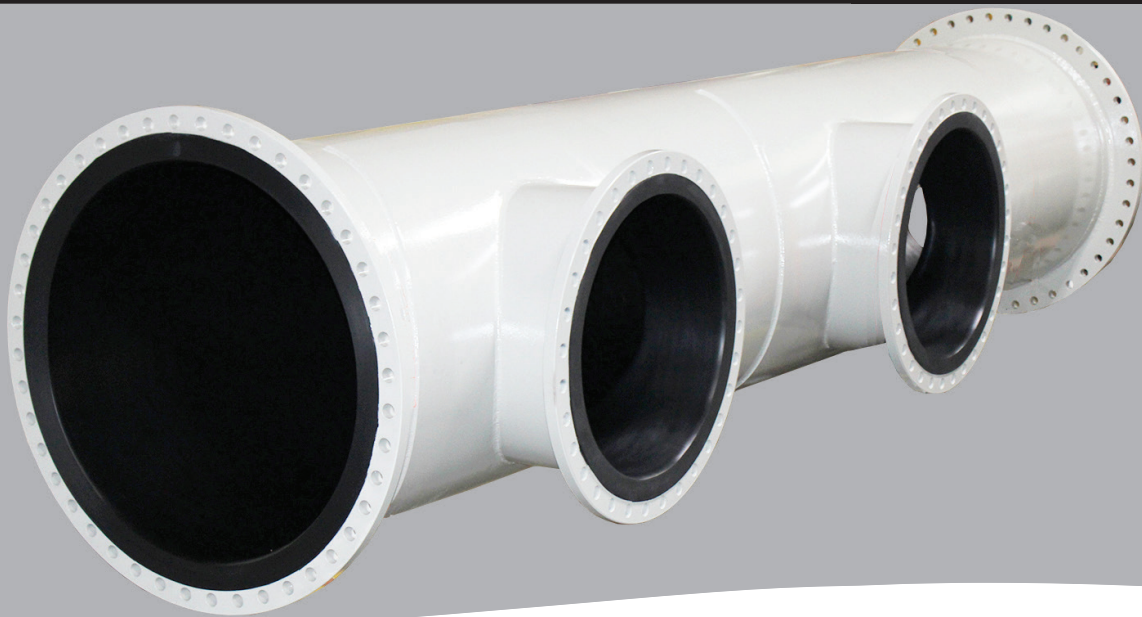




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Installation and Maintenance
Instructions For 1" - 48" Plastic-Lined Piping



Flange Bolt Torquing

Torquing

When assembling flange connections, always use a full complement of clean, new high strength A193-B7 bolting. If using stainless steel bolting, the bolts should be A320/A320M Class 2 B8 (304 SS) or Class 2 B8M (316 SS) with A194/A194M Grade 8 or 8A Nuts (for 304 SS) or Grade 8M or 8MA (for 316 SS). If other bolting materials are used, the end user must ensure that the new bolting material strength properties exceed the calculated bolt stress values to be generated in making the piping connection.

- 1) Always use flat washers on both sides of the connection.
- 2) Tighten the flange bolts with a calibrated torque wrench. The recommended bolt torque values are shown in the tables on next pages. Note: For zinc-plated bolts, or with anti-seize compounds, the torque values will be different. Please contact Resistoflex for more information.
- 3) Tighten the flange bolts with a torque wrench, using a "crisscross" pattern that alternately tightens the bolts located 180 degrees apart.
- 4) Using this pattern, tighten the bolts in 20% increments of the final bolt torque until 80% of final bolt torque has been achieved.
- 5) For tightening to the final torque values, tighten bolts sequentially clockwise once around the flange. This will help ensure that the bolts are evenly stressed.
- 6) Care should be taken to avoid over-torquing, which can cause damage to the plastic sealing surfaces.

When bolting together dissimilar materials, always tighten to the lowest recommended torque of the components in the joint. Using higher torques may cause excessive deformation of the "softer" material in the joint.

Install a 1/2" (12mm) thick spacer between Resistoflex plastic-lined pipe or fittings and other plastic-lined components, if the diameters of the raised plastic faces are different, as is often the case with plastic-lined valves. Spacers should also be used when mating plastic-lined piping to unlined pipe, fittings, valves, pumps, etc.

