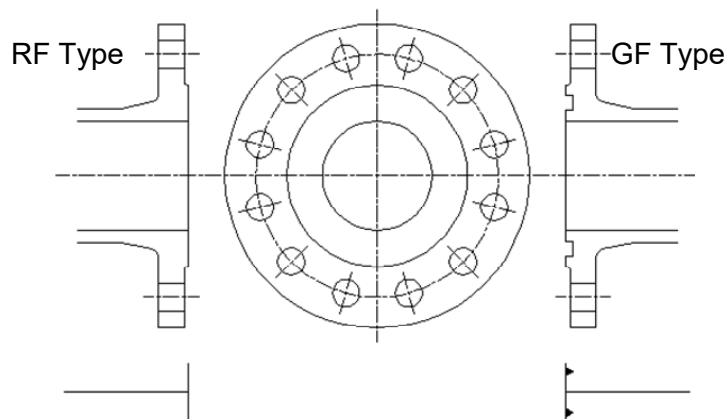
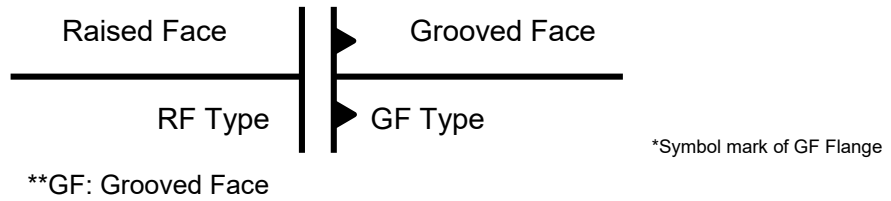


I. General

1. GF Flange

- 1) Denomination      GF 1 Flanged joint (Metal touch type: Both flanges have no gap.)  
                                  GF 2 Flanged joint (Non-metal touch type: Both flanges have a gap.)

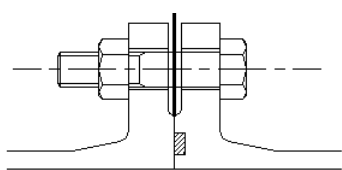
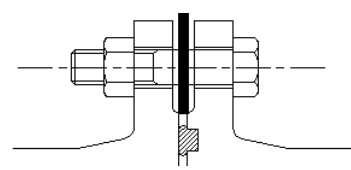


- 2) Nominal Size      2in. to 104in. (Hereinafter called DN2" to DN104")

2. Joint Structure and Pressure Class

1) Joint Structure

Table 1      Joint Structure

Item/Type	GF 1 Metal touch	GF 2 Non-metal touch
Pairing of flanges	RF – GF	RF – GF
Gasket Type	GF 1: O-Ring Type	GF 2: O-Ring Type
Gasket shape	cross-sectional shape Semicircular shape	cross-sectional shape Horseshoe shape
Joint Structure	Flange gap: None or very small  RF Type      GF Type	Flange gap: Keep some gap  RF Type      GF Type

2) Pressure Class

Table 2 Pressure Class of GF Flange

Pressure Class		Applicable Size
7.5K (kgf/cm <sup>2</sup> )	100psi	3" – 104"
10K (kgf/cm <sup>2</sup> )	140psi	2" – 104"
16K (kgf/cm <sup>2</sup> )	220psi	3" – 60"
20K (kgf/cm <sup>2</sup> )	280psi	3" – 36"

\*To convert kgf/cm<sup>2</sup> to psi, multiply by 14.2.

\*\*Conversion to psi is shown as equivalent pressure.

\*\*\*Pressure class larger than 300psi shall be manufactured thru consultation between a manufacturer and user at each time.

3) Material of accessories

- |                            |  |
|----------------------------|--|
| (1) Rubber gasket          | SBR (CR, NBR, EPDM)                                      |
| (2) Hexagonal bolt and nut | Rolled steel for general structural use, Stainless steel |

## II. Jointing Procedure

Assemble GF Flange joint strictly in accordance with this manual. To ensure the assembled joint, it is recommended to check the joint conditions with "Joint check sheet".

### 1. Jointing of GF 1 Flange

#### 1.1 Checking of joint accessories and tools

Be sure to check joint accessories and tools.

#### 1.2 Cleaning

Remove all foreign materials such as sand, mud, gravel, and paint flakes.

Be sure that flange faces, rubber gasket, bolts, and nuts are clean before assembly.

**⚠ CAUTION:** Joint with foreign materials results in a leak, as well as unclean rubber gasket.

#### 1.3 Attachment of rubber gasket

Attach the GF 1 rubber gasket in the groove on the GF flange face.

Cyanoacrylate adhesive may be used at 4-6 points in the groove if the rubber gasket is hard to keep in the groove.

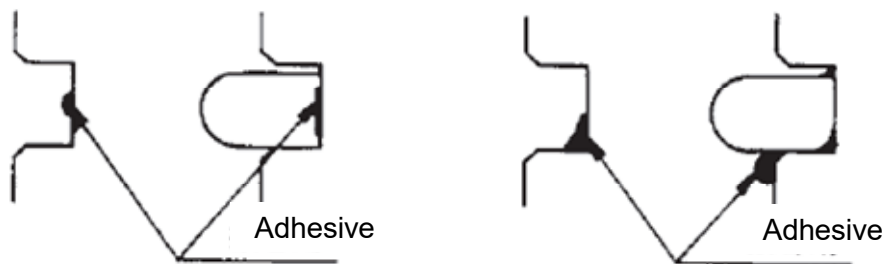


Figure 1-1 How to use adhesive in the groove

**⚠ CAUTION:** Be sure that the rubber gasket is securely set in the groove without any kink or dislocation. Kink or dislocation of the rubber gasket results in a leak.

