



INSTALLATION GUIDE

Important: If these instructions are not followed while installing tank(s) into your system, we are not responsible for damage that happens due to negligence to these instructions and your warranty will be voided.

- Installer is required to avoid continuous weight on flanges such as pipes, valves, and all accessories. All weight needs to be supported by the ground and not supported by flanges on tank.
- All flanges need to have the full face of the flange gasketed (gasket no less than 3/16" thick) with 80 Duro or less.
- Tank must be insulated from any vibration source using adapters like but not limited to expansion joints.
- Fittings should not be in direct contact with our plastic flange. Washer and lockwasher are required.
- All bolt connections to the tank must be torqued according to the guidelines provided here in this document, set by Plastics Pipe Institute's Technical Notes # 38 2011 which can be found at this web address:
http://plasticpipe.org/pdf/tn-38_bolt_torque_flanged_joints.pdf
- All instructions in following pages apply as a required action.

Please make as many copies of the "TORQUE AND INSTALLATION RECORD" as needed to document the correct installation and torquing for each connection

TORQUE AND INSTALLATION RECORD

Project: _____ Flange Set Location: _____

Connecting HDPE Flange to _____ Flange.

Bolt Dia. & Grade: _____ Nut Diameter & Grade: _____

Lap-Joint Flange Dia. & Pressure Rating: _____

Lubricant Used: _____ Flange Temp: _____

Toque Wrench ID #: _____ Calibration Date: _____

If Specified: Full-face Gasket Info: Material: _____ Thickness: _____

Deep-Well Socket / Heavy-Hex Nut Wrench Size Used: _____

Axis off-set: _____ Angular & Facial Gap: Top _____ Bottom _____ L _____ R _____

“Initial” Each Step Upon Completion

- _____ 1. Tank flange is being connected to a flexible connection.
- _____ 2. Washers and lock washers are being used.
- _____ 3. Connections’ weight is supported by ground and not causing continuous weight on tank flange.
- _____ 4. Gasket used is no less than 1/8” Thick and 80 Duro or less

- _____ 1. Visually examine and clean both flanges, bolts, nuts and washers. Replace damaged units.
- _____ 2. Liberally lubricate bolt threads & nut threads & flange surface under nut.
- _____ 3. Insert full-face gasket. Do not use wrinkled or damaged gaskets.
- _____ 4. Number the bolt-holes in circumferential sequence starting at 12:00 position.
- _____ 5. Check flange alignment, concentricity, angularity, and gap for acceptability.
- _____ 6. To firm the flanges squarely together, hand tighten, then pre-tighten all bolts in proper sequence to 10-20 foot-pounds torque. Do not exceed 20% of the TARGET TORQUE.
- _____ 7. Re-check any flange-adapter face gap and LJF gap for uniformity. ****
- _____ 8. Use the appropriate criss-cross pattern tightening in numerical sequence for Rounds 1,2,3, and 4 (tightening all bolts once in sequence constitutes a “round”).

****Note: Check LJF gap around the flange circumference between each of these rounds measured at every other bolt. If any gap is not reasonably uniform around the circumference, make the appropriate adjustments by selective bolt tightening before proceeding.

TARGET TORQUE (and 4 to 24-HOUR RE-TORQUE): _____ foot-pounds.

____ Lubricate, Hand tighten, Pre-tighten

____ Round 1 – Tighten to ____ ft.lbs. (30%)

____ Round 2 – Tighten to ____ ft.lbs. (60%)

____ Round 3 – Tighten to ____ ft.lbs. (100%)

____ Rotational (clockwise) Round

____ For Large Flanges ≥ 16 + Bolts

____ Lubricate, Hand tighten, Pre-tighten

____ Round 1 – Tighten to ____ ft.lbs. (25%)

____ Round 2 – Tighten to ____ ft.lbs. (50%)

____ Round 3 – Tighten to ____ ft.lbs. (75%)

____ Round 4 – Tighten to ____ ft.lbs. (100%)

____ Rotational (clockwise) Round

____ Rotational (clockwise) Round: 100% of Target Torque. Use rotational clockwise tightening sequence, starting with bolt #1, for one complete round and continue until no further bolt or nut rotation occurs at 100% of the target torque value for each nut.

____ 4 – 24 Hour Re-Torque & Inspection:

Re-torque to target torque value using one or two sequence-rounds, followed by one Rotational round at the target Torque value

Must be properly initialed, signed, and dated for warranty to be valid on flange repairs.

Documentation Recorded By: _____ Date: _____

Joint Technical/Mechanic: _____ Date: _____

TIGHTENING SEQUENCE:

Number the bolts in rotation around the Lap-Joint Flange circumference in a clockwise order, beginning with the first bolt at the top in the nominal 12:00 position, the second being the next bolt to the right, the third being the next bolt to the right, etc until all bolts are numbered sequentially.