Belleville washers may be used if properly engineered.

Retorquing

A retorquing should be applied within 24 hours of the initial

torque or after the first thermal cycle. This allows for seating of the plastic and for relaxation of the bolts. If the system is to perform at elevated temperatures, it is recommended that hot water be circulated at the maximum operating temperature of the process (if possible) for a minimum of 24 hours. This allows for the pipe system to experience one thermal cycle. After cool-down, retorquing of the system should be done. Torquing should only be done on the system in the ambient, cooled state, never while the process is at elevated temperature, or excessive force could be applied to the plastic faces. Never disassemble a flange joint in a hot system. Wait until the system has cooled to ambient temperature.

Annual retorquing

Retorquing should be considered at least annually thereafter, especially if the process line experiences elevated temperatures or extreme ambient temperature situations. Torquing should only be done on the system in the ambient, cooled state, never while the process is at elevated temperature or excessive force could be applied to the plastic faces.

NOTES:

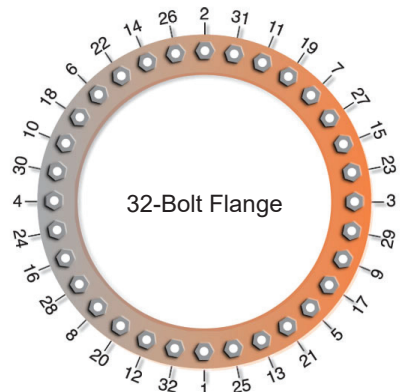
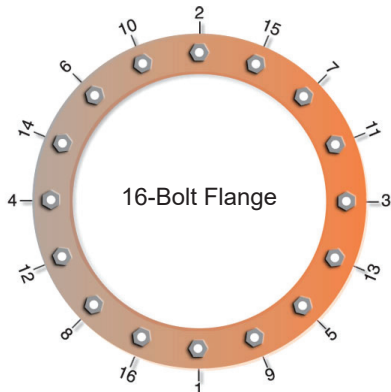
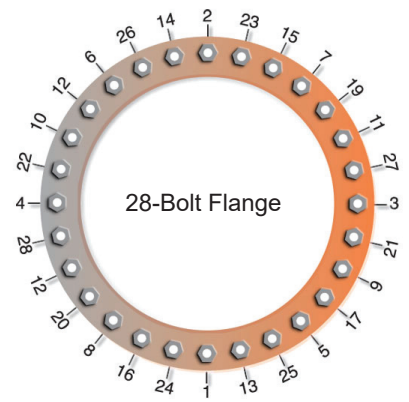
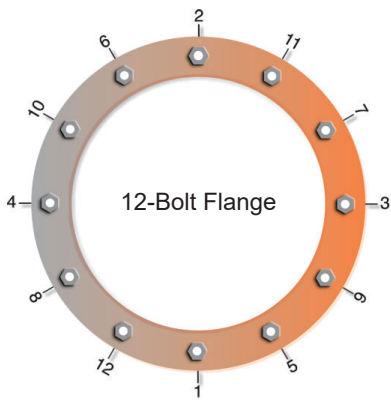
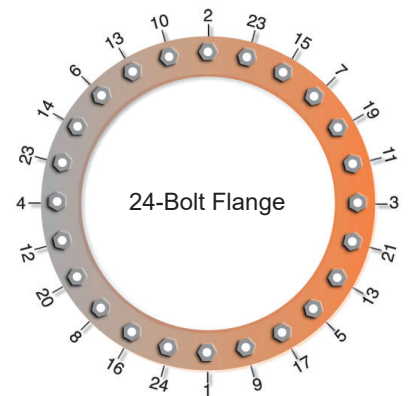
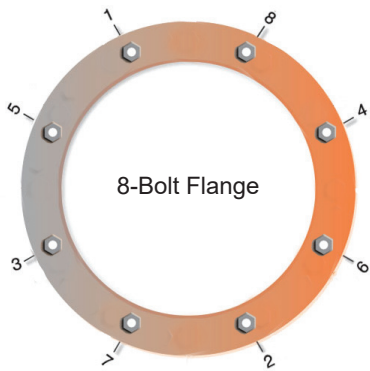
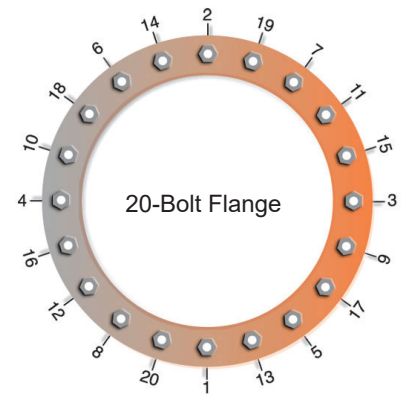
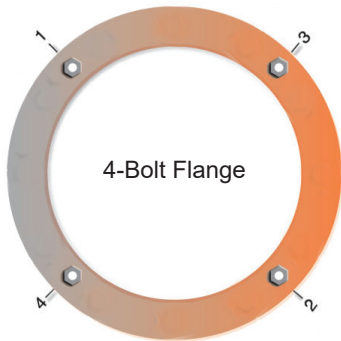
Gaskets: Not required for 1" NPS - 12" NPS lined pipe. For large diameter (>12" NPS) PP, ETFE or HDPE-lined flange connections, gaskets are required for sealability and long term joint performance. These stiff plastic liners have minimal resilience and are sensitive to installer technique and support imperfections. Properly selected and installed gaskets add resilience and can help accommodate for these variables. We do not recommend the use of gaskets that contain non-resilient components such as metal inserts, as these can increase seating stress by concentrating force over a reduced area.

