

Description of Bolt Torque Tables

Nominal Pipe Size (in)	Raised Face Contact I.D. (in)	Raised Face Contact O.D. (in)	Gasket Contact Area (sq.in.)	Number Of Bolts	Size of Bolts (in)	Bolt Torque at 60ksi Stress (ft.lbs.)	Comp Force Per Bolt @ 60ksi (psi)	Max. Gasket Stress Avail. (psi)	Internal Pressure (psig)	Min. Rec'd Gasket Stress (psi)	Min. Rec'd Torque/Bolt (ft.lbs.)	Max. Rec'd/Avail. Gasket Stress (psi)	Preferred Torque/Bolt (ft.lbs.)
0.5	0.84	1.38	0.94	4	0.5	60	7560	32134	<300	2500	5	15000	28
0.75	1.06	1.69	1.36	4	0.5	60	7560	22235	<300	2500	7	15000	40
1	1.31	2	1.79	4	0.5	60	7560	16867	<300	2500	9	15000	53
1.25	1.66	2.5	2.74	4	0.5	60	7560	11024	<300	2500	14	11024	60
1.5	1.91	2.88	3.65	4	0.5	60	7560	8291	<300	2500	18	8291	60
2	2.38	3.62	5.84	4	0.63	120	12120	8301	<300	2500	36	8301	120
2.5	2.88	4.12	6.81	4	0.63	120	12120	7115	<300	2500	42	7115	120
3	3.5	5	10.01	4	0.63	120	12120	4844	<300	2500	62	4844	120
Nominal pipe size (inches - actual line size)	Contacted I.D. - inside diameter of the gasket (inches).	Contacted O.D. - outside diameter of the raised face portion of the flange (inches).	Gasket contact area (square inches) as defined by previous columns (1)	Number of bolts used	Size of bolts (inches)	Maximum torque per bolt at 60,000 psi bolt stress (foot pounds). See <i>Load on Stud Bolts Under Torque</i> table in the Engineered Gasketing Products catalog.	Compressive force per bolt at 60,000 psi bolt stress (pounds). See <i>Load on Stud Bolts Under Torque</i> table in the Engineered Gasketing Products catalog.	Maximum gasket compression available (psi). Based on 60,000 psi tensile stress in the bolts. (2)	Internal pressure rating (psig) of the piping system.	Garlock's minimum recommended gasket stress (psi) for GYLON, GRAPH-LOCK and compressed sheet products.	Minimum torque required per bolt (foot pounds) to arrive at the minimum gasket stress shown in the previous column. (3)	Maximum gasket stress recommended or available (psi). Garlock does not recommend exceeding 15,000 psi on GYLON, GRAPH-LOCK or compressed sheet materials. Therefore the maximum compression is based on 15,000 psi gasket stress or 60,000 psi bolt stress:	Maximum (preferred) torque required per bolt (foot pounds) to arrive at the maximum available / recommended gasket stress shown in the previous column. (4)

(1) See sample calculation #1 (2) See sample calculation #2 (3) See sample calculation #3 (4) See sample calculation #4

Garlock Bolt Torque Values for .062" thick Ring Gaskets - ANSI B16.47 Series A Class 150# Flanges

Nominal Pipe Size (in)	Raised Face Contact I.D. (in)	Raised Face Contact O.D. (in)	Gasket Contact Area (sq.in.)	Number Of Bolts	Size of Bolts (in)	Bolt Torque at 60ksi Stress (ft.lbs.)	Comp Force Per Bolt @ 60ksi (lbs.)	Max. Gasket Stress Avail. (psi)	Internal Pressure (psig)	Min. Rec'd Gasket Stress (psi)	Min. Rec'd Torque/Bolt (ft.lbs.)	Max. Rec'd/Avail. Gasket Stress (psi)	Preferred Torque/Bolt (ft.lbs.)
26	26.00	29.50	152.49	24	1.25	1000	55740	8773	<300	4644	529	8773	1000
28	28.00	31.50	163.48	28	1.25	1000	55740	9547	<300	4729	495	9547	1000
30	30.00	33.75	187.66	28	1.25	1000	55740	8317	<300	4729	569	8317	1000
32	32.00	36.00	213.52	28	1.50	1600	84300	11055	<300	4729	684	11055	1600
34	34.00	38.00	226.08	32	1.50	1600	84300	11932	<300	4804	644	11932	1600
36	36.00	40.25	254.39	32	1.50	1600	84300	10604	<300	4800	724	10604	1600
38	38.00	42.25	267.73	32	1.50	1600	84300	10076	<300	4870	773	10076	1600
40	40.00	44.25	281.08	36	1.50	1600	84300	10797	<300	4941	732	10797	1600
42	42.00	47.00	349.33	36	1.50	1600	84300	8688	<300	4789	882	8688	1600
44	44.00	49.00	365.03	40	1.50	1600	84300	9238	<300	4849	840	9238	1600
46	46.00	51.00	380.73	40	1.50	1600	84300	8857	<300	4909	887	8857	1600
48	48.00	53.50	438.23	44	1.50	1600	84300	8464	<300	4838	915	8464	1600
50	50.00	55.50	455.50	44	1.75	3000	118800	11476	<300	4893	1279	11476	3000
52	52.00	57.50	472.77	44	1.75	3000	118800	11057	<300	4947	1342	11057	3000
54	54.00	59.50	490.04	44	1.75	3000	118800	10667	<300	5001	1406	10667	3000
56	56.00	62.00	555.78	48	1.75	3000	118800	10260	<300	4929	1441	10260	3000
58	58.00	64.00	574.62	48	1.75	3000	118800	9924	<300	4979	1505	9924	3000
60	60.00	66.00	593.46	52	1.75	3000	118800	10409	<300	5029	1449	10409	3000

