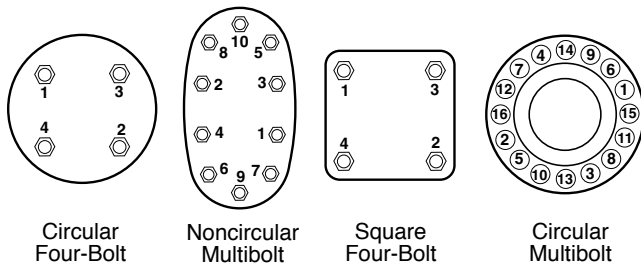


## Before Installation

- » Remove old gasket, and clean flange surface of all debris. For best results, use a soft metal flange scraper, an aerosol gasket remover and a soft 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.
- » It is best to install gaskets as received. On compressed fiber gaskets, if additional release agents are needed, dry is better than wet. 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.



## Installation

- » Center the gasket on the flange. This is extremely vital where raised faces are involved.
  - NOTE: Standard ANSI ring gaskets, when properly cut, should center themselves when the bolts are in place.
- » Fasteners must be new or "as new" condition
- » Use of a torque wrench and well-lubricated fasteners with hardened flat washers is essential 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 diagrams on left.
- » Starting with all fasteners "snug", 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.

## Gasket Assembly Stress Recommendations

The minimum recommended assembly stress for Garlock compressed sheet such as BLUE-GARD®, GYLON® and GRAPH-LOCK® products differs from "M" and "Y" values. "M" and "Y" do not take factors such as flange condition and blowout resistance into account. Garlock offers the following minimum assembly stresses as rules of thumb for calculating installation bolt torques.

| Operating Pressure<br>in psig (bar) | Minimum Assembly Stress Recommended<br>psi (N/mm <sup>2</sup> ) |                        |                       |
|-------------------------------------|-----------------------------------------------------------------|------------------------|-----------------------|
|                                     | 1/32" (0.8mm)<br>Thick                                          | 1/16" (1.6mm)<br>Thick | 1/8" (3.2mm)<br>Thick |
| Up to 300 (21)                      | 2,500 (17)                                                      | 3,600 (25)             | 4,800 (33)            |
| Up to 800 (55)                      | 4,800 (33)                                                      | 5,400 (37)             | 6,400 (44)            |
| Up to 2,000 (140)                   | 7,400 (51)                                                      | 8,400 (58)             | 9,400 (65)            |

### FLAT FACE FLANGES

Minimum recommended gasket stress for GYLON® and Compressed Fiber gaskets in full face/flat faced flanges can be much lower. Stresses in the range of 1000 to 2000 psi are usually acceptable for liquid services. Please contact Applications Engineering when using these materials as full face gaskets in flat faced flanges, especially when dealing with gaseous media.

Maximum recommended compressive stress for:

- » Compressed fiber and GYLON® gaskets = 15,000 psi
- » Multi-Swell™ Style 3760 = 10,000 psi
- » GRAPH-LOCK® gaskets = 10,000 psi

Recommended compressive stress for:

- » STRESS SAVER® gaskets = 600 - 1,200 psi
- » Rubber gaskets to 60 duro = 600 - 900 psi
- » Rubber gaskets to 70 duro and higher = 600 - 1,200 psi

\* Maximum stresses assume standard ASME serrated flanges at 125-250 micro-inch flange finish.

### WARNING:

The failure to select the proper sealing product for your application can result in property damage and/or serious personal injury. You should not purchase or use any of the products identified in this brochure without undertaking a thorough, independent study, and obtaining an evaluation of your particular application by qualified professionals. The descriptions of the products contained in this brochure constitute general guidelines as to product selection and installation and may not be appropriate for your particular project.

The performance data and metrics contained in this brochure are not specification min/max limits, or guarantees of performance, but instead represent typical values that have been established based upon field testing, customer field reports, and/or in-house testing. Actual performance will vary from these values and you should not rely upon these figures in determining the suitability of the use of the product for any particular application.

While the utmost care has been used in compiling this brochure, we assume no responsibility for errors. Specifications subject to change without notice. This edition cancels all previous issues. Subject to change without notice.

