

# **CL PIPING SYSTEM**

## **INSTALLATION MANUAL**

AGC TECHNOLOGY SOLUTIONS CO.,LTD.

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※ In this manual, "ATG" stands for Asahi Techno Glass and "GL" for GL pipes.

1999 Asahi Techno Glass is formed as a merger between Iwaki Glass Co., Ltd. and Toshiba Glass Corporation.
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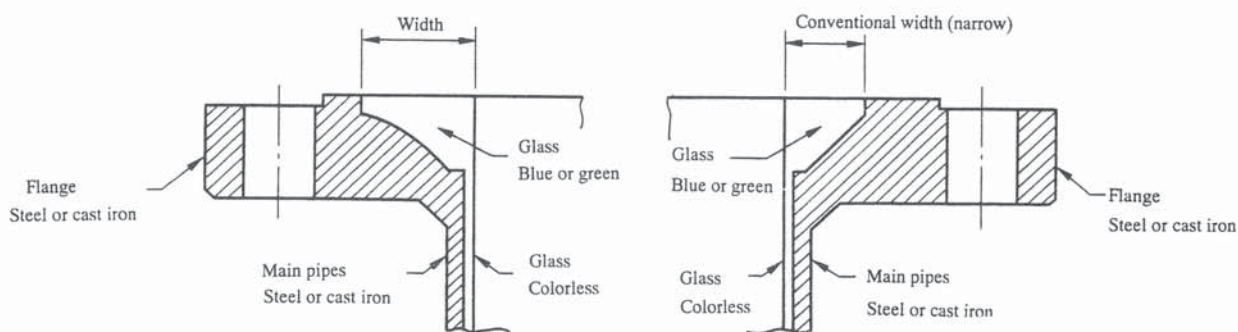
# I GL PIPING INSTALLATION

GL is lined on the inside surface of steel or cast iron pipes in GL as shown below, making inside surface glass far stronger than ordinary glass. Unexpected glass damage may occur, because GL cannot be easily differentiated from ordinary steel pipes in appearance during handling.

The key is to avoid external impact, external load, and exposure to naked flame, which may damage inside surface glass.

To ensure that GL performs as designed, handle and install piping with care.

## STRUCTURES OF GL



### NEW GL

Manufactured from 1996

### OLD GL

Manufactured before 1995

GL uses 2 types of inside surface glass.

End Face Glass Blue: Standard glass

Green: Highly Corrosion-Resistant Glass

※ GL was switched from conventional to a new performance-improved type in 1996.

#### [Precaution]

A light anticorrosion coating (yellow) is provided at the iron part of end faces in GL pipes when shipped.

Note that this coating is easily wiped away using solvent.

## II GL PIPING INSTALLATION POINTS

### Point 1. Handling

- External impact, external load, and fire are strictly prohibited.

### Point 2. Gaskets

- Use ATG standard product for old GL.
- Commercially available products can be used for new GL.  
(Because commercially available products have a large bore dimension depending on the manufacturer and may not be appropriate to use, ensure bore dimension before use.)
- In connection with other than ATG GL, check whether donut gaskets are needed.

### Point 3. Connection to Flange

- Observe to counter-tighten the bolt with proper torque.
- After final bolt tightening, go to the flange connection.  
(Proceeding the work of connecting flanges in turn with bolts being not finally tightened may cause inappropriate dimensional adjustment and piping.)

### Point 4. Dimensional Adjustment

- Do not forcibly adjust dimensions pushing or pulling GL.  
(Adjust dimensions so that the opposite flange face is parallel to the same core.)

### Point 5. Supports

- Use "U" bands, not "U" bolts.
- The support point is determined considering thermal expansion during piping and equipment operation.

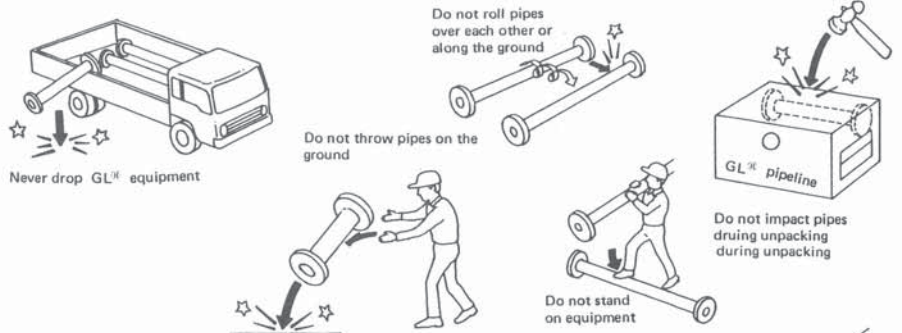
※ For details, see the explanation on the next page.

### III GL PIPE GENERAL CARE AND HANDLING

Note the points below in handling GL to prevent damaging inside surface glass.

#### ● Unpacking and Transport

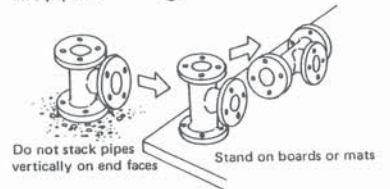
- Do not drop.
- Do not throw.
- Do not roll.
- Do not step on.
- Do not bump.



#### ● Storage

- Fence off storage areas.
- Place pipes on square timber or mats.
- Stop straight pipes from rolling.
- Do not put pipes directly on the ground flange down.
- Do not stack pipes with a bore diameter exceeding 150 A.