**⚠ CAUTION:** Follow the instruction of cyanoacrylate adhesive.

**⚠ CAUTION:** Do not substitute vinyl acetate based adhesive and synthetic rubber adhesive for cyanoacrylate adhesive. Using these adhesives deteriorate a rubber gasket and may result in a leak.

**⚠ CAUTION:** Be sure to select the correct type and size of the rubber gasket. Incorrect selection results in a leak.

## 1.3.1 Size 2"-18"

Attach the GF 1 rubber gasket in the groove on the GF flange face.

The outside of the gasket and the outside of the groove are attached all around.

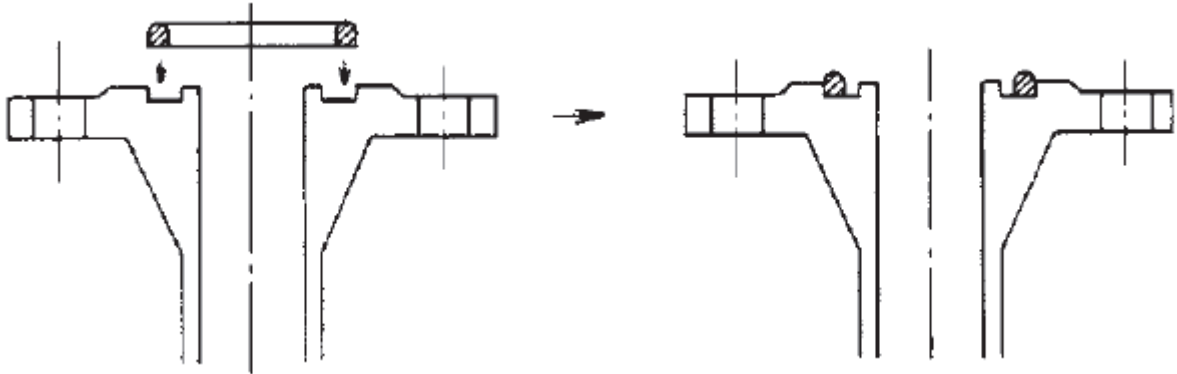
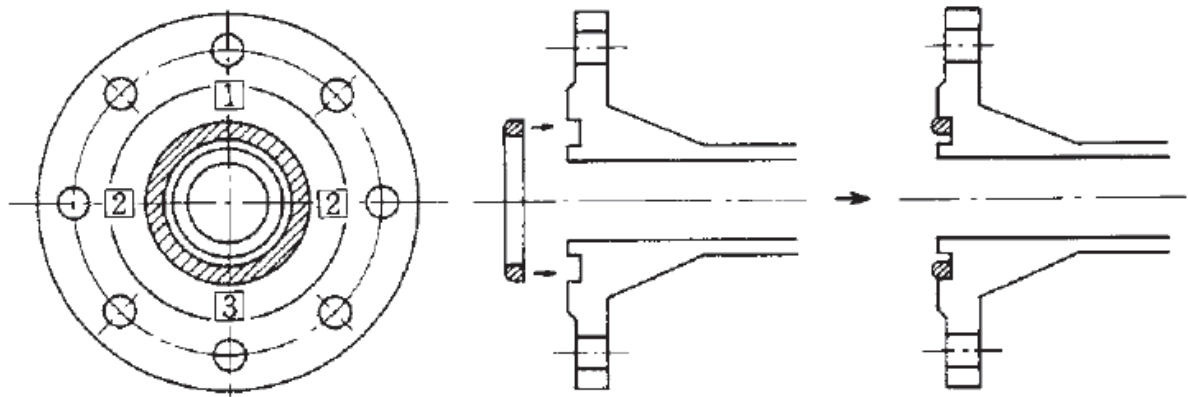


Figure 1-2 Vertical attachment



Attach the rubber gasket in the order of ①, ②, and ③.

Figure 1-3 Horizontal attachment

## 1.3.2 Size 20"-104"

Stretch the GF 1 rubber gasket evenly all around. Attach the gasket in the groove. The inside of the gasket and the inside of the groove are attached all around.

