Chemical Industry Standard

of the People's Republic of China

HG

HG/T 20635-2009

Replacing HG 20635-1997

Specification for Selection of Steel Pipe Flanges, Gaskets and Bolting (Class designated)

钢制管法兰，垫片，紧固件选配规定

(Class 系列)

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1. Scope

This standard specifies the general rules for the selection of steel pipe flanges, gaskets and bolting (C1ass designated).

This standard is applicable to the steel pipe flanges, gaskets and bolting specified in HG/T 20615- HG/T 20634.

2. Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this national standard. For dated reference, subsequent amendments (excluding amending error in the text) to, or revisions of, any of these publications do not apply. However, parties to agreement based on this standard are encouraged to research whether the latest editions of these references are applied or not. For undated references, the latest edition of the normative document is applicable to this national standard.

"Steel Pipe Flanges (Class Designated)" HG/T 20615

"Steel Pipe Flanges in Large Diameter (C1ass designated)" HG/T 20623

"Non-metallic Flat Gaskets for use with Steel Pipe Flanges (C1ass designated)" HG/T 20627

"PTFE Envelope Gaskets for use with Steel Pipe Flanges (C1ass designated)" HG/T 20628

"Metal Jacketed Gaskets for use with Steel Pipe Flanges (C1ass designated)" HG/T 20630

"Spiral Wound Gaskets for use with Steel Pipe Flanges (C1ass designated)" HG/T 20631

"Covered Serrated Metal Gaskets for use with Steel Pipe Flanges (C1ass designated)" HG/T 20632

"Metallic Ring Joint Gaskets for use with Steel Pipe Flanges (C1ass designated)" HG/T 20633

"Bolting for use with Steel Pipe Flanges (C1ass designated)" HG/T 20634

3. Selection rules

3.1 Pipe flanges

3.1.1 The type and application scope of flanges shall meet the provisions of Table 3.1.4 of HG/T 20615 and Table 3.1 of HG/T 20623. For its common scope, refer to Table 3.1.1.

temperature shall not exceed 450℃.

3.2.7 The asbestos and non-asbestos gaskets shall not be used in dangerous media or high vacuum seal occasions.

3.2.8 As for the PTFE flat gaskets which have cold flow inclination, their sealing surface type should be flat face type or their maximum service temperature should be no bigger than 100℃.

3.2.9 As for the standard pipe flanges whose nominal pressure is Class150, when semimetal gaskets such as spiral wound gaskets, metallic envelope gaskets or metallic ring gaskets are adopted, flanges (e.g.: weld neck flange) that have good rigidity shall be selected.

3.2.10 The inside diameter of the nonmetallic flat gaskets and wound gaskets listed in HG/T 20627 and HG/T 20631 may be larger than that of the corresponding flanges, if the inside diameter of required gaskets (or inner rings) is equal to that of the flanges, the users may put forward the following requirements:

1 Adopting integral type flanges, weld neck flanges or socket welding flanges.

2 Provide corresponding flange inside diameter to the gasket manufacturer as the inside diameter of gaskets.

3.2.11 Table 3.2.11 is the selection table of gasket types.

Semimetallic			15~1500 (A, B)				Socket welding flange Butt welding ring loose flange Blind flange
	Serrated compound gaskets	150~2500		e	Raised face Female face/male face Tongue face/groove face	3.2~6.3	Slip on neck flange Weld neck flange Long hubbed flanges Integral type flange Socket welding flange Blind flange
	Metallic envelope gaskets	300~900		f	Raised face	1.6~3.2 (Carbon steel, non-ferrous metal) 0.8~1.6 (Stainless steel, nickel-base alloy)	Weld neck flange Long hubbed flange Integral type flange Blind flange
Metallic	Metallic ring gaskets	150~2500		700	Ring joint face	0.8~1.6 (Carbon steel, chrome steel) 0.4~0.8 (Stainless steel)	Weld neck flange Long hubbed flange Integral type flange Blind flange

a The service temperature scope of different natural rubber and synthetic rubber varies, refer to Appendix A of this standard and HG/T 20627.

b The main raw materials for non-asbestos fiber rubber plate are different and their service temperature scope are also different, you may refer to Appendix A of this standard and consult to the producer.

c When the reinforced flexible graphite plates are used for oxidizing media, the maximum service temperature shall be 450℃.

d The wound gaskets shall be combined according to the metallic tapes and filling materials, their service temperature scope

HG/T 20634 as well as Table 3.2.11 of this standard.