NOTE: The values shown above are based on raised face metallic flanges. For lined and/or non-metallic raised face flanges consult the flange manufacturer to confirm the suitability of the values shown.

¹ The maximum recommended gasket stress on Multi-Swell™ 3760 is 10,000psi.

Garlock Bolt Torque Values for .125" thick Ring Gaskets - ANSI B16.47 Series A Class 150# Flanges

Nominal Pipe Size (in)	Raised Face Contact I.D. (in)	Raised Face Contact O.D. (in)	Gasket Contact Area (sq.in.)	Number Of Bolts	Size of Bolts (in)	Bolt Torque at 60ksi Stress (ft.lbs.)	Comp Force Per Bolt @ 60ksi (lbs.)	Max. Gasket Stress Avail. (psi)	Internal Pressure (psig)	Min. Rec'd Gasket Stress (psi)	Min. Rec'd Torque/Bolt (ft.lbs.)	Max. Rec'd/Avail. Gasket Stress (psi)	Preferred Torque/Bolt (ft.lbs.)
26	26.00	29.50	152.49	24	1.25	1000	55740	8773	<300	5844	666	8773	1000
28	28.00	31.50	163.48	28	1.25	1000	55740	9547	<300	5929	621	9547	1000
30	30.00	33.75	187.66	28	1.25	1000	55740	8317	<300	5929	713	8317	1000
32	32.00	36.00	213.52	28	1.50	1600	84300	11055	<300	5929	858	11055	1600
34	34.00	38.00	226.08	32	1.50	1600	84300	11932	<300	6004	805	11932	1600
36	36.00	40.25	254.39	32	1.50	1600	84300	10604	<300	6000	905	10604	1600
38	38.00	42.25	267.73	32	1.50	1600	84300	10076	<300	6070	964	10076	1600
40	40.00	44.25	281.08	36	1.50	1600	84300	10797	<300	6141	910	10797	1600
42	42.00	47.00	349.33	36	1.50	1600	84300	8688	<300	5989	1103	8688	1600
44	44.00	49.00	365.03	40	1.50	1600	84300	9238	<300	6049	1048	9238	1600
46	46.00	51.00	380.73	40	1.50	1600	84300	8857	<300	6109	1104	8857	1600
48	48.00	53.50	438.23	44	1.50	1600	84300	8464	<300	6038	1141	8464	1600
50	50.00	55.50	455.50	44	1.75	3000	118800	11476	<300	6093	1593	11476	3000
52	52.00	57.50	472.77	44	1.75	3000	118800	11057	<300	6147	1668	11057	3000
54	54.00	59.50	490.04	44	1.75	3000	118800	10667	<300	6201	1744	10667	3000
56	56.00	62.00	555.78	48	1.75	3000	118800	10260	<300	6129	1792	10260	3000
58	58.00	64.00	574.62	48	1.75	3000	118800	9924	<300	6179	1868	9924	3000
60	60.00	66.00	593.46	52	1.75	3000	118800	10409	<300	6229	1795	10409	3000

NOTE: The values shown above are based on raised face metallic flanges. For lined and/or non-metallic raised face flanges consult the flange manufacturer to confirm the suitability of the values shown.

¹ The maximum recommended gasket stress on Multi-Swell™ 3760 is 10,000psi.

