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Steel pipe flanges

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Pipe Fittings Association (JPFA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS B 2220:2004** is replaced with this Standard.

However, **JIS B 2220:2004** may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until February 19th, 2013.

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Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public or utility model right. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public or the utility model right after opening to the public which have the said technical properties.

Steel pipe flanges

Introduction

This Japanese Industrial Standard was established in 1984 and has gone through six revisions up to the present. The last revision was made in 2004, and the revision at this time is intended to correspond to the revisions of the related standards and expansion of the product scope which have occurred since the last revision.

No corresponding International Standard has been established at this point.

1 Scope

This Standard specifies steel pipe flanges (hereafter referred to as "flanges") of nominal sizes 10 A to 1 500 A for nominal pressures 5 K, 10K, 10K light type, 16K, 20K, 30K, 40K and 63K which are used to join parts for piping, such as steel pipes and valves used for ordinary piping ¹⁾, pressure piping ²⁾, high pressure piping ³⁾, high temperature piping ⁴⁾, alloy steel piping ⁵⁾ and stainless steel piping ⁶⁾ for steam, air, gas, water, oil, etc.

This Standard is also applicable to flanges which are integral with the piping part, and constituting a part thereof (hereafter referred to as the "integral flanges").

NOTE 1: The outside diameters of JIS steel pipes are shown in Annex B.

NOTE 2: All the pressure values indicated in this Standard are of the gauge pressure.

Notes ¹⁾ Piping using carbon steel pipes for ordinary piping of JIS G 3452 and arc welded carbon steel pipes of JIS G 3457.

²⁾ Piping using carbon steel pipes for pressure service of JIS G 3454.

³⁾ Piping using carbon steel pipes for high pressure service of JIS G 3455.

⁴⁾ Piping using carbon steel pipes for high temperature service of JIS G 3456.

⁵⁾ Piping using alloy steel pipes of JIS G 3458.

⁶⁾ Piping using stainless steel pipes of JIS G 3459 and large diameter welded stainless steel pipes of JIS G 3468.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) listed below shall be applied.

JIS B 0151 *Iron and steel pipe fittings—Vocabulary*

JIS B 0203 *Taper pipe threads*

- JIS B 0601 *Geometrical Product Specifications (GPS)–Surface texture: Profile method–Terms, definitions and surface texture parameters*
- JIS B 0621 *Definitions and designations of geometrical deviations*
- JIS B 1180 *Hexagon head bolts and hexagon head screws*
- JIS B 1181 *Hexagon nuts and hexagon thin nuts*
- JIS B 1256 *Plain washers*
- JIS G 0404 *Steel and steel products–General technical delivery requirements*
- JIS G 3101 *Rolled steels for general structure*
- JIS G 3201 *Carbon steel forgings for general use*
- JIS G 3202 *Carbon steel forgings for pressure vessels*
- JIS G 3203 *Alloy steel forgings for pressure vessels for high-temperature service*
- JIS G 3214 *Stainless steel forgings for pressure vessels*
- JIS G 4051 *Carbon steels for machine structural use*
- JIS G 4304 *Hot-rolled stainless steel plate, sheet and strip*
- JIS G 4305 *Cold-rolled stainless steel plate, sheet and strip*
- JIS G 5101 *Carbon steel castings*
- JIS G 5121 *Corrosion-resistant cast steels for general applications*
- JIS G 5151 *Steel castings for high temperature and high pressure service*
- JIS H 0401 *Test methods for hot dip galvanized coatings*
- JIS H 2107 *Zinc ingots*
- JIS H 8610 *Electroplated coatings of zinc on iron or steel*
- JIS Z 2241 *Metallic materials–Tensile testing–Method of test at room temperature*
- JIS Z 2320-1 *Non-destructive testing–Magnetic particle testing–Part 1: General principles*
- JIS Z 2343-1 *Non-destructive testing–Penetrant testing–Part 1: General principles–Method for liquid penetrant testing and classification of the penetrant indication*
- JIS Z 3001-1 *Welding and allied processes–Vocabulary–Part 1: General*
- JIS Z 3001-2 *Welding and allied processes–Vocabulary–Part 2: Welding processes*
- JIS Z 3121 *Methods of tensile test for butt welded joints*
- JIS Z 3122 *Methods of bend test for butt welded joint*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in JIS B 0151, JIS Z 3001-1 and JIS Z 3001-2 apply.