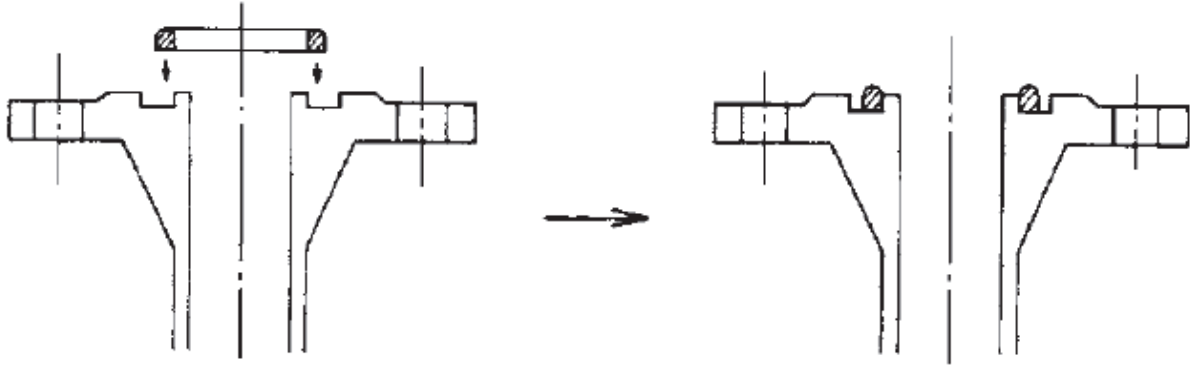
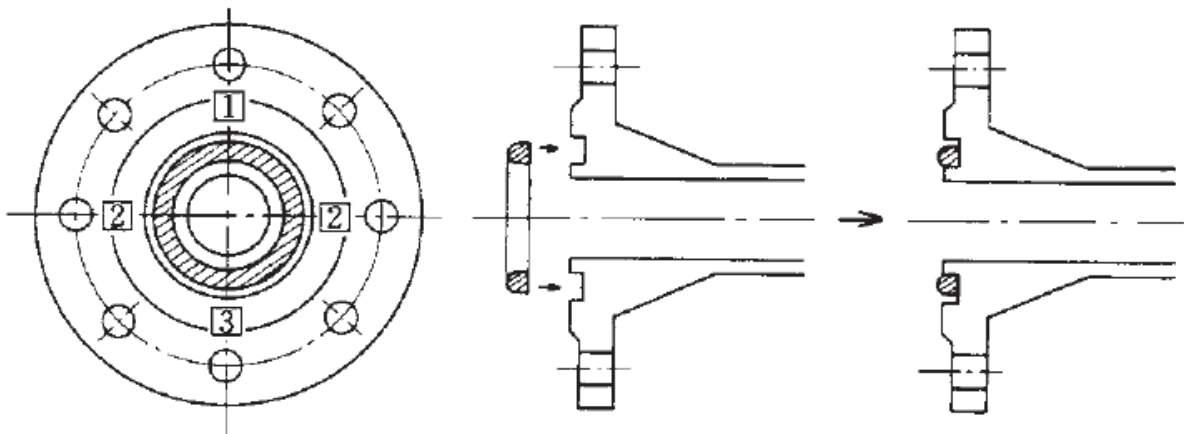


Figure 1-4 Vertical attachment



Attach the rubber gasket in the order of **1**, **2**, and **3**.

Figure 1-5 Horizontal attachment

Size 28" or larger size has 4 white marks in the diagonal direction on the rubber gasket and the flange face. Be sure to match and align each of the white marks for balanced installation of the rubber gasket.