3.3.3 The commercial-grade bolting and special-grade bolting shall be used in accordance with the provisions of Chapter 5 of HG/T 20634 and Table 3.2.11 of this standard.

3.3.4 As for the bolting used under low temperature, provisions shall be made on its low-temperature impact tenacity.

3.3.5 When the bolting is used within the range of creep temperature, the loss of bolt load caused by loose bolts shall be considered as this may influence the sealability of the flange joints.

3.3.6 The bolting material used at high temperature shall have similar thermal expansion coefficient as the flange material.

3.3.7 The low intensity bolting can only be used when the nominal pressure is less than or equal to Class300; the flange joints that adopt nonmetallic flat gaskets shall not be used at severe cyclic working condition. The applicable working temperature of Grade 5.6 low intensity carbon steel bolting should not be greater than 200℃.

3.3.8 The hexagon head bolts are only applicable to occasions when the nominal pressure is less than or equal to class150.

3.3.9 The bolting and screw nuts shall be combined according to the provisions of Table 5.0.4 of HG/T 20634 while the selection match between screw bolts and nuts shall meet the provisions of Table 3.3.1.

3.3.10 The selection match of flanges, bolting and gaskets shall meet the provisions of Table 3.3.10.

Table 3.3.10 Selection Match of Bolting and Gaskets for Standard Flanges

Nominal pressure Class	Gasket type	Strength level of screw bolt
150	·Nonmetallic flat gaskets ·PTFE envelope gaskets	Low strength, medium strength [a], high strength [a]
	·Spiral wound gaskets ·Cladding with serrated gaskets	Medium strength, high strength [b]
	·Metallic ring gaskets (not adopted generally)	High strength
300	·Nonmetallic flat gaskets ·PTFE envelope gaskets	Medium strength, high strength [b]
	·Spiral wound gaskets ·Cladding-with serrated gaskets or metallic flat gaskets	Medium strength, high strength
	·Metallic envelope gaskets ·Metallic ring gaskets	High strength
600	·Reinforced flexible graphite plates ·High temperature vermiculite composite reinforcement plates	Medium strength, high strength [b]
	·Spiral wound gaskets ·Cladding-with serrated gaskets or metallic flat gaskets	Medium strength, high strength
	·Metallic envelope gaskets ·Metallic ring gaskets	High strength
≥900	·Spiral wound gaskets ·Cladding-with serrated gaskets or metallic flat gaskets	High strength
	·Metallic envelope gaskets (not adopted generally) ·Metallic ring gaskets	High strength

a Flat face gaskets shall be adopted or controlled tightening torque shall be controlled.

b Tightening torque shall be controlled.

3.4 Flange joints

3.4.1 The flange joint is consisted of a pair of flanges, bolting and gaskets. The flange connection shall be selected according to the design conditions, fluid properties and sealing requirements, and at the same time, the selection match of flanges, gaskets and bolting shall be considered comprehensively.

3.4.2 Such nonmetallic flat gaskets as rubber gaskets, paronite gaskets, non-asbestos fiber rubber plates and filled PTFE gaskets shall be adopted for the flat face flanges.

3.4.3 For the match of flanges, gaskets and bolting at dangerous working condition, the tightening torque and tightening sequence of bolting, refer to the provisions of Table 3.3.1.

3.4.4 There shall be only one gasket between the sealing surfaces of the flange joint.

3.4.5 Certain fastening steps shall be complied with when screwing down the screw bolts. As for the flange joints used at important applications (e.g.: high pressure, high temperature, dangerous media etc.), torque wrench or other devices that can control bolt load shall be adopted to guarantee the flange joint is sealed and the gasket is not broken due to overtorque.

