrigerant passes. It includes vessels of not more than 160 mm in shell inner diameter, and further piping through which absorption solution passes.
- (15) low pressure vessel The pressure vessel of less than 2 kgf/cm² {0.2 MPa} in working pressure under the normal working condition, and the pressure vessel to be used for refrigerant or absorption solution of which saturated vapour pressure becomes less than 2 kgf/cm² {0.2 MPa} at the temperature of 35°C. Further, the vessel to be used at vacuum condition is included.
- (16) required thickness The thickness to be calculated according to the formula in this Standard, and it does not include the corrosion allowance.
- (17) minimum thickness The thickness of required thickness added with corrosion allowance.
- (18) actual thickness The actually measured thickness. However, the thickness of nominal thickness on the market subtracted by the negative permissible deviation on the thickness specified in JIS and by the working allowance may be used substitutionally.
- (19) blowing start pressure The pressure at the inlet side of the safety valve when the safety valve actually begins to blow, and it is the pressure when micro-amount of gas flow is detected at the outlet side.
- (20) blowing out pressure The pressure at the inlet side when the gas blows out violently actually from the outlet side of the safety valve, and in the case of spring safety valve, the pressure when it has valve body lift of safety valve of such degree capable of being measured or the continuous gas exhaust condition is sensible.
- (21) blowing stop pressure The pressure when the flowing out of a micro amount of gas at outlet side has become not to be detected with the pressure at inlet side of safety valve reduced from the blowing start pressure or blowing out pressure.

3. Materials

3.1 Material General The metallic materials to be used for pressure resistant part of the pressure vessel based on this Standard shall be as follows:

- (1) The standard material specified in this Standard shall be the materials shown in classification columns of materials in Tables 3 to 5, and the materials shown in those columns of Tables 2.2 and 2.3 of JIS B 8243.
- (2) In the case where concerning the using of materials other than (1), the manufacturer of the pressure vessel has deliberated with the purchaser and the material manufacturer and the parties concerned have affirmed that those materials have quality equal or superior to the standard specified in (1) depending upon the uses, the materials may be used for the parts receiving the pressure of the pressure vessel.
- (3) Even in the material having no Standard certificate, when the material has been affirmed that it resists the using sufficiently, it may be used for pressure vessel of less than 1 kgf/cm² { 0.1 MPa } in design pressure.

Remark: Even in the pressure vessel of not less than 1 kgf/cm² { 0.1 MPa }, it may be used for non-pressure-resistant parts such as skirt, baffle board, supporting lug, etc.

- (4) Even in the material for other than pipe, of which actual thickness is less than the minimum thickness, when the difference between the actual thickness and the minimum thickness is 0.25 mm or 6 % of the nominal thickness, whichever is the less value, this material may be used.

Remark: In the case where the pipe material is used for the pressure resistant part, the permissible deviation of negative side specified in JIS shall be taken into calculation.

3.2 Restriction of Using Materials The restriction of using materials shall be as follows:

- (1) The materials of the parts to be contacted with the refrigerant, absorption solution and substances to be cooled, according to the kind of refrigerants and the like, the materials shown in the following shall not be used:
 - (a) Copper and copper alloy for ammonia
 - (b) Aluminium and aluminium alloy for chloromethyl
 - (c) Aluminium alloy containing magnesium exceeding 2 % for freon.
- (2) For the parts contacting water always, aluminium of less than 99.7 % in purity shall not be used. However, except where an adequate corrosion resistant treatment is applied.

- (3) The standard materials shall not be used with exceeding the temperature range corresponding to the described range of allowable tensile stress values shown in Tables 3 to 5, and Tables 2.2 and 2.3 of JIS B 8243. However, in the case where the working pressure at the lowest working temperature becomes not more than $1/2.5$ of the design pressure, the material may be used in the range until the lowest allowable temperature shown in Table 6. In this case, the value of allowable tensile stress of the concerning material shall be taken as the value of allowable tensile stress at the working temperature corresponding to the design pressure.

However, when the working temperature is 0°C or lower, the value at 0°C shall be taken.

- (4) The carbon steels or low alloy steels containing carbon exceeding 0.35 % shall not be used for welding structure.
- (5) Class 1 A, Class 2 A, and Class 3 A of JIS G 3101, and JIS G 3106, SPHC of JIS G 3131, Class 1 of JIS G 3141 and the arc welded carbon steel pipes of JIS G 3457 shall not be used to the pressure resistant parts of pressure vessels shown in the following.
- (a) The shell, heads and other pressure resistant parts similar to those of pressure vessel exceeding 16 kgf/cm^2 {1.6 MPa} in design pressure.
 - (b) In the case of design pressure exceeding 10 kgf/cm^2 {1 MPa}, the shell of which longitudinal joint is welded and the head having welded joints.
 - (c) The shell, head, and other pressure resistant parts similar to those (excluding tube sheet) of which welded parts have thickness of parent metal exceeding 16 mm.
 - (d) The shell, heads and other pressure resistant parts similar to these of pressure vessel for toxic gases of Class 2 and Class 3.
- (6) Those specified in JIS G 3106 (excluding Class 1 A, Class 2 A and Class 3 A), SPHD and SPHE of JIS G 3131 and Class 2 and Class 3 of JIS G 3141 shall not be used for shell, heads, and other pressure resistant parts similar to these of the pressure vessel exceeding 30 kgf/cm^2 {3 MPa} in design pressure.
- (7) The carbon steel pipes for ordinary piping shall not be used for the pressure resistant parts of the pressure vessel shown in the following.
- (a) The parts exceeding 10 kgf/cm^2 {1 MPa} in design pressure.
 - (b) The parts exceeding 100°C in design temperature. However, in the cases of compressed air, steam, or water, those may be used for up to 200°C , and in the case of fluids less than 2 kgf/cm^2 {0.2 MPa}, those, for up to 350°C .
 - (c) Those specified in (5) (d).

- (8) Those specified in JIS G 5501 and other iron castings [excluding iron castings shown in following (9) and (10)] shall not be used for the pressure vessels shown in the following:
- (a) Those to handle Class 2 or Class 3 refrigerant or fluids similar to these (however, the low pressure vessel to handle only steam is excepted).
 - (b) Those exceeding 11 kgf/cm^2 {1.1 MPa} in design pressure.
- (9) Those iron castings specified in JIS G 5502, JIS G 5702, and JIS G 5703 shall not be used for the pressure vessels shown in the following:
- (a) Those specified in (8) (a).
 - (b) Those exceeding 18 kgf/cm^2 {1.8 MPa} in design pressure.
- (10) The ductile iron castings and malleable iron castings specified in JIS B 8243 Appendix 1 shall not be used for pressure vessels shown in the following:
- (a) Those exceeding 18 kgf/cm^2 {1.8 MPa} in design pressure.
 - (b) Those to handle toxic gas of Class 3.
- (11) For generator of which shell, head, dome and those pressure resistant parts similar thereto are jointed by welding, steels in accordance with JIS G 3103 or those having quality equal or superior thereto shall be used. However, for generator not higher than 350°C in maximum design temperature, the following materials may be used:
- (a) In the case where the design pressure is not more than 16 kgf/cm^2 {1.6 MPa}, SPV 24, SPV 32, and SPV 36 of JIS G 3115. In this case, the allowable tensile stress of the material shall be 9.8 kgf/mm^2 {96.0 N/mm²}.
 - (b) In the case where the design pressure is not more than 10 kgf/cm^2 {1.0 MPa}, Class 1 of JIS G 3106. In this case, the allowable tensile stress of materials shall, respectively, be 9.8 kgf/mm^2 {96.0 N/mm²} and 8.0 kgf/mm^2 {78.4 N/mm²}.

[Bar, Shape, Plate and Strip]

Table 3. Allowable Tensile Stresses of

Classification	Class	Symbol	Nominal composition (%)	Specified minimum tensile strength (kgf/mm ²)	P-No.	Group No.	External pressure chart Fig. No.	Manufacturing process	Notes	Allowable tensile stress																
										Temp.	-268	-196	-100	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200
JIS G 3101	1	SS 34		34	1	1	2		—	—	—	—	—	—	—	—	—	—	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
	2	SS 41		41	1	1	2		—	—	—	—	—	—	—	—	—	—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
JIS G 3103	2	SB 42		42	1	1	2		(⁶)(⁸)	—	—	—	—	—	—	—	—	—	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
	3	SB 46		46	1	1	2		(⁶)(⁸)	—	—	—	—	—	—	—	—	—	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
	4	SB 49		49	1	2	2		(⁶)(⁸)	—	—	—	—	—	—	—	—	—	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3
	5	SB 46M	0.5Mo	46	3	1	2		(⁷)(⁸)	—	—	—	—	—	—	—	—	—	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
	6	SB 49M	0.5Mo	49	3	2	2		(⁷)(⁸)	—	—	—	—	—	—	—	—	—	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3
JIS G 3106	1	A SM 41A		41	1	1	2		—	—	—	—	—	—	—	—	—	—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
		B SM 41B		41	1	1	2		(⁹)	—	—	—	—	—	—	—	—	—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
		C SM 41C		41	1	1	2		—	—	—	—	—	—	—	—	—	—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
	2	A SM 50A		50	1	2	2		—	—	—	—	—	—	—	—	—	—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
		B SM 50B		50	1	2	2		(⁹)	—	—	—	—	—	—	—	—	—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
		C SM 50C		50	1	2	2		—	—	—	—	—	—	—	—	—	—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
	3	A SM 50YA		50	1	2	2		—	—	—	—	—	—	—	—	—	—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
		B SM 50YB		50	1	2	2		(⁹)	—	—	—	—	—	—	—	—	—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
	4	B SM 53B		53	1	2	2		(⁹)	—	—	—	—	—	—	—	—	—	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
		C SM 53C		53	1	2	2		—	—	—	—	—	—	—	—	—	—	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
	5	SM 58		58	1	3	2		(¹⁰)	—	—	—	—	—	—	—	—	—	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
JIS G 3126		SLA 24A		41	1	1	2		—	—	—	—	—	—	—	—	—	—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
		SLA 24B		41	1	1	2		—	—	—	—	—	—	—	—	—	—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3
		SLA 33A		45	1	1	2		—	—	—	—	—	—	—	—	—	—	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
									(¹⁰)	—	—	—	—	—	—	—	—	—	14.3	14.3	14.3	14.3	13.9	13.6	13.2	12.8
		SLA 33B		45	1	1	2		—	—	—	—	—	—	—	—	—	—	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
									(¹⁰)	—	—	—	—	—	—	—	—	—	14.3	14.3	14.3	14.3	14.3	13.9	13.6	13.2
		SLA 37		50	1	2	2		—	—	—	—	—	—	—	—	—	—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
JIS G 3131		SPHC		28	1	1	1		—	—	—	—	—	—	—	—	—	—	7.0	7.0	7.0	7.0	—	—	—	—
		SPHD		28	1	1	1		—	—	—	—	—	—	—	—	—	—	7.0	7.0	7.0	7.0	—	—	—	—
		SPHE		28	1	1	1		—	—	—	—	—	—	—	—	—	—	7.0	7.0	7.0	7.0	—	—	—	—
JIS G 3141	1	SPCC		28	1	1	1		—	—	—	—	—	—	—	—	—	—	7.0	7.0	7.0	7.0	—	—	—	—
	2	SPCD		28	1	1	1		—	—	—	—	—	—	—	—	—	—	7.0	7.0	7.0	7.0	7.0	7.0	—	—
	3	SPCE		28	1	1	1		—	—	—	—	—	—	—	—	—	—	7.0	7.0	7.0	7.0	7.0	7.0	—	—