Note: Resistoflex requires the use of flat washers on both flanges.

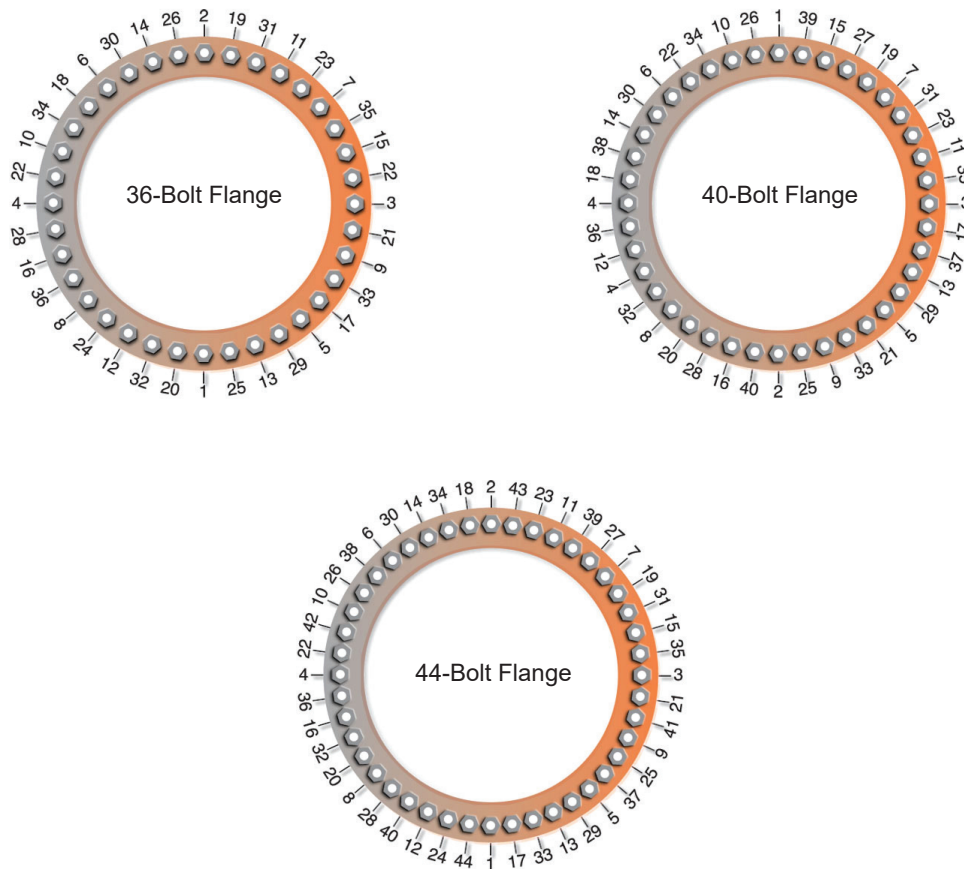
Note: "Lightly Oiled" is considered lubrication with WD-40* or equivalent. Please contact us for guidance on torques for other bolting/lubrication systems, such as zinc-plated bolts, or bolts with anti-seize lubricants. Note: The maximum recommended torque values are suggested for lined systems operating at or near the maximum recommended pressures and temperatures. Systems operating under less severe conditions can, in general, experience leak-free performance using lower torque values. Additionally, when gaskets are used, we suggest comparing the torque values of the plastic-lined piping and the gasket, and using the lower torque value. For systems that will require frequent disassembly, we suggest using the minimum recommended torque value initially to avoid distortion of the plastic face.