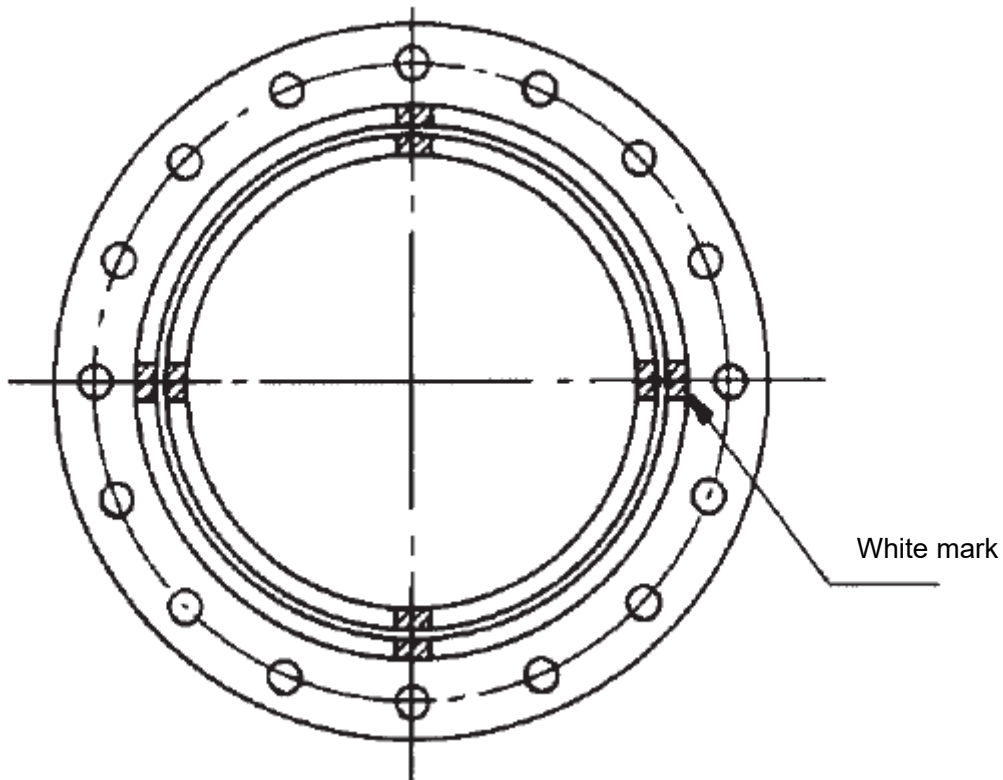


Figure 1-6 White marks on the flange face

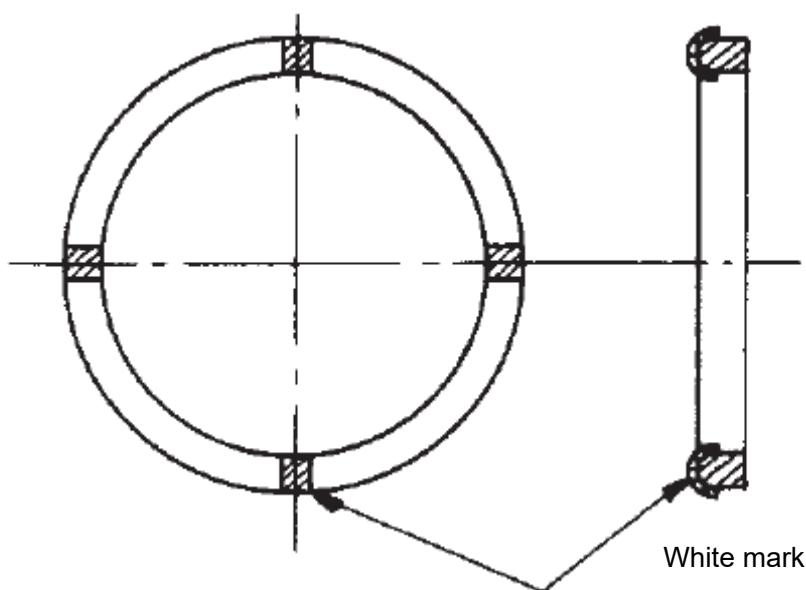


Figure 1-7 White marks on the rubber gasket

#### 1.4 Mating of the flanges

Place all bolts and nuts. Mate the flanges uniformly all around.

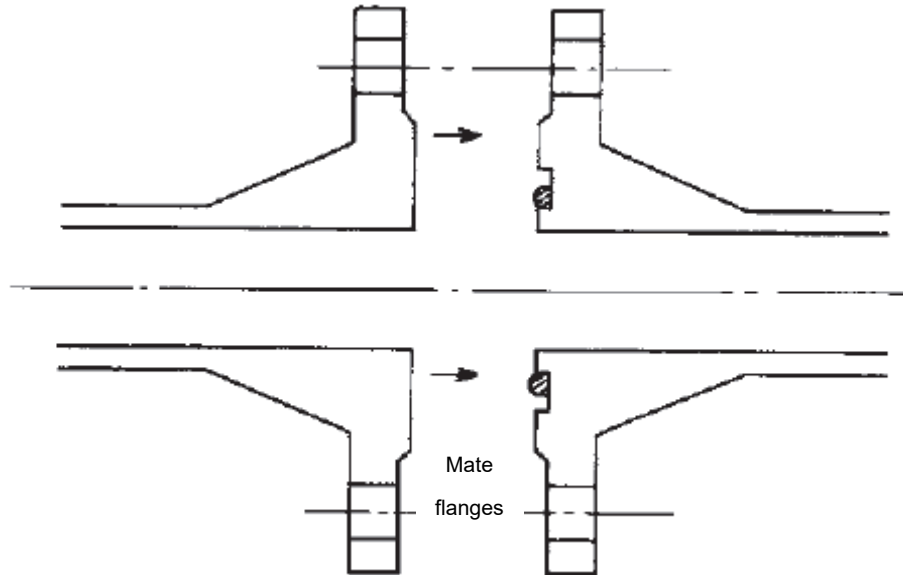







Figure 1-8 Mating of the flanges

 CAUTION: Use a lead rope when lowering pipe in a trench to avoid damaging the pipe from hitting a beam, a wale, and existing pipe.

 CAUTION: Cover a wire with a rubber tube to protect the paint of pipe from a scratch.

 CAUTION: If the paint is damaged, use the repair paint for ductile iron pipe. Do not leave the damage of the paint to prevent the corrosion from rust.

 CAUTION: Check a combination of the flange types and pressure class when mating the flanges. Incorrect combination of the flanges may result in a leak.

 CAUTION: Do not reuse the rubber gasket of disassembly. This may result in a leak.

### 1.5 Pre-bolting

Tighten all bolts alternately by paying attention to a position of the rubber gasket and bolt holes. Keep the same distance between the flange faces. Repeat the process until the flange faces are close to touch. At this point, the flange faces are not touching yet. (Refer to Figure 1-9.)

**⚠ CAUTION:** Do not tighten bolts partially. Unbalanced bolting may result in a leak.

### 1.6 Finish bolting

Tighten every other bolt by skipping one bolt forward and going backward until all bolts are tightened by this way. Repeat the same process until all bolts are close to the approximate torque and there is no gap between the flange faces. In large sizes (20"-104"), five or more repetitions may be required. Use a torque wrench to finish bolting. Be sure that torque is more than 45 ft·lbf (60N·m). This process shall only be repeated one time by the same manner as tightening bolts. (Refer to Figure 1-10.)