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# Torque and Stress Tables

*Bolt Torque Tables for ASME B 16.5 Raised Face Flanges with A 193 Gr B7 Bolts*

## COMPRESSED SHEET\* & GYLON® GASKETS 150# FLANGES

| 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                       | 1,000                       |

## COMPRESSED SHEET\* & GYLON® GASKETS 300# FLANGES

| 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                   | 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                       |

## GRAPH-LOCK® GASKETS 150# FLANGES

| 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                         | 20                          |
| 0.75                    | 4            | 0.50                   | 300                      | 13                        | 27                          |
| 1.00                    | 4            | 0.50                   | 300                      | 17                        | 35                          |
| 1.25                    | 4            | 0.50                   | 300                      | 26                        | 54                          |
| 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                       | 1,000                       |

## GRAPH-LOCK® GASKETS 300# FLANGES

| 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                   | 800                      | 12                        | 20                          |
| 0.75                    | 4            | 0.63                   | 800                      | 21                        | 34                          |
| 1.00                    | 4            | 0.63                   | 800                      | 28                        | 45                          |
| 1.25                    | 4            | 0.63                   | 800                      | 43                        | 68                          |
| 1.50                    | 4            | 0.75                   | 800                      | 64                        | 101                         |
| 2.00                    | 8            | 0.63                   | 800                      | 46                        | 72                          |
| 2.50                    | 8            | 0.75                   | 800                      | 60                        | 94                          |
| 3.00                    | 8            | 0.75                   | 800                      | 88                        | 138                         |
| 3.50                    | 8            | 0.75                   | 800                      | 99                        | 154                         |
| 4.00                    | 8            | 0.75                   | 800                      | 125                       | 196                         |
| 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                       | 341                         |
| 12.00                   | 16           | 1.13                   | 800                      | 319                       | 498                         |
| 14.00                   | 20           | 1.13                   | 800                      | 287                       | 435                         |
| 16.00                   | 20           | 1.25                   | 800                      | 401                       | 608                         |
| 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                       | 1,035                       |

NOTE:

\* Refers to fiber gaskets such as BLUE-GARD®, 9900, etc.

# Torque and Stress Tables

## Bolt Stress to Bolt Torque Conversion Tables

### LOAD ON MACHINE BOLTS AND COLD ROLLED STEEL STUD BOLTS UNDER TORQUE (UNC)

| Nom. Diameter of Bolts (inches) | No. of Threads per inch | Diameter of Root of Thread (inches) | Area at Root of Thread (sq. in.) | Stress            |                            |                   |                            |                   |                            |
|---------------------------------|-------------------------|-------------------------------------|----------------------------------|-------------------|----------------------------|-------------------|----------------------------|-------------------|----------------------------|
|                                 |                         |                                     |                                  | 7,500 psi         |                            | 15,000 psi        |                            | 30,000 psi        |                            |
|                                 |                         |                                     |                                  | Torque (ft. lbs.) | Clamping Force (lbs./bolt) | Torque (ft. lbs.) | Clamping Force (lbs./bolt) | Torque (ft. lbs.) | Clamping Force (lbs./bolt) |
| 1/4                             | 20                      | 0.185                               | 0.027                            | 1                 | 203                        | 2                 | 405                        | 4                 | 810                        |
| 5/16                            | 18                      | 0.240                               | 0.045                            | 2                 | 338                        | 4                 | 675                        | 8                 | 1,350                      |
| 3/8                             | 16                      | 0.294                               | 0.068                            | 3                 | 510                        | 6                 | 1,020                      | 12                | 2,040                      |
| 7/16                            | 14                      | 0.345                               | 0.093                            | 5                 | 698                        | 10                | 1,395                      | 20                | 2,790                      |
| 1/2                             | 13                      | 0.400                               | 0.126                            | 8                 | 945                        | 15                | 1,890                      | 30                | 3,780                      |
| 9/16                            | 12                      | 0.454                               | 0.162                            | 12                | 1,215                      | 23                | 2,430                      | 45                | 4,860                      |
| 5/8                             | 11                      | 0.507                               | 0.202                            | 15                | 1,515                      | 30                | 3,030                      | 60                | 6,060                      |
| 3/4                             | 10                      | 0.620                               | 0.302                            | 25                | 2,265                      | 50                | 4,530                      | 100               | 9,060                      |
| 7/8                             | 9                       | 0.731                               | 0.419                            | 40                | 3,143                      | 80                | 6,285                      | 160               | 12,570                     |
| 1                               | 8                       | 0.838                               | 0.551                            | 62                | 4,133                      | 123               | 8,265                      | 245               | 16,530                     |
| 1-1/8                           | 7                       | 0.939                               | 0.693                            | 98                | 5,190                      | 195               | 10,380                     | 390               | 20,760                     |
| 1-1/4                           | 7                       | 1.064                               | 0.890                            | 137               | 6,675                      | 273               | 13,350                     | 545               | 26,700                     |
| 1-3/8                           | 6                       | 1.158                               | 1.054                            | 183               | 7,905                      | 365               | 15,810                     | 730               | 31,620                     |
| 1-1/2                           | 6                       | 1.283                               | 1.294                            | 219               | 9,705                      | 437               | 19,410                     | 875               | 38,820                     |
| 1-5/8                           | 5.5                     | 1.389                               | 1.515                            | 300               | 11,363                     | 600               | 22,725                     | 1,200             | 45,450                     |
| 1-3/4                           | 5                       | 1.490                               | 1.744                            | 390               | 13,080                     | 775               | 26,160                     | 1,550             | 52,320                     |
| 1-7/8                           | 5                       | 1.615                               | 2.049                            | 525               | 15,368                     | 1,050             | 30,735                     | 2,100             | 61,470                     |
| 2                               | 4.5                     | 1.711                               | 2.300                            | 563               | 17,250                     | 1,125             | 34,500                     | 2,250             | 69,000                     |