wable Tensile Stresses of Iron and Steel Materials

Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																														Symbol					
-10	0	40	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	750	775	800			
—	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SS 34	
—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SS 41
—	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	9.9	9.0	7.7	5.8	(5.0)	(3.7)	(2.4)	(1.8)	—	—	—	—	—	—	—	—	—	—	—	—	SB 42
—	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	10.8	9.7	8.2	5.9	(5.0)	(3.7)	(2.4)	(1.8)	—	—	—	—	—	—	—	—	—	—	—	—	SB 46
—	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	11.5	10.3	8.6	5.9	(5.1)	(3.7)	(2.4)	(1.8)	—	—	—	—	—	—	—	—	—	—	—	—	SB 49
—	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.0	10.3	9.1	(7.7)	(4.5)	(3.4)	—	—	—	—	—	—	—	—	—	—	—	—	SB 46M
—	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	11.7	10.8	9.3	(7.7)	(4.5)	(3.4)	—	—	—	—	—	—	—	—	—	—	—	—	SB 49M
—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 41A
—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 41B
10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 41C
—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 50A
—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 50B
12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 50C
—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 50YA
—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 50YB
—	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 53B
13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 53C
14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SM 58
10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SLA 24A
10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SLA 24B
11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SLA 33A
14.3	14.3	14.3	13.9	13.6	13.2	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SLA 33B
11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SLA 37
15.9	15.9	15.9	15.4	15.1	14.7	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SPHC
—	7.0	7.0	7.0	7.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SPHD
—	7.0	7.0	7.0	7.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SPHE
—	7.0	7.0	7.0	7.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SPCC
7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SPCD
7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SPCE

Table 3 (Continued)

[Steel Pipe]

Classification	Class	Symbol	Nominal composition (%)	Specified minimum tensile strength (kgf/mm ²)	P-No.	Group No.	External pressure chart Fig. No.	Manufacturing process	Notes	Allowable tensile																
										Temp. -268	-196	-100	-80	-60	-45	-30	-10	0	40	75	100	125	150	175		
JIS G 3452		SGP		30	1	1	1	S	(11)	—	—	—	—	—	—	—	—	7.5	7.5	7.5	7.5	7.5	(7.5)	(7.5)		
								E	(11)	—	—	—	—	—	—	—	—	6.4	6.4	6.4	6.4	6.4	(6.4)	(6.4)		
								B	(11)	—	—	—	—	—	—	—	—	4.9	4.9	4.9	4.9	4.9	(4.9)	(4.9)		
JIS G 3454		STPG38		38	1	1	2	S	—	—	—	—	—	—	—	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	
								E	—	—	—	—	—	—	—	—	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	
		STPG42		42	1	1	2	S	—	—	—	—	—	—	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5			
								E	—	—	—	—	—	—	—	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9		
JIS G 3457		STPY41		41	1	1	2	A	(12)	—	—	—	—	—	—	—	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	
JIS G 3459		SUS 304 TP	18Cr, 8Ni	53	8	(3)		S	(13)(14)(15)	—	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	11.9	11.1	10.4	9.6	9.2	
									(13)(14)(15)	—	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	12.1	11.6	11.3	10.9	10.5	
									(16)(17)	—	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.1	9.4	8.8	8.2	7.8	
								W	(13)(14)(15)	—	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.1	9.4	8.8	8.2	7.8	
									(16)(18)	—	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.3	9.9	9.6	9.3	9.0	
									(13)(14)(15)	—	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	10.3	9.9	9.6	9.3	9.0	
		SUS304H TP	18Cr, 8Ni	53	8	(3)		S	—	—	—	—	—	—	—	—	13.1	13.1	13.1	13.1	11.9	11.1	10.4	9.6	9.2	
									(17)	—	—	—	—	—	—	—	—	13.1	13.1	13.1	13.1	12.1	11.6	11.3	10.9	10.5
									(17)	—	—	—	—	—	—	—	—	13.1	13.1	13.1	13.1	12.1	11.6	11.3	10.9	10.5
		SUS 304L TP	18 Cr, 8 Ni Extra low C	49	8	(5)		S	(16)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	10.6	9.9	9.2	8.5		
									(16)(17)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.2	10.9	
									(16)(18)	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.0	8.4	7.8	7.2
		SUS316L TP	16 Cr, 12 Ni 2 Mo Extra low C	49	8	(6)		S	(16)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	10.7	10.0	9.3		
									(16)(17)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.1	10.8	
									(16)(18)	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.1	8.5	7.9	
		W	(16)(18)	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.4	9.1						
			(16)(17)(18)	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.4	9.1						
			(16)(17)(18)	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.4	9.1						
JIS G 3460		STPL 39		39	1	1	2	S	—	—	—	—	—	—	9.8	9.8	9.9	9.8	9.8	9.8	9.8	9.8	9.8	9.8		
								E	—	—	—	—	—	—	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	
		STPL 46	3.5 Ni	46	9B	1	2	S	—	—	—	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5		
JIS G 3464		STBL 39		39	1	1	2	S	—	—	—	—	—	—	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8		
								E	—	—	—	—	—	—	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	
		STBL 46	3.5 Ni	46	9B	1	2	S	—	—	—	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5		

Table 3 (Continued)

Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																														Symbol						
-30	-10	0	40	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	750	775	800			
—	—	7.5	7.5	7.5	7.5	7.5	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SGP	
—	—	6.4	6.4	6.4	6.4	6.4	(6.4)	(6.4)	(6.4)	(6.4)	(6.4)	(6.4)	(6.4)	(6.4)	(6.4)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	4.9	4.9	4.9	4.9	4.9	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	STPG 38	
—	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	STPG 42
—	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
—	—	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	STPY 41
3.1	13.1	13.1	13.1	11.9	11.1	10.4	9.6	9.2	8.7	8.4	8.1	7.9	7.7	7.6	7.5	7.4	7.3	7.2	7.1	7.0	6.9	6.7	6.5	6.1	5.6	4.7	3.8	3.1	2.5	2.0	1.6	1.3	1.0	—	SUS 304 TP	
3.1	13.1	13.1	13.1	12.1	11.6	11.3	10.9	10.7	10.5	10.4	10.3	10.2	10.1	10.1	10.0	10.0	9.9	9.8	9.7	9.6	9.5	9.1	8.4	7.2	5.8	4.7	3.8	3.1	2.5	2.0	1.6	1.3	1.0	—		
1.1	11.1	11.1	11.1	10.1	9.4	8.8	8.2	7.8	7.4	7.1	6.9	6.7	6.5	6.5	6.4	6.3	6.2	6.1	6.0	6.0	5.9	5.7	5.5	5.2	4.8	4.0	3.2	2.6	2.1	1.7	1.4	1.1	0.9	—		
1.1	11.1	11.1	11.1	10.3	9.9	9.6	9.3	9.1	8.9	8.8	8.8	8.7	8.6	8.6	8.5	8.5	8.4	8.3	8.2	8.2	8.1	7.7	7.1	6.1	4.9	4.0	3.2	2.6	2.1	1.7	1.4	1.1	0.9	—		
3.1	13.1	13.1	13.1	11.9	11.1	10.4	9.6	9.2	8.7	8.4	8.1	7.9	7.7	7.6	7.5	7.4	7.3	7.2	7.1	7.0	6.9	6.7	6.5	6.1	5.6	4.7	3.8	3.1	2.5	2.1	1.6	1.3	1.0	—	SUS304H	
3.1	13.1	13.1	13.1	12.1	11.6	11.3	10.9	10.7	10.5	10.4	10.3	10.2	10.1	10.1	10.0	10.0	9.9	9.8	9.7	9.6	9.5	9.1	8.4	7.2	5.8	4.7	3.8	3.1	2.5	2.1	1.6	1.3	1.0	—	TP	
1.3	11.3	11.3	11.3	11.3	10.6	9.9	9.2	8.5	7.8	7.4	7.0	6.7	6.4	6.3	6.1	6.0	5.8	5.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS304L TP
1.3	11.3	11.3	11.3	11.3	11.3	11.3	11.2	10.9	10.6	10.3	10.0	9.7	9.3	9.0	8.7	8.4	8.1	7.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9.6	9.6	9.6	9.6	9.6	9.0	8.4	7.8	7.2	6.6	6.3	6.0	5.7	5.4	5.4	5.2	5.1	4.9	4.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.5	9.3	9.0	8.8	8.5	8.2	7.9	7.7	7.4	7.1	6.9	6.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
1.3	11.3	11.3	11.3	11.3	11.3	10.7	10.0	9.3	8.6	8.2	7.9	7.5	7.3	7.0	6.8	6.6	6.4	6.2	6.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS316L TP
1.3	11.3	11.3	11.3	11.3	11.3	11.3	11.1	10.8	10.4	10.2	9.9	9.9	9.6	9.5	9.4	9.3	9.1	8.9	8.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9.6	9.6	9.6	9.6	9.6	9.6	9.1	8.5	7.9	7.3	7.0	6.7	6.4	6.2	6.0	5.8	5.6	5.4	5.3	5.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.4	9.2	8.8	8.7	8.4	8.4	8.2	8.1	8.0	7.9	7.7	7.6	7.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9.8	9.9	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	STPL 39
8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
5.1	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	STPL 46
8.3	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	STBL 39
8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
5.1	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	STBL 46