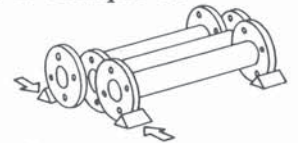
Pipes more than 100A in bore diameter may be stacked up to 4 stages if collapse is prevented.



#### ● Installation

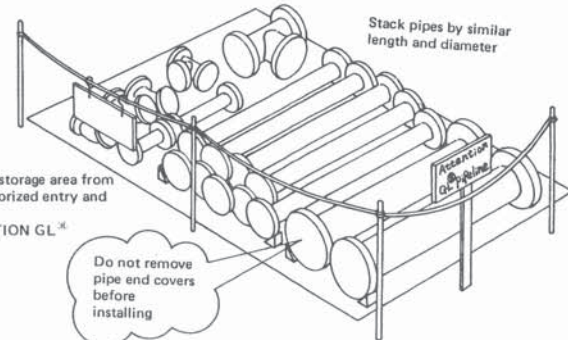
##### [External impact]

- Do not strike pipes.
- Do not subject to falling objects.
- Do not directly touch with chains during suspension.



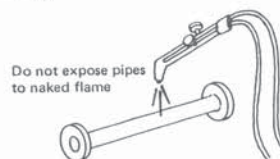
##### [External load]

- Do not stand or hang on pipes.
- Do not forcibly pull or push pipes.
- Do not hang pipes using steel wire, etc.
- Do not use as support for other piping.



##### [Fire]

- Do not expose to welding or joining sparks or flame.
- Do not bring in contact with flame.
- Do not weld supports.
- Do not use pipes for arc testing or grounding.



Do not use pipe external surface for welding arc testing and do not use pipes for electrical grounding



## IV GL PIPE ASSEMBLY

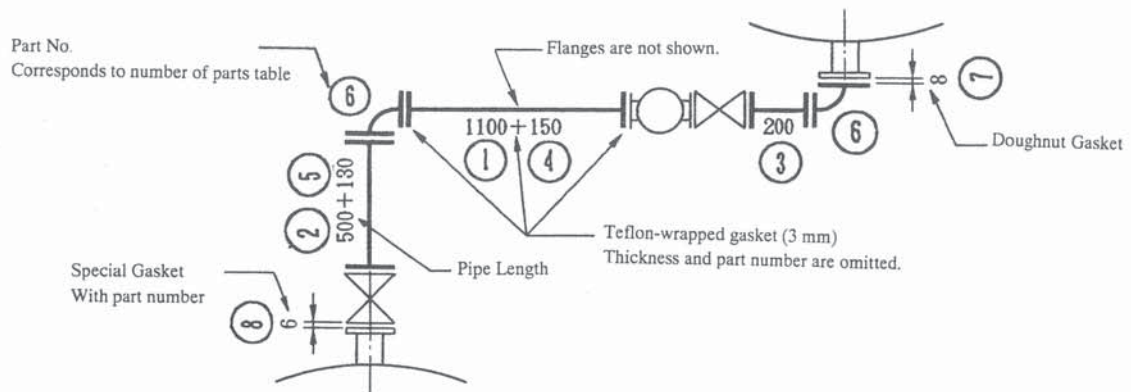
### ■ Reading piping drawings

#### ● Explanation of Part Code

Part Code	Part Name	Part Code	Part Name
S	Straight Pipe	X	Cross
SJ	Double Pipe	NLK	Sight Glass (Cross)
SP	Spacer	LG	Sight Glass (Lantern)
SH	Short pipe (No flange)	RF, HF, HA, HB	Reducing Flange
L	90° Elbow	BE	Bellows
B	45° Elbow	BN	Bolts & Nuts No instructions STN1 STN2
T	Tee		
RT	Reducing Tee	AGT, AGK	Gaskets (3 mm)
R	Reducer		
NE	Eccentric Reducer	AGD	Doughnut Gaskets (8 mm)
CF, CA	Blind Flange	OGT	Special Gaskets

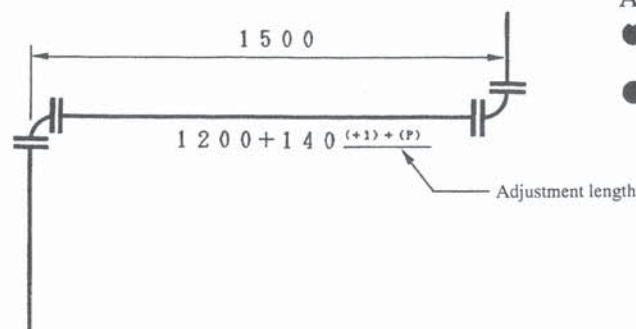
#### ● Assembly of piping

##### Example of piping



#### ● Adjustment length

##### Example of piping



##### Adjustment length

● Difference in drawing between piping length and allocation.

