

# GASKETS

## Engineering Data/FAQs

### Bolting & Flange Information

The gasket's function is to seal two different surfaces held together by one of several means, the most common being screw-threaded devices such as bolts. Sometimes the fastener itself must be sealed, as in the case of a steel drum bung.

The bolt is a spring. It is an elastic member that has been stretched to develop a load. The more spring provided by the bolt, the better the retention of stress on the gasket to maintain a leak proof joint. It must not be over-elongated (over-strained), or the elastic limit of the steel will be exceeded. The bolt then deforms and, with continued loading (stressing), may rupture.

To avoid such problems with bolt tightening, the use of a torque wrench is recommended. Reference Table 2 shows the loadings achieved under various torques. The equipment designer normally specifies the torque required for a product. This ensures that the maximum available load is applied consistently to the gasket. The load will be better retained by using a bolt with a longer grip, thereby ensuring a leak proof joint.

There are limits on the degree of flange surface imperfection that can be sealed successfully with a gasket. Large nicks, dents, or gouges must be avoided, since a gasket cannot properly seal against them. The surface finish of a flange is described as follows:

1. Roughness - Roughness is read in millionths of an inch (or meter) as the average of the peaks and valleys measured from a midline of the flange surface. This is expressed either as rms (root mean square) or AA (arithmetic average). The difference between these two methods of reading is so small that they may be used interchangeably. Roughness is also expressed as AARH (arithmetic average roughness height).
2. Lay - Lay is the direction of the predominant surface-roughness pattern. Example: multidirectional, phonographic spiral serrations, etc.
3. Waviness - Waviness is measured in thousandths or fractions of an inch. Basically, it is the departure from overall flatness.

Typical roughness readings can be from 125 to 500 micro-inches for serrated flanges and 125-250 micro-inches for non-serrated flanges. Fine finishes, such as polished surfaces, should be avoided. Adequate "bite" in the surface is required to develop enough friction to prevent the gasket from being blown out or from extruding or creeping excessively.

The lay of the finish should follow the midline of the gasket. For example, concentric circles on a round flange, or a phonographic spiral. Every effort should be made to avoid lines across the face, such as linear surface grinding, which at 180° points will cross the seal area at right angles to the gasket, allowing a direct leak path.

Waviness is seldom a problem under normal conditions. There are two areas that must be watched, however, since excessive waviness is very difficult to handle.

The first area is glass-lined equipment where the natural flow of the fused glass creates extreme waviness. Often the answer here is to use thick and highly compressible gasketing.

The second area of concern is warped flanges. If warpage is caused by heat or internal stresses, re-machining is generally sufficient. However, warpage due to excessive bolt loads or insufficient flange thickness results in what is generally called bowing. See Figure 1.

The solution is to redesign for greater flange rigidity. Sometimes backer plates can be added to strengthen the design without replacing the parts. Another step would be to add more bolts. When this is done, usually smaller bolt diameters are possible, thus adding more bolt stretch and better joint performance.

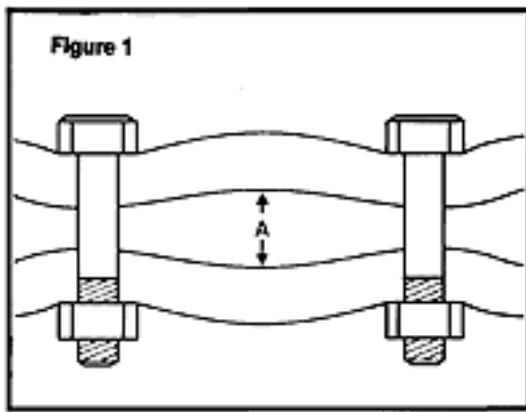
**WARNING:**

Properties applications shown here are typical. Your specific application should not be undertaken without independent study and evaluation for suitability. For specific application recommendations consult Garlock. Failure to select the proper sealing products could result in property damage and/or serious personal injury.

This performance data has been developed from field testing, customer field reports and/or in-house testing. While the utmost care has been used in compiling this information, we assume no responsibility for errors. Specifications subject to change without notice. This edition cancels all previous issues. Subject to change without notice.

## Before Installation

- Remove old gasket, and clean flange surface of all debris. For best results, use a metal flange scraper, an aerosol gasket remover and a wire brush, then inspect the flange for damage. Be sure surface finish and flatness are satisfactory.
- Use the thinnest possible gasket. However, flanges that are warped, bowed or severely pitted require thicker gaskets.
- Whenever possible, use ring gaskets. Full face gaskets have more surface area, requiring additional compressive load on the gasket.
- Use dry anti-seize, rather than wet. Talc is best, while graphite and mica are also acceptable. Never use metal-based anti-seize, since particles may accumulate in the surface imperfections, thereby creating a flange surface that is too smooth to be effective.