4 Classification of flanges and their designations

Classification of flanges and their designations shall be based on their shapes as shown in table 1.

The types of slip-on welding flanges (hubbed flanges) (SOH) for nominal pressure 20K and 30K shall be as shown in table 2.

5 Classification of gasket faces and their designations

Classification of gasket faces and their designations shall be as shown in table 3.

Male-female face gasket (MF) indicates a combination of male seat (MF-M) and female seat (MF-F) and a tongue and groove (TG) indicates a combination of tongue seat (TG-T) and a groove seat (TG-G).

Table 1 Classification of flanges and their designations

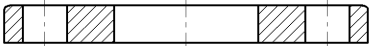
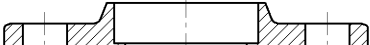
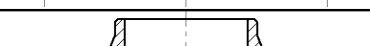
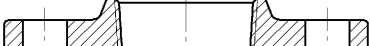
Classification of flange		Designation	Figure
Welding flange	Slip-on welding flange (plate flange)	SOP	
	Slip-on welding flange (hubbed flange)	SOH	
	Socket welding flange	SW	
	Welding neck flange	WN	
Lap joint flange		LJ	
Threaded flange		TR	
Integral flange		IT	
Blank flange		BL	

Table 2 Types of slip-on welding flanges (hubbed flanges)(SOH) for nominal pressure 20K and 30K

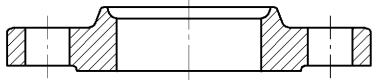
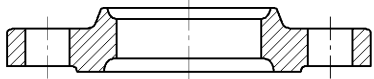
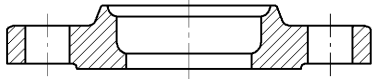
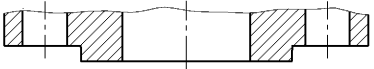
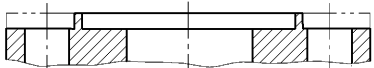
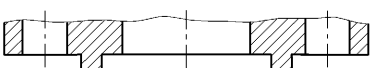
Classification of flange	Type	Figure
Slip-on welding flange (hubbed flange)	Type A	
	Type B	
	Type C	

Table 3 Classification of gasket faces and their designations

Classification of gasket face		Designation		Figure
Full face		FF		
Raised face		RF		
Male-female face	Male seat	MF	MF-M	
	Female seat		MF-F	
Tongue and groove	Tongue seat	TG	TG-T	
	Groove seat		TG-G	

6 Designation of flanges according to zinc coating

Designation according to the presence of zinc coating shall be as given in table 4.

Table 4 Designation according to the presence of zinc coating

Designation	Definitions
Black flange	Flanges not given zinc coating
White flange (ZN)	Flanges given hot-dip zinc coating or electroplated zinc coating

7 Performance

7.1 Mechanical properties

The mechanical properties of flanges, when tested by 17.5, shall satisfy the mechanical properties specified in the material standards as shown in table 5.

S 20 C of JIS G 4051 shall be 400 N/mm² or over in tensile strength, and S 25 C shall be 440 N/mm² or over in tensile strength.

7.2 Soundness

7.2.1 Liquid penetrant testing

Cast steel flanges shall, when tested by 17.1, satisfy the requirements for the soundness in liquid penetrant testing specified in standards for individual steel castings.

7.2.2 Magnetic particle testing

Cast steel flanges shall, when tested by 17.2, satisfy the requirements for the soundness in magnetic particle testing specified in standards for individual steel castings.

7.2.3 Ultrasonic testing

Forged steel and cast steel flanges shall, when tested by 17.3, satisfy the requirements for the soundness in ultrasonic testing specified in standards for individual steel forgings and steel castings.

For forged steel of S 20 C and S 25 C of JIS G 4051, the specification of JIS G 3201 shall apply.

8 Materials

Materials of the flanges shall be the ones given in table 5 or those at least equivalent thereto in both the mechanical properties and corrosion resistance. Materials of welding flanges shall be suitable for welding.