Appendix A (Informative Appendix) Use Direction of the Gaskets for Pipe Flanges

A.0.1 The major invalidation form of pipe flange connection is leaking. Leaking has much to do with a wide range of factors such as the seal structure type, rigidity of the fastening piece, property, operation, installation and matching of the sealing members. As a major component for flange joint, the gaskets play an important role in sealing.

A.0.2 The gasket type used for pipe flanges in this series of standards include: nonmetallic flat gaskets, PTFE envelope gaskets, metallic envelope gaskets, wound gaskets, cladding-with serrated gaskets and metallic ring gaskets. The service temperature of reinforced flexible graphite plates is restricted by the high temperature oxidation property of flexible graphite materials. The high temperature mica composite plate is composed of 316 two-way impacting corrosion-resistant plate and mica layer and can be used at high temperature. The applicable sealing surface type includes raised face, female face/male face and tongue face/groove face.

A.0.3 The application scope of gaskets shall be determined according to the structure, material and actual sealing property of all kinds of gaskets as well as the structural type of flange, major parameter and sealing surface type of the flanges that match, refer to Table A.0.3 of this Appendix.

gasket material that is mixed by organic or (and) inorganic fiber, stuffing and rubber adhesive agent and compacted through rolling and heating, and they are used in place of asbestos fiber rubber plates. Abroad the reinforced flexible graphite gaskets are often used in place of asbestos rubber gaskets at low temperature services. Table A.0.7-2 and A.0.7-3 list out the major properties of the non-asbestos fiber rubber plate gaskets and reinforced flexible graphite plates gaskets that have been confirmed by the professional chemical standard (HG).

3 The PTFE which possesses superior corrosion-resisting properties is the most important product among the fluoroplastics, and as a sealant, it can be used at a majority of deep-etching medium. For ordinary PTFE, its hardness is low, cold flow property is big and dimensional rigid stability is poor. Specific processing and (or) different stuffing is adopted by the filled or expanded PTFE in order to improve its property and especially to reduce its cold flow property so as to meet the corrosion resistant requirement in various mediums.

In the PTFE gasket material produced by Durabla, stuffing is added in with the special DURL0N technology so that it is more uniform than the stuffing added with rolling press method or multilayer stitching method. As a result, the PTFE filled with DURL0N method has more uniform physical property and mechanical properties. The DURL0N gasket material is free from such problems as void, lamination and chemical normality. DURL0N9000 and DURL0N9200 are the common used filled PTFE gasket grades. The major performance parameters of the filled PTFE gaskets that have been confirmed by the professional chemical standard (HG) are listed in Table A.0.7-4 of this appendix.

4 The high temperature mica composite plates are compounded by 316 stainless steel two-way toothed plate and mica layer and the stainless steel toothed plate play a part of enhancement. The mica possesses elevated-temperature seal property and extensive chemical resistance.

5 The PTFE envelope gaskets are made up through adopting pure PTFE plates or strips as the outer layer, nonmetallic plates as the embedding layer or core material as well as coating technology. However, due to the defects on the outer layer of the PTFE plates or strips as well as the rupture easy to occur at installation, the operating media (liquid) might enter the embedding layer or core material through penetrating the PTFE clad. Such kind of penetration is likely to erode the gaskets. Therefore, at important occasions, it is proposed to replace the gaskets frequently or select filled PTFE gaskets in place.

6 This professional chemical standard (HG) cancelled GB/T 2520 "Electrolytic Tinplate and Steel Strips ", as this material is seldom used, and added the stainless steel clad metallic materials and filling material for flexible graphite and non-asbestos fiber rubber plates.

7 This professional chemical standard (HG) reduced the upper value of the hardness of metallic ring gaskets (relative to flange material) and therefore meets the requirement that the hardness of metallic ring gasket material should be lower than that of the flange material. As for the metallic ring gaskets, random hardness inspection is specified in this standard.