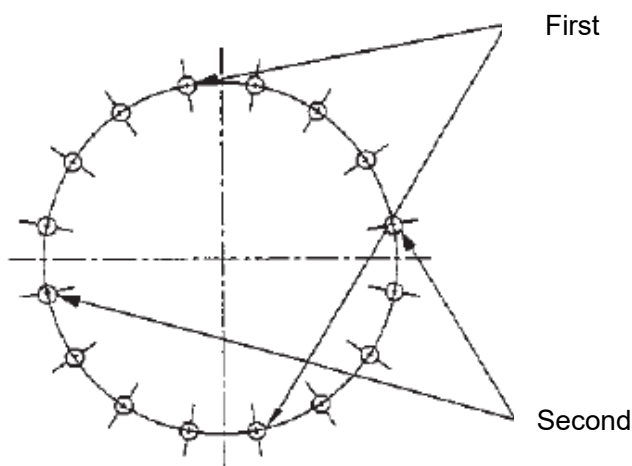


Figure 1-9 Pre-bolting

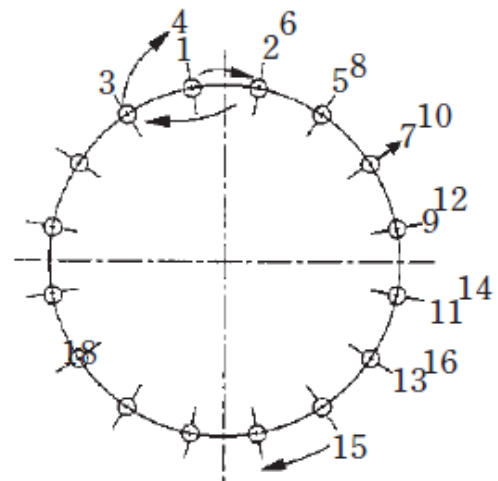


Figure 1-10 Bolting method

### 1.7 Checking of joint

Insert a thickness gauge (1/16 in.) between the flange faces at four spots evenly spaced on the circumference of the flanges. Check the gap and confirm that there is no gap larger than 1/16" at these four checking spots and at the same time all bolts are tightened by larger than 45 ft·lbf (60N·m).



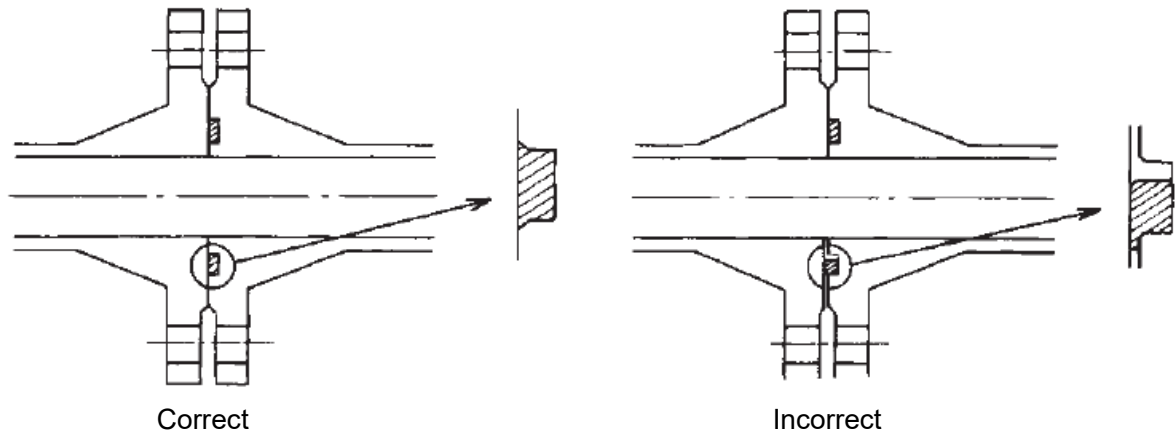




Figure 1-11 Correct position of the rubber gasket

 CAUTION: Be sure that the torque wrench is inspected and calibrated.

 CAUTION: If the rubber gasket is rolled between the flange faces, which results in a leak, disassemble the joint and do the same jointing procedure (The rubber gasket must be replaced to the new one.).

### 1.8 Joint check sheet

Filling out a joint check sheet is recommended for quality control of assembly. Fill out the joint check sheet at every time after completing assembly. The sample sheets may be provided.

## 2. Jointing of GF 2 Flange

### 2.1 Checking of joint accessories and tools

Be sure to check joint accessories and tools.

### 2.2 Cleaning

Remove all foreign materials such as sand, mud, gravel, and paint flakes.

Be sure that flange faces, rubber gasket, bolts, and nuts are clean before assembly.

**⚠ CAUTION:** Joint with foreign materials results in a leak, as well as unclean rubber gasket.

### 2.3 Attachment of rubber gasket

#### 2.3.1 Attach the GF 2 rubber gasket in the groove on the GF flange face.

Cyanoacrylate adhesive may be used at 4-6 points in the groove if the rubber gasket is hard to keep in the groove.

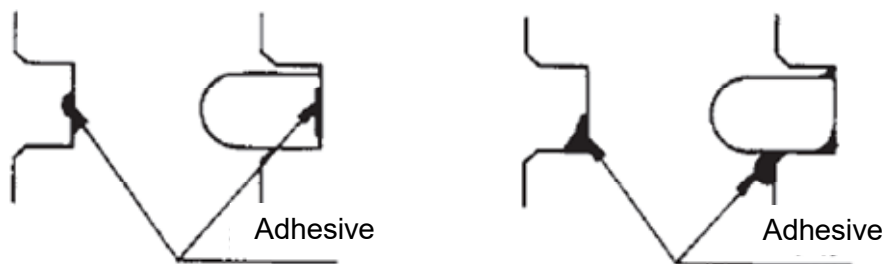


Figure 2-1 How to use adhesive in the groove

2.3.2 Attach the GF 2 rubber gasket in the groove on the GF flange face.

The inside of the gasket and the inside of the groove are attached all around.