● Range of adjustment length

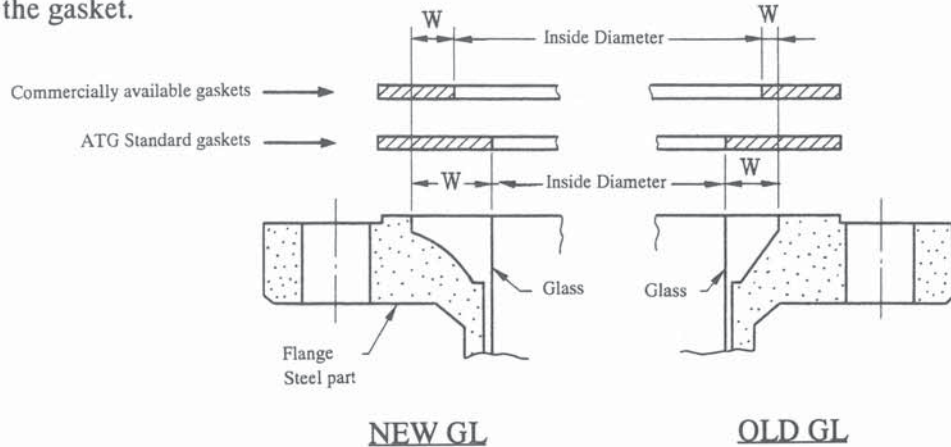
- (- 3)
- (- 2)
- (- 1)
- (+ 1)
- (+ 2)
- (+ 3)
- (+ 1) + (P)
- (+ 2) + (P)
- (+ 3) + (P)

+ (P) ; Insert 1 more gasket (3 mm)

## ■ GL gasket features and precautions

### ● Teflon-wrapped gaskets

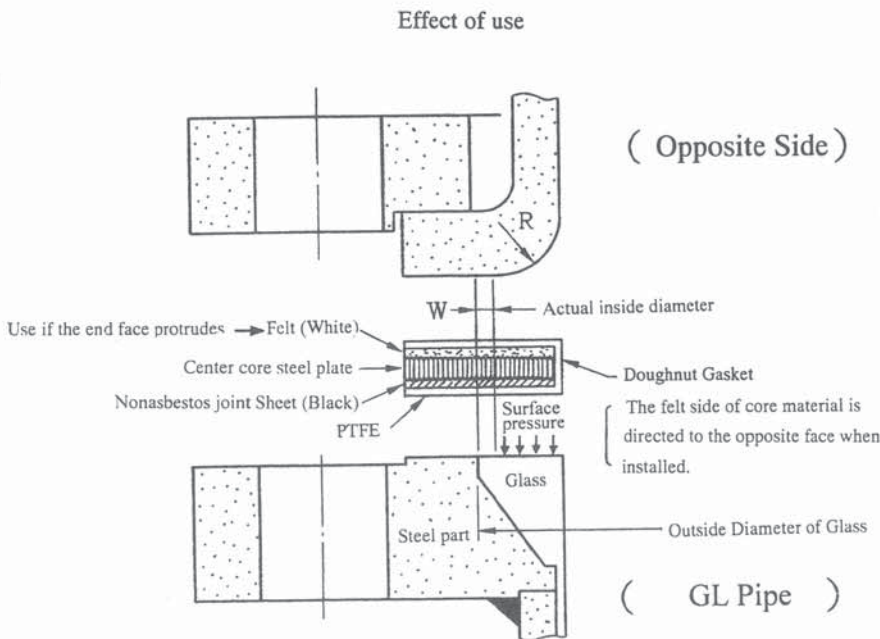
As shown in the drawing below, the GL gasket reduces inside diameter to below that of commercially available products to maintain the contact width (W) between glass of flange surface and the gasket.



- Use ATG standard products for the old GL.
- Commercially available products may be used for the new GL, but note that contact width (W) may be short due to the inside diameter being large, depending on the manufacturer.
- Use ATG standard gaskets when old and new GL are connected.

### ● Doughnut Gaskets

As shown in the drawing below, this gasket is used to connect GL to other types if the end face of other types protrudes or contact width (W) between the glass and gasket is limited due to large R of the inside diameter opening.



Criteria for doughnut gasket requirement

Connected opposite side	≤80A	≥100A
Vessel Nozzle (Enamel)	○	○
Reducing Flange (Enamel)	○	○
Valve (Enamel)	—	○
Bellows, Flexible Hose	—	○ (-)
Rubber Lining Pipe	○	○
Resin Lining Pipe	—	○ (-)
Metal Pipe	—	○ (-)
Carbon, Ceramics	—	—

#### Precaution

- The above table shows rough standards.
- Instructions determine whether doughnut gaskets are required.
- Items in parentheses ( ) indicate the new GL.
- ○ necessity
- — useless

The arrow mark tightening surface pressure is also given on the GL glass surface of the part overlapped on opposite side R by steel plate of the doughnut gasket center core as shown in the above drawing. Since the arrow mark tightening pressure is not given in the ordinary gasket, a defect may occur on the seal.

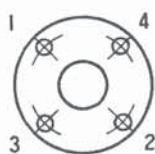
## ■ GL Pipe Assembly Procedures

- Start installing from a fixed point such as an equipment nozzle.
  - ※ For connecting equipment nozzles for glass lining, precautions should be taken so that the glass lining is not broken by hitting the split flange of the nozzle on waist and head plates.
- Connect flanges as follows:
  - Remove foreign objects and rust from the flange surface of GL and the connected counterpart.
    - Adjust positions to the same core inserting more than 3 bolts after fitting the flange.
    - Insert the gasket to be the same core with GL.
      - ※ Verify that the gasket is for GL. (See page 5)
      - ※ Verify whether a doughnut gasket is required. (See page 5)
      - ※ Remove foreign objects from the gasket surface.
      - ※ Apply paste thinly on the gasket surface. (Recommended paste: Tombo #9400)  
Verify application beforehand because paste may not be required, depending on piping.
      - ※ Precautions should be taken so that Teflon is not rolled up when the gasket is inserted.
    - Let the bolt through, and tighten by hand.
    - Make a temporary support for pipes using steel wire or wooden props modifying horizontal and vertical angles with a spirit level so that excessive load and moment are not applied to the equipment nozzle and GL.
    - Conduct final tightening of bolts based on the table below.  
Use counter (diagonal) tightening sequentially in 3 or 4 processes as in the drawing below, tightening little by little.