NOTE: ASTM materials known to be equivalent or superior to the materials given in table 5 are shown in table 6 for reference.

Table 5 Materials

Classification of material	Rolled steels		Steel forgings		Steel castings		Material group No.
	Standard number	Symbol of material	Standard number	Symbol of material	Standard number	Symbol of material	
Carbon steel	JIS G 3101 JIS G 4051	SS 400 ^{a)} S 20 C ^{b)}	JIS G 3201 JIS G 3202 JIS G 4051	SF 390A ^{a)} SFVC 1 S 20 C ^{b)}	JIS G 5101 JIS G 5151	SC 410 SCPH 1	001
	JIS G 4051	S 25 C ^{b)}	JIS G 3201 JIS G 4051	SF 440A ^{a)} S 25 C ^{b)}	JIS G 5101	SC 480	002
	—	—	JIS G 3202	SFVC 2A	JIS G 5151	SCPH 2	003a
Low alloy steel	—	—	JIS G 3203	SFVA F1	JIS G 5151	SCPH 11	013a
	—	—	JIS G 3203	SFVA F11A	JIS G 5151	SCPH 21	015a
Stainless steel	JIS G 4304 JIS G 4305	SUS 304 SUS 304	JIS G 3214	SUS F304	JIS G 5121	SCS 13A	021a
	—	—	—	—	JIS G 5121	SCS 19A	021b
	JIS G 4304 JIS G 4305	SUS 316 SUS 316	JIS G 3214	SUS F316	JIS G 5121	SCS 14A	022a
	—	—	—	—	JIS G 5121	SCS 16A	022b
	JIS G 4304 JIS G 4305	SUS 304L SUS 304L	JIS G 3214	SUS F304L	—	—	023a
	JIS G 4304 JIS G 4305	SUS 316L SUS 316L	JIS G 3214	SUS F316L	—	—	023b
	—	—	—	—	—	—	—

Notes ^{a)} SS 400 of **JIS G 3101** and SF 390A and SF 440A of **JIS G 3201** shall be those with a maximum carbon content of 0.35 %.

^{b)} The inspection of S 20 C and S 25 C of **JIS G 4051** shall be conducted according to **JIS G 0404**, and the tensile strength of S 20 C shall be 400 N/mm² or over and that of S 25 C, 440 N/mm² or over.

Table 6 ASTM materials (informative)

Classification of material	Rolled steels		Steel forgings		Steel castings		Material group No.
	Standard number	Symbol of material	Standard number	Symbol of material	Standard number	Symbol of material	
Carbon steel	A 515 A 516 A 537	70 70 CL1	A 105 A 350	— LF2	A 216	WCB	1.1
	A 204 A 204	A B	A 182	F1	A 217 A 352	WC1 LC1	1.5
	A 387	11 CL2	A 182 A 182	F11 CL2 F12 CL2	A 217	WC6	1.9
Stainless steel	A 240 A 240	304 304H	A 182 A 182	F304 F304H	A 351 A 351	CF3 CF8	2.1
	A 240 A 240 A 240	316 316H 317	A 182 A 182	F316 F316H	A 351 A 351 A 351	CF3M CF8M CG8M	2.2
	A 240 A 240	304L 316L	A 182 A 182	F304L F316L	— —	— —	2.3
	—	—	—	—	—	—	—
	—	—	—	—	—	—	—

NOTE: For standards shown in this table, see Annex G.

9 Relationship between fluid temperature and maximum working pressure

The relationship between fluid temperature and maximum working pressure (hereafter referred to as "pressure-temperature rating") shall be as given in table 11. The

light flange for nominal pressure 10K shall generally be used for steady flow at a temperature of 120 °C or less and a pressure of 0.7 MPa or less.

The working temperature for white flanges shall be maximum 300 °C.

10 Nominal size of flange and application of pressure-temperature rating

The nominal sizes of flanges, and application of the pressure-temperature rating to each classification and nominal size of flanges shall be as given in table 12. However, the nominal sizes of light flanges for nominal pressure 10K shall be as given in table 7 regardless of its temperature-pressure rating.