Table 3 (Continued)

[Steels for Structural Use]

Classification	Class	Symbol	Nominal composition (%)	Specified minimum tensile strength (kgf/mm ²)	P.No.	Group No.	External pressure chart Fig. No.	Manufacturing process	Notes	Allowable tensile stress																				
										Temp. 268	-196	-100	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200	225				
JIS G 4051		S10 C		32	1	1	2		(19)	—	—	—	—	—	—	—	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0		
		S12 C		38	1	1	2		(19)	—	—	—	—	—	—	—	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5		
		S15 C		32	1	1	2		(19)	—	—	—	—	—	—	—	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0		
		S17 C		41	1	1	2		(19)	—	—	—	—	—	—	—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3		
		S20 C		38	1	1	2		(19)	—	—	—	—	—	—	—	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5		
		S22 C		45	1	1	2		(19)	—	—	—	—	—	—	—	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3		
		S25 C		41	1	1	2		(19)	—	—	—	—	—	—	—	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3		
		S28 C		48	1	1	2		(19)	—	—	—	—	—	—	—	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		
	S30 C		45	1	1	2		(19)	—	—	—	—	—	—	—	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3			

[Steels for Special Use]

Classification	Class	Symbol	Nominal composition (%)	Specified minimum tensile strength (kgf/mm ²)	P-No.	Group No.	External pressure chart Fig. No.	Manufacturing process	Notes	Allowable tensile stress																
										Temp.	-196	-100	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200	225
JIS G 4303		SUS 302	18 Cr, 8 Ni	53	8		—		(17)	—	—	—	—	—	—	13.1	13.1	13.1	13.1	11.9	11.1	10.4	9.6	9.2	8.7	8.4
		SUS 304	18 Cr, 8 Ni	53	8	3			(13)(14)(15) (16)(17)	—	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	11.9	11.1	10.4	9.6	9.2	8.7	8.4
		SUS 304 L	18 Cr, 8 Ni Extra low C	49	8	5			(16)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	10.6	9.9	9.2	8.5	7.8	7.4
		SUS 316	16 Cr, 12 Ni 2 Mo	53	8	4			(13)(14)(15) (16)(17)	—	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	11.9	11.2	10.7	10.2	9.9	9.6	9.3
JIS G 4304		SUS 316 L	16 Cr, 12 Ni 2 Mo Extra low C	49	8	6			(16)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	10.7	10.0	9.3	8.6	8.1
		SUS 316 J1	18 Cr, 12 Ni 2 Mo, 2 Cu	53	8				(13)(14)(15) (16)(17)	—	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	11.9	11.2	10.7	10.2	9.9	9.6	9.3
		SUS 316 J1 L	18 Cr, 12 Ni 2 Mo, 2 Cu Extra low C	49	8				(16)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	10.7	10.0	9.3	8.6	8.1
		SUS 317	18 Cr, 13 Ni 3 Mo	53	8	4			(13)(14)	—	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	11.9	11.2	10.7	10.2	9.9	9.6	9.3
JIS G 4305		SUS 317 L	18 Cr, 13 Ni 3 Mo Extra low C	49	8	6			(14)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.0	10.7	9.7	8.6	8.1
		SUS 410	13 Cr	45	6	2			(*)	—	—	—	—	—	—	—	11.3	11.3	11.3	11.0	10.8	10.7	10.5	10.4	10.2	10.0
		SUS 430	16 Cr	46	7	—			(*)	—	—	—	—	—	—	—	11.5	11.5	11.5	11.0	11.0	10.7	10.5	10.4	10.2	10.0

Table 3 (Continued)

Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																														Symbol				
-10	0	40	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725		750	775	800	
8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.7	7.2	6.2	5.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S 10 C
																																	S 12 C	
9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.1	8.2	7.1	5.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S 15 C
8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.7	7.2	6.2	5.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S 17 C
10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	9.7	8.8	7.6	5.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S 20 C
9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.1	8.2	7.1	5.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S 22 C
11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	10.6	9.6	8.1	5.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S 25 C
10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	9.7	8.8	7.6	5.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S 28 C
12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	11.2	10.1	8.4	5.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S 30 C
11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	10.6	9.6	8.1	5.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S 30 C

Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																													Symbol			
0	40	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	750	775	800	
13.1	13.1	11.9	11.1	10.4	9.6	9.2	8.7	8.4	8.1	7.9	7.7	7.6	7.5	7.4	7.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 302
13.1	13.1	12.1	11.6	11.3	10.9	10.7	10.5	10.4	10.3	10.2	10.1	10.1	10.0	10.0	9.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 304
13.1	13.1	11.9	11.1	10.4	9.6	9.2	8.7	8.4	8.1	7.9	7.7	7.6	7.5	7.4	7.3	7.2	7.1	7.0	6.9	6.7	6.5	6.1	5.6	4.7	3.8	3.1	2.5	2.0	1.6	1.3	1.0	SUS 304
13.1	13.1	12.1	11.6	11.3	10.9	10.7	10.5	10.4	10.3	10.2	10.1	10.1	10.0	10.0	9.9	9.8	9.7	9.6	9.5	9.1	8.4	7.2	5.8	4.7	3.8	3.1	2.5	2.0	1.6	1.3	1.0	SUS 304 L
11.3	11.3	11.3	10.6	9.9	9.2	8.5	7.8	7.4	7.0	6.7	6.4	6.3	6.1	6.0	5.8	5.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 304 L
11.3	11.3	11.3	11.3	11.3	11.2	10.9	10.6	10.3	10.0	9.7	9.3	9.0	8.7	8.4	8.1	7.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 304 L
13.1	13.1	11.9	11.2	10.7	10.2	9.9	9.6	9.3	9.0	8.7	8.5	8.3	8.1	7.9	7.7	7.6	7.5	7.3	7.2	7.0	6.8	6.7	6.5	5.9	4.8	3.8	3.0	2.1	1.6	1.2	0.9	SUS 316
13.1	13.1	12.6	12.3	12.1	11.9	11.7	11.5	11.4	11.3	11.2	11.2	11.2	11.2	11.2	11.1	10.9	10.8	10.5	10.3	10.0	9.6	9.0	8.0	6.4	4.8	3.8	3.0	2.1	1.6	1.2	0.9	SUS 316
11.3	11.3	11.3	11.3	10.7	10.0	9.3	8.6	8.2	7.9	7.5	7.3	7.0	6.8	6.6	6.4	6.2	6.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 316 L
11.3	11.3	11.3	11.3	11.3	11.1	10.8	10.4	10.2	9.9	9.8	9.6	9.5	9.4	9.3	9.1	8.9	8.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 316 L
13.1	13.1	11.9	11.2	10.7	10.2	9.9	9.6	9.3	9.0	8.7	8.5	8.3	8.1	7.9	7.7	7.6	7.5	7.3	7.2	7.0	6.8	6.7	6.5	5.9	4.8	3.8	3.0	2.1	1.6	1.2	0.9	SUS 316 J1
13.1	13.1	12.6	12.3	12.1	11.9	11.7	11.5	11.4	11.3	11.2	11.2	11.2	11.2	11.2	11.1	10.9	10.8	10.5	10.3	10.0	9.6	9.0	8.0	6.4	4.8	3.8	3.0	2.1	1.6	1.2	0.9	SUS 316 J1
11.3	11.3	11.3	11.3	10.7	10.0	9.3	8.6	8.2	7.9	7.5	7.3	7.0	6.8	6.6	6.4	6.2	6.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 316 J1 L
11.3	11.3	11.3	11.3	11.3	11.1	10.8	10.4	10.2	9.9	9.8	9.6	9.5	9.4	9.3	9.1	8.9	8.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 316 J1 L
13.1	13.1	11.9	11.2	10.7	10.2	9.9	9.6	9.3	9.0	8.7	8.5	8.3	8.1	7.9	7.7	7.6	7.5	7.3	7.2	7.0	6.8	6.7	6.5	5.9	4.8	3.8	3.0	2.1	1.6	1.2	0.9	SUS 317
13.1	13.1	12.6	12.3	12.1	11.9	11.7	11.7	11.4	11.3	11.2	11.2	11.2	11.2	11.2	11.1	10.9	10.8	10.5	10.3	10.0	9.6	9.0	8.0	6.4	4.8	3.8	3.0	2.1	1.6	1.2	0.9	SUS 317
11.3	11.3	11.3	11.3	11.0	10.7	9.7	8.6	8.2	7.9	7.5	7.3	7.0	6.8	6.6	6.4	6.2	6.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 317 L
11.3	11.3	11.3	11.3	11.3	11.1	10.8	10.4	10.2	9.9	9.8	9.6	9.5	9.4	9.3	9.1	8.9	8.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	SUS 317 L
11.3	11.3	11.0	10.8	10.7	10.5	10.4	10.2	10.0	9.8	9.7	9.5	9.4	9.3	9.1	8.8	8.5	8.0	7.5	6.6	5.3	3.8	2.7	1.8	1.1	0.7	—	—	—	—	—	SUS 410	
11.5	11.5	11.0	11.0	10.7	10.5	10.4	10.2	10.0	9.8	9.7	9.5	9.4	9.3	9.1	8.8	8.5	8.0	7.5	6.6	5.4	4.0	2.9	2.1	1.6	1.2	—	—	—	—	—	SUS 430	