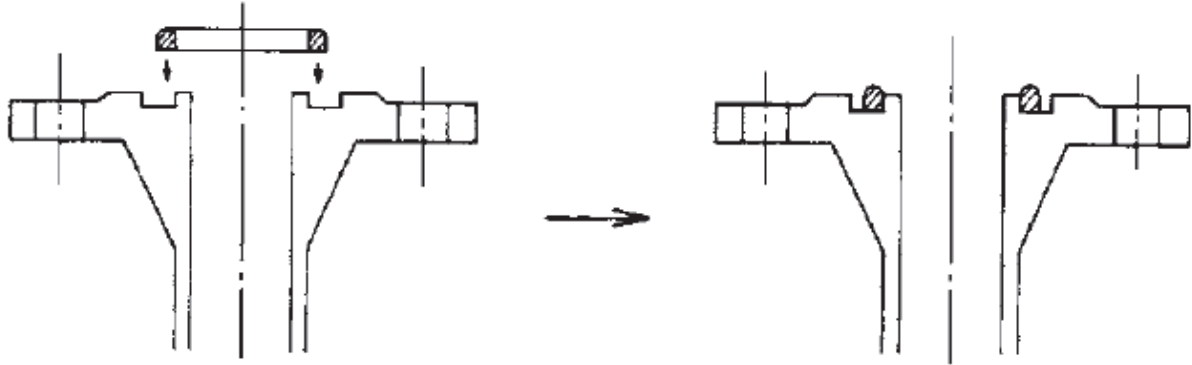
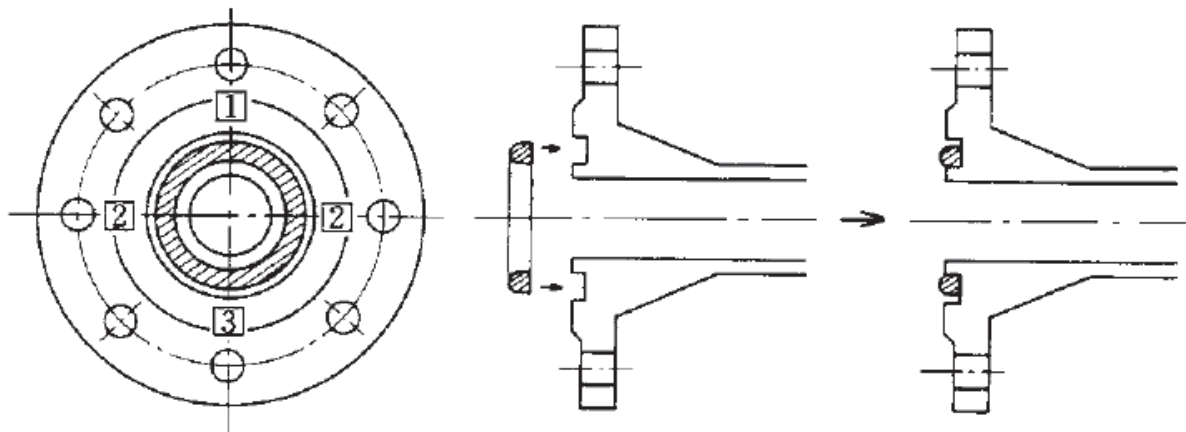


Figure 2-2 Vertical attachment



Attach the rubber gasket in the order of 1, 2, and 3.

Figure 2-3 Horizontal attachment

2.3.3 Size 28" or larger size has 4 white marks in the diagonal direction on the rubber gasket and the flange face. Be sure to match and align each of the white marks for balanced installation of the rubber gasket.