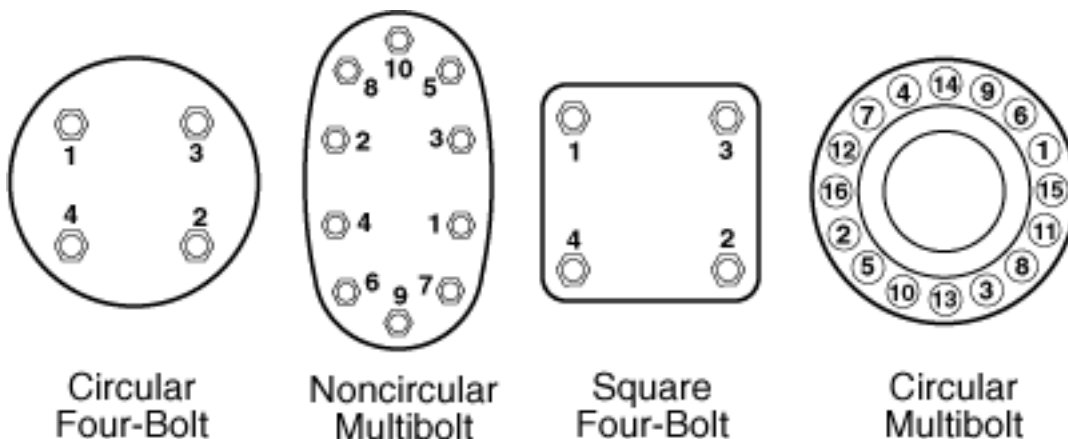


*Bowing of flanges because of excessive bolt load or insufficient flange thickness.*

## Installation

- Center the gasket on the flange. This is extremely vital where raised faces are involved. Note: standard ANSI ring gaskets, when cut properly, should center themselves with the bolts in place.
- Use a torque wrench and well-lubricated fasteners with hardened flat washers to ensure correct initial loading.
- Tighten bolts to compress gasket uniformly. This means going from side to side around the joint, in a star-like crossing pattern. See Figure 1.
- All bolts should be tightened in one-third increments, according to proper bolting patterns.
- Retorque 12 to 24 hours after start-up, whenever possible. All applicable safety standards including lockout/tagout procedure should be observed.
- Never use liquid or metallic based anti-stick or lubricating compounds on the gaskets. Premature failure could occur as a result.

## Correct Bolting Patterns



Circular  
Four-Bolt

Noncircular  
Multibolt

Square  
Four-Bolt

Circular  
Multibolt

**Bolt torque values for ASME B 16.5 Class 150#  
RF Flanges with A193GrB7 Bolts**  
for compressed sheet, GYLON® and GRAPH-LOCK® gaskets

Nom. Pipe Size (Inches)	No. of Bolts	Size of Bolts (Inches)	Internal Pressure (psig)	Minimum Torque (ft.-lbs)	Preferred Torque ft.-lbs.
0.50	4	0.50	300	9	28
0.75	4	0.50	300	13	40
1.00	4	0.50	300	17	53
1.25	4	0.50	300	26	60
1.50	4	0.50	300	35	60
2.00	4	0.63	300	69	120
2.50	4	0.63	300	81	120
3.00	4	0.63	300	119	120
3.50	8	0.63	300	66	120
4.00	8	0.63	300	84	120
5.00	8	0.75	300	117	200
6.00	8	0.75	300	148	200
8.00	8	0.75	300	200	200
10.00	12	0.88	300	188	320
12.00	12	0.88	300	250	320
14.00	12	1.00	300	317	490
16.00	16	1.00	300	301	490
18.00	16	1.13	300	448	710
20.00	20	1.13	300	395	710
24.00	20	1.25	300	563	1000

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**Bolt torque values for ASME B 16.5 Class 300#  
RF Flanges with A193GrB7 Bolts**  
for compressed sheet, GYLON® and GRAPH-LOCK® gaskets

Nom. Pipe Size (Inches)	No. of Bolts	Size of Bolts (Inches)	Internal Pressure (psig)	Minimum Torque (Ft.Lbs.)	Preferred Torque Ft.Lbs.
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0.50	4	0.50	800	12	28
0.75	4	0.63	800	21	51
1.00	4	0.63	800	28	67
1.25	4	0.63	800	43	102
1.50	4	0.75	800	64	151
2.00	8	0.63	800	46	108
2.50	8	0.75	800	60	141
3.00	8	0.75	800	88	200
3.50	8	0.75	800	99	200
4.00	8	0.75	800	125	200
5.00	8	0.75	800	156	200
6.00	12	0.75	800	131	200
8.00	12	0.88	800	205	320
10.00	16	1.00	800	219	490
12.00	16	1.13	800	319	710
14.00	20	1.13	800	287	652
16.00	20	1.25	800	401	912
18.00	24	1.25	800	439	1,000
20.00	24	1.25	800	484	1,000
24.00	24	1.50	800	662	1,552

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