• Bolt tightening torque for GL (kg · m) ANSI 150LB GL Flange

	20 A ↔ 40 A	50 A ↔ 100 A	150 A ↔ 200 A
Old GL	4 – 6	10 – 12	15 – 18
New GL	4	10	15

Process 1



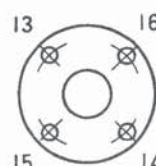
Process 2



Process 3



Process 4



- The torque table above shows connection of the same type of GL.
- When new and old GL are connected, use the old GL torque as a guide.
- If material is weaker than GL is connected, consult the manufacturer. (Carbon, ceramics, glass lining, etc.)
- Go to the following flange connection step after final tightening.  
Proceeding the work of connecting flanges in turn with bolts being not finally tightened may cause inappropriate dimensional adjustment and piping.



## ■ Dimensional Adjustment

Do not forcibly connect flanges by pushing or pulling.

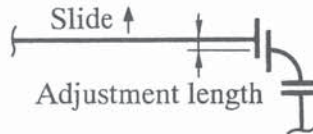
Adjust dimensions so that opposite flanges are parallel with the same core with bolts removed.

### ● Short pipe length



#### ◆ Less than 10 mm

- Use 2 gaskets. Do not use more than 3 gaskets at one connection point.
- Slide the flange using space between the bolt and bolt hole as in the drawing below.



#### ◆ More than 10 mm

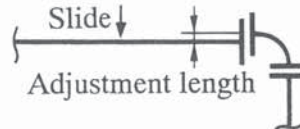
- Insert a spacer (SP) or a short pipe (SH). Do not use more than 3 at one connection point.
- Change straight pipe (S) length.

### ● Too long pipes



#### ◆ Less than 3 mm

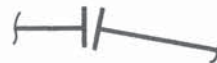
- Slide the flange using space between the bolt and bolt hole as in the drawing below.



#### ◆ More than 3 mm

- Change to a spacer (SP) or a short pipe (SH). Do not use more than 3 at one connection point.
- Change straight pipe (S) length.

### ● Unfitted angles



#### ◆ Minute angles

- Rotate pipe. The GL flange does not have a complete right angle against the pipe core due to tolerance differences in manufacturing.
- Trim the center core of the Teflon-wrapped gasket using a file.

#### ◆ Cannot be adjusted as above.

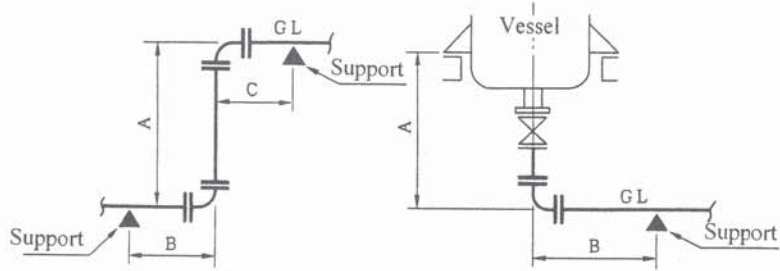
- Use a spacer with a gradient less than  $3^\circ$ .
- Use bellows.

## ■ Supports

- The support interval when joints, valves, etc., are not available is 3.5 m. (20 A - 200 A.)

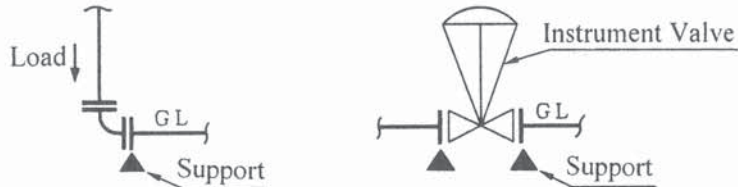


- The support point is determined taking pipe and vessel thermal expansion during operation into account.

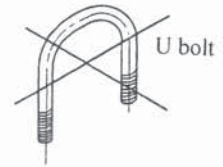
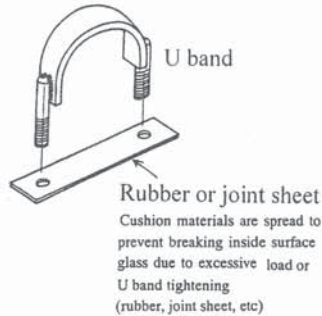
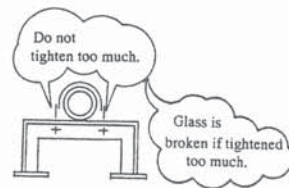
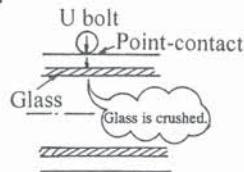


※ Determine B and C considering A's thermal expansion.

- Receive with the flange when receiving long vertical pipe and heavy one.



- Use U bands when GL is installed on the support.  
U bolts contact GL and must not be used if they may damage inside surface glass due to strong compression loading.