### LOAD ON ALLOY STEEL STUD BOLTS UNDER TORQUE (8UN)\*

| Nom. Diameter of Bolts (inches) | No. of Threads per inch | Diameter of Root of Thread (inches) | Area at Root of Thread (sq. in.) | Stress            |                            |                   |                            |                   |                            |
|---------------------------------|-------------------------|-------------------------------------|----------------------------------|-------------------|----------------------------|-------------------|----------------------------|-------------------|----------------------------|
|                                 |                         |                                     |                                  | 30,000 psi        |                            | 45,000 psi        |                            | 60,000 psi        |                            |
|                                 |                         |                                     |                                  | Torque (ft. lbs.) | Clamping Force (lbs./bolt) | Torque (ft. lbs.) | Clamping Force (lbs./bolt) | Torque (ft. lbs.) | Clamping Force (lbs./bolt) |
| 1/4                             | 20                      | 0.185                               | 0.027                            | 4                 | 810                        | 6                 | 1,215                      | 8                 | 1,620                      |
| 5/16                            | 18                      | 0.240                               | 0.045                            | 8                 | 1,350                      | 12                | 2,025                      | 16                | 2,700                      |
| 3/8                             | 16                      | 0.294                               | 0.068                            | 12                | 2,040                      | 18                | 3,060                      | 24                | 4,080                      |
| 7/16                            | 14                      | 0.345                               | 0.093                            | 20                | 2,790                      | 30                | 4,185                      | 40                | 5,580                      |
| 1/2                             | 13                      | 0.400                               | 0.126                            | 30                | 3,780                      | 45                | 5,670                      | 60                | 7,560                      |
| 9/16                            | 12                      | 0.454                               | 0.162                            | 45                | 4,860                      | 68                | 7,290                      | 90                | 9,720                      |
| 5/8                             | 11                      | 0.507                               | 0.202                            | 60                | 6,060                      | 90                | 9,090                      | 120               | 12,120                     |
| 3/4                             | 10                      | 0.620                               | 0.302                            | 100               | 9,060                      | 150               | 13,590                     | 200               | 18,120                     |
| 7/8                             | 9                       | 0.731                               | 0.419                            | 160               | 12,570                     | 240               | 18,855                     | 320               | 25,140                     |
| 1                               | 8                       | 0.838                               | 0.551                            | 245               | 16,530                     | 368               | 24,795                     | 490               | 33,060                     |
| 1-1/8                           | 8                       | 0.963                               | 0.728                            | 355               | 21,840                     | 533               | 32,760                     | 710               | 43,680                     |
| 1-1/4                           | 8                       | 1.088                               | 0.929                            | 500               | 27,870                     | 750               | 41,805                     | 1,000             | 55,740                     |
| 1-3/8                           | 8                       | 1.213                               | 1.155                            | 680               | 34,650                     | 1,020             | 51,975                     | 1,360             | 69,300                     |
| 1-1/2                           | 8                       | 1.338                               | 1.405                            | 800               | 42,150                     | 1,200             | 63,225                     | 1,600             | 84,300                     |
| 1-5/8                           | 8                       | 1.463                               | 1.680                            | 1,100             | 50,400                     | 1,650             | 75,600                     | 2,200             | 100,800                    |
| 1-3/4                           | 8                       | 1.588                               | 1.980                            | 1,500             | 59,400                     | 2,250             | 89,100                     | 3,000             | 118,800                    |
| 1-7/8                           | 8                       | 1.713                               | 2.304                            | 2,000             | 69,120                     | 3,000             | 103,680                    | 4,000             | 138,240                    |
| 2                               | 8                       | 1.838                               | 2.652                            | 2,200             | 79,560                     | 3,300             | 119,340                    | 4,400             | 159,120                    |
| 2-1/4                           | 8                       | 2.088                               | 3.423                            | 3,180             | 102,690                    | 4,770             | 154,035                    | 6,360             | 205,380                    |
| 2-1/2                           | 8                       | 2.338                               | 4.292                            | 4,400             | 128,760                    | 6,600             | 193,140                    | 8,800             | 257,520                    |
| 2-3/4                           | 8                       | 2.588                               | 5.259                            | 5,920             | 157,770                    | 8,800             | 236,655                    | 11,840            | 315,540                    |
| 3                               | 8                       | 2.838                               | 6.324                            | 7,720             | 189,720                    | 11,580            | 284,580                    | 15,440            | 379,440                    |

These tables are for reference only. See torque tables for recommended installation torques. Values shown in these tables are based on steel bolting that has been well-lubricated with heavy graphite and oil mixture. Research has shown that a non-lubricated bolt has about 50% of the efficiency of a well-lubricated bolt. It has been further found that different lubricants produce results varying between the limit of 50% and 100% of the tabulated stress figures.