Garlock Bolt Torque Values for .062" thick Ring Gaskets - ANSI B16.47 **Series A** Class 300# Flanges

Nominal Pipe Size (in)	Raised Face Contact I.D. (in)	Raised Face Contact O.D. (in)	Gasket Contact Area (sq.in.)	Number Of Bolts	Size of Bolts (in)	Bolt Torque at 60ksi Stress (ft.lbs.)	Comp Force Per Bolt @ 60ksi (lbs.)	Max. Gasket Stress Avail. (psi)	Internal Pressure (psig)	Min. Rec'd Gasket Stress (psi)	Min. Rec'd Torque/Bolt (ft.lbs.)	Max. Rec'd/Avail. Gasket Stress (psi)	Preferred Torque/Bolt (ft.lbs.)
26	26.00	29.50	152.49	28	1.63	2200	100800	18509	<800	6384	759	15000	1783
28	28.00	31.50	163.48	28	1.63	2200	100800	17265	<800	6612	843	15000	1911
30	30.00	33.75	187.66	28	1.75	3000	118800	17725	<800	6612	1119	15000	2539
32	32.00	36.00	213.52	28	1.88	4000	138240	18128	<800	6612	1459	15000	3310
34	34.00	38.00	226.08	28	1.88	4000	138240	17121	<800	6811	1591	15000	3504
36	36.00	40.25	254.39	32	2.00	4400	159120	20016	<800	6799	1495	15000	3297
38	38.00	40.50	154.06	32	1.50	1600	84300	17510	<800	9486	867	15000	1371
40	40.00	42.75	178.64	32	1.63	2200	100800	18057	<800	9225	1124	15000	1828
42	42.00	44.75	187.27	32	1.63	2200	100800	17224	<800	9515	1215	15000	1916
44	44.00	47.00	214.31	32	1.75	3000	118800	17739	<800	9273	1568	15000	2537
46	46.00	49.00	223.73	28	1.88	4000	138240	17301	<800	9540	2206	15000	3468
48	48.00	51.25	253.21	32	1.88	4000	138240	17470	<800	9314	2133	15000	3434
50	50.00	53.50	284.37	32	2.00	4400	138240	15556	<800	9121	2580	15000	4243
52	52.00	55.50	295.36	32	2.00	4400	138240	14977	<800	9349	2747	14977	4400
54	54.00	57.75	328.96	28	2.25	6360	205380	17481	<800	9167	3335	15000	5457
56	56.00	59.75	340.74	28	2.25	6360	205380	16877	<800	9380	3535	15000	5653
58	58.00	62.00	376.80	32	2.25	6360	205380	17442	<800	9207	3357	15000	5470
60	60.00	64.00	389.36	32	2.25	6360	205380	16879	<800	9406	3544	15000	5652

Garlock Bolt Torque Values for .125" thick Ring Gaskets - ANSI B16.47 Series A Class 300# Flanges

Nominal Pipe Size (in)	Raised Face Contact I.D. (in)	Raised Face Contact O.D. (in)	Gasket Contact Area (sq.in.)	Number Of Bolts	Size of Bolts (in)	Bolt Torque at 60ksi Stress (ft.lbs.)	Comp Force Per Bolt @ 60ksi (lbs.)	Max. Gasket Stress Avail. (psi)	Internal Pressure (psig)	Min. Rec'd Gasket Stress (psi)	Min. Rec'd Torque/Bolt (ft.lbs.)	Max. Rec'd/Avail. Gasket Stress (psi)	Preferred Torque/Bolt (ft.lbs.)
26	26.00	29.50	152.49	28	1.63	2200	100800	18509	<800	7584	901	15000	1783
28	28.00	31.50	163.48	28	1.63	2200	100800	17265	<800	7812	995	15000	1911
30	30.00	33.75	187.66	28	1.75	3000	118800	17725	<800	7812	1322	15000	2539
32	32.00	36.00	213.52	28	1.88	4000	138240	18128	<800	7812	1724	15000	3310
34	34.00	38.00	226.08	28	1.88	4000	138240	17121	<800	8011	1872	15000	3504
36	36.00	40.25	254.39	32	2.00	4400	159120	20016	<800	7999	1758	15000	3297
38	38.00	40.50	154.06	32	1.50	1600	84300	17510	<800	10686	976	15000	1371
40	40.00	42.75	178.64	32	1.63	2200	100800	18057	<800	10425	1270	15000	1828
42	42.00	44.75	187.27	32	1.63	2200	100800	17224	<800	10715	1369	15000	1916
44	44.00	47.00	214.31	32	1.75	3000	118800	17739	<800	10473	1771	15000	2537
46	46.00	49.00	223.73	28	1.88	4000	138240	17301	<800	10740	2483	15000	3468
48	48.00	51.25	253.21	32	1.88	4000	138240	17470	<800	10514	2407	15000	3434
50	50.00	53.50	284.37	32	2.00	4400	138240	15556	<800	10321	2919	15000	4243
52	52.00	55.50	295.36	32	2.00	4400	138240	14977	<800	10549	3099	14977	4400
54	54.00	57.75	328.96	28	2.25	6360	205380	17481	<800	10367	3772	15000	5457
56	56.00	59.75	340.74	28	2.25	6360	205380	16877	<800	10580	3987	15000	5653
58	58.00	62.00	376.80	32	2.25	6360	205380	17442	<800	10407	3795	15000	5470
60	60.00	64.00	389.36	32	2.25	6360	205380	16879	<800	10606	3996	15000	5652