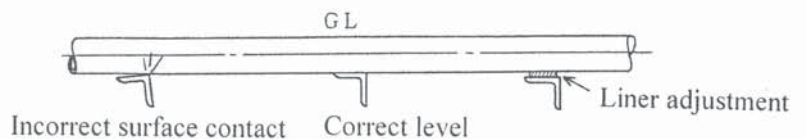


Recommended torque for U-band bolts

	Tightening torque kg-m
Less than ≤100 A	0.6~1.0
150 A 200 A	0.8~1.2

### ● Precautions on installing supports

- Do not weld support onto GL.
- Do not push supports forcibly into GL.
- Do not push the support forcibly onto GL.
- Do not let support edges contact GL.



## V POSTOPERATION AND MAINTENANCE

### ■ Postoperation

#### ● Piping Check

- Pipe Shape

If horizontal and vertical degrees of piping are not correct, an inappropriate dimensional adjustment was sometimes made. Therefore, in this case a dimensional adjustment is again made and defective places are modified.

- Bolt tightening

After checking whether there are places where bolts are tightened not finally or excessively, tighten properly if needed.

- Insertion of Doughnut Gaskets

After checking whether the doughnut gasket is inserted at necessary places and are not backward, insert and reverse if backward.

- Settings of Bellows

After checking face-to-face dimensions of bellows, modify defective places.

#### ● Support Check

- Support methods

Replace U-bolts are used by mistake with U-bands.

- Support point

After checking whether the support point has been determined considering thermal expansion of GL when an apparatus including GL is operating, modify the support point if needed.

#### ● Airtightness Test

- Unless otherwise specified, the airtightness test is pneumatic.

- Insert stoppage plates into the instrument and the equipment nozzle in piping so that pressure cannot be applied before testing. Note that equipment and instruments in GL piping are expensive.

The stoppage plate is thin for resisting pressure. Use gaskets on both sides of the stoppage plate during insertion.

- Remove foreign objects before pressurized air is passed through pipes.

- Use the specified pressure.

- If leakage occurs, tighten bolts.

If the leakage does not stop even after tightening, check by separating connected parts because leakage is abnormal.

- Abnormal piping
- Teflon rollup of gaskets
  - Foreign objects are on the surface of the flange and gasket.
  - Forcible piping dimension adjustment

**DO NOT USE STEAM OR ALKALINE WATER FOR PRESSURE AND/OR LEAKAGE TESTS**

- Reconfirming the work and removal of temporary materials
  - After removing the stoppage plate inserted in the airtightness test, tighten the bolt again.
  - Loosen the limit bolt nut of the bellows to the specified position.
  - Remove scaffolding and temporary supports and clean up the site.  
Do not bump or hit GL.

## ■ Maintenance

- Storage of remaining materials and spare parts

Remaining materials and spare parts are stored after anticorrosion treatment.

- Checking GL piping lines

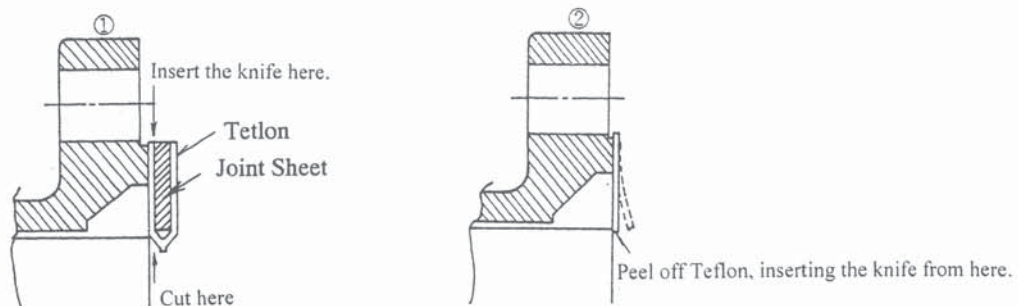
Since bolts may loosen during operations such as thermal cycling, check regularly and tighten if needed.

- Points to note in GL piping disassembly

- Loosening bolts  
Load shall not be applied by a wrench directly contacting GL pipes.  
For example, do not hit the wrench in such condition by a hammer.  
Do not warm bolts using a burner or cut using a flame.
- Do not forcibly remove gaskets.  
Remove as shown in the drawing below.

(1) Putting a knife from between Teflon and the joint sheet, cut the bore side of Teflon.

(2) Teflon adhering to the flange is peeled off by inserting the knife between Teflon and glass.

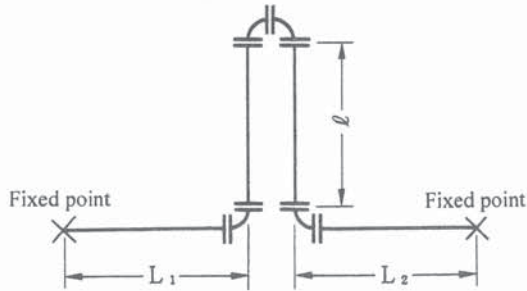


## VI APPENDICES

### ■ Simple Fixed Support Point Inspection

The following simple inspection roughly determines the support point for GL piping.