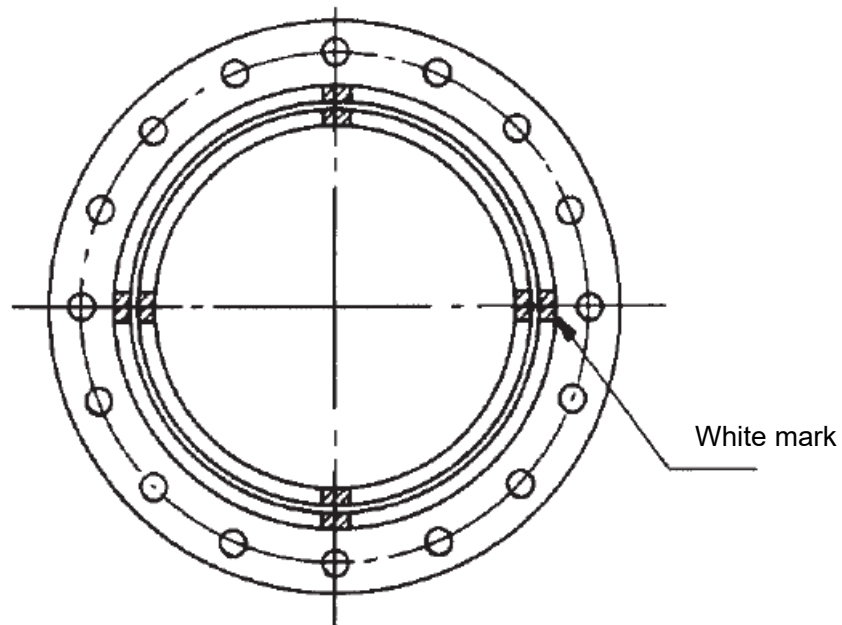


Figure 2-4 White marks on the flange face

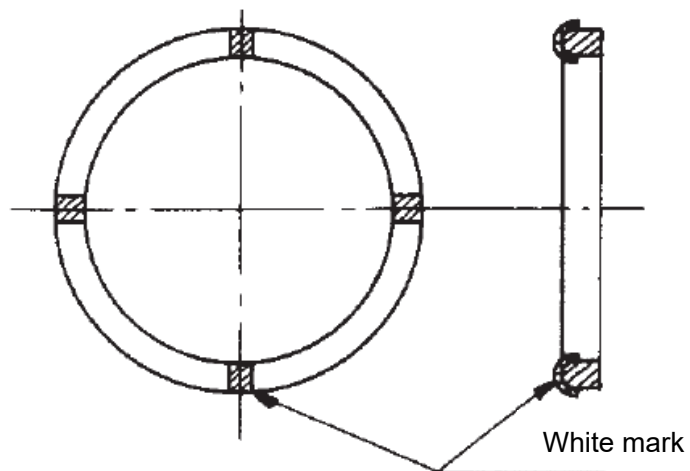


Figure 2-5 White marks on the rubber gasket



CAUTION: Be sure that the rubber gasket is securely set in the groove without any kink or dislocation. Kink or dislocation of the rubber gasket results in a leak.



CAUTION: Follow the instruction of cyanoacrylate adhesive.



CAUTION: Do not substitute vinyl acetate based adhesive and synthetic rubber adhesive for cyanoacrylate adhesive. Using these adhesives deteriorate a rubber gasket and may result in a leak.

**⚠ CAUTION:** Be sure to select the correct type and size of the rubber gasket. Incorrect selection results in a leak.

#### 2.4 Mating of the flanges

Place all bolts and nuts. Mate the flanges uniformly all around.

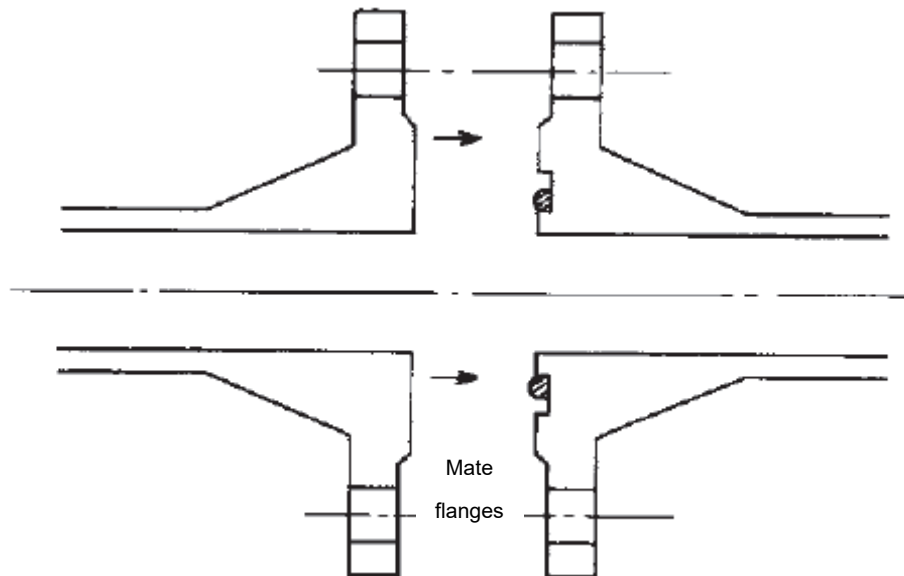


Figure 2-6 Mating of the flanges

**⚠ CAUTION:** Use a lead rope when lowering pipe in a trench to avoid damaging the pipe from hitting a beam, a wale, and existing pipe.

**⚠ CAUTION:** Cover a wire with a rubber tube to protect the paint of pipe from a scratch.

**⚠ CAUTION:** If the paint is damaged, use the repair paint for ductile iron pipe. Do not leave the damage of the paint to prevent the corrosion from rust.

**⚠ CAUTION:** Check a combination of the flange types and pressure class when mating the flanges. Incorrect combination of the flanges may result in a leak.

**⚠ CAUTION:** Do not reuse the rubber gasket of disassembly. This may result in a leak.

### 2.5 Pre-bolting

Tighten all bolts alternately by paying attention to a position of the rubber gasket and bolt holes. Keep the same distance between the flange faces. Repeat the process until the flange faces are close to the standard range of flange gap. (Refer to Figure 2-7.)

**⚠ CAUTION:** Do not tighten bolts partially. Unbalanced bolting may result in a leak.

### 2.6 Finish bolting

Tighten every other bolt by skipping one bolt forward and going backward until all bolts are tightened by this way. Repeat the same process until the flange gap is within the standard range. In large sizes (20"-104"), five or more repetitions may be required. (Refer to Figure 2-8.)

