Garlock
SEALING TECHNOLOGIES

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 *Load on Stud Bolts Under Torque* table in the Engineered Gasketing Products catalog.	Compressive force per bolt at 60,000 psi bolt stress (pounds). See *Load on Stud Bolts Under Torque* 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 recommended 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

1/16”

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Garlock Bolt Torque Values for .062" thick Compressed Sheet[1] & GYLON® Ring Gaskets - ANSI B16.5 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.)
0.5	0.84	1.38	0.94	4	0.50	60	7560	32134	<300	3600	7	15000	28
0.75	1.06	1.69	1.36	4	0.50	60	7560	22235	<300	3600	10	15000	40
1	1.31	2.00	1.79	4	0.50	60	7560	16867	<300	3600	13	15000	53
1.25	1.66	2.50	2.74	4	0.50	60	7560	11024	<300	3600	20	11024	60
1.5	1.91	2.88	3.65	4	0.50	60	7560	8291	<300	3600	26	8291	60
2	2.38	3.62	5.84	4	0.63	120	12120	8301	<300	3600	52	8301	120
2.5	2.88	4.12	6.81	4	0.63	120	12120	7115	<300	3600	61	7115	120
3	3.50	5.00	10.01	4	0.63	120	12120	4844	<300	3600	89	4844	120
3.5	4.00	5.50	11.19	8	0.63	120	12120	8668	<300	3600	50	8668	120
4	4.50	6.19	14.18	8	0.63	120	12120	6837	<300	3600	63	6837	120
5	5.56	7.31	17.68	8	0.75	200	18120	8199	<300	3600	88	8199	200
6	6.62	8.50	22.31	8	0.75	200	18120	6496	<300	3600	111	6496	200
8	8.62	10.62	30.21	8	0.75	200	18120	4799	<300	3600	150	4799	200
10	10.75	12.75	36.90	12	0.88	320	25140	8177	<300	3600	141	8177	320
12	12.75	15.00	49.01	12	0.88	320	25140	6155	<300	3600	187	6155	320
14	14.00	16.25	53.43	12	1.00	490	33060	7425	<300	3600	238	7425	490
16	16.00	18.50	67.71	16	1.00	490	33060	7813	<300	3600	226	7813	490
18	18.00	21.00	91.85	16	1.13	710	43680	7609	<300	3600	336	7609	710
20	20.00	23.00	101.27	20	1.13	710	43680	8627	<300	3600	296	8627	710
24	24.00	27.25	130.75	20	1.25	1000	55740	8526	<300	3600	422	8526	1000

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.

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Garlock Bolt Torque Values for .125" thick Compressed Sheet[1] & GYLON® Ring Gaskets - ANSI B16.5 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.)
0.5	0.84	1.38	0.94	4	0.50	60	7560	32134	<300	4800	9	15000	28
0.75	1.06	1.69	1.36	4	0.50	60	7560	22235	<300	4800	13	15000	40
1	1.31	2.00	1.79	4	0.50	60	7560	16867	<300	4800	17	15000	53
1.25	1.66	2.50	2.74	4	0.50	60	7560	11024	<300	4800	26	11024	60
1.5	1.91	2.88	3.65	4	0.50	60	7560	8291	<300	4800	35	8291	60
2	2.38	3.62	5.84	4	0.63	120	12120	8301	<300	4800	69	8301	120
2.5	2.88	4.12	6.81	4	0.63	120	12120	7115	<300	4800	81	7115	120
3	3.50	5.00	10.01	4	0.63	120	12120	4844	<300	4800	119	4844	120
3.5	4.00	5.50	11.19	8	0.63	120	12120	8668	<300	4800	66	8668	120
4	4.50	6.19	14.18	8	0.63	120	12120	6837	<300	4800	84	6837	120
5	5.56	7.31	17.68	8	0.75	200	18120	8199	<300	4800	117	8199	200
6	6.62	8.50	22.31	8	0.75	200	18120	6496	<300	4800	148	6496	200
8	8.62	10.62	30.21	8	0.75	200	18120	4799	<300	4800	200	4799	200
10	10.75	12.75	36.90	12	0.88	320	25140	8177	<300	4800	188	8177	320
12	12.75	15.00	49.01	12	0.88	320	25140	6155	<300	4800	250	6155	320
14	14.00	16.25	53.43	12	1.00	490	33060	7425	<300	4800	317	7425	490
16	16.00	18.50	67.71	16	1.00	490	33060	7813	<300	4800	301	7813	490
18	18.00	21.00	91.85	16	1.13	710	43680	7609	<300	4800	448	7609	710
20	20.00	23.00	101.27	20	1.13	710	43680	8627	<300	4800	395	8627	710
24	24.00	27.25	130.75	20	1.25	1000	55740	8526	<300	4800	563	8526	1000

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.

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To: Distribution

From: Applications Engineering

Re: Sample Torque Calculation

Date: January 14, 2000

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

Sample	Calculation
# 1	**Gasket Contact Area** = Area of the raised face flange – Area of the gasket I.D.
	Gasket Contact Area = π (O.D.^{2} - I.D.^{2}) ÷ 4
	Gasket Contact Area = π (5^2 - 3.5^2) ÷ 4
	Gasket Contact Area = 10.01 in.^{2}
# 2	**Maximum Gasket Compression Available** = (# of Bolts) x (Maximum Compressive Force per Bolt) ÷ (Gasket Contact Area).
	Max. Gasket Comp. Avail. = (4 bolts) x (12,120 lbs/bolt) ÷ (10.01 in.^{2})
	Max. Gasket Comp. Avail. = 4,844 psi
# 3	**Minimum Torque recommended per Bolt** = (Minimum Recommended Gasket Compression) ÷ (Maximum Gasket Compression Available) x (Maximum Torque per Bolt @ 60ksi Bolt Stress)
	Minimum Torque recommended per Bolt = (2,500 psi) ÷ (4,844 psi) x (120 ft.lbs.)
	Minimum Torque recommended per Bolt = 62 ft.lbs.
# 4	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:
	Preferred Torque = (15,000 psi gasket stress) ÷ (Maximum Gasket Stress Available) x (Bolt Torque Available @ 60 ksi Bolt Stress).

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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.

10/01

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