\* 8UN (8 thread series) is the standard for ASTM A193 B7, A193 B8, B8M and A320 bolts and studs

# Torque and Stress Tables

Available Gasket Stress vs. Bolt Stress

## 150# FLAT FACE FLANGES

| Nom. Pipe Size (inches) | Number of Bolts | Size of Bolts (inches) | Bolt Stress            |                     |                        |                     |                        |                     | Minimum Recommended Assembly Stress Compressed Fiber & GYLON® |                   |                  |
|-------------------------|-----------------|------------------------|------------------------|---------------------|------------------------|---------------------|------------------------|---------------------|---------------------------------------------------------------|-------------------|------------------|
|                         |                 |                        | 30,000 psi             |                     | 60,000 psi             |                     | 75,000 psi             |                     | 1/32" Thick (psi)                                             | 1/16" Thick (psi) | 1/8" Thick (psi) |
|                         |                 |                        | Bolt Torque (ft. lbs.) | Gasket Stress (psi) | Bolt Torque (ft. lbs.) | Gasket Stress (psi) | Bolt Torque (ft. lbs.) | Gasket Stress (psi) |                                                               |                   |                  |
| 0.5                     | 4               | 0.50                   | 30                     | 1,929               | 60                     | 3,857               | 75                     | 4,821               | 2,500                                                         | 3,600             | 4,800            |
| 0.75                    | 4               | 0.50                   | 30                     | 1,557               | 60                     | 3,114               | 75                     | 3,893               | 2,500                                                         | 3,600             | 4,800            |
| 1                       | 4               | 0.50                   | 30                     | 1,302               | 60                     | 2,605               | 75                     | 3,256               | 2,500                                                         | 3,600             | 4,800            |
| 1.25                    | 4               | 0.50                   | 30                     | 1,125               | 60                     | 2,250               | 75                     | 2,813               | 2,500                                                         | 3,600             | 4,800            |
| 1.5                     | 4               | 0.50                   | 30                     | 973                 | 60                     | 1,946               | 75                     | 2,432               | 2,500                                                         | 3,600             | 4,800            |
| 2                       | 4               | 0.63                   | 60                     | 1,100               | 120                    | 2,201               | 150                    | 2,751               | 2,500                                                         | 3,600             | 4,800            |
| 2.5                     | 4               | 0.63                   | 60                     | 803                 | 120                    | 1,606               | 150                    | 2,008               | 2,500                                                         | 3,600             | 4,800            |
| 3                       | 4               | 0.63                   | 60                     | 740                 | 120                    | 1,479               | 150                    | 1,849               | 2,500                                                         | 3,600             | 4,800            |
| 3.5                     | 8               | 0.63                   | 60                     | 1,194               | 120                    | 2,388               | 150                    | 2,985               | 2,500                                                         | 3,600             | 4,800            |
| 4                       | 8               | 0.63                   | 60                     | 1,099               | 120                    | 2,197               | 150                    | 2,746               | 2,500                                                         | 3,600             | 4,800            |
| 5                       | 8               | 0.75                   | 100                    | 1,466               | 200                    | 2,931               | 250                    | 3,664               | 2,500                                                         | 3,600             | 4,800            |
| 6                       | 8               | 0.75                   | 100                    | 1,299               | 200                    | 2,598               | 250                    | 3,247               | 2,500                                                         | 3,600             | 4,800            |
| 8                       | 8               | 0.75                   | 100                    | 906                 | 200                    | 1,813               | 250                    | 2,266               | 2,500                                                         | 3,600             | 4,800            |
| 10                      | 12              | 0.88                   | 160                    | 1,497               | 320                    | 2,993               | 400                    | 3,742               | 2,500                                                         | 3,600             | 4,800            |
| 12                      | 12              | 0.88                   | 160                    | 1,031               | 320                    | 2,062               | 400                    | 2,577               | 2,500                                                         | 3,600             | 4,800            |
| 14                      | 12              | 1.00                   | 245                    | 1,099               | 490                    | 2,198               | 613                    | 2,748               | 2,500                                                         | 3,600             | 4,800            |
| 16                      | 16              | 1.00                   | 245                    | 1,220               | 490                    | 2,440               | 613                    | 3,050               | 2,500                                                         | 3,600             | 4,800            |
| 18                      | 16              | 1.13                   | 355                    | 1,613               | 710                    | 3,226               | 888                    | 4,033               | 2,500                                                         | 3,600             | 4,800            |