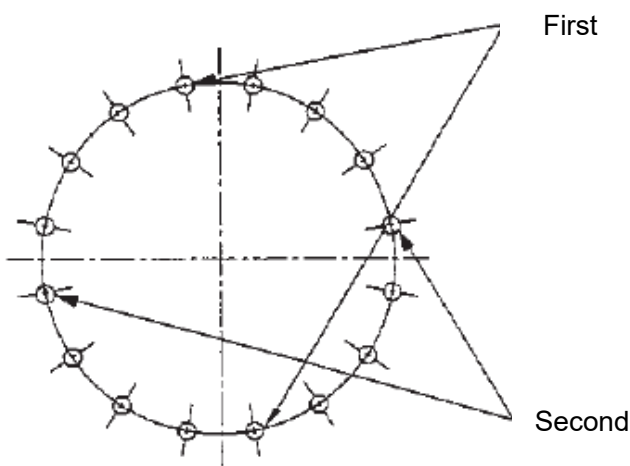


Figure 2-7 Pre-bolting

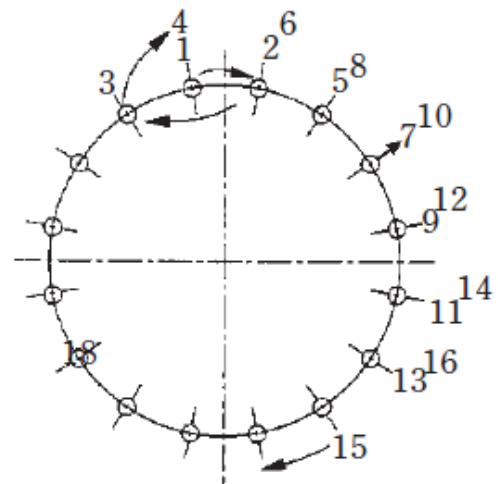


Figure 2-8 Bolting method

Table 3 Standard range of flange gap (Non-metal touch)

Size	Standard range of flange gap	
	Minimum gap	Maximum gap
3"-36"	1/8 in.	3/16 in.
40"-60"	3/16 in.	1/4 in.
64"-96"	1/4 in.	5/16 in.
104"	5/16 in.	3/8 in.

\* Standard range of flange gap is defined as dimension "X" in the Figure 2-9.

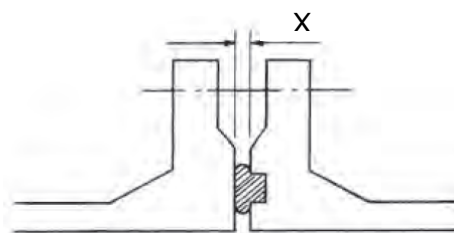


Figure 2-9 Standard range of flange gap "X"

### 2.7 Checking of joint

Insert a gap gauge (1/8 in. – 3/8 in.) between the flange faces at four spots evenly spaced on the circumference of the flanges. Check the gap and confirm that each of the gaps is within the standard range at these four checking spots and at the same time all bolts are securely tightened, not loose.

Table 4 How to check the gap using the gap gauge

Judgement	Standard range of flange gap	
	Minimum gap gauge	Maximum gap gauge
Good	Insertable	Not insertable
Bad	Not insertable	-
Bad	Insertable	Insertable

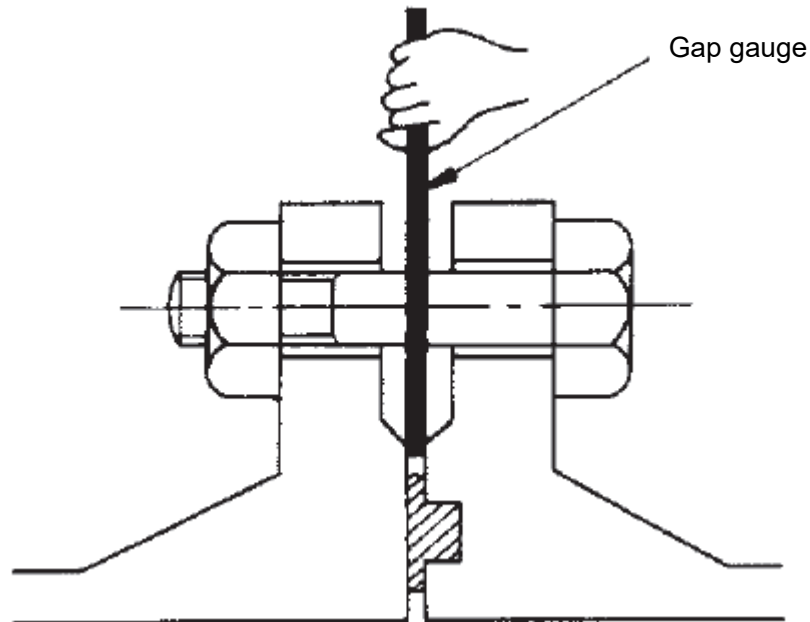


Figure 2-10 How to check the gap (Non- metal touch)

### 2.8 Joint check sheet

Filling out a joint check sheet is recommended for quality control of assembly. Fill out the joint check sheet at every time after completing assembly. The sample sheets may be provided.