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Table 3 (Continued)

[Castings and Forgings]

Classification	Class	Symbol	Nominal composition (%)	Specified minimum tensile strength (kgf/mm ²)	P.No.	Group No.	External pressure chart Fig. No.	Manufacturing process	Notes	Allowable tensile strength (kgf/cm ²)																
										Temp. -268	-196	-100	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200	
JIS G 3201		SF 35A		35	1	1	1		(⁹)(²⁰)	—	—	—	—	—	—	—	—	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
		SF 40 A		40	1	1	1		(⁹) (⁶)(⁸)(²⁰)	—	—	—	—	—	—	—	—	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
		SF 45 A		45	1	1	2		(⁹) (⁶)(⁸)(²⁰)	—	—	—	—	—	—	—	—	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
		SF 50 A		50	1	2	2		(⁹) (⁶)(⁸)(²⁰)	—	—	—	—	—	—	—	—	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
JIS G 5101		SC 37		37	1	1	1		(⁹)(²¹) (⁹)(²²)(²³)	—	—	—	—	—	—	—	—	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
		SC 42		42	1	1	2		(⁹)(²¹) (⁶)(⁸)(⁹)(²²)(²³)	—	—	—	—	—	—	—	—	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
		SC 46		46	1	1	2		(⁹)(²¹) (⁶)(⁸)(⁹)(²²)(²³)	—	—	—	—	—	—	—	—	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
		SC 49		49	1	2	2		(⁹)(²¹) (⁶)(⁸)(⁹)(²²)(²³)	—	—	—	—	—	—	—	—	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
JIS G 5501	1	FC10		10			7		—	—	—	—	—	—	—	—	—	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	2	FC15		15			7		—	—	—	—	—	—	—	—	—	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	3	FC20		20			7		—	—	—	—	—	—	—	—	—	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	4	FC25		25			7		—	—	—	—	—	—	—	—	—	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	5	FC30		30			7		—	—	—	—	—	—	—	—	—	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	6	FC35		35			7		—	—	—	—	—	—	—	—	—	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
JIS G 5502	1	FCD40		40					—	—	—	—	—	—	—	—	—	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	2	FCD45		45			8		—	—	—	—	—	—	—	—	—	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
	3	FCD50		50			8		—	—	—	—	—	—	—	—	—	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
	4	FCD60		60			8		—	—	—	—	—	—	—	—	—	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
JIS G 5702	1	FCMB 28		28					—	—	—	—	—	—	—	—	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	
	2	FCMB 32		32					—	—	—	—	—	—	—	—	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
	3	FCMB 35		35					—	—	—	—	—	—	—	—	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	
	4	FCMB 37		37					—	—	—	—	—	—	—	—	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	
B 8 2 4 3	Ductile iron castings Appendix 1	FCD — S		42			8		(²⁴)(²⁵)	—	—	—	—	—	—	—	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	
	Malleable iron castings Appendix 1	FCMB-S35		35					(²⁴)(²⁵)	—	—	—	—	—	—	—	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	
		FCMB-S37		37					(²⁴)(²⁵)	—	—	—	—	—	—	—	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	

- Notes (6) In the case where it is used at a temperature exceeding 450°C, the numerical value in parentheses may be used, but where it is used for a long period of time, care shall be taken for graphitization of the materials.
- (7) In the case where it is used at a temperature exceeding 475°C, the numerical values in parentheses may be used, but where it is used for a long period of time, care shall be taken for graphitization of the materials.
- (8) 550°C shall be read out as 538°C substitutionally.
- (9) 0°C shall be read out as -5°C substitutionally.
- (10) It indicates the allowable tensile strength calculated on the base of 3.3.2.2.
- (11) The numerical value in the parentheses may be used only in the case where the conditions of 3.2 (7) are applied.
- (12) The numerical value of this allowable tensile stress is the numerical value multiplied by 0.6 of welding efficiency factor according to class (3) of joint of Table 19. In the case where manufactured in accordance with classes (1) or (2) of joint in the same table and further radiation inspection is carried out, it may be calculated by multiplying the corresponding joint efficiency factor by using the allowable tensile stress of Class 2, SS 41 of JIS G 3101.
- (13) The value of 550°C or over in this column applies to the material of 0.04 % or more in carbon content.
- (14) The value exceeding 525°C in this column applies to the material carried out with the solution treatment by quenching from a temperature of 1040°C or higher.
- (15) -196°C shall be read out as -253°C substitutionally.
- (16) In the case of using at a low temperature below -196°C, the impact test of 8.7.5 shall be carried out, and the results shall comply with the test.
- (17) The value in this column is applicable when a certain degree of deformation is allowable.
- (18) The value exceeding 350°C in this column applies to the material made by automatic arc welding with using no filler metal, and carried out with most suitable solution treatment after cold working in order to obtain complete corrosion resistance of parent metal and weld.
- (19) In the case of using this numerical value, the inspection shall be carried out according to Class A of JIS G 0303, and after affirming the definite minimum tensile strength, the upper stage value applies to those of which steel diameter, width across flats or thickness of main body is not more than 100 mm and the lower stage value, to those of which steel diameter, width across flats or thickness of main body exceeds 100 mm up to and including 200 mm.

- (²⁰) The value in this column applies to that of 0.35 % or less in carbon content.
- (²¹) The value in this column is the value of allowable tensile stress obtained according to 3.3.2.1 multiplied by casting factor 0.67.
- (²²) In the case of using the value of this column, the chemical components of following Table shall be satisfied.

Component Classification	C	Mn	P	S	Si
SC 37 SC 42	0.25 % max.	0.70 % max.	0.04 % max.	0.04 % max.	0.60 % max.
SC 46 SC 49	0.35 % max.	0.70 % max.	0.04 % max.	0.04 % max.	0.60 % max.

Remarks 1. For each decrease of 0.01 % of C content from the highest value of the above table, the content of Mn may be increased by 0.04 % to the highest value of the above table. However, the content of Mn shall not exceed 1.10 %.

2. Ni, Cr, and Cu contained in impurities shall be restricted respectively to not more than 0.5 %, and their sum, to not more than 1.0 %.

- (²³) The value in this column is the value of allowable tensile stress obtained from 3.3.2.1 or 3.3.3 multiplied by casting factor 0.8. In the case where the test of following Table is carried out, the casting factor 0.9 or 1.0 may be taken.

Test	Casting factor
To be in accordance with Remark 2. of Note (²³)	0.9
To be in accordance with Remark 4. of Note (²³)	0.9
To be in accordance with Remarks 1. and 3. of Note (²³)	0.9
To be in accordance with Remarks 2. and 4. of Note (²³)	1.0

Remarks 1. The product shall be sampled according Remark 5. of Note (²³) to carry out the radiation test according to JIS G 0581, and the results shall comply with respectively Grade 3 or superior relative to 3 kind defects specified in the mentioned Standard.

- Remarks 2. For 100 % of products (including the case of one piece), the radiographic test shall be carried out according to JIS G 0581, and the results shall comply with the Grade 3 or superior respectively relative to 3 kind defects specified in the same Standard.
3. The product shall be sampled according to Remark 5. of Note (²³), the magnetic particle testing shall be carried out according to 8.8.4 or the liquid penetrant testing, be carried out according to 8.8.5 and the results shall satisfy.
4. The magnetic particle testing shall be carried out according to 8.8.4 or the liquid penetrant testing, be carried out according to 8.8.5 on the 100 % product and the results shall satisfy.
5. For sampling inspection, for each newly designed wooden model, out of 5 pieces made at first, not less than 3 pieces, and in thereafter manufacturing, for each 5 pieces or its fraction, one piece shall be taken, and the inspection shall be carried out on the parts for defects to appear easily.

(²⁴) In the case where it is used at a low temperature exceeding -10°C, the impact test specified in the material Standard shall be carried out, and the results satisfy the specifications.

(²⁵) The value in this column, in the case where after heat treatment, whole surface is machine finished and no defect is confirmed, it may be taken as 1.0625 multiplication and in the case where comply with the following conditions, be taken as 1.125 multiplication.

- (1) In the case where out of first lot 5 pieces, 3 pieces satisfy RT, and thereafter out of 5 pieces one piece satisfies RT and in every case all the remainders satisfy MT or PT.

RT means that the test is carried out according to JIS G 0581, and relative to three kinds of defects specified therein, respectively are not inferior to Grade 3.

For MT, the whole surface shall, as a rule, be inspected according to JIS G 0565. The judgement on defects shall be in accordance with the following:

- (a) The crackings of 9. of JIS G 0565 of not larger than 2 mm shall be judged to be satisfactory.
- (b) In the case where there are linear indications, when these comply with the following grade, these shall be taken to have passed.

Nominal thickness of flaw detecting part	Grade of linear indication
20 mm and under	Grade 1, Grade 2
Over 20 mm to 60 mm incl.	Grade 1, Grade 2
Over 60 mm	Grade 1, Grade 2, Grade 3

- (c) In the case where there are circular indications, Grade 1 and Grade 2 of Table 5 of JIS G 0565 shall be taken as to be satisfied.
- (d) Groups 1 and 2 of Table 6 of JIS G 0565 shall be taken as to be satisfied. However, the magnetic powder indication of Class 1, Grade 1 shall not be taken as defect magnetic powder indication.
PT shall be in accordance with MT as appropriate.
- (2) When 100 % satisfies RT.
- (3) In the case where many worked holes in whole thickness as in the tube sheet and the inner inspection is possible.
- (*) Because this kind steels, after used at a temperature exceeding 425°C, the brittleness at ordinary temperature becomes larger, these shall not be used at not lower than this temperature, as far as there is no sufficient reason.