To: Distribution
Re: Sample Torque Calculation

From: Applications
Engineering
Date: January 14, 2000

Sample Torque Calculation
(Example based on 3"-150# raised face flanges
and ASTM A193 B7 bolts)

<u>Sample</u>	<u>Calculation</u>
# 1	<p>Gasket Contact Area = Area of the raised face flange – Area of the gasket I.D.</p> $\text{Gasket Contact Area} = \pi (\text{O.D.}^2 - \text{I.D.}^2) \div 4$ $\text{Gasket Contact Area} = \pi (5^2 - 3.5^2) \div 4$ $\text{Gasket Contact Area} = 10.01 \text{ in.}^2$
# 2	<p>Maximum Gasket Compression Available = (# of Bolts) x (Maximum Compressive Force per Bolt) ÷ (Gasket Contact Area).</p> $\text{Max. Gasket Comp. Avail.} = (4 \text{ bolts}) \times (12,120 \text{ lbs/bolt}) \div (10.01 \text{ in.}^2)$ $\text{Max. Gasket Comp. Avail.} = 4,844 \text{ psi}$
# 3	<p>Minimum Torque recommended per Bolt = (Minimum Recommended Gasket Compression) ÷ (Maximum Gasket Compression Available) x (Maximum Torque per Bolt @ 60ksi Bolt Stress)</p> $\text{Minimum Torque recommended per Bolt} = (2,500 \text{ psi}) \div (4,844 \text{ psi}) \times (120 \text{ ft.lbs.})$ $\text{Minimum Torque recommended per Bolt} = 62 \text{ ft.lbs.}$
# 4	<p>Neither 15,000 psi compressive stress on the gasket (crush point) or 60,000 psi bolt stress (60% of bolt yield for a A193 B7 bolt) should be exceeded. The preferred torque is identical to the bolt torque available at 60,000 psi bolt stress unless this value generates a compressive stress on the gasket greater than 15,000 psi. Where this occurs, the preferred torque is calculated as follows:</p> $\text{Preferred Torque} = (15,000 \text{ psi gasket stress}) \div (\text{Maximum Gasket Stress Available}) \times (\text{Bolt Torque Available @ 60 ksi Bolt Stress}).$



Qualification Statement for the use of Garlock Bolt Torque Tables - 150# - 300# Class Flanges with Compressed Sheet, GYLON® or HOCHDRUCK® Style 3128 Ring Gaskets

- These bolt torque tables are only to be used as a general guide. They should not be considered to contain absolute values due to the large number of uncontrollable variables involved with bolted joints.
- The tables were developed to be used with all of our IFG, BLUE-GARD, HTC, G-9900, ST-706, HOCHDRUCK® 3128 and GYLON® Styles.
- All bolt torque values are based upon the use of new nuts (A194 Grade 2H) and new bolts (A193 Grade B7) of proper design, acceptable quality and approved materials of construction as well as metallurgy. It is also required that two hardened steel flat washers be used under each nut and that a lubricant be used on the nuts, bolts and washers, but **not on the gasket.**
- The contact dimensions used to calculate the gasket area are based on the I.D. of the gasket, per ANSI B16.21, and the O.D. of the raised face of the flange.
- The flanges are assumed to be in good condition and in compliance with ANSI B16.5 or B16.47 specifications. Special attention with respect to the seating surface finish and flatness should be given.
- The relationship between the bolt torque values and their transmitted loads is taken from the bolt tables listed in the Engineered Gasketing Products catalog.
- Only torque wrenches that have been calibrated shall be used. The proper bolt tightening pattern must be followed (see Installation Instructions section of the Engineered Gasketing Products catalog for proper bolting pattern) with the desired ultimate torque value arrived at in a minimum of three even increments. All bolts in the flanges should then be checked in consecutive order in a counter-clockwise direction.
- The ring contact dimensions listed are the actual flange raised face dimensions which are different from the ANSI ring gasket dimensions.
- No provisions have been made in these tables to account for vibration effects on the bolts. These tables are not compensated for elevated or fluctuating temperatures, but are based on ambient conditions. If conditions different from these exist, we suggest that further analysis be performed to determine the proper solution.

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