Table 7 Nominal sizes of light flanges for nominal pressure 10K

Nominal pressure	Classification of flange	Nominal size A																			
		10	15	20	25	32	40	50	65	80	90	100	125	150	175	200	225	250	300	350	400
10K light type	SOP	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	—
	SOH	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	○

11 Combination of flanges and gasket faces

The combination of flanges and gasket faces shall be as given in table 8.

Table 8 Combination of flanges and gasket faces

Flange		Gasket face			
Nominal pressure	Type	FF	RF	MF	TG
5K	SOP, SOH, SW, TR, BL	○	—	—	—
	WN, IT	○	○	—	—
10K	SOP, SOH, SW, TR, BL	○	—	○	○
	WN, IT	○	○	○	○
10K light type	SOP, SOH	○	—	—	—
16K	SOH, SW, TR, BL	○	—	○	○
	WN, IT	○	○	○	○
20K	SOH, SW, TR, WN, IT, BL	—	○	○	○
30K	SOH, WN, IT, BL	—	○	○	○
40K	WN, BL	—	○	○	○
63K	WN, BL	—	○	○	○
NOTE: Flange type LJ has no gasket face.					

12 Dimensions

12.1 Dimensions of gasket faces

The dimensions of gasket faces of the flange shall be as given in table 13.

NOTE: The dimensions of the small raised face are shown in Annex C.

12.2 Dimensions of flanges

The dimensions of flanges for each nominal pressure shall be as given in tables 14 to 21.

NOTE 1 The values of the inside diameter of the integral flange (IT) (d) and the diameter of larger side of hub (b) and radius of fillet (r) given in table 14, table 15, and tables 17 to 19 are informative.

For inside diameter (d), see JIS B 2001.

NOTE 2 The details of welds of welding flange are shown in Annex D.

NOTE 3 The pressure-temperature rating and basic dimensions of flanges for nominal pressure 2K are shown in Annex E

NOTE 4 The calculated masses of the flange are shown in Annex F.

12.3 Integral flanges (IT)

When applying other values than given in table 14, table 15 and tables 17 to 19 for inside diameter (d), the diameter of larger side of hub (b) and radius of fillet (r) of integral flange (IT), the flange strength shall be checked.

12.4 Thread

The thread of threaded flange (TR) shall be in accordance with JIS B 0203.

12.5 Dimensional tolerances

The dimensional tolerances for flanges shall be as specified in table 22.

Perpendicularity of the axis line of the thread of threaded flange (TR) to the gasket face shall be within 0.9 mm per 100 mm of the axis line.

Perpendicularity shall be in accordance with 5.8 of JIS B 0621.

13 Appearance

The flanges shall be free from any cracks or flaws detrimental to use.

14 Surface finishing

14.1 Gasket face

The gasket faces of the flanges shall be finished in accordance with table 9. Gasket faces of full face (FF), raised face (RF), and male-female face (MF) shall be finished by turning with a round-end tool. The turning condition for obtaining surface roughness of Ra 3.2 μm and Ra 6.3 μm shall be as given in table 10.

The gasket face may be finished by other method upon agreement between the inter-

ested parties.

Table 9 Finishing of gasket face

Unit: μm	
Gasket face	Ra^a
Full face (FF)	3.2 to 6.3
Raised face (RF)	3.2 to 6.3
Male-female face (MF) (Male seat and female seat)	3.2 or under
Tongue and groove (TG) (Tongue seat and groove seat)	3.2 or under
Note ^{a)} The values of Ra are in accordance with the definitions of JIS B 0601 .	

Table 10 Turning condition for gasket face

Ra μm	Turning condition	
	Radius of blade edge mm	Pitch of serration mm
3.2	0.8	0.25 to 0.30
	1.6	0.36 to 0.42
6.3	0.8	0.35 to 0.42
	1.6	0.52 to 0.60

14.2 Welds

Welds of welding flange and a steel pipe shall be machined smooth and finished to Ra 12.5 μm or better. However, for the welds of the back side of slip-on welding flange (plate flange) (SOP) and a steel pipe need not be finished.

14.3 Facing given hot-dip zinc coating

The inside diameter surface of flanges which is given hot-dip zinc coating [excluding the smaller inside diameter of socket welding flanges (SW) and the inside diameter of welding neck flanges (WN)] may be grinded or machined to remove the coating as required.