#### Form of piping



$$l \geq a \sqrt{L T}$$

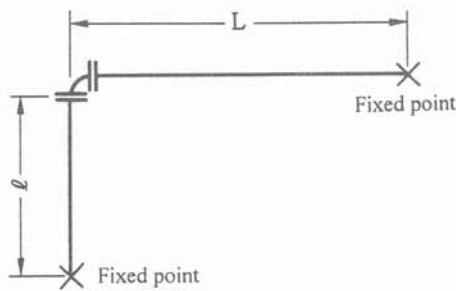
#### Formula of examination

$l$  : needed length (mm)

$L$  :  $L_1 + L_2$  (m)

$T$  : Difference of temperature ( $^{\circ}\text{C}$ )

$a$  : Constant (Lower Table)



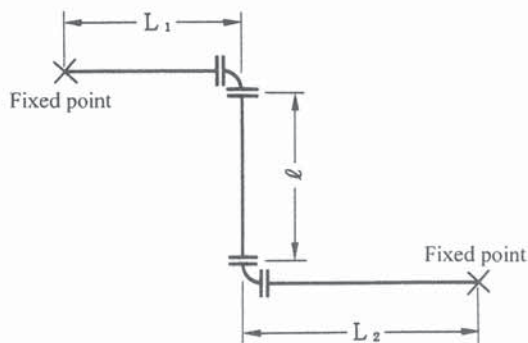
$$l \geq a \sqrt{2 L T}$$

$l$  : needed length (mm)

$L$  : (m)

$T$  : Difference of temperature ( $^{\circ}\text{C}$ )

$a$  : Constant (Lower Table)



$$l \geq 2 a \sqrt{L T}$$

$l$  : needed length (mm)

$L$  :  $L_1 + L_2$  (m)

$T$  : Difference of temperature ( $^{\circ}\text{C}$ )

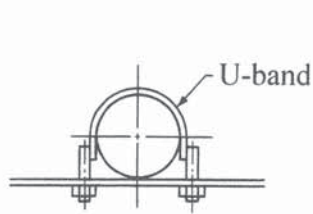
$a$  : Constant (Lower Table)

Pipe bore	20A	25A	40A	50A	80A	100A	150A	200A
$a$	26	33	44	53	72	87	122	143

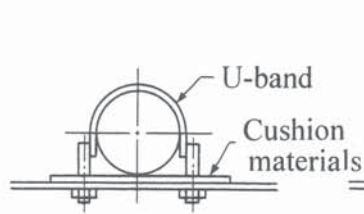
- The above formula roughly determines required pipe length ( $l$ ) against the pipe length ( $L$ ).
- If the above formula holds, the pipe dimension and the fixed point are adequate.
- If the above formula does not hold, change pipe dimensions and fixed points or insert an expansion joint.

■ GL Pipe Support Example (1/2)

