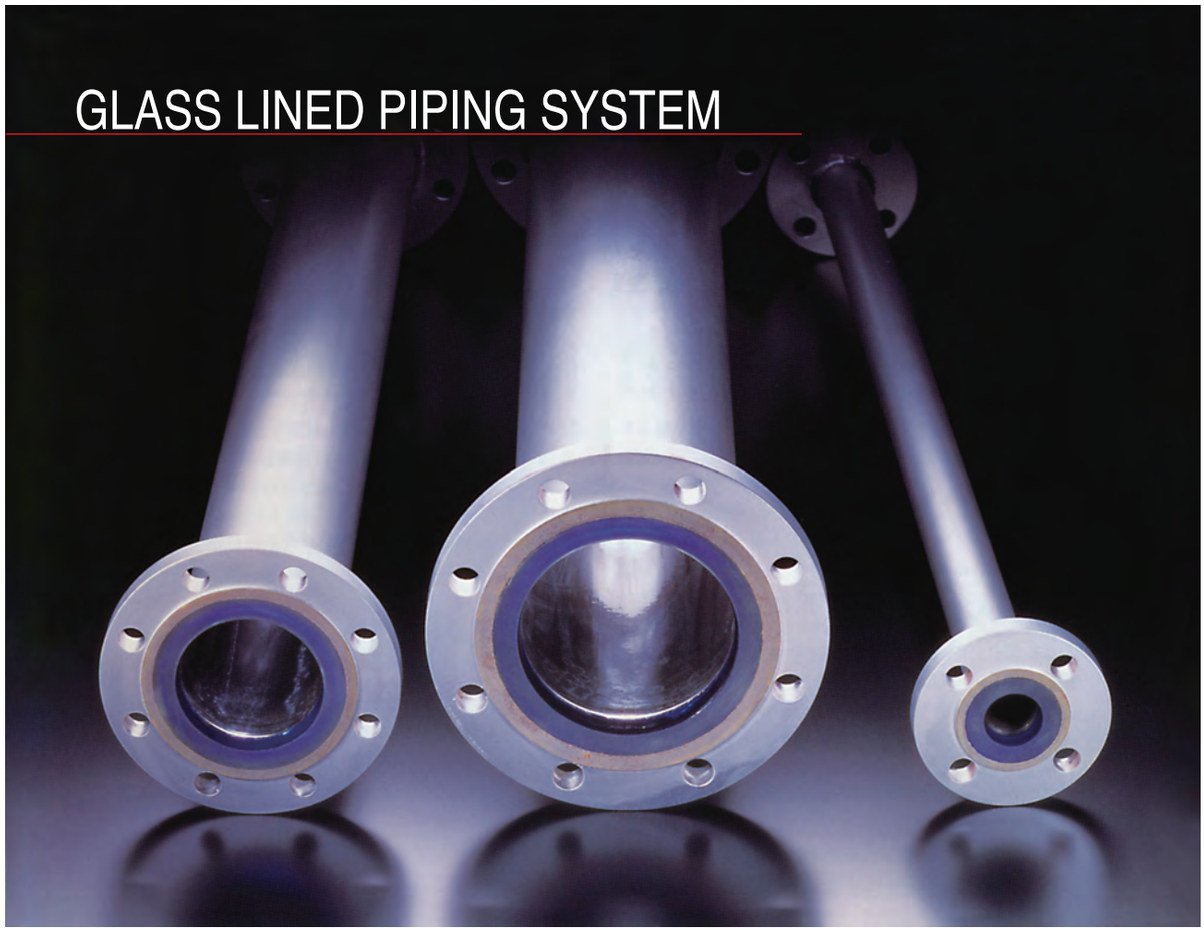
AGC

GLASS LINED PIPING SYSTEM



REV 2018.00

GL™

AGC TECHNOLOGY SOLUTIONS CO.,LTD.

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Inquiry

If you have any inquiries, please contact with AGC Technology Solutions Co., Ltd.
For making a proper proposal, we would like you to send us the following information.

1. Name of chemical substance
2. Temperature of chemical substance
3. Pressure of chemical substance
4. State of chemical substance (gas, fluid, slurry, etc.)
5. Flange standard
6. Whether any regulation is applied to the production line or not.

Introduction

GL™ (GL™ and GLP™) is the registered trademark standing for "Glass Lined". GL™ is made by unique manufacturing technique that glass tube is expanded to the surface inside steel pipe.
GL™ has got splendid reputations for anti corrosion, anti adhesion, and anti penetration in chemical industry since 1949.
GL™ was produced by IWAKI Glass Co., Ltd. The predecessor of AGC Technology Solutions Co., Ltd.

Combination of steel and glass

Glass is well known as a strong resistance to chemicals (especially in acid substances).
GL™ is made of steel pipe, soda-lime glass tube and glass rings colored blue.
GL™ shows a excellent performance as a piping system in chemical industry.

Great demand in Chemical industry

GL™ has been used in chemical, pharmaceutical, agrichemical and various other industries.
Features of GL™ are high resistance to heat, pressure, and full vacuum. It's very durable.
Therefore using GL™ in chemical production line would reduce the cost of production and maintenance.

GL™ pipes and fittings never have any pinhole.

Please see the illustration shows "How to make GL™".
Production process of GL™ is as follows;

1) Attach glass rings colored blue to both flanges
2) Insert glass tube closed both sides into steel pipe.
3) Heat steel pipe with glass tube together.
4) Rising inner pressure makes glass tube expand and stick to inner surface of steel pipe.
5) When cooling heated steel pipe down to room temperature, shrinkage ratio of steel pipe is more than that of glass tube.
6) Inner glass tube is uniformly compressed by constricted steel pipe and this action makes lined glass much tougher.

If there is a pinhole in glass tube when heating (Process No.3), inner glass tube inevitably blows out. That's why GL™ never have any pinhole. After heating, we can easily check good items and defective items.

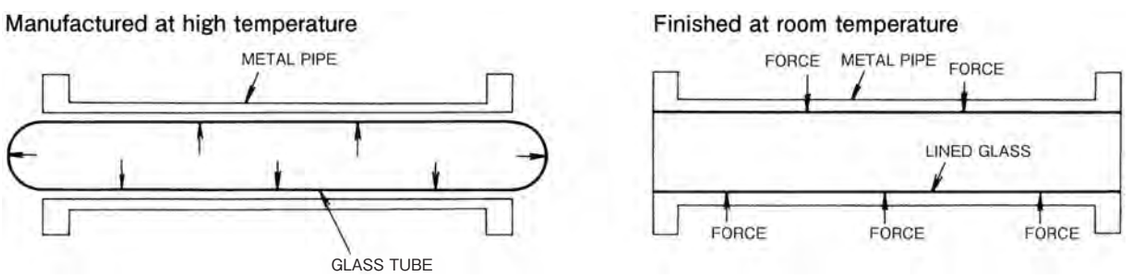


Fig. How to make GL™

History of GL™

1949	IWAKI GLASS CO.,LTD. (Foundation 1883)	GL™ was invented by Iwaki Glass Co., Ltd. Iwaki Glass is joint venture between Asahi Glass Co., Ltd. And Corning Glass Works Corporation.
1999	AGC TECHNO GLASS CO.,LTD. (AGC 100%)	Iwaki Glass merged with Toshiba Glass corporation. Company name was changed to AGC Techno Glass Co., Ltd.
2007	ASAHI GLASS CO.,LTD. (=AGC) (Foundation 1907)	GL™ business was transferred from AGC Techno Glass Co., Ltd. To Asahi Glass Co., Ltd.
2010	AGC TECHNOLOGY SOLUTIONS CO.,LTD. (AGC 100%)	GL™ business was transferred from Asahi Glass Co., Ltd. To AGC Technology Solutions Co., Ltd.

General

Advantages

- There is no pinhole in glass lined layer.
- Glass lined layer has a great toughness to mechanical and thermal stress.
  GL™ can be used under high temperature, high pressure and full vacuum.
- Glass lined surface is very smooth, so it can inhibit the growth of scale and the adhesion of them.
- Surface of GL™ flange is polished evenly.
  There remains less residual liquid in connected flange area. Because pipe and surface of flange is at right angles to one another.
- Installation of fixed flange pipe and fitting is much easir than split loosen flange.
  Many constructors of large chemical plant prefer to install fixed flange one called GL™.