| 20                      | 20              | 1.13                   | 355                    | 1,713               | 710                    | 3,425               | 888                    | 4,282               | 2,500                                                         | 3,600             | 4,800            |
| 24                      | 20              | 1.25                   | 500                    | 1,730               | 1,000                  | 3,460               | 1,250                  | 4,326               | 2,500                                                         | 3,600             | 4,800            |
| 26                      | 24              | 1.25                   | 500                    | 1,886               | 1,000                  | 3,771               | 1,250                  | 4,714               | -                                                             | 4,049             | 5,249            |
| 28                      | 28              | 1.25                   | 500                    | 2,006               | 1,000                  | 4,012               | 1,250                  | 5,015               | -                                                             | 4,075             | 5,275            |
| 30                      | 28              | 1.25                   | 500                    | 1,811               | 1,000                  | 3,622               | 1,250                  | 4,528               | -                                                             | 4,092             | 5,292            |
| 32                      | 28              | 1.50                   | 800                    | 2,329               | 1,600                  | 4,659               | 2,000                  | 5,823               | -                                                             | 4,076             | 5,276            |
| 34                      | 32              | 1.50                   | 800                    | 2,550               | 1,600                  | 5,099               | 2,000                  | 6,374               | -                                                             | 4,115             | 5,315            |
| 36                      | 32              | 1.50                   | 800                    | 2,335               | 1,600                  | 4,670               | 2,000                  | 5,838               | -                                                             | 4,129             | 5,329            |
| 38                      | 32              | 1.50                   | 800                    | 2,025               | 1,600                  | 4,050               | 2,000                  | 5,063               | -                                                             | 4,111             | 5,311            |
| 40                      | 36              | 1.50                   | 800                    | 2,194               | 1,600                  | 4,389               | 2,000                  | 5,486               | -                                                             | 4,145             | 5,345            |
| 42                      | 36              | 1.50                   | 800                    | 2,034               | 1,600                  | 4,068               | 2,000                  | 5,085               | -                                                             | 4,157             | 5,357            |
| 44                      | 40              | 1.50                   | 800                    | 2,124               | 1,600                  | 4,247               | 2,000                  | 5,309               | -                                                             | 4,175             | 5,375            |
| 46                      | 40              | 1.50                   | 800                    | 2,033               | 1,600                  | 4,066               | 2,000                  | 5,083               | -                                                             | 4,201             | 5,401            |
| 48                      | 44              | 1.50                   | 800                    | 2,108               | 1,600                  | 4,217               | 2,000                  | 5,271               | -                                                             | 4,217             | 5,417            |
| 50                      | 44              | 1.75                   | 1,500                  | 2,873               | 3,000                  | 5,746               | 3,750                  | 7,182               | -                                                             | 4,247             | 5,447            |
| 52                      | 44              | 1.75                   | 1,500                  | 2,690               | 3,000                  | 5,379               | 3,750                  | 6,724               | -                                                             | 4,256             | 5,456            |
| 54                      | 44              | 1.75                   | 1,500                  | 2,525               | 3,000                  | 5,050               | 3,750                  | 6,313               | -                                                             | 4,264             | 5,464            |
| 56                      | 48              | 1.75                   | 1,500                  | 2,553               | 3,000                  | 5,105               | 3,750                  | 6,381               | -                                                             | 4,262             | 5,462            |
| 58                      | 48              | 1.75                   | 1,500                  | 2,406               | 3,000                  | 4,812               | 3,750                  | 6,015               | -                                                             | 4,269             | 5,469            |
| 60                      | 52              | 1.75                   | 1,500                  | 2,544               | 3,000                  | 5,089               | 3,750                  | 6,361               | -                                                             | 4,299             | 5,499            |

NOTES:

<sup>1</sup> The values shown are not recommended values. The intent of this table is to illustrate the relationship between bolt torque, bolt stress, gasket stress, and how these three factors relate to the contact area of ASME B16.5 & B16.47 Series A flat face flanges.

<sup>2</sup> Full face gaskets will typically seal at stresses well below the minimum recommended values shown. See also "Flanges" on page 56.

<sup>3</sup> Contact Garlock Applications Engineering at 1.800.448.6688 for further discussions regarding the use of compressed, GYLON® or GRAPH-LOCK® products in flat face flanges.