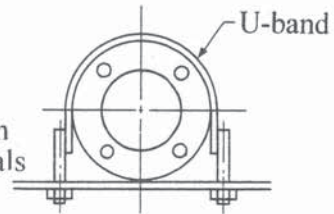
● Pipe support instructions



(A) Pipe U-band



(B) Pipe U-band



(C) Flange U-band



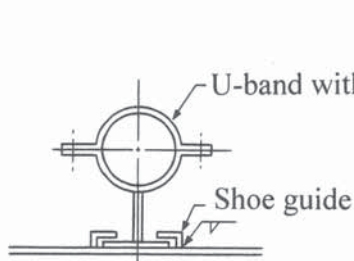
(D) Pipe support



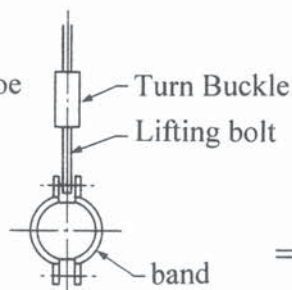
(E) Pipe support



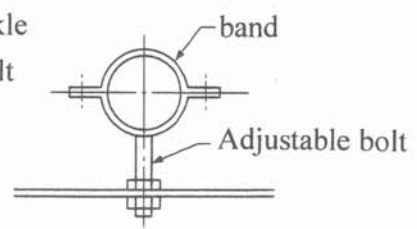
(F) Pipe support



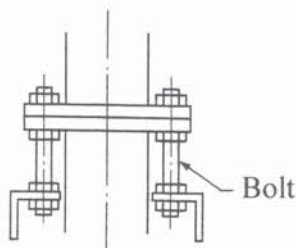
(G) Thermal insulation piping support



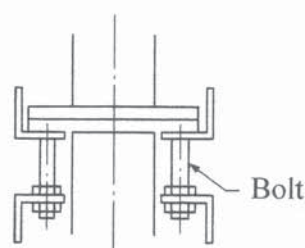
(H) Pipe lifting



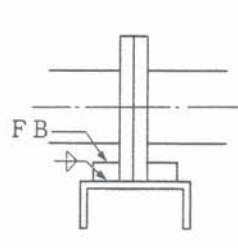
(I) Pipe support



(J) Flange part support



(K) Flange part support

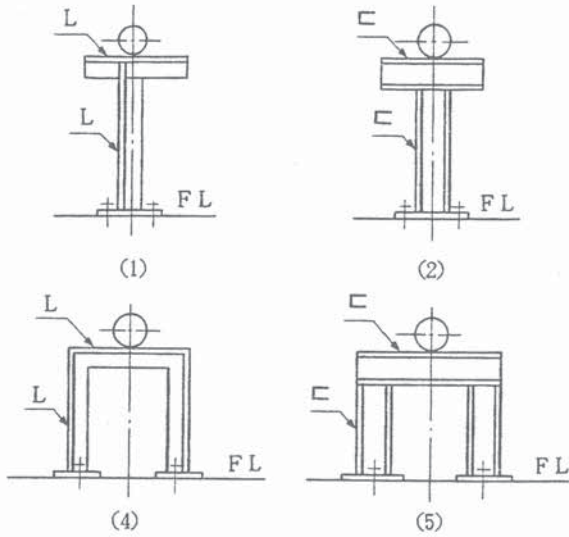


(L) Horizontal piping fixed point

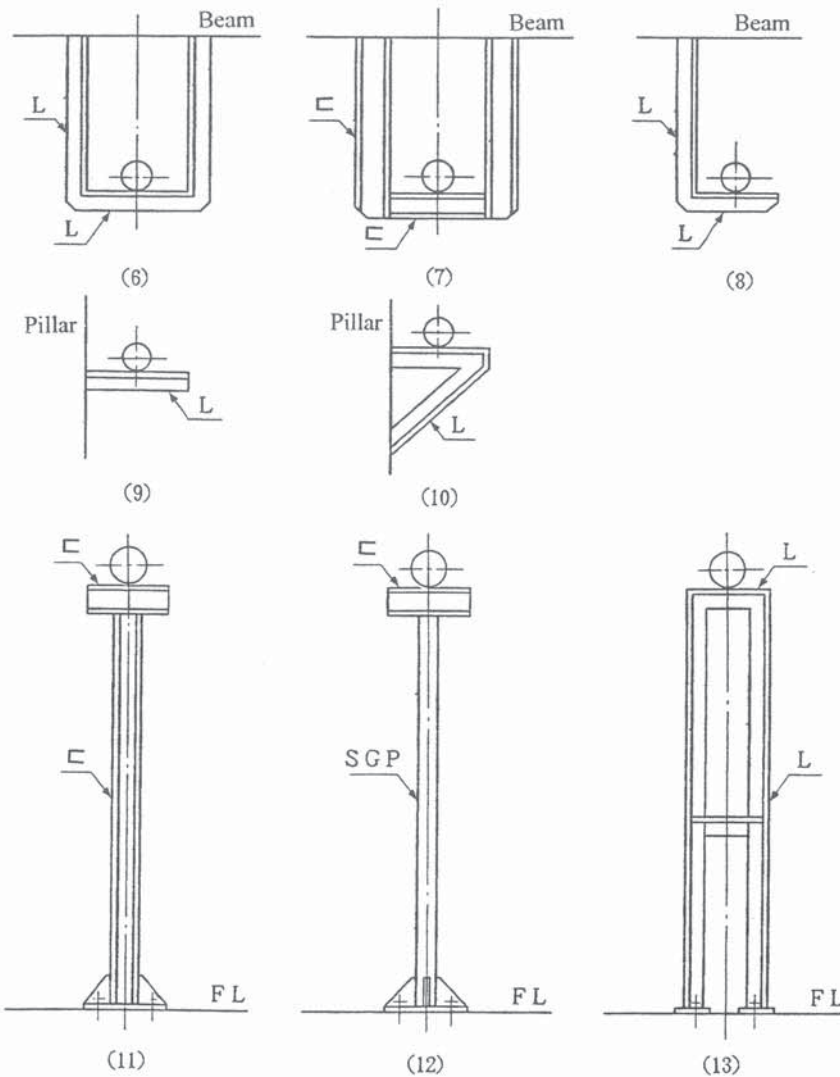
## ■ GL Pipe Support Example(2/2)

### ● Pipe support instructions

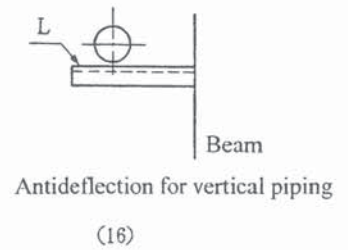
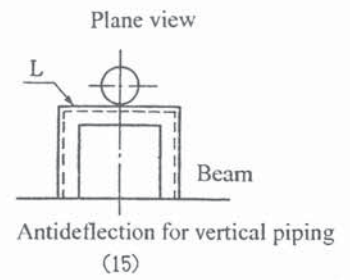
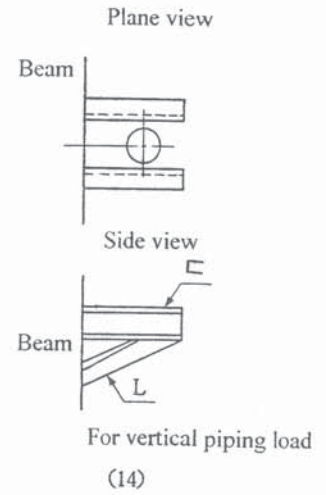
#### • Piping support at low level



#### • Piping support at high level

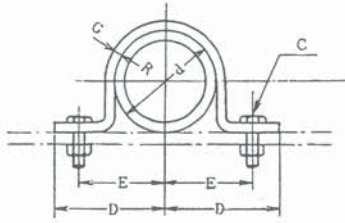


#### • Vertical piping support

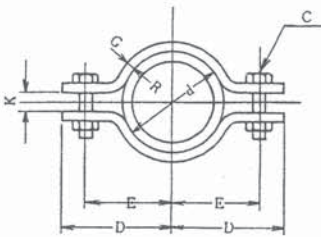


## ■ Support Band Dimension Tables

**Band A**



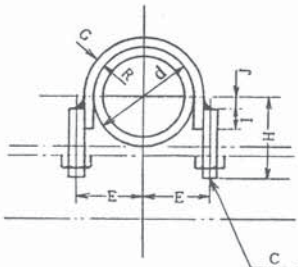
**Band C**



**Band A/C dimension table**

	Dimensions mm							
	d	R	G	E	D	C		K
						Band A	Band C	
20 A	28	14	3.0t×25	33	47	M10×30	M10×30	5
25 A	35	17.5	3.0t×25	36	50	M10×30	M10×30	5
40 A	50	25	3.0t×25	43	58	M10×30	M10×30	5
50 A	62	31	3.0t×25	50	65	M10×30	M10×30	5
80 A	90	45	4.0t×32	68	88	M12×35	M12×35	8
100 A	116	58	4.0t×32	82	105	M12×35	M12×35	8
150 A	166	83	4.0t×38	105	125	M12×35	M12×40	10
200 A	217	108.5	4.0t×38	131	150	M12×35	M12×40	10