Features

1. Corrosion resistance

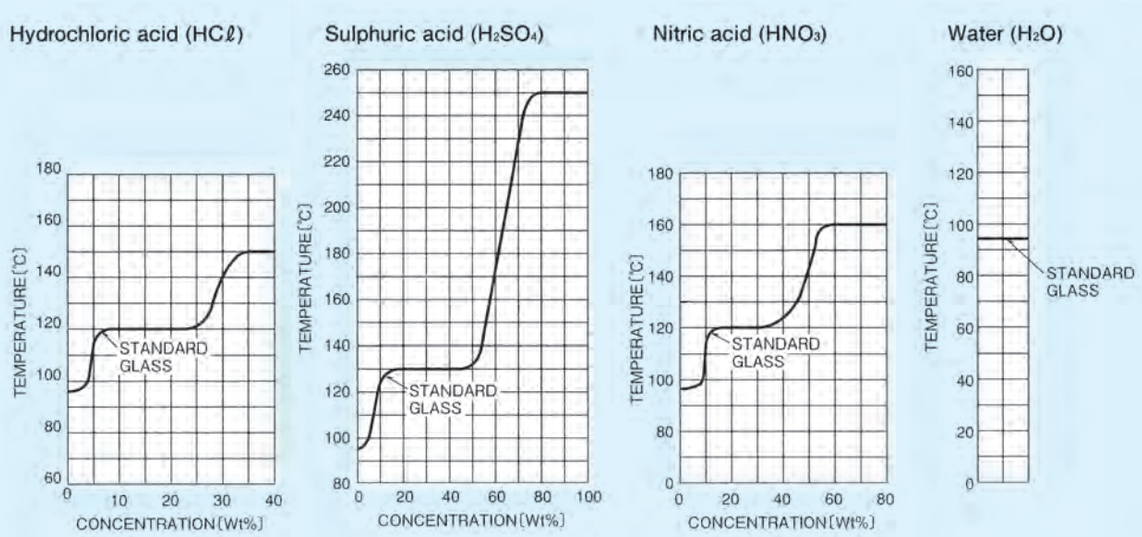
GL™ has an exellent corrosion resistance to acid substances except for hydrofluoric acid.
The charts below show GL™ corrosion-proof performance of major acid substances and water.

*Generally, glass has a resistance to acid substances. However, it may be corroded by boiled water, steam and alkaline substances depending on operating conditions.

*Regarding the ceramic lined parts like spacers (SP) and blind flanges (CF), operation temperature limit is less than 150℃.

2. Thermal resistance

- Operating temperature
  Standard GL™: −15～150℃ (depending on fluid type)
  There are practical examples of using GL™ at −45～250℃ (depending on types of steel pipe or gasket)
- Thermal shock
  Thermal shock: Up to 70℃.
  *Please avoid from rapid heating or cooling.



Standard glass: Soda-lime glass

3. Mechanical strength

- Pressure capacity
  Maximum allowable operating pressure is up to 0.98Mpa (10kgf/cm²).
  Please contact with us when using in excess of the above pressure.

- Bending stress
  GL™ 3/4B Pipe is durable up to 4.9kN by Amsler testing machine (400mm).

- Impact
  GL™ is not broken when steel ball(175g) is dropped from the height of 600mm.

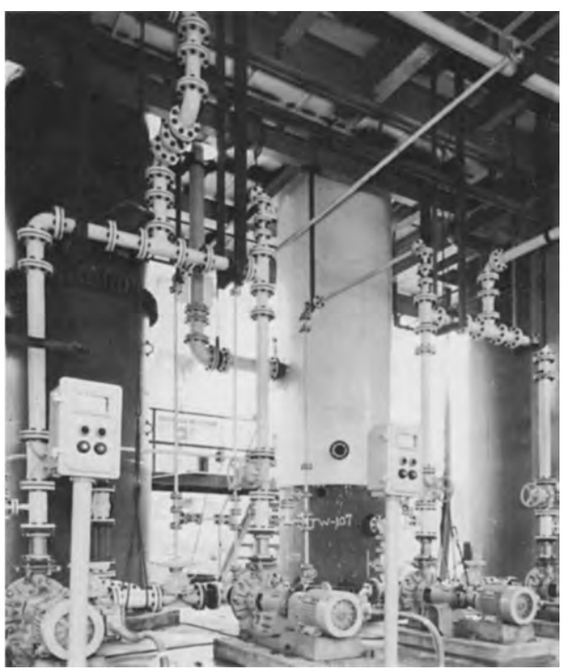
*GL™ is much stronger than general glass, but please be careful to impact while transportation and installation.

Specifications

- Flange
  ANSI 150Lb type
  JIS 10K type

- Material
  Flange : SS400 (JIS)
  Straight pipe : SGP (JIS)
  Fitting : SGP (JIS)

  Regarding material of pipe, STPG (JIS) and STPL (JIS) are available upon request.



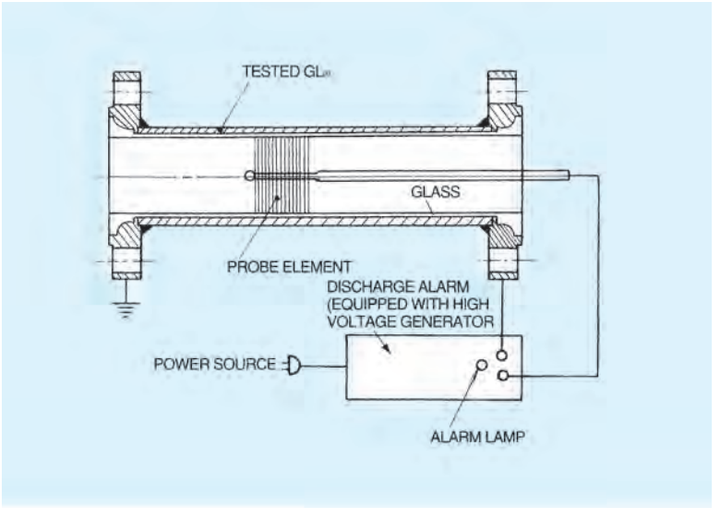
Inspections

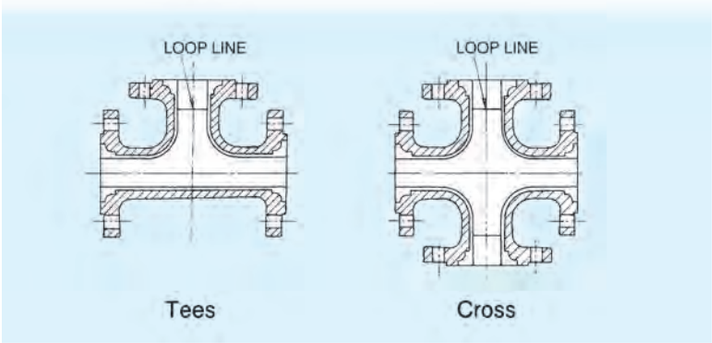
1. Appearance and dimension inspection

2. Pressure inspection
   Pressure inspection at 0.98MPaG by water at random.

3. Pin hole inspection
   Inspected by High voltage discharged method.

Loop line on branch joints (Tees, Reducing Tees and Cross)
It's not a defect if you see the loop line inside Tees, Reducing Tees and Cross because they are generated from the manufacturing process.





Precautions

- The standard GL™ does not conform to ASME Boiler and vessel code and other standards.
  Please remind that GL™ is not applied any legal requirement.
  We can produce special made GL™ to adapt some of standards.

- Glass is corroded by boiled water and steam, please contact with us before using these substances in GL™ process.

Coating

Steel circumference around blue glass ring is painted for preventing rust.
Details of paint is as follows;
Epoxy resin type : US primer #100 yellow. (manufacturer : Shinto paint Co., Ltd.)

This paint could be easily removed when using thinner for US primer.

Standard paint
Our standard paint is as follows;
phthalic alkyd resin paint at one time.
(Color : Red-brown)
We can paint GL™ by other color or other paint as your request.

Base metal

Base metal dimensions

The following table shows each dimension of standard material for GL™.