<sup>4</sup> For full face GYLON®, compressed sheet and GRAPH-LOCK® gasketing, 1,000 to 2,000 psi is normally acceptable for installation for liquid service.

# Torque and Stress Tables

Available Gasket Stress vs. Bolt Stress

## 300# FLAT FACE FLANGES

| Nom. Pipe Size (inches) | Number of Bolts | Size of Bolts (inches) | Bolt Stress            |                     |                        |                     |                        |                     | Minimum Recommended Assembly Stress Compressed Fiber, GRAPH-LOCK® & GYLON® |                   |                  |
|-------------------------|-----------------|------------------------|------------------------|---------------------|------------------------|---------------------|------------------------|---------------------|----------------------------------------------------------------------------|-------------------|------------------|
|                         |                 |                        | 30,000 psi             |                     | 60,000 psi             |                     | 75,000 psi             |                     | 1/32" Thick (psi)                                                          | 1/16" Thick (psi) | 1/8" Thick (psi) |
|                         |                 |                        | Bolt Torque (ft. lbs.) | Gasket Stress (psi) | Bolt Torque (ft. lbs.) | Gasket Stress (psi) | Bolt Torque (ft. lbs.) | Gasket Stress (psi) |                                                                            |                   |                  |
| 0.5                     | 4               | 0.50                   | 30                     | 1,632               | 60                     | 3,264               | 75                     | 4,081               | 4,800                                                                      | 5,400             | 6,400            |
| 0.75                    | 4               | 0.63                   | 60                     | 1,650               | 120                    | 3,300               | 150                    | 4,125               | 4,800                                                                      | 5,400             | 6,400            |
| 1                       | 4               | 0.63                   | 60                     | 1,506               | 120                    | 3,013               | 150                    | 3,766               | 4,800                                                                      | 5,400             | 6,400            |
| 1.25                    | 4               | 0.63                   | 60                     | 1,328               | 120                    | 2,656               | 150                    | 3,319               | 4,800                                                                      | 5,400             | 6,400            |
| 1.5                     | 4               | 0.75                   | 100                    | 1,428               | 200                    | 2,857               | 250                    | 3,571               | 4,800                                                                      | 5,400             | 6,400            |
| 2                       | 8               | 0.63                   | 60                     | 1,924               | 120                    | 3,848               | 150                    | 4,810               | 4,800                                                                      | 5,400             | 6,400            |
| 2.5                     | 8               | 0.75                   | 100                    | 2,124               | 200                    | 4,247               | 250                    | 5,309               | 4,800                                                                      | 5,400             | 6,400            |
| 3                       | 8               | 0.75                   | 100                    | 1,798               | 200                    | 3,597               | 250                    | 4,496               | 4,800                                                                      | 5,400             | 6,400            |
| 3.5                     | 8               | 0.75                   | 100                    | 1,525               | 200                    | 3,051               | 250                    | 3,813               | 4,800                                                                      | 5,400             | 6,400            |
| 4                       | 8               | 0.75                   | 100                    | 1,226               | 200                    | 2,453               | 250                    | 3,066               | 4,800                                                                      | 5,400             | 6,400            |
| 5                       | 8               | 0.75                   | 100                    | 1,099               | 200                    | 2,198               | 250                    | 2,748               | 4,800                                                                      | 5,400             | 6,400            |
| 6                       | 12              | 0.75                   | 100                    | 1,341               | 200                    | 2,682               | 250                    | 3,352               | 4,800                                                                      | 5,400             | 6,400            |
| 8                       | 12              | 0.88                   | 160                    | 1,357               | 320                    | 2,714               | 400                    | 3,393               | 4,800                                                                      | 5,400             | 6,400            |
| 10                      | 16              | 1.00                   | 245                    | 1,928               | 490                    | 3,855               | 613                    | 4,819               | 4,800                                                                      | 5,400             | 6,400            |
| 12                      | 16              | 1.13                   | 355                    | 1,841               | 710                    | 3,682               | 888                    | 4,602               | 4,800                                                                      | 5,400             | 6,400            |
| 14                      | 20              | 1.13                   | 355                    | 1,808               | 710                    | 3,615               | 888                    | 4,519               | 4,800                                                                      | 5,400             | 6,400            |
| 16                      | 20              | 1.25                   | 500                    | 1,924               | 1,000                  | 3,847               | 1,250                  | 4,809               | 4,800                                                                      | 5,400             | 6,400            |