*WD-40 is a trademark of WD-40 Company, San Diego, CA USA

Bolting Sequence



Bolting Sequence and Storage / Maintenance



Handling and Storing Plastic-Lined Pipe

To obtain maximum performance from Plastic-Lined Piping Products, it is important that the flared or molded end faces of the plastic are protected from damage during storage, handling and installation. The following should be considered when handling Plastic-Lined Piping Products:

- Store indoors or under cover.
- Never put the lifts of a forklift inside of the pipe to transport. This can damage the plastic liner.
- Never weld on plastic-lined pipe or fittings.
- Protective end caps are not designed for prolonged outdoor exposure.
- Protective end caps on all pipe and fittings should be left in place until the pipe is ready to be installed.
- Do not damage the plastic sealing faces when removing the end caps.
- If end caps are removed for inspection, they must be re-installed with bolting as soon as possible.
- Avoid rough handling of plastic-lined pipe in temperatures below 40°F. Plastic becomes brittle in low temperatures, and is more susceptible to cracking during rough handling.
- Avoid mechanical or thermal shock to piping that is stored in cold temperatures.
- All paint systems have a poor resistance to handling and transit damage. This fact should be considered when evaluating pre-erection shop painting versus in-place painting. If shop painting is selected, touch-up will be required after job-site receipt. Touch-up costs are for Buyer's account.

Torque Values

Class 150 Flanges									
Bolts "Lightly Oiled" (nut factor = 0.20)									
Size		Torque Values ft-lbs per bolt (Nm per bolt)							
		HDPE		PP		ETFE			
NPS	(DN)	Min	Max	Min	Max	Min	Max	Min	Max
1	(25)	3 (5)	5 (7)	13 (19)	17 (24)	17 (24)	21 (29)		
1.5	(40)	8 (11)	11 (16)	31 (43)	41 (56)	41 (56)	50 (69)		
2	(50)	16 (22)	23 (32)	65 (89)	85 (116)	85 (116)	104 (142)		
3	(75)	25 (34)	37 (51)	103 (140)	134 (182)	134 (182)	165 (224)		
4	(100)	16 (22)	24 (33)	68 (92)	88 (120)	88 (120)	108 (147)		
6	(150)	30 (41)	45 (61)	124 (169)	161 (220)	161 (220)	199 (271)		
8	(200)	40 (55)	60 (82)	167 (227)	217 (295)	217 (295)	267 (363)		
10	(250)	38 (52)	57 (77)	157 (214)	204 (279)	204 (279)	252 (343)		
12	(300)	46 (63)	69 (95)	193 (263)	251 (342)	251 (342)	309 (420)		
14	(350)	58 (78)	86 (117)	240 (327)	312 (424)	312 (424)	384 (522)		
16	(400)	52 (71)	78 (107)	218 (297)	283 (386)	283 (386)	349 (474)		
18	(450)	74 (101)	111 (151)	308 (419)	400 (545)	400 (545)	493 (670)		
20	(500)	65 (89)	97 (133)	271 (369)	352 (479)	352 (479)	433 (590)		
24	(600)	90 (122)	135 (183)	374 (509)	486 (662)	486 (662)	598 (814)		
26	(650)	84 (115)	127 (172)	351 (479)	457 (622)	457 (622)	562 (765)		
28	(700)	77 (105)	116 (158)	322 (439)	419 (570)	419 (570)	516 (702)		
30	(750)	86 (117)	129 (175)	359 (488)	466 (635)	466 (635)	574 (781)		
32	(800)	114 (155)	171 (233)	476 (647)	618 (842)	618 (842)	761 (1036)		
34	(850)	106 (144)	158 (215)	440 (599)	572 (778)	572 (778)	704 (958)		
36	(900)	116 (157)	173 (235)	482 (656)	626 (852)	626 (852)	771 (1049)		
38	(950)	121 (165)	182 (247)	506 (689)	658 (895)	658 (895)	810 (1102)		
40	(1000)	113 (154)	170 (231)	472 (642)	613 (835)	613 (835)	755 (1027)		
42	(1050)	131 (178)	196 (267)	546 (743)	709 (965)	709 (965)	873 (1188)		
44	(1100)	123 (167)	185 (251)	513 (698)	666 (907)	666 (907)	820 (1116)		
46	(1150)	128 (175)	193 (262)	535 (729)	696 (947)	696 (947)	857 (1165)		
48	(1200)	128 (175)	193 (262)	535 (729)	696 (947)	696 (947)	857 (1165)		