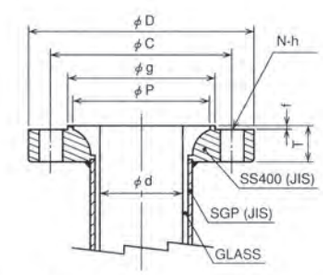
Carbon steel pipe SGP (JIS)

Nominal Dia. (mm)	Code	Outside diameter (mm)	Thickness (mm)	Intside diameter (mm)
20	20A	27.2	2.8	21.6
25	25A	34.0	3.2	27.6
40	40A	48.6	3.5	41.6
50	50A	60.5	3.8	52.9
65	65A	76.3	4.2	67.9
80	80A	89.1	4.2	80.7
(90)	(90A)	101.6	4.2	93.2
100	100A	114.3	4.5	105.3
(125)	(125A)	139.8	4.5	130.8
150	150A	165.2	5.0	155.2
200	200A	216.3	5.8	204.7
(250)	(250A)	267.4	6.6	254.2

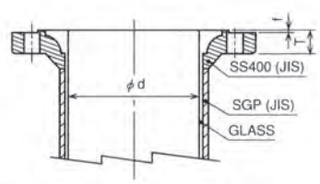
Flanges (GL™ ANSI 150Lb type)

Nominal Dia. (mm)	Code	Flange dimension (mm)							Bolt Nominal diameter		P (mm)		d (mm) Reference value
		D	C	g	f	T	N	h	Metric	Unified	New	Previous	
20	20A	98	70.0	54	2	19	4	15	M12	U1/2	49	42	19
25	25A	108	79.5	63	2	19	4	15	M12	U1/2	57	48	25
40	40A	127	98.5	82	2	21	4	15	M12	U1/2	70	62	39
50	50A	152	120.5	100	2	21	4	19	M16	U5/8	85	75	50
65	65A	178	139.5	119	2	23	4	19	M16	U5/8	105	88	65
80	80A	190	152.5	132	2	24	4	19	M16	U5/8	113	101	78
100	100A	229	190.5	170	2	24	8	19	M16	U5/8	136	125	102
150	150A	279	241.5	215	2	27	8	22	M20	U3/4	190	175	152
200	200A	343	298.5	274	2	30	8	22	M20	U3/4	243	228	202

Raised face diameter (g), Flange thickness (T) and bolt hole (h), each dimensions is different from ANSI standards.
Under the P Colmn, New and Previous mean the new types and the previous types of GL™.



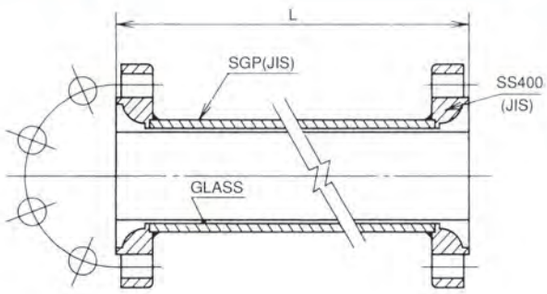
Nominal Dia. 20mm~100mm



Nominal Dia. 150mm~200mm

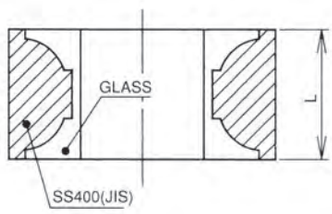
Straight pipes and fittings [Flange: ANSI 150Lb type]

OS Straight pipes

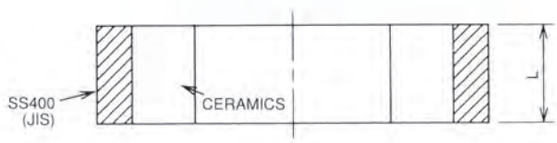


*Pipes with loose flanges are also available.

OSH Short pipes



OSP Spacers



*Ceramics is made of Alumina (alumina purity 96% in white).

Symbol	Nominal Dia. (mm) / L(mm)	20	25
		Code	Code
OSP	10	GLOSP020A0010	GLOSP025A0010
	15	GLOSP020A0015	GLOSP025A0015
	20	GLOSP020A0020	GLOSP025A0020
OSH	30	GLOSH020A0030	GLOSH025A0030
	40	GLOSH020A0040	GLOSH025A0040
	50	GLOSH020A0050	GLOSH025A0050
OS	100	GLOS 020A0100	GLOS 025A0100
	110	GLOS 020A0110	GLOS 025A0110
	120	GLOS 020A0120	GLOS 025A0120
	130	GLOS 020A0130	GLOS 025A0130
	140	GLOS 020A0140	GLOS 025A0140
	150	GLOS 020A0150	GLOS 025A0150
	160	GLOS 020A0160	GLOS 025A0160
	170	GLOS 020A0170	GLOS 025A0170
	180	GLOS 020A0180	GLOS 025A0180
	190	GLOS 020A0190	GLOS 025A0190
	200	GLOS 020A0200	GLOS 025A0200
	300	GLOS 020A0300	GLOS 025A0300
	400	GLOS 020A0400	GLOS 025A0400
	500	GLOS 020A0500	GLOS 025A0500
	600	GLOS 020A0600	GLOS 025A0600
	700	GLOS 020A0700	GLOS 025A0700
	800	GLOS 020A0800	GLOS 025A0800
	900	GLOS 020A0900	GLOS 025A0900
	1000	GLOS 020A1000	GLOS 025A1000
	1100	GLOS 020A1100	GLOS 025A1100
	1200	GLOS 020A1200	GLOS 025A1200
	1300	GLOS 020A1300	GLOS 025A1300
	1400	GLOS 020A1400	GLOS 025A1400
	1500	GLOS 020A1500	GLOS 025A1500
	1600	GLOS 020A1600	GLOS 025A1600
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	1800	GLOS 020A1800	GLOS 025A1800
	1900	GLOS 020A1900	GLOS 025A1900
	2000	GLOS 020A2000	GLOS 025A2000
	2100	GLOS 020A2100	GLOS 025A2100
	2200	GLOS 020A2200	GLOS 025A2200
	2300	GLOS 020A2300	GLOS 025A2300
	2400	GLOS 020A2400	GLOS 025A2400
	2500	GLOS 020A2500	GLOS 025A2500
	2600	GLOS 020A2600	GLOS 025A2600
	2700	GLOS 020A2700	GLOS 025A2700
	2800	GLOS 020A2800	GLOS 025A2800
	2900	GLOS 020A2900	GLOS 025A2900
	3000	GLOS 020A3000	GLOS 025A3000
	3100	GLOS 020A3100	GLOS 025A3100
	3200	GLOS 020A3200	GLOS 025A3200
	3300	GLOS 020A3300	GLOS 025A3300
	3400	GLOS 020A3400	GLOS 025A3400
	3500	GLOS 020A3500	GLOS 025A3500

- Pipes and fittings of Nominal diameter 65A (2 1/2) are also available.
- Other length pipes (at 5mm or 10mm intervals) are available upon request.

40	50	80	100	150	200
Code	Code	Code	Code	Code	Code
GLOSP040A0010	GLOSP050A0010	GLOSP080A0010			
GLOSP040A0015	GLOSP050A0015	GLOSP080A0015	GLOSP100A0015	GLOSP150A0015	
GLOSP040A0020	GLOSP050A0020	GLOSP080A0020	GLOSP100A0020	GLOSP150A0020	GLOSP200A0020
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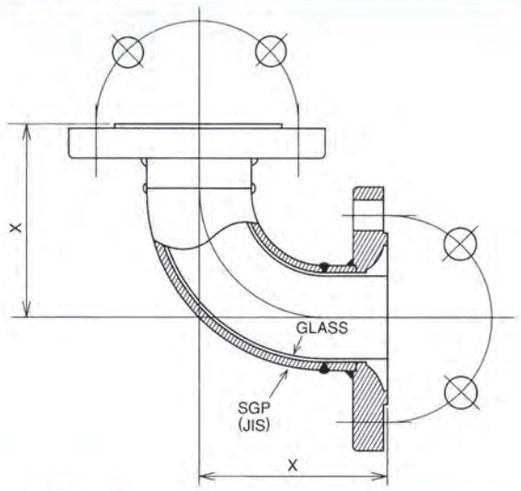
GLOS 040A3500	GLOS 050A3500	GLOS 080A3500	GLOS 100A3500		