8 This professional chemical standard (HG) supplements the property requirements of nonmetallic flat gaskets; while for wound gaskets, the standard of cladding with serrated gaskets and metallic ring gaskets supplement the material property requirement, manufacture and inspection provision. This is propitious to guarantee the quality of gaskets and to improve the sealing property.

9 On the labeling of gaskets, it specifies that when users select specific manufacturer

(AAA) and grade (BBB), they shall add a mark (AAA/BBB).

Table A.0.7-1 Gasket Type and Typical Product Grade of the Manufacturing Plant

Name	Explanation	Typical product grade of the manufacturing plant (for reference)			
Non-asbestos fiber rubber plate	Inorganic fiber Organic fiber	DURL0N®7900 DURL0N®8500 (Durabla)[a]	Garl0ckIFG®5500 (Inorganic fiber) Garl0ckBLUE-GARD®3000 (Aramid organic fiber) (Garlock)[b]		
PTFE plates	Filled and modified	DURL0N®9000 DURL0N®9200 (Durabla)[a]	Garl0ckGYL0N®3500 (Filled and modified) Garl0ckGYL0N®3545 (modified and expanded) (Garlock)[b]		
Reinforced flexible graphite plates	Corrosion resistant plate Stainless steel toothed plate	DURL0N®FGL316/304 DURL0N®FGT316/304 (Durabla)[a]	CPS®3001A CPS®3001B (Cathay)[c]	Garlock GRAPH—L0CK®3125 SS (Embed 316SS plate) Garlock GRAPH-L0CK®3125TC (Embed 316SS toothed plate) (Garlock)[b]	5Star®300S 5Star®700S (IDT Sinyuan)[h]
PTFE expanded sealing strip		DURL0N®J0intSealant (Durabla)[a]	CPS®6100 (Cathay)[c]	ENVIR0 8360(AIG)[d]	
PTFE envelope gaskets		DURL0N®PTFEENG (Durabla)[a]	CPS®6018 (Cathay)[c]	DBS-SJ (Dongbang)[e]	
Metallic envelope gaskets		DURL0N®METALJKG (Durabla)[a]	CPS®4000 (Cathay)[c]	Chumen Seal Element Factory[f]	
Serrated compound gaskets		DURL0N®Campr0file (Durabla)[a]	CPS®7200 (Cathay)[c]	ISS®KD(IDT Sinyuan)[h]	
Spiral wound gaskets		DURL0N®SWG (Durabla)[a]	CPS®7100 (Cathay)[c]	ENVIR08100SU (AIG)[d]	HLG100~400(Hengli)[g]
Metallic ring gaskets		DURL0N®MRG (Durabla)[a]	CPS®7010 (Cathay)[c]	Chumen Seal Element Factory[f]	HLG650(Hengli)[g]

Note: The R-with product grade is the registered trade mark of the corresponding manufacturer.

Table A.0.7-2 Gasket Performance Parameters - Non-asbestos Fiber Rubber Pressing Plates