- Remarks
- The value of allowable tensile stress at an intermediate temperature between each temperature in Table 3, shall be calculated by proportional method.
 - "Division of parent metal" and "Group number" in Table 3, indicate P-number of 12. of JIS B 8243 (see Table 5 of JIS Z 3040).
 - "Outer pressure chart number" of Table 3 indicates the number of Figure of Fig. 4.6 of JIS B 8243.
 - In the column of "manufacturing method" of Table 3, S indicates the seamless pipe; E, the electric resistance welding pipe; B, the forging pipe; A, the arc-welding pipe; W, automatic arc welding pipe or electric-resistance welding pipe. Because the allowable stress shown herein includes the welding efficiency shown in 3.3.10, for σ_w to be used for calculation of inner pressure, the value of this Table shall be taken.
 - In the case where values of the minimum tensile stress and allowable tensile stress at each temperature of Table 3 are expressed by using the International System of Units (SI), the respective numerical values shall be multiplied by 9.8 N/mm².

Further, 1 N/mm² = 1 MPa

Table 4. Allowable Tensile Stress

[Metallic Material Other than Copper and Aluminium, and Its Alloys]

Classification	Class	Temper	Symbol	Specified minimum tensile strength (kgf/mm ²)	P.No.	Group No.	External pressure chart Fig. No.	Notes					
									-268	-196	-125	-80	-60
JIS H 3100	C1020 **	O	C 1020 P-O	20 (Thickness 0.3 mm to 30 mm incl.)	31		10		4.6	4.6	4.6	4.6	4.6
	C1020 *	O	C 1020 R-O	20 (Thickness 0.3 mm to 3 mm incl.)	31		10		4.6	4.6	4.6	4.6	4.6
	C1100 **	O	C 1100 P-O	20 (Thickness 0.3 mm to 30 mm incl.)	31		10		4.6	4.6	4.6	4.6	4.6
	C1100 *	O	C 1100 R-O	20 (Thickness 0.3 mm to 3 mm incl.)	31		10		4.6	4.6	4.6	4.6	4.6
	C1201 **	O	C 1201 P-O	20 (Thickness 0.3 mm to 30 mm incl.)	31		10		4.6	4.6	4.6	4.6	4.6
	C1201 *	O	C 1201 R-O	20 (Thickness 0.3 mm to 3 mm incl.)	31		10		4.6	4.6	4.6	4.6	4.6
	C1220 **	O	C 1220 P-O	20 (Thickness 0.3 mm to 30 mm incl.)	31		10		4.6	4.6	4.6	4.6	4.6
	C1220 *	O	C 1220 R-O	20 (Thickness 0.3 mm to 3 mm incl.)	31		10		4.6	4.6	4.6	4.6	4.6
	C4621 **	F	C 4621 P-F	38 (Thickness 0.8 mm to 20 mm excl.)	32				—	8.8	8.8	8.8	8.8
				35 (Thickness 20 mm to 40 mm excl.)	32				—	8.8	8.8	8.8	8.8
				32 (Thickness 40 mm to 125 mm incl.)	32				—	8.0	8.0	8.0	8.0
	C4640 **	F	C 4640 P-F	38 (Thickness 0.8 mm to 20 mm excl.)	32				—	8.8	8.8	8.8	8.8
				35 (Thickness 20 mm to 40 mm excl.)	32				—	8.8	8.8	8.8	8.8
				32 (Thickness 40 mm to 125 mm incl.)	32				—	8.0	8.0	8.0	8.0
	C6161 **	O	C 6161 P-O	50 (Thickness 0.8 mm to 50 mm excl.)	35		13		—12.3	12.3	12.3	12.3	12.3
				46 (Thickness 50 mm to 125 mm incl.)	35		13		—11.4	11.4	11.4	11.4	11.4
	C6280 **	F	C 6280 P-F	63 (Thickness 0.8 mm to 50 mm excl.)			13		—14.0	14.0	14.0	14.0	14.0
				60 (Thickness 50 mm to 90 mm excl.)			13						
				56 (Thickness 90 mm to 125 mm incl.)			13						
	C6301 **	F	C 6301 P-F	65 (Thickness 0.8 mm to 50 mm excl.)			13		—15.8	15.8	15.8	15.8	15.8
				60 (Thickness 50 mm to 125 mm incl.)			13		—14.9	14.9	14.9	14.9	14.9
	C7060 **	F	C 7060 P-F	28 (Thickness 0.5 mm to 50 mm incl.)	34		11		—7.0	7.0	7.0	7.0	7.0
	C7150 **	F	C 7150 P-F	35 (Thickness 0.5 mm to 50 mm incl.)	34		12		—8.8	8.8	8.8	8.8	8.8
JIS H 4551		O	NCuP-O	49 (Thickness 0.5 mm to 50 mm incl.)	42		9		—12.3	12.3	12.3	12.3	12.3
JIS H 3320		O	C 2600 TW	28					—6.0	6.0	6.0	6.0	6.0
		OL											
		1/2H		38			(26)		—8.1	8.1	8.1	8.1	8.1
		H	C 2680 TW	46			(26)		—9.8	9.8	9.8	9.8	9.8
		O		30					—6.4	6.4	6.4	6.4	6.4
		OL											
JIS H 3300		1/2H	C 2600 TW	38			(26)		—8.1	8.1	8.1	8.1	8.1
		H		46			(26)		—9.8	9.8	9.8	9.8	9.8
		O											
		OL	C 2680 TW	30					—6.4	6.4	6.4	6.4	6.4
		1/2H		38			(26)		—8.1	8.1	8.1	8.1	8.1
		H		46			(26)		—9.8	9.8	9.8	9.8	9.8
JIS H 3300	C1020	O	C 1020 T-O	21 (Outer diameter 4 mm to 100 mm incl.)	31		10		4.8	4.8	4.8	4.8	4.8
		O	C 1020 TS-O	Wall thickness 0.3 mm to 30 mm incl.)	31		10		4.8	4.8	4.8	4.8	4.8
	C1100	O	C 1100 T-O	21 (Outer diameter 5 mm to 250 mm incl.)	31		10		4.8	4.8	4.8	4.8	4.8
JIS H 3300		O	C 1100 TS-O	Wall thickness 0.5 mm to 30 mm incl.)	31		10		4.8	4.8	4.8	4.8	4.8
	C1201	O	C 1201 T-O	21 (Outer diameter 4 mm to 250 mm incl.)	31		10		4.8	4.8	4.8	4.8	4.8
		O	C 1201 TS-O	Wall thickness 0.3 mm to 30 mm incl.)	31		10		4.8	4.8	4.8	4.8	4.8

Remark: The mark * in the column of class means a plate or sheet and the mark ** means a bar.

Notes	Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																												Symbol	
	-268	-196	-125	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500		
	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.1	3.9	3.6	3.5	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	C1020	
	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.1	3.9	3.6	3.5	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	C1100	
	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.1	3.9	3.6	3.5	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	C1201	
	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.1	3.9	3.6	3.5	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	C1220	
	—	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	4.4	1.8	—	—	—	—	—	—	—	—	—	—	—	—	C4621	
	—	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	4.4	1.8	—	—	—	—	—	—	—	—	—	—	—	—		
	—	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	4.4	1.8	—	—	—	—	—	—	—	—	—	—	—	—		
	—	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	4.4	1.8	—	—	—	—	—	—	—	—	—	—	—	—	C4640	
	—	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	4.4	1.8	—	—	—	—	—	—	—	—	—	—	—	—		
	—	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	4.4	1.8	—	—	—	—	—	—	—	—	—	—	—	—		
	—	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	11.9	11.6	11.2	—	—	—	—	—	—	—	—	—	C6161	
	—	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.1	10.7	10.3	—	—	—	—	—	—	—	—	—		
	—	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	13.8	13.7	13.0	12.1	11.2	10.3	9.5	8.6	7.7	6.8	5.9	5.1	4.4	—	—	—	—	—	C6280	
	—	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.7	15.4	14.9	11.2	9.0	6.0	4.2	—	—	—	—	—	C6301		
	—	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.7	14.6	14.4	14.1	13.7	11.2	9.0	6.0	4.2	—	—	—	—		—	
	—	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.8	6.7	6.5	6.3	6.1	6.0	5.7	5.6	4.9	4.2	—	—	—	—	—	—	—	—	C7060	
	—	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	7.9	7.4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	6.5	—	C7150	
	—	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	11.9	11.5	11.2	10.8	10.6	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.3	10.2	10.0	9.9	NCuP
	—	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	C2600	
)	—	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
)	—	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
	—	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	C2680	
)	—	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
)	—	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	3.6	3.4	3.4	3.3	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	C1020	
	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	3.6	3.4	3.4	3.3	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	C1100	
	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	3.6	3.4	3.4	3.3	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	C1201	

Table 4 (Continued)