Following the table below, tighten the given bolt number to the desired torque value for the given round of tightening as specified on the Torque Record Checklist.

TABLE 1 [refer to ASME Document PCC-1 for Bolt Sequences]

NUMBER OF BOLTS	CRISS-CROSS PATTERN TIGHTENING SEQUENCE
4	1-3-2-4
8	1-5-3-7 >> 2-6-4-8
12	1-7-4-10 >> 2-8-5-11 >> 3-9-6-12
16	1-9-5-13 >> 3-11-7-15 >> 2-10-6-14 >> 4-12-8-16
20	1-11-6-16 >> 3-13-8-18 >> 5-10-15-20 >> 2-12-7-17 >> 4-14-9-19
24	1-13-7-19 >> 4-16-10-22 >> 2-14-8-20 >> 5-17-11-23 >> 3-15-9-21 >> 6-18-12-24
28	1-15-8-22 >> 4-18-11-25 >> 6-20-13-27 >> 2-16-9-23 >> 5-19-12-26 >> 7-21-14-28 >> 3-17-10-24
32	1-17-9-25 >> 5-21-13-29 >> 3-19-11-27 >> 7-23-15-31 >> 2-18-10-26 >> 6-22-14-30 >> 4-20-12-28 >> 8-24-16-32
36	1-2-3 >> 19-20-21 >> 10-11-12 >> 28-29-30 >> 4-5-6 >> 22-23-24 >> 13-14-15 >> 31-32-33 >> 7-8-9 >> 25-26-27 >> 16-17-18 >> 34-35-36
40	1-2-3-4 >> 21-22-23-24 >> 13-14-15-16 >> 33-34-35-36 >> 5-6-7-8 >> 25-26-27-28 >> 17-18-19-20 >> 37-38-39-40 >> 9-10-11-12 >> 29-30-31-32
44	1-2-3-4 >> 25-26-27-28 >> 13-14-15-16 >> 37-38-39-40 >> 5-6-7-8 >> 29-30-31-32 >> 17-18-19-20 >> 41-42-43-44 >> 9-10-11-12 >> 33-34-35-36 >> 21-22-23-24
48	1-2-3-4 >> 25-26-27-28 >> 13-14-15-16 >> 37-38-39-40 >> 5-6-7-8 >> 29-30-31-32 >> 17-18-19-20 >> 41-42-43-44 >> 9-10-11-12 >> 33-34-35-36 >> 21-22-23-24 >> 45-46-47-48
52	1-2-3-4 >> 29-30-31-32 >> 13-14-15-16 >> 41-42-43-44 >> 5-6-7-8 >> 33-34-35-36 >> 17-18-19-20 >> 45-46-47-48 >> 21-22-23-24 >> 49-50-51-52 >> 25-26-27-28 >> 9-10-11-12 >> 37-38-39-40

The criss-cross bolt tightening sequence and multi-round tightening are necessary to counteract the flange / bolt elastic interaction.

TABLE 2

EXAMPLES OF ESTIMATED BOLT TORQUE TO SEAL HDPE FLANGE FACES:

The **engineer of record** is usually responsible for establishing each flange joint criteria, and performing the required calculations to determine the initial and residual torque values.

These estimated values are based on non-plated bolts and studs, using a nut factor of $K=0.16$ for lightly greased bolts and nuts. The calculations uses a HDPE flange face seating stress of **1200-psi** as a minimum and **1800-psi** as a maximum, and assumes the flanged joint is between two HDPE flange adapters (in which the contact area is largest), without a rubber gasket.

NOTE: For bolting to ductile-iron pipe, steel flanges or butterfly valves, the flange face contact area is about half, so bolt torque for that flange pair will be measurably less (refer to Table #3).

IPS Nominal Pipe Size	LJF Bolt Diameter	Number of bolts	Initial	Minimum Lubed Torque (Ft-Lbs)	Initial	Maximum Lubed Torque (Ft-Lbs)	Flange OD/ID (in.)
2"	0.625	4		23		35	3.9/1.94
3"	0.625	4		33		50	5.0/2.86
4"	0.625	8		33		50	6.6/3.68
5"	0.75	8		44		66	7.5/4.40
6"	0.75	8		50		75	8.5/5.42
8"	0.75	8		80		120	10.63/6.76
10"	0.875	12		80		120	12.75/8.79
12"	0.875	12		105		160	15.00/10.43
14"	1	12		180		270	17.50/11.45
16"	1	16		180		270	20.00/13.09
18"	1.125	16		200		300	21.12/14.73
20"	1.125	20		200		300	23.50/16.36
22"	1.25	20		260		390	25.60/18.00
24"	1.25	20		290		435	28.00/19.64
26"	1.25	24		290		435	30.00/21.27
28"	1.25	28		290		435	32.30/22.91
30"	1.25	28		325		488	34.30/24.54
32"	1.5	28		425		640	36.50/26.18
34"	1.5	32		425		640	38.50/27.82
36"	1.5	32		460		690	40.80/29.45
40"	1.5	36		460		690	46.00/35.29
42"	1.5	36		460		690	47.50/37.06
48"	1.5	44		460		690	54.00/43.43
54"	1.75	44		560		840	60.00/48.86