Major physical property	Unit	Product grade		
		Non-asbestos fiber rubber pressing plate		
		DURL0N®7900 (Aramid)	DURL0N®8500 (Aramid-In0rganic)	DURL0N®8400 (Phen0lic)
Sealability(ASTMF37)[a] Fuel A Nitrogen	mL/h mL/h	0.03 0.5	0.01 0.4	0.01 0.3
Swelling test(ASTMF146)[a] IRM903Oil, 5h/149℃ Thickness addition: Mass addition(max): ASTM Fuel oil B, 5h/21℃ Thickness addition: Mass addition(max):	 % % % %	 0~15 15 0~10 12	 0~15 15 0~10 10	 0~15 15 0~10 15
Creep relaxation rate(ASTMF38)[a]≤	%	20	20	25
Compressibility scope(ASTMF36)[a]	%	7~17	8~16	8~16
Rebound rate≥	%	40	50	50
Tensile strength(ASTMF152)[a]	MPa	11.7	13.8	12.4
Service temperature scope	℃	-73~+371	-73~+371	-73~+427
Sustained maximum temperature	℃	260	287	290
Extreme service pressure	bar	82	103	103
(p×T), max	MPa×℃	FigureA.0.4-1	FigureA.0.4-1	FigureA.0.4-1
Density	g/cm^2	1.7	1.7	1.7
Leakage rate of gas penetration (DIN3535)[a]	cc/min	0.05	0.03	0.03
Adhesive or filler		NBR	NBR	NBR
Applicable pH value of fluid medium (room temperature)		3~11	3~11	2~13
Recommended application range		Steam, water, inert gases, oil, fuel, diluted acid, dilute base	Saturated steam, oil, diluted acid, dilute base, solvent Fuel, refrigerant	Steam, oil, fuel, solvent, caustic alkali, corrosive materials, refrigerant, diluted acid, dilute base
Chemical corrosion resistance property		See the manufacturer's catalogue		
Others		Use certification of drinking water acquired	Pass the API607 flameproof test and acquire the use certification of drinking water	Possess the most extensive chemical corrosion resistance effect (the strongest resistance to chemical attack)

Note: 1. The above data are extracted from the catalogue (DURL0N®) of Durabla, it is just for general reference.

2 The gaskets shall be used within the specified range. When it is at the critical state, consult and get approval from

Table A.0.7-3 Gasket Performance Parameters - Reinforced Flexible Graphite Plates

Major physical property	Unit	Product grade			
		DURL0N®FGL316/304 (Corrosion resistant plate)	DURL0N®FGT316/304 (Stainless steel toothed plate)	5Star®700S (Corrosion resistant plate)	5Star®300S (Stainless steel toothed plate)
Sealability(ASTM F37)[a] FuelA Nitrogen	mL/h mL/h	0.5 2.0	0.5 5.0	——	——
Creep relaxation rate(ASTM F38)[a] ≤	%	5	5	5	5
Compressibility scope(ASTM F36)[a]	%	35~40	30~35	40~50	30~40
Rebound rate ≥	%	18	20	10~15	15~25
Service temperature scope	℃	Saturated vapor: 650 Oxidizing media: -260~+450 Non-oxidizing media: -260~+3000		Oxidizing media: -200~+450 Non-oxidizing media: -200~+550	
Extreme service presure	bar	200	200	60	100
Density	g/cm^2	1.1(Graphite)		1.0(Graphite)	1.0(Graphite)
Leakage rate of gas penetration	cc/min	0.40 (DIN 3535)a	0.80 (DIN 3535)a	≤1.0	≤1.0
Adhesive or filler		Yes	No	Yes	No
Carbon content(min)	%	>99	>99	≥98	≥99
Sulfur content(max)	mg/kg	<1000×10-6	<1000×10-6	≤1000×10-6	≤1000×10-6
Content of chloride ion(max)	mg/kg	50×10-6	50×10-6	50×10-6	50×10-6
Ash content	%	<1		<2	
Loss on ignition 450℃	%	1	1	<1	
Loss on ignition 650℃	%	6	6	—	
Applicable pH value of fluid medium (room temperature)		0~14	0~14	0~14	
Recommended application range		Occasions with high temperature, steam, hot oil and frequently changing load		High temperature, medium/low-pressure, repeated load	
Chemical corrosion resistance property		See the manufacturer's catalogue			

Note: 1. The above data are extracted from the catalogue (DURL0N) of Durabla and IDT Sinyuan (5Star®), it is just for general reference.

2 The gaskets shall be used within the specified range. When it is at the critical state, consult and get approval from the manufacturer.

3 316L may be adopted for corrosion resistant plates or stainless steel toothed plates.

a The performance data of ASTM and DIN standard listed in the table is based on the measuring of corresponding gasket material in thickness of 1.6mm. Thereinto, the creep relaxation rate is based on the measuring of corresponding gasket material in thickness of 0.8mm.

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