Classification	Class	Temper	Symbol	Specified minimum tensile strength (kgf/mm ²)	p-No.	Group No.	External pres- sure chart Fig. No.	Notes						
									-268	-196	-125	-80	-60	-40
JIS H 3300	C1220	O O	C 1220 T-O C 1220 TS-O	21 (Outer diameter 4 mm to 250 mm Incl. Wall thickness 0.3 mm to 30 mm Incl.)	31 31		10 10		4.8	4.8	4.8	4.8	4.8	4.8
	C1020	OL OL	C 1020 T-OL C 1020 TS-OL	21 (Outer diameter 4 mm to 100 mm Incl. Wall thickness 0.3 mm to 30 mm Incl.)	31 31		10 10		4.8	4.8	4.8	4.8	4.8	4.8
	C1201	OL OL	C 1201 T-OL C 1201 TS-OL	21 (Outer diameter 4 mm to 250 mm Incl. Wall thickness 0.3 mm to 30 mm Incl.)	31 31		10 10		4.8	4.8	4.8	4.8	4.8	4.8
	C1220	OL OL	C 1220 T-OL C 1220 TS-OL	21 (Outer diameter 4 mm to 250 mm Incl. Wall thickness 0.3 mm to 25 mm Incl.)	31 31		10 10		4.8	4.8	4.8	4.8	4.8	4.8
	C1020	1/2H 1/2H	C 1020 T-1/2H C 1020 TS-1/2H	25 (Outer diameter 4 mm to 100 mm Incl. Wall thickness 0.3 mm to 25 mm Incl.)	31 31		10 10	(26)	6.3	6.3	6.3	6.3	6.3	6.3
	C1100	1/2H 1/2H	C 1100 T-1/2H C 1100 TS-1/2H	25 (Outer diameter 5 mm to 250 mm Incl. Wall thickness 0.5 mm to 25 mm Incl.)	31 31		10 10	(26)	6.3	6.3	6.3	6.3	6.3	6.3
	C1201	1/2H 1/2H	C 1201 T-1/2H C 1201 TS-1/2H	25 (Outer diameter 4 mm to 250 mm Incl. Wall thickness 0.3 mm to 25 mm Incl.)	31 31		10 10	(26)	6.3	6.3	6.3	6.3	6.3	6.3
	C1220	1/2H 1/2H	C 1220 T-1/2H C 1220 TS-1/2H	25 (Outer diameter 4 mm to 250 mm Incl. Wall thickness 0.3 mm to 25 mm Incl.)	31 31		10 10	(26)	6.3	6.3	6.3	6.3	6.3	6.3
	C1020	H H	C 1020 T-H C 1020 TS-H	32 (Outer diameter 25 mm to 100 mm Incl. Wall thickness 0.3 mm to 6 mm Incl.)	31 31		10 10	(26)	7.9	7.9	7.9	7.9	7.9	7.9
	C1100	H H	C 1100 T-H C 1100 TS-H	27 (Outer diameter 5 mm to 100 mm Incl. Wall thickness 0.5 mm to 10 mm Incl.)	31 31		10 10	(26)	6.5	6.5	6.5	6.5	6.5	6.5
	C1201	H H	C 1201 T-H C 1201 TS-H	32 (Outer diameter 25 mm and under Wall thickness 0.3 mm to 3 mm Incl. Outer diameter 25 mm to 50 mm Incl. Wall thickness 0.9 mm to 4 mm Incl. Outer diameter 50 mm to 100 mm Incl. Wall thickness 1.5 mm to 6 mm Incl.)	31 31		10 10	(26)	7.9	7.9	7.9	7.9	7.9	7.9
	C1220	H H	C 1220 T-H C 1220 TS-H		31 31		10 10	(26)	7.9	7.9	7.9	7.9	7.9	7.9
	C2300	O OL	C 2300 T-O C 2300 TS-O C 2300 T-OL C 2300 TS-OL						—	5.6	5.6	5.6	5.6	5.6
	C2800	O	C 2800 T-O C 2800 TS-O	32 (Outer diameter 10 mm to 250 mm Incl. Wall thickness 1 mm to 15 mm Incl.)					—	8.0	8.0	8.0	8.0	8.0
	C4430	O	C 4430 T-O C 4430 TS-O	32 (Outer diameter 5 mm to 250 mm Incl. Wall thickness 0.8 mm to 10 mm Incl.)					—	7.0	7.0	7.0	7.0	7.0
	C6561	O	C 6561 T-O	35 (Outer diameter 10 mm to 60 mm Incl. Wall thickness 0.3 mm to 5 mm Incl.)	32		11		—	7.0	7.0	7.0	7.0	7.0
	C6870	O	C 6870 T-O C 6870 TS-O	38 (Outer diameter 5 mm to 250 mm Incl. Wall thickness 0.8 mm to 10 mm Incl.)					—	8.4	8.4	8.4	8.4	8.4
	C6871	O	C 6871 T-O C 6871 TS-O	38 (Outer diameter 5 mm to 250 mm Incl. Wall thickness 0.8 mm to 10 mm Incl.)					—	8.4	8.4	8.4	8.4	8.4
	C6872	O	C 6872 T-O C 6872 TS-O	38 (Outer diameter 5 mm to 250 mm Incl. Wall thickness 0.8 mm to 19 mm Incl.)					—	8.4	8.4	8.4	8.4	8.4



Table 4 (Continued)

Notes	Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																												Symbol	
	-268	-196	-125	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500		
	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	3.6	3.4	3.4	3.3	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	—	C1220
	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	3.6	3.4	3.4	3.3	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	—	C1020
	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	3.6	3.4	3.4	3.3	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	—	C1201
	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	3.6	3.4	3.4	3.3	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	—	C1220
(26)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.1	6.0	5.7	—	—	—	—	—	—	—	—	—	—	—	—	—	C1020
(26)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.1	6.0	5.7	—	—	—	—	—	—	—	—	—	—	—	—	—	C1100
(26)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.1	6.0	5.7	—	—	—	—	—	—	—	—	—	—	—	—	—	C1201
(26)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.1	6.0	5.7	—	—	—	—	—	—	—	—	—	—	—	—	—	C1220
(26)	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.7	7.2	3.0	—	—	—	—	—	—	—	—	—	—	—	—	—	C1020
(26)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.0	5.8	5.6	3.5	1.7	—	—	—	—	—	—	—	—	—	—	—	—	—	C1100
(26)	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.7	7.2	3.0	—	—	—	—	—	—	—	—	—	—	—	—	—	C1201
(26)	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.7	7.2	3.0	—	—	—	—	—	—	—	—	—	—	—	—	—	C1220
	—	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	4.9	3.5	1.4	—	—	—	—	—	—	—	—	—	—	—	—	C2300
	—	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.6	3.7	—	—	—	—	—	—	—	—	—	—	—	—	—	C2800
	—	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.9	2.5	1.4	—	—	—	—	—	—	—	—	—	—	—	—	C4430
	—	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	3.5	3.5	—	—	—	—	—	—	—	—	—	—	—	—	—	C6561
	—	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.3	8.3	8.2	8.2	4.6	2.3	1.3	—	—	—	—	—	—	—	—	—	—	—	—	C6870
	—	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.3	8.3	8.2	8.2	4.6	2.3	1.3	—	—	—	—	—	—	—	—	—	—	—	—	C6871
	—	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.3	8.3	8.2	8.2	4.6	2.3	1.3	—	—	—	—	—	—	—	—	—	—	—	—	C6872

Table 4 (Conti

Classification	Class	Temper	Symbol	Specified minimum tensile strength (kgf/mm ²)	P.No.	Group No.	External pres- sure chart Fig. No.	Notes								
									-268	-196	-125	-80	-60	-45	-30	
JIS H 3300	C7060	O	C 7060 T-O C 7060 TS-O	28 (Outer diameter 5 mm to 50 mm Incl.) Wall thickness 0.8 mm to 5 mm Incl.)	34 34		12 12		—	7.0	7.0	7.0	7.0	7.0	7.0	7.0
	C7100	O	C 7100 T-O C 7100 TS-O	32 (Outer diameter 5 mm to 50 mm Incl.) Wall thickness 0.8 mm to 5 mm Incl.)	34 34		12 12		—	7.5	7.5	7.5	7.5	7.5	7.5	
	C7150	O	C 7150 T-O C 7150 TS-O	37 (Outer diameter 5 mm to 50 mm Incl.) Wall thickness 0.8 mm to 5 mm Incl.)	34 34		13 13		—	8.4	8.4	8.4	8.4	8.4	8.4	
JIS H 4552		O	NCuT-O	49 (Outer diameter 15 mm to 51 mm Incl.) Wall thickness 0.8 mm to 3 mm Incl.)	42		9		—	12.3	12.2	12.3	12.3	12.3	12.3	
		S R	NCuT-SR	60 (Outer diameter 15 mm to 51 mm Incl.) Wall thickness 0.8 mm to 3 mm Incl.)	42		9		—	14.9	14.9	14.9	14.9	14.9	14.9	
JIS H 3250	C1020 C1100	F	C 1020 BE-F C 1100 BE-F	20 (Diameter 6 mm and over)	31				4.7	4.7	4.7	4.7	4.7	4.7	4.7	
	C1201 C1220	F	C 1201 BE-F C 1220 BE-F													
	C1020 C1100 C1201	O	C 1020 BD-O C 1100 BD-O C 1201 BD-O	20 (Diameter 6 mm to 75 mm Incl.)	31				4.7	4.7	4.7	4.7	4.7	4.7		
	C1220	O	C 1220 BD-O													
	C3601	O	C 3601 BD-O	30 (Diameter 6 mm to 75 mm Incl.)				—	7.5	7.5	7.5	7.5	7.5	7.5		
	C3602	F F	C 3602 BE-F C 3602 BD-F	32 (Diameter 6 mm to 75 mm Incl.)				—	8.0	8.0	8.0	8.0	8.0	8.0		
	C3603	O	C 3603 BD-O	32 (Diameter 6 mm to 75 mm Incl.)				—	8.0	8.0	8.0	8.0	8.0	8.0		
	C3604	F	C 3604 BE-F C 3604 BD-F	34 (Diameter 6 mm to 75 mm Incl.)				—	8.5	8.5	8.5	8.5	8.5	8.5		
	C3712	F	C 3712 BE-F C 3712B D-F	32 (Diameter 6 mm and over)				—	8.0	8.0	8.0	8.0	8.0	8.0		
	C3771	F	C 3771 BE-F C 3771 BD-F	32 (Diameter 6 mm and over)				—	8.0	8.0	8.0	8.0	8.0	8.0		

Table 4 (Continued)

Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																													Symbol
-196	-125	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500			
7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.8	6.7	6.5	6.3	6.1	6.0	5.7	5.6	4.9	4.2	—	—	—	—	—	—	—	—	—	C7060	
7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.4	7.4	7.3	7.2	7.0	6.9	6.7	6.5	6.2	5.9	5.4	4.9	—	—	—	—	—	—	—	C7100	
8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.1	7.9	7.7	7.6	7.4	7.2	7.1	6.9	6.8	6.7	6.7	6.6	—	—	—	—	—	—	—	C7150	
12.3	12.2	12.3	12.3	12.3	12.3	12.3	12.3	11.8	11.5	11.2	10.8	10.7	10.4	10.4	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.0	7.7	5.0	NCu		
14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.8	14.8	14.8	14.8	14.8	14.8	14.7	14.5	14.1	12.7	8.9	1.4	1.4				
4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.1	3.9	3.6	3.6	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	—	C1020 C1100 C1201 C1220	
4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.1	3.9	3.6	3.6	2.8	2.1	—	—	—	—	—	—	—	—	—	—	—	—	—	C1020 C1100 C1201 C1220	
7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.0	6.9	6.9	3.8	1.8	—	—	—	—	—	—	—	—	—	—	—	—	—	C3601	
8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.2	6.9	3.8	1.8	—	—	—	—	—	—	—	—	—	—	—	—	—	C3602	
8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.2	6.9	3.8	1.8	—	—	—	—	—	—	—	—	—	—	—	—	—	C3603	
8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	7.2	6.9	3.8	1.8	—	—	—	—	—	—	—	—	—	—	—	—	—	C3604	
8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.4	7.4	4.3	4.3	—	—	—	—	—	—	—	—	—	—	—	—	—	C3712	
8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.4	7.4	4.3	4.3	—	—	—	—	—	—	—	—	—	—	—	—	—	C3771	

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[Aluminium]

Table 4 (Continued)

Classification	Symbol	Temper	Specified minimum tensile strength (kgf/mm ²)	p-No.	Group No.
JIS H 4000	A 1080 P A 1070 P	O	5.5	21	
		H12, H22	7.0	21	
		H14, H24	8.5	21	
		H112	7.5 (Thickness 4 mm to 6.5 mm Incl.)	21	
			7.0 (Thickness over 6.5 mm to 13 mm Incl.)	21	
			6.0 (Thickness over 13 mm to 25 mm Incl.)	21	
			5.5 (Thickness over 25 mm to 50 mm Incl.)	21	
			5.5 (Thickness over 50 mm to 75 mm Incl.)	21	
	A 1050 P	O	6.0	21	
		H12, H22	8.0	21	
		H14, H24	9.5	21	
		H112	8.5 (Thickness over 4 mm to 6.5 mm Incl.)	21	
			8.0 (Thickness over 6.5 mm to 13 mm Incl.)	21	
			7.0 (Thickness over 13 mm to 25 mm Incl.)	21	
			6.5 (Thickness over 25 mm to 50 mm Incl.)	21	
			6.5 (Thickness over 50 mm to 75 mm Incl.)	21	
	A 1100 P A 1200 P	O	7.5	21	
		H12, H22	9.5	21	
		H14, H24	12	21	
		H112	9.5 (Thickness 4 mm to 6.5 mm Incl.)	21	
			9.0 (Thickness over 6.5 mm to 13 mm Incl.)	21	
			8.5 (Thickness over 13 mm to 50 mm Incl.)	21	
			8.0 (Thickness over 50 mm to 75 mm Incl.)	21	

Table 4 (Continued)

Strength	P-No.	Group No.	External pressure chart Fig. No.	Notes	Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																
					Temp. -268	-196	-125	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200	
	21				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.7	0.6	0.5	
	21			(26)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.6	1.5	1.3	1.2	0.8	
	21			(26)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	1.8	1.3	0.9	
	21			(26)	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.7	1.5	1.3	1.1	1.0	0.7
(incl.)	21			(26)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.6	1.5	1.3	1.1	1.0	0.7
(incl.)	21			(26)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.3	1.1	1.0	0.8	0.6
(incl.)	21			(26)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.1	0.9	0.7	0.6	0.5
(incl.)	21			(26)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.7	0.6	0.5
	21				1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.1	1.0	0.8	0.6
	21			(26)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.8	1.6	1.5	1.3	0.9
	21			(26)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.2	2.1	1.8	1.3	0.9
(incl.)	21			(26)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	1.9	1.7	1.4	1.3	1.1	0.8
(incl.)	21			(26)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.8	1.6	1.4	1.3	1.1	0.8
(incl.)	21			(26)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.5	1.3	1.2	1.0	0.7
(incl.)	21			(26)	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.4	1.3	1.2	1.0	0.8	0.6
(incl.)	21			(26)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.1	1.0	0.8	0.6
	21				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.3	1.0	0.7
	21			(26)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.1	1.9	1.4	0.9
	21			(26)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.8	2.5	1.9	1.4	0.9
	21			(26)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.1	1.9	1.7	1.2	0.8
(incl.)	21			(26)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.1	1.9	1.7	1.2	0.8
(incl.)	21			(26)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	1.9	1.7	1.5	1.2	0.8
(incl.)	21			(26)	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.3	1.0	0.7

Table 4 (C)

Classification	Symbol	Temper	Specified minimum tensile strength (kgf/mm ²)	p.No.	Group No.
JIS H 4000	A 3003 P A 3203 P	O	9.5	21	
		H12, H22	12	21	
		H14, H24	14	21	
		H112	12 (Thickness 4 mm to 13 mm Incl.)	21	
			11 (Thickness over 13 mm to 50 mm Incl.)	21	
			10 (Thickness over 50 mm to 75 mm Incl.)	21	
	A 5052 P A 5652 P	O	18	22	
		H12, H22 H32	22	22	
		H14, H24 H34	24	22	
		H112	20 (Thickness 4 mm to 13 mm Incl.)	22	
			18 (Thickness over 13 mm to 75 mm Incl.)	22	
	A 5154 P A 5254 P	O	21	22	
		H12, H22 H32	26	22	
		H14, H24 H34	28	22	
		H112	24 (Thickness 4 mm to 6.5 mm Incl.)	22	
			23 (Thickness over 6.5 mm to 13 mm Incl.)	22	
			21 (Thickness over 13 mm to 75 mm Incl.)	22	
	A 5454 P	O	22	22	
	A 5083 P	O	28 (Thickness over 0.8 mm to 80 mm Incl.)	25	
			27 (Thickness over 80 mm to 100 mm Incl.)	25	
		H32	32 (Thickness over 0.8 mm to 2.9 mm Incl.)	25	
			31 (Thickness over 2.9 mm to 12 mm Incl.)	25	
		H112	29 (Thickness 4 mm to 6.5 mm Incl.)	25	
			28 (Thickness over 6.5 mm to 75 mm Incl.)	25	

Table 4 (Continued)

	P.No.	Group No.	External pressure chart Fig. No.	Notes	Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																	
					Temp. -268	-196	-125	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200		
	21		18		2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.0	1.7	1.3	1.0		
	21			(26)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.8	2.5	2.1	1.8		
	21		19	(26)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.4	3.0	2.1	1.8		
	21		18	(26)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.8	2.5	2.1	1.8		
	21		18	(26)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6	2.5	2.2	1.7	1.3	1.0	
	21		18	(26)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.2	1.7	1.3	1.0	
	22		20		4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	3.8	2.9	1.9	
	22			(26)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.4	5.1	4.3	2.9	1.9	
	22			(26)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.7	4.3	2.9	1.9	
	22		20	(26)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.9	4.8	4.3	2.9	1.9	
	22		20	(26)	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	3.8	2.9	1.9	
	22		23		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.9	4.5	—	—	
	22			(26)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.4	6.3	6.0	4.7	—	—
	22			(26)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.9	6.8	6.4	4.7	—	—
	22		23	(26)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.9	5.4	4.7	—	—	
	22		23	(26)	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.7	5.4	4.7	—	—
	22		23	(26)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.9	4.5	—	—	
	22		22	(27)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.4	5.0	3.8	2.9	2.2
	25		21	(27)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—
	25		21	(27)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	—	—	—	—	—	—
	25			(26)(27)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	—	—	—	—	—	—
	25			(26)(27)	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	—	—	—	—	—	—
	25		22	(26)(27)	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	—	—	—	—	—	—
	25		22	(27)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—

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Table 4 (Continued)

Classification	Symbol	Temper	Specified minimum tensile strength (kgf/mm ²)	P-No.	Group No.
JIS H 4000	A 5086 P	O	25	25	
		H32	28	25	
		H34	31	25	
		H112	26 (Thickness 4 mm to 6.5 mm Incl.)	25	
			25 (Thickness over 6.5 mm to 50 mm Incl.)	25	
			24 (Thickness over 50 mm to 75 mm Incl.)	25	
	A 6061 P	T 4	21	23	
		T 6	30	23	
		(T 4 W) (T 5 W)	17	23	
	A 7 N 01 P	T 4	32		
		T 6	34		
		(T 4 W) (T 6 W)	29		
JIS H 4040	A 1070 BE	H112	5.5	21	
	A 1050 BE	H112	6.5	21	
	A 1100 BE A 1200 BE	H112	7.5	21	
	A 2024 BE	T 4	40 (Dia. or min. width across flats 6 mm and under)		
			42 (Over 6 mm to 19 mm Incl.)		
			46 (Over 19 mm to 38 mm Incl.)		
			48 (Over 38 mm)		
	A 2024 BD	T 4	44		
	A 3003 BE	H112	9.5	21	
	A 5052 BE	H112	18	22	
		O	25		

Table 4 (Continued)

Strength	P-No.	Group No.	External pressure chart Fig. No.	Notes	Allowable tensile stress at various temperatures (°C) (kgf/mm ²)															
					Temp. -268	-196	-125	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200
	25		24	(27)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	—	—	—	—	—	—
	25			(26)(27)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—
	25			(26)(27)	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	—	—	—	—	—	—
(1.)	25		24	(26)(27)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	—	—	—	—	—	—
(mm Incl.)	25		24	(27)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	—	—	—	—	—	—
(mm Incl.)	25		24	(27)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	—	—	—	—	—	—
	23		25	(28)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.2	4.8	4.4	3.4
	23		25	(28)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.4	7.3	6.8	5.9	4.4	3.4
	23				4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	4.2	4.1	3.8	3.2	2.6
				(27)(28)	—	—	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	—	—	—	—	—	—
				(27)(28)	—	—	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	—	—	—	—	—	—
				(27)	—	—	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	—	—	—	—	—	—
	21				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.7	0.6	0.5
	21				1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.1	1.0	0.8	0.6
	21				1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	0.9	0.7
(5 mm and under)				(28)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	9.8	8.5	6.6	4.2	3.1
				(28)	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.2	9.0	7.0	4.4	3.3
				(28)	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.1	9.7	7.6	4.8	3.5
				(28)	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	11.6	10.2	7.9	5.0	3.7
				(28)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	10.6	9.3	7.3	4.6	3.4
	21				2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.0	1.7	1.3	1.0
	22				4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	3.8	2.9	1.9