15 Zinc coating

Zinc coating shall be as follows.

- Flanges given hot-dip zinc coating shall not attain the final point in a cupric sulphate test specified in 17.4, after being subjected to 5 cycles of immersion.
- The electroplated zinc coating shall be of Grade 2 as specified in **JIS H 8610** or at least equivalent thereto in corrosion resistance.

16 Manufacturing method

16.1 Flange

Flanges shall be manufactured by forging in accordance with the method in **a)** or by casting in accordance with the method in **b)**, and then performing the required machining (see clause 14).

Slip-on welding flange (plate flange) (SOP) and lap joint flange (LJ) without hub may

be manufactured by forming in accordance with the method in **c)** or **d)** and then performing the required machining (see clause 14).

Blank flange (BL) may be manufactured by forming in accordance with the method in **c)** and then performing the required machining (see clause 14).

- a) Hot-forging from a steel ingot or billet. In this case, a heat treatment specified in the relevant individual forgings standard shall be applied.
- b) Casting using appropriate melting and casting equipment. In this case, a heat treatment specified in the relevant individual castings standard shall be applied.
- c) Press-work punching, gas cutting, plasma arc cutting, etc. of a steel sheet. Where the gas or plasma arc cutting is applied, the cut surface of the flange shall be eliminated at least 2 mm by machining.
- d) Flash welding as specified in Annex A.

16.2 Zinc coating

Zinc coating, when it is applied to the flange, shall be as follows.

- a) Zinc coating shall be applied after machining. In the case of applying hot-dip zinc coating, however, in which case the coating on the inside diameter surface or welding area, etc. are to be removed after coating, coating may be applied based on estimation of the required working allowances.
- b) Flanges shall be coated after cleaning by means of sandblasting, pickling and the like.
- c) Zinc materials used for the hot-dip coating shall be distilled zinc specified in **JIS H 2107** or zinc ingots at least equivalent thereto in quality.

17 Test methods

17.1 Liquid penetrant testing

The liquid penetrant test shall be performed as specified in the individual steel castings standards.

17.2 Magnetic particle testing

The magnetic particle test shall be performed as specified in the individual steel casting standards.

17.3 Ultrasonic testing

The ultrasonic test shall be performed as specified in the individual steel forgings or steel castings standards. For steel forgings of S 20 C and S 25 C of **JIS G 4051**, specification of **JIS G 3201** shall be applied.

17.4 Cupric sulfate testing

The cupric sulfate test on hot-dip zinc coatings shall be performed as specified in clause 6 in **JIS H 0401**.

17.5 Material testing

The material test shall be performed as specified in the individual material standards.

For materials of S 20 C and S 25 C of JIS G 4051, specification of JIS G 0404 shall be applied.

18 Inspection

18.1 Dimensional inspection

The dimensions of flanges shall be inspected by direct measurements, limit gauging or other means, and shall meet the requirements of clause 12.

18.2 Appearance inspection

The appearance of flanges shall be inspected visually and shall meet the requirements of clause 13.

18.3 Surface finish inspection

Finishing of gasket face shall be judged by visual or tactile inspection, comparing with the reference sample agreeing with the value of finishing roughness R_a specified in table 9, and shall satisfy the requirements of table 9.

Surface finishing of welding portion of welding flange and steel pipe shall be inspected visually and shall satisfy the specification of 14.2.

18.4 Inspection by liquid penetrant testing

The liquid penetrant test on cast steel flanges shall be carried out as specified in 17.1, and the result shall meet the requirements of 7.2.1.

18.5 Inspection by magnetic particle testing

The magnetic particle test on cast steel flanges shall be carried out as specified in 17.2, and the result shall meet the requirements of 7.2.2.

18.6 Inspection by ultrasonic testing

The ultrasonic test on cast steel flanges and forged steel flanges shall be carried out as specified in 17.3, and the result shall meet the requirements of 7.2.3.

18.7 Hot-dip zinc coating inspection

The hot-dip zinc coating of the flanges shall be tested as specified in 17.4, and the result shall meet the requirements of 15 a).