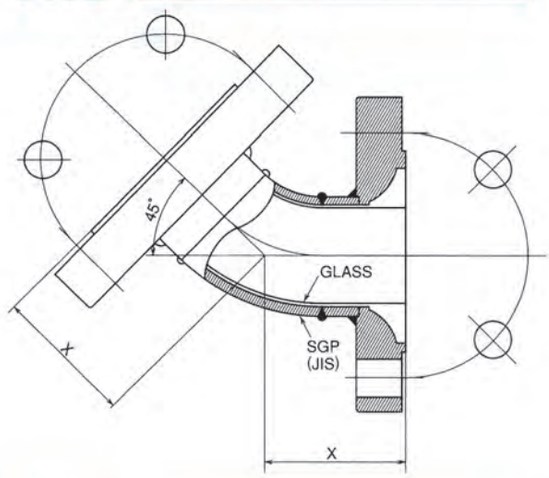
Fittings

ONL 90° Bends



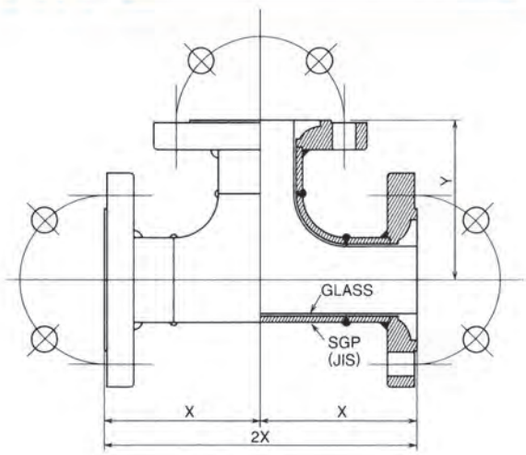
Nominal Dia. (mm)	Code	X (mm)	Flange
20	GLONL020A	86	GL™ ANSI 150Lb TYPE
25	GLONL025A	89	
40	GLONL040A	102	
50	GLONL050A	114	
65	GLONL065A	127	
80	GLONL080A	140	
100	GLONL100A	165	
150	GLONL150A	203	
200	GLONL200A	229	

ONB 45° Bends



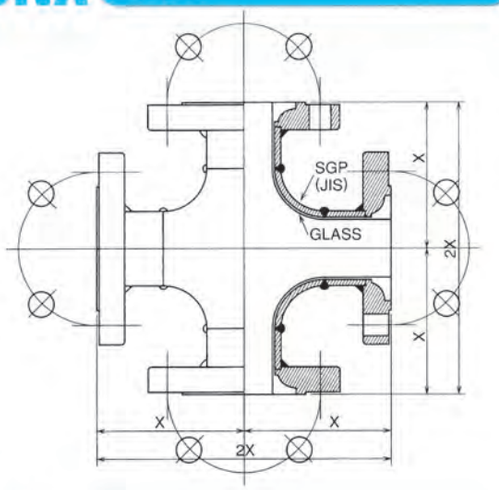
Nominal Dia. (mm)	Code	X (mm)	Flange
20	GLONB020A	44	GL™ ANSI 150Lb TYPE
25	GLONB025A	44	
40	GLONB040A	57	
50	GLONB050A	63	
65	GLONB065A	76	
80	GLONB080A	76	
100	GLONB100A	102	
150	GLONB150A	127	
200	GLONB200A	140	

ONT Tees



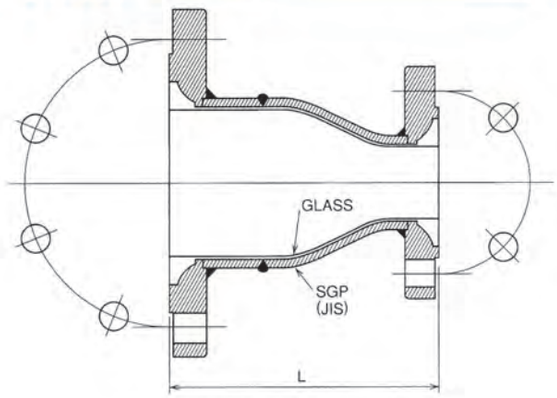
Nominal Dia. (mm)	Code	2X (mm)	X (mm)	Y (mm)	Flange
20	GLONT020A	172	86	86	GL™ ANSI 150Lb TYPE
25	GLONT025A	178	89	89	
40	GLONT040A	204	102	102	
50	GLONT050A	228	114	114	
65	GLONT065A	254	127	127	
80	GLONT080A	280	140	140	
100	GLONT100A	330	165	165	
150	GLONT150A	406	203	160	
200	GLONT200A	458	229	190	

ONX Cross



Nominal Dia. (mm)	Code	2X (mm)	X (mm)	Flange
20	GLONX020A	172	86	GL™ ANSI 150Lb TYPE
25	GLONX025A	178	89	
40	GLONX040A	204	102	
50	GLONX050A	228	114	
80	GLONX080A	280	140	
100	GLONX100A	330	165	

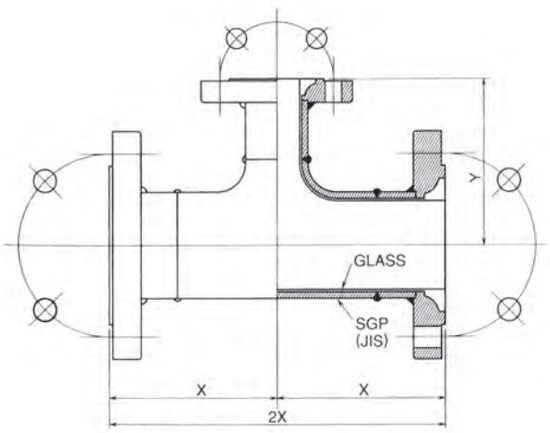
ONR Reducers



Eccentric type (GLONE) is also available.

Nominal Dia. (mm)	Code	X (mm)	Flange
25×20	GLONR025A020A	114	GL™ ANSI 150Lb TYPE
40×20	GLONR040A020A	114	
40×25	GLONR040A025A	114	
50×20	GLONR050A020A	127	
50×25	GLONR050A025A	127	
50×40	GLONR050A040A	127	
65×50	GLONR065A050A	152	
80×40	GLONR080A040A	152	
80×50	GLONR080A050A	152	
80×65	GLONR080A065A	152	
100×50	GLONR100A050A	178	
100×65	GLONR100A065A	178	
100×80	GLONR100A080A	178	
150×80	GLONR150A080A	229	
150×100	GLONR150A100A	229	
200×100	GLONR200A100A	279	
200×150	GLONR200A150A	279	

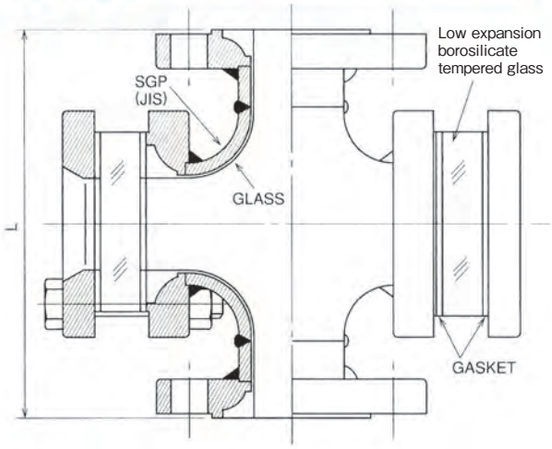
NRT Reducing Tees



Nominal Dia. (mm)	Code	2X (mm)	X (mm)	Y (mm)	Flange
25×20	GLNRT025A020A	178	89	89	GL™ ANSI 150Lb TYPE
40×20	GLNRT040A020A	204	102	102	
40×25	GLNRT040A025A	204	102	102	
50×25	GLNRT050A025A	228	114	114	
50×40	GLNRT050A040A	228	114	114	
80×40	GLNRT080A040A	280	140	140	
80×50	GLNRT080A050A	280	140	140	
100×50	GLNRT100A050A	330	165	165	
100×80	GLNRT100A080A	330	165	165	
150×80	GLNRT150A080A	406	203	160	
150×100	GLNRT150A100A	406	203	160	
200×100	GLNRT200A100A	458	229	190	
200×150	GLNRT200A150A	458	229	190	

Fittings

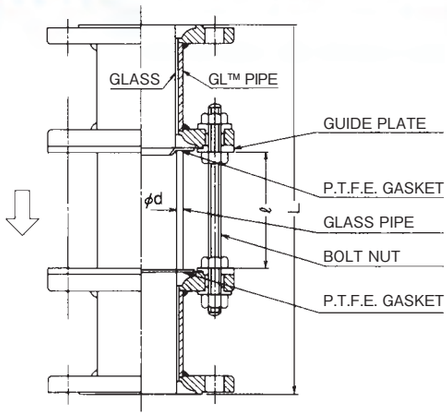
NLK Cross-type lookings



Nominal Dia. (mm)	Code	L (mm)	Flange
25	GLNLK025A	190	GL™ ANSI 150Lb TYPE
40	GLNLK040A	204	
50	GLNLK050A	252	
80	GLNLK080A	286	
100	GLNLK100A	286	

Protective cover can be attached to sight glass part upon request.