| 18                      | 24              | 1.25                   | 500                    | 2,016               | 1,000                  | 4,031               | 1,250                  | 5,039               | 4,800                                                                      | 5,400             | 6,400            |
| 20                      | 24              | 1.25                   | 500                    | 1,728               | 1,000                  | 3,457               | 1,250                  | 4,321               | 4,800                                                                      | 5,400             | 6,400            |
| 24                      | 24              | 1.50                   | 800                    | 1,909               | 1,600                  | 3,818               | 2,000                  | 4,773               | 5,000                                                                      | 5,600             | 6,400            |
| 26                      | 28              | 1.63                   | 1,100                  | 2,562               | 2,200                  | 5,124               | 2,750                  | 6,405               | -                                                                          | 6,171             | 7,171            |
| 28                      | 28              | 1.63                   | 1,100                  | 2,272               | 2,200                  | 4,544               | 2,750                  | 5,680               | -                                                                          | 6,193             | 7,193            |
| 30                      | 28              | 1.75                   | 1,500                  | 2,491               | 3,000                  | 4,982               | 3,750                  | 6,228               | -                                                                          | 6,247             | 7,247            |
| 32                      | 28              | 1.88                   | 2,000                  | 2,703               | 4,000                  | 5,406               | 5,000                  | 6,758               | -                                                                          | 6,299             | 7,299            |
| 34                      | 28              | 1.88                   | 2,000                  | 2,493               | 4,000                  | 4,987               | 5,000                  | 6,234               | -                                                                          | 6,336             | 7,336            |
| 36                      | 32              | 2.00                   | 2,200                  | 3,058               | 4,400                  | 6,115               | 5,500                  | 7,644               | -                                                                          | 6,378             | 7,378            |
| 38                      | 32              | 1.50                   | 800                    | 2,921               | 1,600                  | 5,841               | 2,000                  | 7,301               | -                                                                          | 7,365             | 8,365            |
| 40                      | 32              | 1.62                   | 1,100                  | 3,026               | 2,200                  | 6,052               | 2,750                  | 7,566               | -                                                                          | 7,286             | 8,286            |
| 42                      | 32              | 1.62                   | 1,100                  | 2,878               | 2,200                  | 5,756               | 2,750                  | 7,194               | -                                                                          | 7,378             | 8,378            |
| 44                      | 32              | 1.75                   | 1,500                  | 3,077               | 3,000                  | 6,155               | 3,750                  | 7,693               | -                                                                          | 7,369             | 8,369            |
| 46                      | 28              | 1.88                   | 2,000                  | 2,800               | 4,000                  | 5,600               | 5,000                  | 7,000               | -                                                                          | 7,323             | 8,323            |
| 48                      | 32              | 1.88                   | 2,000                  | 3,119               | 4,000                  | 6,237               | 5,000                  | 7,796               | -                                                                          | 7,441             | 8,441            |
| 50                      | 32              | 2.00                   | 2,200                  | 3,287               | 4,400                  | 6,574               | 5,500                  | 8,217               | -                                                                          | 7,428             | 8,428            |
| 52                      | 32              | 2.00                   | 2,200                  | 3,156               | 4,400                  | 6,311               | 5,500                  | 7,889               | -                                                                          | 7,506             | 8,506            |
| 54                      | 28              | 2.25                   | 3,180                  | 3,095               | 6,360                  | 6,190               | 7,950                  | 7,737               | -                                                                          | 7,372             | 8,372            |
| 56                      | 28              | 2.25                   | 3,180                  | 2,981               | 6,360                  | 5,963               | 7,950                  | 7,453               | -                                                                          | 7,443             | 8,443            |
| 58                      | 32              | 2.25                   | 3,180                  | 3,346               | 6,360                  | 6,693               | 7,950                  | 8,366               | -                                                                          | 7,552             | 8,552            |
| 60                      | 32              | 2.25                   | 3,180                  | 3,230               | 6,360                  | 6,460               | 7,950                  | 8,075               | -                                                                          | 7,623             | 8,623            |