**Band B**

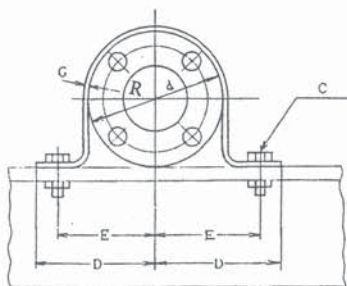


Dimensions of d, R and G are given in the above table.

**Band B dimension table**

	Dimensions mm				
	I	J	H	C	E
20 A	8	5	45	M10×40	22
25 A	8	5	50	M10×45	25
40 A	10	10	60	M10×50	33
50 A	10	15	65	M10×50	39
80 A	15	25	80	M12×55	56
100 A	15	30	90	M12×60	69
150 A	15	30	115	M12×85	94
200 A	15	30	140	M12×110	120

**Band D**



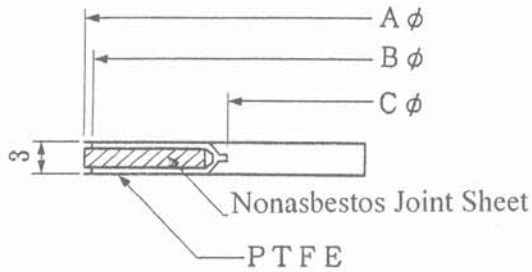
**Band D dimension table (For ANSI 150 LB FLANGE TYPE)**

	Dimensions mm					
	d	R	G	E	D	C
20 A	98	49	3.0t×32	70	85	M10×30
25 A	108	54	3.0t×32	74	90	M10×30
40 A	127	63.5	3.0t×32	84	100	M10×30
50 A	152	76	3.0t×32	96	110	M10×30
80 A	190	95	4.0t×38	120	140	M12×35
100 A	229	114.5	4.0t×38	140	160	M12×35
150 A	279	139.5	4.0t×44	165	185	M12×35
200 A	343	171.5	4.0t×44	200	220	M12×35



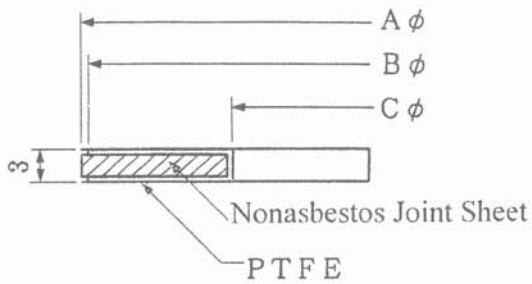
## ■ Gasket Dimension Tables for GL Pipes

### ● AGT Type (ANSI 150LB Type)



AGT Type			
Item number	A	B	C
GL AGT025A	67.5	65	25
GL AGT040A	86.5	84	38
GL AGT050A	104.5	102	50
GL AGT065A	123.5	122	65
GL AGT080A	136.5	134	77
GL AGT100A	174.5	172	103
GL AGT150A	221.5	220	153
GL AGT200A	278.5	276	201

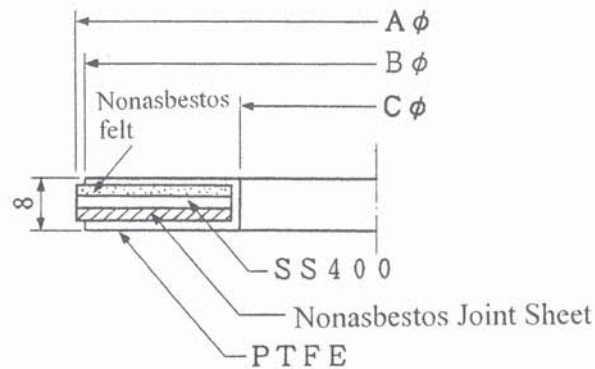
### ● AGK Type (ANSI 150LB Type)



AGK Type			
Item number	A	B	C
GL AGK025A	67.5	65	28
GL AGK040A	86.5	84	41
GL AGK050A	104.5	102	53
GL AGK065A	123.5	122	68
GL AGK080A	136.5	134	80
GL AGK100A	174.5	172	106
GL AGK150A	221.5	220	156
GL AGK200A	278.5	276	204

## ■ Doughnut Gasket

### ● AGD type (ANSI 150LB Type)



AGD Type			
Item number	A	B	C
GL AGD025A	67.5	65	28
GL AGD040A	86.5	84	41
GL AGD050A	104.5	102	52
GL AGD065A	123.5	122	67
GL AGD080A	136.5	134	80
GL AGD100A	174.5	172	104
GL AGD150A	221.5	220	154
GL AGD200A	278.5	276	204



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