OLG Lantern-type lookings

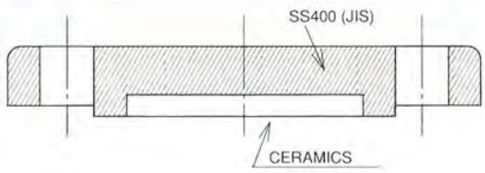


Nominal Dia. (mm)	Code	d (mm)	L (mm)	ℓ (mm)	Maximum operating pressure	Flange
25	GLOLG025A	27	330	100	0.392MPa	GL™ ANSI 150Lb TYPE
40	GLOLG040A	40	330	100		
50	GLOLG050A	52	330	100		
80	GLOLG080A	79	330	100	0.294MPa	
100	GLOLG100A	108	330	100	0.196MPa	
150	GLOLG150A	159	330	100		

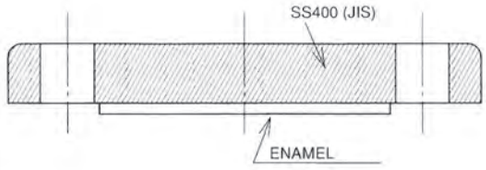
Protective cover can be attached to the sight glass part upon request.

OCF-OCA Blind flanges

GL OCF
Nominal Dia.
20mm~50mm



GL OCA
Nominal Dia.
80mm~200mm



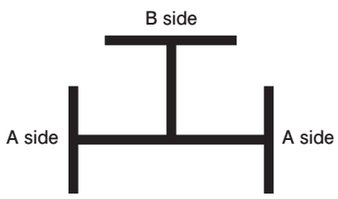
Nominal Dia. (mm)	Code	Flange
20	GLOCF020A	GL™ ANSI 150Lb TYPE
25	GLOCF025A	
40	GLOCF040A	
50	GLOCF050A	
80	GLOCA080A	
100	GLOCA100A	
150	GLOCA150A	
200	GLOCA200A	

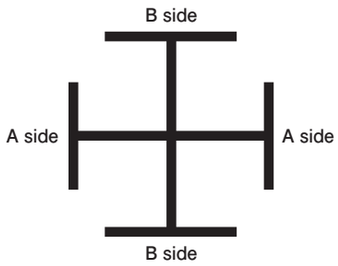
Ceramics is made of Alumina (alumina purity 96% white).

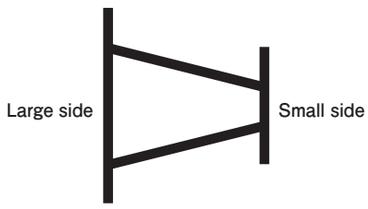
Available loose flange type list

"Y" means Available.

		¾B	1B	1・½B	2B	3B	4B	6B	8B
90° Elbow	One side loose flange	Y	Y	Y	Y	Y	Y	Y	Y
45° Elbow	One side loose flange	–	–	–	–	–	Y	Y	Y
Tee	One side loose flange of "A"	Y	Y	Y	Y	Y	Y	–	–
	Loose flange of "B"	Y	Y	Y	Y	Y	Y	–	–
	One side loose flange of "A" and loose flange of "B"	–	–	–	–	–	Y	–	–
	Both side loose flanges of "A"	Y	Y	Y	Y	Y	Y	–	–
Cross	One side loose flange of "A"	Y	Y	Y	Y	Y	Y	–	–
	One side loose flange of "A" and loose flange of "B"	–	–	–	–	–	Y	–	–
	Both side loose flanges of "A"	Y	Y	Y	Y	Y	Y	–	–







●Loose flange type list of Reducing Tee

	1B	1・½B	2B	3B	4B	6B	8B
¾B	–	Y*	–	–	–	–	–
1B	–	Y	Y	–	–	–	–
1・½B	–	–	Y	Y*	–	–	–
2B	–	–	–	Y*	Y*	–	–
3B	–	–	–	–	Y*	Y*	–
4B	–	–	–	–	–	Y*	Y*
6B	–	–	–	–	–	–	Y*

"Y*" means that both A side loose flange with B side loose flange is available.
"Y" means that one of A side and B side or both A side loose flange is available.

●Loose flange type list of Concentric Reducer and Eccentric Reducer

	1B	1・½B	2B	3B	4B	6B	8B
¾B	Y	Y	Y	–	–	–	_
1B	–	Y	Y	–	–	–	_
1・½B	–	–	Y	Y	–	–	_
2B	–	–	–	Y	Y	–	_
3B	–	–	–	–	Y	Y	_
4B	–	–	–	–	–	Y	Y
6B	–	–	–	–	–	–	Y

Loose flange of both large side and small side or one side loose flange is available

Heat exchanger

Thermal conductivity

Heat exchange rate of GL™ is approximately 80% comparing with same diameter and thickness of steel pipe.
GL™ heat exchanger is widely used as cooler, heater and condenser.

Overall coefficient of heat transfer

●Dubble-tube type heat exchanger

Material	Thickness (mm)	Overall heat transfer coefficient W/(m²·K)
GL™	GLASS 1.0~1.5	174~348
	Steel pipe 2.8~5.8	

●Cascade-type heat exchanger

Material	Thickness (mm)	Overall heat transfer coefficient W/(m²·K)
GL™	GLASS 1.0~1.5	58~174
	Steel pipe 2.8~5.8	

*Overall coefficient of heat transfer changes depending on the design conditions.

Advantage

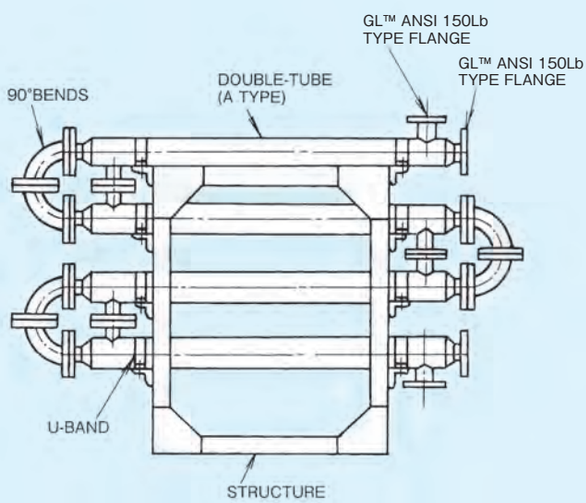
GL™ has an excellent resistance to corrosion, heat, pressure and full vacuum.
This durability reduce the cost of maintenance.

Specification

Showing table.

HE type	Nominal Dia. (mm)	Maximum length per pipe (mm)
Cascade-type cooler	20~100	3,500
	150	3,000
Dubble-tube type HE	200	2,500

Example of the assembly
Double-tube type heat exchanger (sample)



Double-tube type heat exchanger (standard unit)

●Standard unit

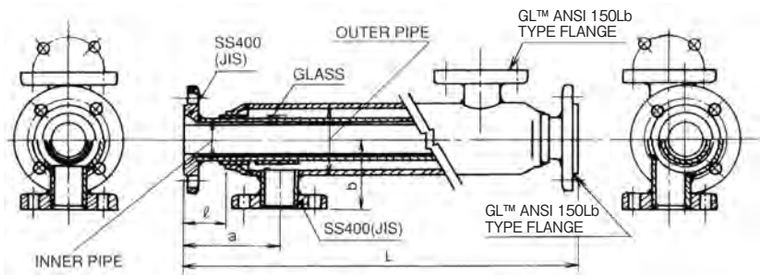
Nominal Dia.× Length		20mm× 3500mm	25mm× 3500mm	40mm× 3500mm	50mm× 3500mm	80mm× 3500mm	100mm× 3000mm
Heat transfer area	1m²	(1×4)	(1×3)				
	2m²	(1×7)	(1×6)	(1×4)			
	3m²		(2×5)	(1×6)	(1×5)		
	4m²			(2×4)	(1×7)		
	5m²				(2×4)	(1×6)	
	10m²				(2×8)	(2×6)	
	20m²					(2×11)	(2×11)
	30m²						(4×8)

Above table (1×4) (other types are also available)
Column
Row

●Advantage

The model which is suitable for your production line is based on heat transfer area.
The fully assembled double-tube type heat exchanger can be delivered to the site. (Except for 20 ㎡ and 30㎡)
Main advantage of designed standard unit is low cost and short manufacturing period.