NOTES:

- <sup>1</sup> The values shown are not recommended values. The intent of this table is to illustrate the relationship between bolt torque, bolt stress, gasket stress, and how these three factors relate to the contact area of ASME B16.5 & B16.47 Series A flat face flanges.
- <sup>2</sup> Full face gaskets will typically seal at stresses well below the minimum recommended values shown. See also "Flanges" on page 56.

- <sup>3</sup> Contact Garlock Applications Engineering at 1.800.448.6688 for further discussions regarding the use of compressed, GYLON® or GRAPH-LOCK® products in flat face flanges.
- <sup>4</sup> For full face GYLON®, compressed sheet and GRAPH-LOCK® gasketing, 1,000 to 2,000 psi is normally acceptable for installation.

# Torque and Stress Tables

## Rubber (Elastomeric) Full Face Gaskets

### ASME B16.5 CLASS 150# FLAT FLANGES WITH A193 GRADE B7 BOLTS

| Nom. Pipe Size<br>(inches) | Number<br>of Bolts | Size of Bolts<br>(inches) | Minimum Torque<br>(ft. lbs.) | <70 Durometer<br>Shore A    | >70 Durometer<br>Shore A |
|----------------------------|--------------------|---------------------------|------------------------------|-----------------------------|--------------------------|
|                            |                    |                           |                              | Preferred Torque (ft. lbs.) | Bolt Torque (ft. lbs.)   |
| 0.5                        | 4                  | 0.50                      | 9                            | 14                          | 19                       |
| 0.75                       | 4                  | 0.50                      | 12                           | 17                          | 23                       |
| 1                          | 4                  | 0.50                      | 14                           | 21                          | 28                       |
| 1.25                       | 4                  | 0.50                      | 16                           | 24                          | 32                       |
| 1.5                        | 4                  | 0.50                      | 19                           | 28                          | 37                       |
| 2                          | 4                  | 0.63                      | 33                           | 49                          | 66                       |
| 2.5                        | 4                  | 0.63                      | 45                           | 67                          | 90                       |
| 3                          | 4                  | 0.63                      | 49                           | 73                          | 97                       |
| 3.5                        | 8                  | 0.63                      | 30                           | 45                          | 60                       |
| 4                          | 8                  | 0.63                      | 33                           | 49                          | 66                       |
| 5                          | 8                  | 0.75                      | 41                           | 61                          | 82                       |
| 6                          | 8                  | 0.75                      | 46                           | 69                          | 92                       |
| 8                          | 8                  | 0.75                      | 66                           | 99                          | 132                      |
| 10                         | 12                 | 0.88                      | 64                           | 96                          | 128                      |
| 12                         | 12                 | 0.88                      | 93                           | 140                         | 186                      |
| 14                         | 12                 | 1.00                      | 134                          | 201                         | 268                      |
| 16                         | 16                 | 1.00                      | 120                          | 181                         | 241                      |
| 18                         | 16                 | 1.13                      | 132                          | 198                         | 264                      |
| 20                         | 20                 | 1.13                      | 124                          | 187                         | 249                      |
| 24                         | 20                 | 1.25                      | 173                          | 260                         | 347                      |

### ASME B16.47 SERIES A CLASS 150# FLAT FLANGES WITH A193 GRADE B7 BOLTS

| Nom. Pipe Size<br>(inches) | Number<br>of Bolts | Size of Bolts<br>(inches) | Minimum Torque<br>(ft. lbs.) | <70 Durometer<br>Shore A    | >70 Durometer<br>Shore A |
|----------------------------|--------------------|---------------------------|------------------------------|-----------------------------|--------------------------|
|                            |                    |                           |                              | Preferred Torque (ft. lbs.) | Bolt Torque (ft. lbs.)   |
| 26                         | 24                 | 1.25                      | 238                          | 238                         | 318                      |
| 28                         | 28                 | 1.25                      | 224                          | 224                         | 299                      |
| 30                         | 28                 | 1.25                      | 248                          | 248                         | 331                      |
| 32                         | 28                 | 1.50                      | 309                          | 309                         | 412                      |
| 34                         | 32                 | 1.50                      | 283                          | 283                         | 377                      |
| 36                         | 32                 | 1.50                      | 309                          | 309                         | 411                      |
| 38                         | 32                 | 1.50                      | 356                          | 356                         | 474                      |
| 40                         | 36                 | 1.50                      | 328                          | 328                         | 438                      |
| 42                         | 36                 | 1.50                      | 354                          | 354                         | 472                      |
| 44                         | 40                 | 1.50                      | 339                          | 339                         | 452                      |
| 46                         | 40                 | 1.50                      | 354                          | 354                         | 473                      |
| 48                         | 44                 | 1.50                      | 342                          | 342                         | 456                      |
| 50                         | 44                 | 1.75                      | 470                          | 470                         | 626                      |
| 52                         | 44                 | 1.75                      | 502                          | 502                         | 669                      |
| 54                         | 44                 | 1.75                      | 535                          | 535                         | 713                      |
| 56                         | 48                 | 1.75                      | 528                          | 528                         | 705                      |
| 58                         | 48                 | 1.75                      | 561                          | 561                         | 747                      |
| 60                         | 52                 | 1.75                      | 530                          | 530                         | 707                      |

NOTES:

- » This torque table applies for 1/16" and 1/8" thick homogeneous elastomeric gaskets. The pressure rating of the material may vary depending on the grade
- » The above mentioned torque values are based on a maximum bolt stress of 60,000 psi. Bolt yield should be at least 80,000 psi
- » This table does not take flange strength into consideration. We recommend consulting the flange manufacturer to confirm the suitability of the above-mentioned values
- » Apply torque in increments. When the gasket extends past the OD of the flange by 1/4" to 3/8", stop tightening