18.8 Material inspection

The material of the flanges shall be tested as specified in 17.5 unless otherwise specified by the purchaser and the result shall meet the requirements of 7.1.

18.9 Acceptance inspection

The acceptance inspection of the flange shall be performed on the following inspection items. In this inspection, the sampling plan for the lot inspection shall be subject to the agreement between the interested parties.

- a) Dimensional inspection
- b) Appearance inspection
- c) Surface finish inspection
- d) Inspection by liquid penetrant testing of cast steel flanges (as required by the purchaser)
- e) Inspection by magnetic particle testing of cast steel flanges (as required by the purchaser)
- f) Inspection by ultrasonic testing of forged steel or cast steel flanges (as required by the purchaser)
- g) Material inspection

19 Designation of products

Flange products, except integral flanges (IT), shall be designated by the number of this Standard or title of this Standard, designation or classification of flange, designation or classification of gasket face ⁷⁾, nominal pressure, nominal size and symbol of material.

In the case of the white flange, classification according to the presence of zinc coating (ZN) shall be appended.

Further, the following shall be appended where appropriate.

- a) (L) denoting the light type, for a light type flange for nominal pressure 10K.
- b) (H) denoting a product with alternative dimensions, for welding neck flanges (WN) for nominal pressures 5K and 10K with alternative dimensions.
- c) (A) denoting Type A, (B) denoting Type B, or (C) denoting Type C, for slip-on welding flanges (SOH) for nominal pressures 20K and 30K.

Example 1 JIS B 2220 SOP FF ZN 5K 300A SS 400

or steel pipe flange, slip-on welding flange (plate flange), full face, white flange, 5K, 450A and SF 390A

Example 2 JIS B 2220 LJ 5K 450A SF 390A

or steel pipe flange, lap joint flange, 5K, 450A and SF 390A.

Example 3 JIS B 2220 TR FF 10K 80A SCS 13A

or steel pipe flange, threaded flange, full face, 10K, 80A and SCS 13A.

Example 4 JIS B 2220 WN RF 10K H 1000A SFVC 1

or steel pipe flange, welding neck flange, raised face, 10K, and product with alternative dimensions, 1000A and SFVC 1.

Example 5 JIS B 2220 SOP FF 10K L 150A S 20 C

or steel pipe flange, slip-on welding flange (plate flange), full

face, 10K, light flange, 150A and S 20 C.

Example 6 **JIS B 2220** BL FF 16K 200A S 25 C

or steel pipe flange, blank flange, full face, 16K, 200A and S 25 C.

Example 7 **JIS B 2220** SOH RF 20K A 50A SUS F316L

or steel pipe flange, slip-on welding flange (hubbed flange), raised face, 20K, Type A, 50A and SUS F316L.

Example 8 **JIS B 2220** SOH MF-M 30K C 65A SFVC 2A

or steel pipe flange, slip-on welding flange (hubbed flange), male seat, 30K, Type C, 65A and SFVC 2A.

Example 9 **JIS B 2220** WN TG-G 40K 100A SFVA F1

or steel pipe flange, welding neck flange, groove seat, 40K, 100A and SFVA F1.

Note ⁷⁾ In lap joint flange (LJ), there are no gasket faces.

20 Marking

Flanges, except for integral flange (IT), shall be marked with the following information on the periphery surface by such an indelible means as stamping, die marking, electrolytic etching or spraying.

- a) Nominal pressure, nominal size and symbol of material. However, symbol of the nominal size, A, may be omitted.

The following shall be marked after the nominal pressure.

- 1) Symbol L for the light flange for nominal pressure 10K
- 2) Symbol H for welding neck flanges (WN) for nominal pressures 5K and 10K with alternative dimensions
- 3) Distinction of Type A (A), Type B (B) and Type C (C) for slip-on welding flanges (SOH) for nominal pressures 20K and 30K

Example 1 5K 300 SS 400

Example 2 5K 450A SF 390A

Example 3 10K 80 SCS 13A

Example 4 10K H 1000A SFVC 1

Example 5 10K L 150 S 20 C

Example 6 16K 200A S 25 C

Example 7 20K A 50 SUS F316L

Example 8 30K C 65A SFVC 2A

Example 9 40K 100 SFVA F1