Double tubes OSJ



Nominal Dia. (mm)	Code	Standard length (L)	Nominal Dia.(mm)		ℓ (mm)	Branch pipes			Flange
			Inner pipe	Outer pipe		a (mm)	b (mm)	Nominal Dia.(mm)	
20	GLOSJ020A	1000・1500・2000・2500・3000・3500	20	40	45	100	86	20	GL™ ANSI 150Lb TYPE
25	GLOSJ025A	1000・1500・2000・2500・3000・3500	25	50	45	100	89	20	
40	GLOSJ040A	1000・1500・2000・2500・3000・3500	40	80	55	135	102	40	
50	GLOSJ050A	1000・1500・2000・2500・3000・3500	50	90	60	140	114	40	
80	GLOSJ080A	1000・1500・2000・2500・3000・3500	80	125	65	150	140	40	
100	GLOSJ100A	1000・1500・2000・2500・3000・3500	100	150	65	155	165	40	
150	GLOSJ150A	1000・1500・2000・2500・3000	150	200	65	155	203	40	
200	GLOSJ200A	1000・1500・2000・2500	200	250	85	180	229	40	

●Heat transfer area of double-tube heat exchanger (based on external area of inner tube)

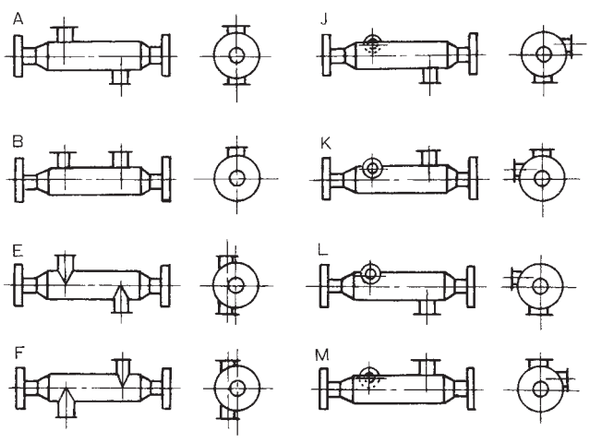
(m^2/pcs)

Nominal Dia. (mm)	Code	Length (mm)					
		1000	1500	2000	2500	3000	3500
20	GLOSJ020A	0.078	0.120	0.163	0.206	0.249	0.291
25	GLOSJ025A	0.097	0.150	0.204	0.257	0.311	0.364
40	GLOSJ040A	0.136	0.212	0.288	0.365	0.441	0.517
50	GLOSJ050A	0.167	0.262	0.357	0.452	0.547	0.642
80	GLOSJ080A	0.243	0.383	0.523	0.663	0.803	0.943
100	GLOSJ100A	0.312	0.492	0.671	0.851	1.030	1.210
150	GLOSJ150A	0.451	0.711	0.970	1.229	1.489	
200	GLOSJ200A	0.564	0.903	1.243	1.583		

●Connection of branch pipes to double-tube heat exchanger (sample)

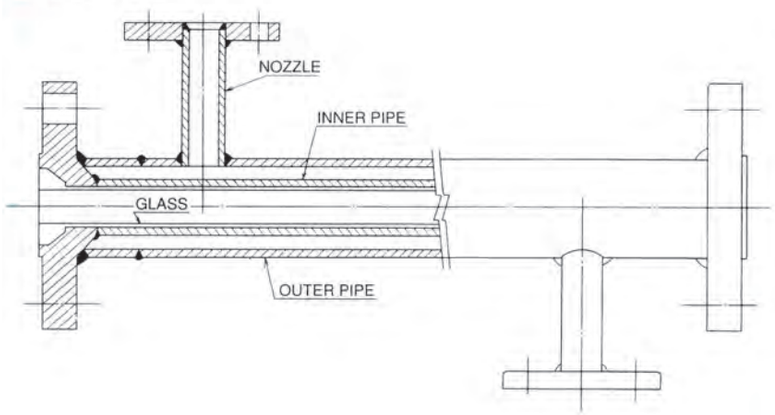
●Branch pipe types

Other types of pipes are also available.



Full jacket-type double tubes

Straight pipes



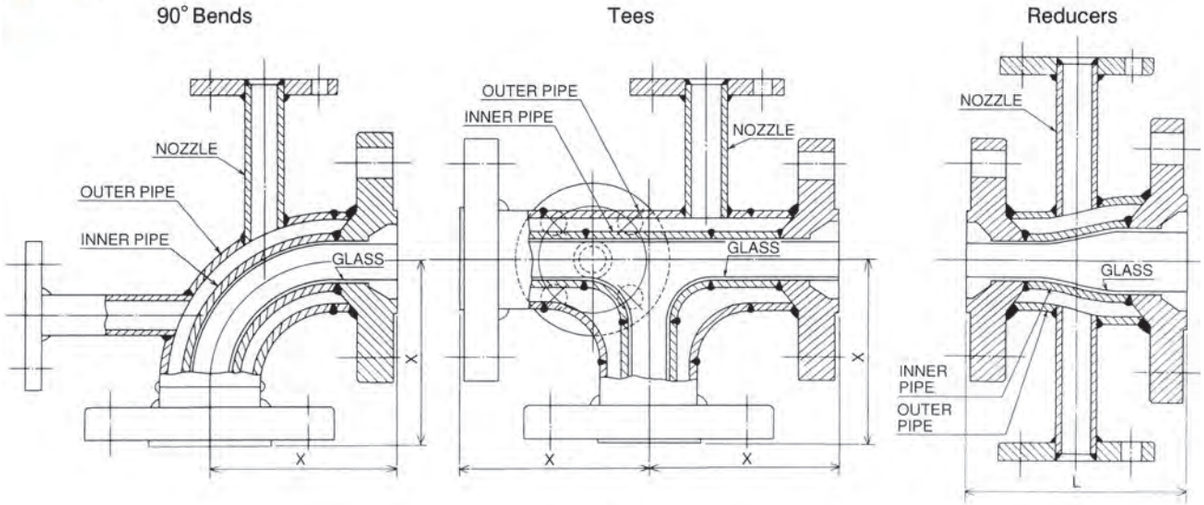
Nominal Dia.(mm)

Inner pipe	Outer pipe
25	50
40	65
50	80
80	100
100	150

Type
Straight pipes, 90° Bends, Tees, Reducers

Flange
GL™ ANSI 150Lb type

Fittings



Inner pipe Nominal Dia.(mm)	X (mm)
25	114
40	127
50	140
80	165
100	203

Inner pipe Nominal Dia.(mm)	L (mm)
40×25	152
50×25	152
50×40	152
80×40	178
80×50	178
100×50	229
100×80	229

*Regarding to nozzle, both flange-type and boss-type are available.

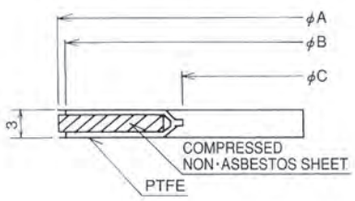
Accessories

Gaskets, bolts and nuts

Three gaskets shown below are suitable for GL™.
Standard gaskets available on the market can be used for GL™.
But inner diameter of standard gasket is larger than designated gaskets for GL™, therefore more residual liquid remains between connected flanges area.

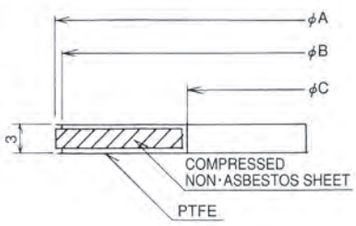
Designated gaskets for GL™

AGT type (ANSI 150LB type)



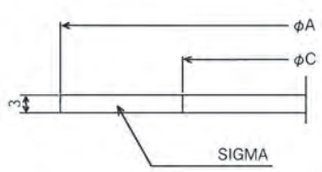
AGT type				
Nominal Dia. (mm)	Code	A (mm)	B (mm)	C (mm)
20	GLAGT020A	58	56	19
25	GLAGT025A	67.5	65	25
40	GLAGT040A	86.5	84	38
50	GLAGT050A	104.5	102	50
65	GLAGT065A	123.5	122	65
80	GLAGT080A	136.5	134	77
100	GLAGT100A	174.5	172	103
150	GLAGT150A	221.5	220	153
200	GLAGT200A	278.5	276	201

AGK type (ANSI 150LB type)



AGK type				
Nominal Dia. (mm)	Code	A (mm)	B (mm)	C (mm)
20	GLAGK020A	58	56	22
25	GLAGK025A	67.5	65	28
40	GLAGK040A	86.5	84	41
50	GLAGK050A	104.5	102	53
65	GLAGK065A	123.5	122	68
80	GLAGK080A	136.5	134	80
100	GLAGK100A	174.5	172	106
150	GLAGK150A	221.5	220	156
200	GLAGK200A	278.5	276	204