Table 4 (Co

Classification	Symbol	Temper	Specified minimum tensile strength (kgf/mm ²)	P-No.	Group No.
JIS H 4040	A 5056 BE	H112	25	25	
	A 5083 BE	H112 O	28	25	
	A 6061 BE	T 4	18	23	
		T 6	27	23	
		(T 4 W) (T 6 W)	17	23	
	A 6061 BD	T 6	30	23	
		(T 6 W)	17	23	
	A 6063 BE	T 1	12 (Wall thickness 12 mm and under)	23	
			11 (Over 12 mm to 25 mm incl.)	23	
		T 5	16 (12 mm and under)	23	
			15 (Over 12 mm to 25 mm incl.)	23	
		T 6	21	23	
		(T 5 W) (T 6 W)	12	23	
	A 7 N 01 BE	T 4	32		
		T 6	34		
		(T 4 W) (T 6 W)	29		
	A 7003 BE	T 5	28		
		(T 5 W)	27		
JIS H 4080	A 1070 TE	H112	5.5	21	
	A 1070 TD	O	5.5	21	
		H14	8.5	21	
	A 1050 TE	H112	6.5	21	



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Table 4 (Continued)

h	p-No.	Group No.	External pres- sure chart Fig. No.	Notes	Allowable tensile stress at various temperatures (°C) (kgf/mm ²)															
					Temp. -268	-196	-125	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200
	25			(27)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	—	—	—	—	—	—
	25			(27)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—
	23			(28)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.4	4.2	4.1	3.2
	23			(28)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.6	6.3	5.5	4.4	3.3
	23				4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	4.2	4.1	3.8	3.2	2.6
	23			(28)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.4	7.3	6.8	5.9	4.4	3.4
	23				4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	4.2	4.1	3.8	3.2	2.6
	23			(28)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.4	1.6
	23			(28)	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.4	1.6
	23			(28)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.8	3.7	3.5	3.2	2.4	1.6
	23			(28)	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.7	3.6	3.4	3.0	2.4	1.6
	23			(28)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.2	5.1	4.5	3.4	2.4	1.6
	23				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.7	2.1	1.5
				(27)(28)	—	—	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	—	—	—	—	—	—
				(27)(28)	—	—	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	—	—	—	—	—	—
				(27)	—	—	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	—	—	—	—	—	—
				(27)(28)	—	—	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—
				(27)	—	—	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	—	—	—	—	—	—
	21				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.7	0.6	0.5
	21				1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.7	0.6	0.5
	21			(26)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	1.8	1.3	0.9
	21				1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.1	1.0	0.8	0.6

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Table 4 (Continued)

Classification	Symbol	Temper	Specified minimum tensile strength (kgf/mm ²)	P-No.	Group No.
JIS H 4080	A 1050 TD	O	6.0	21	
		H14	9.5	21	
	A 1100 TE A 1200 TE	H112	7.5	21	
	A 3003 TE A 3203 TE	H112	9.5	21	
	A 3003 TD A 3203 TD	O	9.5	21	
		H14	14	21	
		H18	19	21	
	A 5052 TE	H112 O	18	22	
	A 5052 TD	O	18	22	
		H34	24	22	
	A 5154 TE	H112 O	21	22	
	A 5154 TD	O	21	22	
	A 5454 TE	H112 O	22	22	
	A 5056 TE	H112	25	25	
	A 5083 TE	H112 O	28	25	
	A 5083 TD	O	28	25	
	A 6061 TE	T 4	18	23	
		T 6	27	23	
		(T 4 W) (T 6 W)	17	23	
	A 6061 TD	T 4	21	23	
		T 6	30	23	
		(T 4 W) (T 6 W)		23	

Table 4 (Continued)

e strength	P.No.	Group No.	External pres- sure chart Fig. No.	Notes	Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																	
					Temp. -268	-196	-125	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200		
	21				1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.1	1.0	0.8	0.6		
	21			(26)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.2	2.1	1.8	1.3	0.9		
	21				1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	0.9	0.7		
	21		18		2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.0	1.7	1.3	1.0		
	21		18		2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.0	1.7	1.3	1.0		
	21		19	(26)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.4	3.0	2.1	1.8		
	21			(26)	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.6	4.3	3.8	2.5	1.9		
	22		20		4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	3.8	2.9	1.9		
	22		20		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.4	4.4	4.3	3.9	2.9	1.9	
	22			(26)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.7	4.3	2.9	1.9		
	22		23		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.9	4.5	—	—		
	22		23		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.9	4.5	—	—		
	22		22		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.4	5.0	3.8	2.9	2.2	
	25			(27)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	—	—	—	—	—	—	
	25		21	(27)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—	
	25		21	(27)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—	
	23			(28)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.4	4.2	4.1	3.2	
	23		25	(28)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.6	6.3	5.5	4.4	3.3	
	23		25 26		4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	4.2	4.1	3.8	3.2	2.6	
	23			(28)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.2	4.8	4.4	3.3	
	23		25	(28)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.4	7.3	6.8	5.9	4.4	3.4
	23		25 26		4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	4.2	4.1	3.8	3.2	2.6	

Table 4 (Cont)

Classification	Symbol	Temper	Specified minimum tensile strength (kgf/mm ²)	P-No.	Group No.	External pres- sure chart Fig. No.
JIS H 4080	A 6063 TE	T 1	12 (Wall thickness 12 mm and under)	23		
			11 (Wall thickness over 12 mm to 25 mm Incl.)	23		
		T 5	16 (Wall thickness 12 mm and under)	23		
			15 (Wall thickness over 12 mm to 25 mm Incl.)	23		
		T 6	21	23		
		(T 5 W) (T 6 W)	12	23		
	A 6063 TD	T 6	23	23		
		(T 6 W)	12	23		
	A 7 N 01 TE	T 4	32			
		T 6	33 (Wall thickness 1.6 mm to 6 mm Incl.)			
			34 (Wall thickness 6 mm to 12 mm Incl.)			
		(T 4 W) (T 6 W)	29			
	A 7003 TE	T 5	28			
		(T 5 W)	27			
JIS H 4090	A 1050 TW	O	7			
	A 1050 TW	H 14	10			
	A 1100 TW	O	8			
	A 1100 TW A 1200 TW	H 14	12			
	A 3003 TW	O	10	21		18
	A 3003 TWS	H 14	14	21		19
	A 3203 TW	H 18	19	21		
	A 5052 TW	O	18	22		20
	5052 TWS	H 14 H 34	24			

Table 4 (Continued)

h	P-No.	Group No.	External pressure chart Fig. No.	Notes	Allowable tensile stress at various temperatures (°C) (kgf/mm ²)																
					Temp. -268	-196	-125	-80	-60	-45	-30	-10	0	40	75	100	125	150	175	200	
	23			(28)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.4	1.6	
cl.)	23			(28)	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.4	1.6	
	23			(28)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.8	3.7	3.5	3.2	2.4	1.6
cl.)	23			(28)	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.7	3.6	3.4	3.0	2.4	1.6
	23			(28)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.2	5.1	4.5	3.4	2.4	1.6
	23				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.7	2.1	1.5
	23			(28)	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.7	5.5	5.0	3.8	2.4	1.6
	23				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.7	2.1	1.5
				(27)(28)	—	—	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	—	—	—	—	—	—
				(27)(28)	—	—	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	—	—	—	—	—	—
				(27)(28)	—	—	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	—	—	—	—	—	—
				(27)	—	—	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	—	—	—	—	—	—
				(27)(28)	—	—	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	—	—	—	—	—	—
				(27)	—	—	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	—	—	—	—	—	—
					1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	0.9	0.9	0.7	0.5
				(26)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.8	1.5	1.1	0.8
					1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.1	0.9	0.6
				(26)	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.4	2.1	1.6	1.2	0.8
	21		18		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.7	1.4	1.1	0.9
	21		19	(26)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.9	2.6	1.8	1.5
	21			(26)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.9	3.7	3.2	2.1	1.6
	22		20		3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.7	3.7	3.7	3.3	2.5	1.6
				(26)	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	4.8	4.3	3.3	2.1

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Table 4 (Continued)

Classification	Symbol	Temper	Specified minimum tensile strength (kgf/mm ²)	P-No.	Group No.	External Load
JIS H 4100	A 1100 S A 1200 S	H 112	7.5	21		
	A 2024 S	T 4	40 (Thickness of test position 6 mm and under)			
			42 (Over 6 mm to 19 mm incl.)			
			46 (Over 19 mm to 38 mm incl.)			
			48 (Over 38 mm)			
	A 3003 S A 3203 S	H 112	9.5	21		
	A 5052 S	H 112 O	18	22		
	A 5454 S	H 112 O	22	22		
	A 5083 S	H 112 O	28	25		
	A 6061 S	T 4	18	23		
		T 6	27	23		
		(T 4 W) (T 6 W)	17	23		
	A 6063 S	T 1	12 (Thickness of test position 12 mm and under)	23		
			11 (Over 12 mm to 25 mm incl.)	23		
		T 5	16 (Thickness of test position 12 mm and under)	23		
			15 (Over 12 mm to 25 mm incl.)	23		
		T 6	21	23		
		(T 5 W) (T 6 W)	12	23		
	A 7N01 S	T 4	32			
		T 5	33			
		T 6	34			



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