NOTE: Uniform bolt pre-load (torque), without large "scatter", is as useful as the target pre-load. Within the limits of the HDPE flange adapter, gasket, or metal LJF, higher pre-load is desirable. The higher the pre-load is safely achievable, the more closely the assembly will behave like the theoretical model and seal well. Higher pre-load means that a given internal pressure will result in the least possible change in contact sealing pressure. Be consistent (avoid changes) with materials and tools when following written assembly procedures.

Train and supervise the bolting personnel. Tell the crew what is to be accomplished, why, and explain that good results are not automatically achieved. Skill and care are essential. Bolted Joint assembly is a technical skill that is not common in the construction and maintenance profession, being considered more like a specialty. There is no universally accepted testing, nor certification, of bolted-joint assembly mechanics. With no common training, certification, nor standards, it is no surprise there is +/- 25% variability in assembly torque. Specifications and instructions by the engineer, followed by trained mechanics, help to solve the dilemma.

(NOTE: Consult ASME Document PCC-1, Appendix A for training and certification of bolted joint assemblers)

TABLE 3**Examples of Estimated Bolt Torque to Seal the HDPE Flange Face To a Butterfly-Valve, Steel Pipe Flange, or Ductile Iron Flange**

The engineer of record is usually responsible for establishing each flange joint criteria, and performing the required calculations to determine the initial and residual torque values.

These estimated liberally lubricated torque values assume the flanged joint connects one HDPE flange-adapter to a Butterfly-Valve or Steel Pipe flange of Schedule 40 ID, or a Ductile-Iron flange. For bolting to steel flanges or butterfly valves, the flange face contact area is just over half that of HDPE to HDPE flanges, so calculated bolt torque for this flange pair will be measurably less than the values listed in Table #2.

Dimensional flange data should be obtained for each case from the pipe flange suppliers, so as to be able to calculate the face contact area.

These estimated values are based on non-plated bolts and studs, using a K=0.16 for lightly greased bolts and nuts. These calculations use an HDPE material minimum and maximum compressive seating stress of **1200-psi to 1800-psi**.

IPS Nominal Pipe Size	LJF Bolt Diameter	Number of bolts	Initial	Minimum Lubed Torque (Ft-Lbs)	Initial	Maximum Lubed Torque (Ft-Lbs)	Flange OD Steep Pipe ID (in.)
2"	0.625	4		22		32	3.90/2.067
3"	0.625	4		30		45	5.00/3.068
4"	0.625	8		30		45	6.60/4.026
5"	0.75	8		44		66	7.50/4.40
6"	0.75	8		44		66	8.50/6.06
8"	0.75	8		58		88	10.63/7.98
10"	0.875	12		58		88	12.75/10.02
12"	0.875	12		75		114	15.00/11.94
14"	1	12		140		210	17.50/13.13
16"	1	16		140		210	20.00/15.00
18"	1.125	16		140		210	21.12/16.88
20"	1.125	20		140		210	23.50/18.81
22"	1.25	20		160		240	25.60/21.25
24"	1.25	20		180		270	28.00/23.25
26"	1.25	24		180		270	30.00/25.25
28"	1.25	28		180		270	32.30/27.25
30"	1.25	28		180		270	34.30/29.25
32"	1.5	28		240		360	36.50/31.00
34"	1.5	32		240		360	38.50/33.00
36"	1.5	32		260		390	40.80/35.00
40"	1.5	36		310		465	46.00/39.00
42"	1.5	36		310		465	47.50/41.00
48"	1.5	44		310		465	54.00/47.00
54"	1.75	44		365		550	60.00/53.00

Train and supervise the bolting personnel. Tell the crew what is to be accomplished, why, and explain that good results are not automatically achieved. Skill and care are essential. Bolted Joint assembly is a technical skill that is not common in the construction and maintenance profession, being considered more like a specialty. There is no universally accepted testing, nor certification, of bolted-joint assembly mechanics. With no common training, certification, nor standards, it is no surprise there is +/- 25% variability in assembly torque. Specifications and instructions by the engineer, followed by trained mechanics, help to solve the dilemma.

(NOTE: Consult ASME Document PCC-1, Appendix A for training and certification of bolted joint assemblers)