SIGMA (ANSI 150LB type)

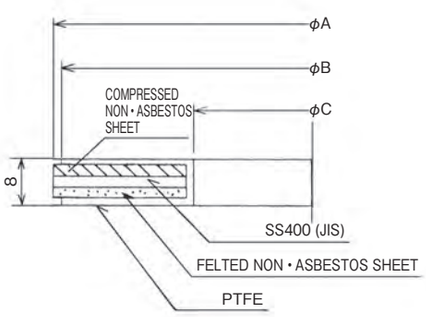


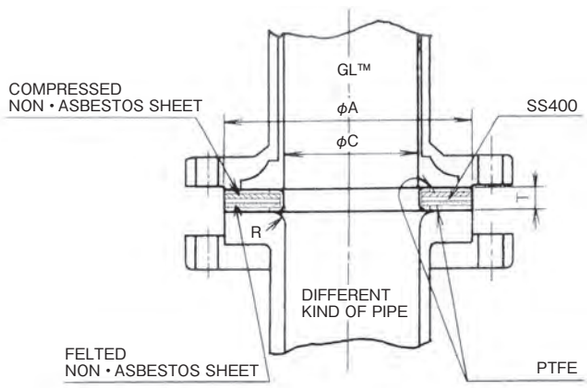
SIGMA		
Nominal Dia. (mm)	A (mm)	C (mm)
20	58	22
25	67.5	28
40	86.5	41
50	104.5	53
65	123.5	68
80	136.5	80
100	174.5	106
150	221.5	156
200	278.5	204

Doughnut gaskets

Doughnut gasket is commonly used when connecting GL™ with other material (Enamel, Fluorine resin lined pipe etc.)
Inner sheets of Doughnut gasket is consist of three material.
One side is Felted non asbestos sheet, the other side is compressed non asbestos sheet. Between both materials is carbon steel.

AGD type (ANSI 150LB type)

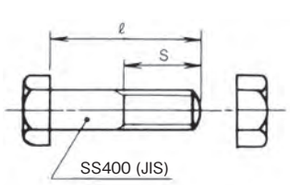


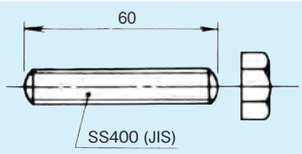


AGD type				
Nominal Dia. (mm)	Code	A (mm)	B (mm)	C (mm)
20	GLAGD020A	58	56	22
25	GLAGD025A	67.5	65	28
40	GLAGD040A	86.5	84	41
50	GLAGD050A	104.5	102	53
65	GLAGD065A	123.5	122	68
80	GLAGD080A	136.5	134	80
100	GLAGD100A	174.5	172	106
150	GLAGD150A	221.5	220	156
200	GLAGD200A	278.5	276	204

Usage: Compressed non-asbestos sheet side →
Face it to GL™'s flange side.
Felted non asbestos sheet side (white) →
Face it to the different kind of pipe's flange side.

Bolts and nuts for GL™ pipes





U½ for GLONB020A,
GLONB025A (for threaded hole)

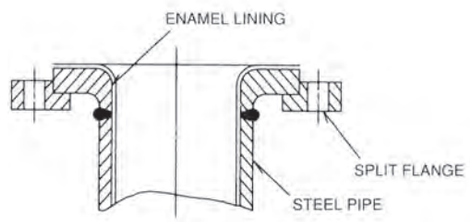
Nominal Dia. (mm)	Bolt nominal diameter ISO	ℓ×S (mm)
20	U½	60×35
25	U½	60×35
40	U½	65×35
50	U⅝	65×40
80	U⅝	75×40
100	U⅝	75×40
150	U¾	85×50
200	U¾	90×50

*These size are applied to joint part of GL™.

*When connecting GL™ with other pipe and fitting, we recommend to use 5mm shorten bolt comparing to the length listed above.

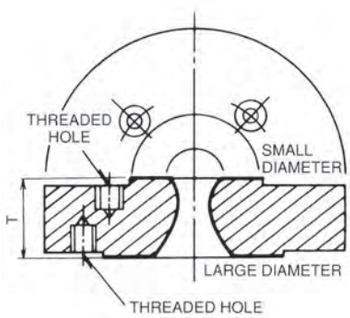
GL™ piping-related parts

Large diameter straight pipes/fittings (enamel lining)

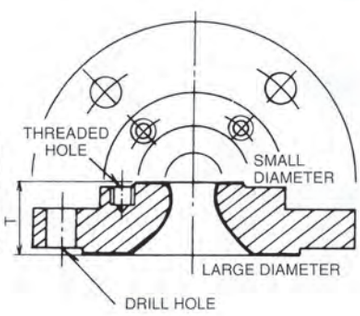


- **Range of products**
  Straight pipe, Short pipe, Spacer, 90° bend, 45° bend, Reducer, Tees, Reducing tees, Gasket
- **Nominal diameter (mm)**
  250, 300, 350
- **Flange**
  GL™ ANSI 150Lb type
- **Base metal**
  Straight pipe: STPG370 SCH40 (JIS)
  Fittings: STPT370 SCH40 (JIS)
- **Glass**
  Enamel lining (standard)

Reducing flange (enamel lining)



〈NO MARK TYPE〉



〈●MARK TYPE〉

- **Flange**
  GL™ ANSI 150Lb type
- **Material**
  SS400 (JIS) or SF440A
- **Glass**
  Enamel lining (standard)
- **Bolt hole**
  There are two types of reducing flange. One is threaded holes at both sides, the other is small diameter side with threaded hole and large diameter side with drill hole.

Nominal Dia.(mm) Large diameter / Nominal Dia.(mm) Small diameter	20	25	40	50	65	80	100	125	150	200	250	300	350
15	30	30											
20		30	40	40	●40	●40	●40	●40	●40	●50	●50	●50	●50
25			40	40	40	40	●40	●40	●40	●50	●50	●50	●50
40				40	40	40	●40	●40	●40	●50	●50	●50	●50
50					40	40	40	●40	●40	●50	●50	●50	●50
65						40	40	40	●40	●50	●50	●50	●50
80							40	40	40	●50	●50	●50	●50
100								40	40	●50	●50	●50	●50
125									40	50	●50	●50	●50
150										50	●50	●50	●50
200											50	●50	●50
250												50	50
300													50

The figures in this table shows Thickness of flange (mm).
The black circle shows the type of small diameter side with threaded hole and large diameter side with drill hole.

GL™ JIS 10k type

Straight pipes, Fittings, Flanges

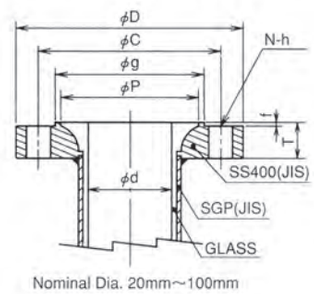
Each dimension of JIS 10K flange is different from that of ANSI 150Lb.

●Flange (GL™ JIS 10k type)

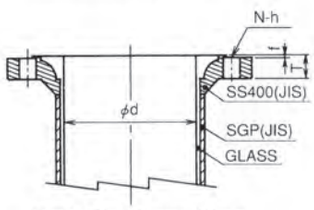
Nominal Dia. (mm)	Code	D (mm)	C (mm)	g (mm)	f (mm)	T(mm)		N	h (mm)	Bolt nominal diameter ISO	P(mm)		d(mm) Reference value
						Straight pipes	Fittings				New	Previous	
20	20A	100	75	56	1	19	19	4	15	M12	49	42	19
25	25A	125	90	67	1	19	19	4	19	M16	57	48	25
40	40A	140	105	81	2	21	21	4	19	M16	70	62	39
50	50A	155	120	96	2	21	21	4	19	M16	85	75	50
65	65A	175	140	116	2	23	23	4	19	M16	105	88	65
80	80A	185	150	126	2	23	25	8	19	M16	113	101	78
100	100A	210	175	151	2	23	25	8	19	M16	136	125	102
150	150A	280	240	212	2	27	27	8	22	M20	190	175	152
200	200A	330	290	262	2	30	30	12	22	M20	243	228	202

The straight pipe is made of steel (Flange: SS400, Pipe: SGP)
Fitting has two types as follows;
Cast iron type: Made of FC200 (JIS)
Welded type: Made of steel (Flange:SS400, Pipe:SGP)

Steel flange (straight pipes)



Nominal Dia. 20mm~100mm



Nominal Dia. 150mm~200mm

Cast iron flange (fittings)