"Lightly Oiled" is considered lubrication with WD-40* or equivalent.

Consult factory for custom torque table when using anti-seize compound or PTFE-coated bolting.

Pressure Testing

Hydrostatic Test

Resistoflex pipe and fittings can be tested at the pressures recommended by ASME B31.3. The fluid used for the hydrostatic test is typically water. Another suitable non-toxic liquid can be substituted if there is the risk of damage due to the adverse effects of having water in the system. The system should be tested at a pressure not less than 1.5 times the design pressure. If the design temperature is above the test temperature then the required test pressure is calculated by the following equation:

$$P_t = (1.5 PS_t) / S$$

Where:

P_t = minimum hydrostatic test gauge pressure
 P = internal design gauge pressure
 S_t = allowable pipe stress value at test temperature
 S = allowable pipe stress value at design temperature

Typically, for the pressures and temperatures in which plastic-lined pipe is used, the above calculation reduces to:

$$P_t = 1.5 P$$

We recommend that the system be retorqued after the first thermocycle. If the hydrostatic test is performed at the expected operating temperature (a "hot hydrotest") then the hydrotest can constitute the first thermocycle and the recommended retorquing can occur after the pressure test.

Pneumatic Leak Test

This pressure test is performed in some situations where the presence of any water in the system is forbidden. The test is very dangerous due to the stored energy of the compressed gas. ASME B31.3 refers to the dangers of performing this test and provides safety considerations in the standard.

Test procedures should follow the requirements of ASME B31.3 Para 345.8 Sensitive Leak Test.

Alternative Leak Test

If a hydrostatic pressure test is undesirable due to the possible chemical reactions with water and a pneumatic test is undesirable due to the potential hazards, then an alternative leak test can be used. This test is not applicable to plastic lined pipe because it relates to welded systems.

Initial Service Leak Test

This test is applicable only to systems, which meet the following requirements:

- The fluid handled is nonflammable, non-toxic, and not damaging to human tissues.
- The design gauge pressure does not exceed 150 psig (10 bar(g)).
- The design temperature is between -20°F and 366°F (-29°C and 185°C).

In this test, the test fluid is the service fluid. It is rare that this test is used with plastic-lined pipe. ASME B31.3 should be considered if more information concerning this test is required.

The above is a description of some pressure test methods. In general, most systems are hydrostatically tested as described in ASME B31.3. If the hydrostatic test is impractical, then the pneumatic test can be substituted, however, extreme caution must be observed during this potentially hazardous test.



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Per the Pressure Equipment Directive 97/23/EC Essential Safety Requirements Annex I Checklist, the following Essential Requirements are within the customer scope for all products: Wind, Earthquake, Reaction forces and Moments, Fire, Safety devices, permeation, temperature and pressure spikes. For all products, it is recommended that customer remove representative sample for examination of internal corrosion every 2 years.

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