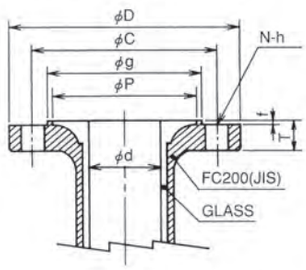
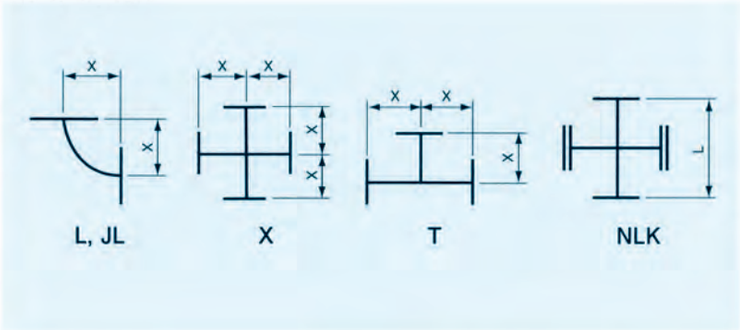


Table of GL™ JIS 10k type fittings dimensions

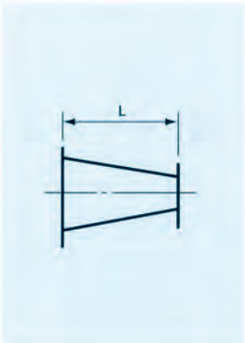
※ Below fittings are manufactured by casting.

L.X.T, JL, NLK



	L.X.T.	JL	NLK
Nominal Dia. (mm)	X (mm)	X (mm)	L (mm)
20	73	86	
25	78	89	190
40	95	102	204
50	102	114	252
65	114		
80	126	140	286
100	143	165	286
150	173	203	
200	229	229	

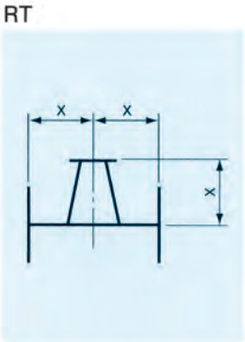
R



R (Lmm)

Nominal Dia.(mm) Large diameter / Nominal Dia.(mm) Small diameter	25	40	50	65	80	100	150	200
20	91	110	130		180			
25		110	110		150			
40			106		140			
50				113	130	160		
65					117	150		
80						131	220	279
100							140	279
150								279

RT



RT (Xmm)

Nominal Dia.(mm) Large diameter / Nominal Dia.(mm) Small diameter	25	40	50	80	100	150	200
20	78	95	102	126			
25		95	102	126			
40			102	126			
50				126	143		
80					143	173	229
100						173	229
150							229

B

B

Nominal Dia. (mm)	X (mm)
20	41
25	45
40	56
50	62
80	79
100	93
150	118
200	150

Piping allocation

The following method is recommended for allocating GL™ pipes and fittings.

1. Firstly allocate fittings (Including gaskets)

2. Then allocate straight pipes

   a. Allocate long pipe and set remaining length between 100mm and 200mm
   *Lineup of short pipe length from 100mm to 200mm is at 10mm intervals.

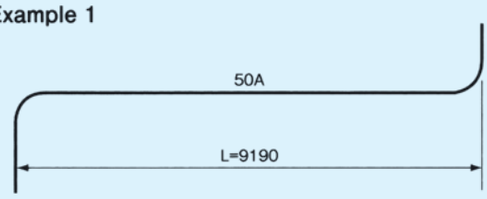
   b. Allocate short one and set remaining length between -3mm and +6mm
   *Spacer is mainly used for adjusting the difference between actual length and design length and when remaining length is under 100mm.

3. Finally adjust remaining length -3mm to +6mm as follows;

   a. Consider -3mm to +3mm as length error margin and write down -3, -2, -1, +1, +2, +3 on the drawings (see calculating formula below)

   b. Use gasket (thickness : 3mm) for adjusting +4mm to +6mm and write down (+1) + (P), (+2) + (P) and (+3) + (P).
   (P) means the symbol of gasket.

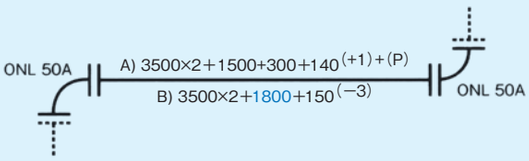
Example 1



1. Allocate fittings.
   9190−(114+3)×2 =8956

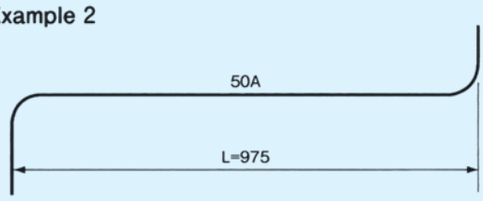
2. Allocate straight pipes.
   a. 8956−(3500+3)×2=1950
      1950−(1500+3)=447
   b. 447−(300+3)−(140) =4
   c. 4=(+1)+(p)

Write down the following on the drawing.



When method A) is applied, 7 sheets of gasket are required. (This method is recommended for JIS 10K standard.
If reducing quantity of GL™ items and gaskets, method B) is suitable.

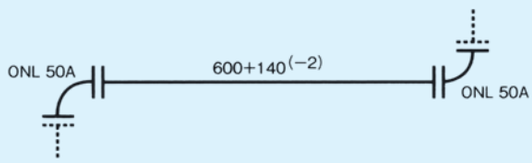
Example 2



1. Allocate fittings.
   975−(114+3)×2=741

2. Allocate straight pipes.
   a. 741−(600+3)−(140)=−2
   b. −2=−2

Write down the following on the drawing.



A total of 3 gaskets are required.

Installation

General notes

When storing and delivering GL™, please refrain from these actions as follows;

1) Do not hit GL™ items against other objects.

2) Do not throw GL™ items away.

3) Do not pile GL™ items with heavy objects.

4) Do not put bending stress on GL™ items.

5) Do not tread on GL™ items

6) Please lay GL™ items down on the mat and put the stopper for avoiding GL™ items rolling. Do not touch Flange of GL™ to the ground or other objects.

7) Do not use GL™ items as grounding wire or spark test. Please keep GL™ items away from the sparks of welding or cutting.

8) Do not pile up 150A and 200A GL™ items. Up to 100A it can be stored in fourth-tiers.

Piping installation

1) Remove sealing cover from both flanges.

2) Remove the rust and extraneous material from flange.

3) Set the nozzle of equipment as a starting point and install GL™ from that point.

4) Insert the gasket into center of pipe.

5) Tighten bolts at diagonal line gradually (at least four steps). Do not fasten bolts by one action.

6) Refer to the following table for tightening bolt torques.

Nominal Dia. (mm)	Torque (N·m)	
	New	Previous
20	40	40~60
25	40	40~60
40	40	40~60
50	100	100~120
65	100	100~120
80	100	100~120
100	100	100~120
150	150	150~180
200	150	150~180

*The figure shows the torques of ANSI ISO Lb type

*It is desirable to use PTFE paste which does not contain any fluorine and spread it thinly.

7) After tightening all bolts of one side, please tighten to all bolts of the opposite side.
Do not tighten the bolts loosely and continue to install GL™ for avoiding heavy-handed adjustment at final phase.

8) Do not install inappropriate dimension and angle.

9) Basically the gap between flanges should be adjusted as follow methods,

a. Insertion of gaskets

b. Insertion of spacers

c. Replacement wrong dimension one with correct one

10) Recommend to use Doughnut gaskets when connecting GL™ with other material pipe such as

a. Enamel items

b. Fluorine resin lining items

Piping support

1) Do not weld a pipe support to GL™

2) Do not use U-bolt as a pipe support. (Preferable tightening torque is under 10N·m). We recommend to use U-band.

3) Recommended interval between GL™ support is under 3.5m.
*This dimension is valid when there are no valves and fittings between the GL™ supports.

Test / trial operation

1) The lining glass inside GL™ may get corroded by boiled water or steam.
If you have any plan to use them, please contact with us in advance.

2) Please check whether the bolts are loosened or not after operation.

Maintenance

1) Please store GL™ items with sealing sheet of flange surface.

2) Please check bolts regularly and tighten again if loosened.

Uninstallation

1) Do not hit the edge face of flange.

2) Do not hit the wrench or bolts by a hammer.

3) Do not heat the bolts with a burner or cut them with flame

4) Do not peel off the gaskets by force.

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