HEATEC TEC-NOTE

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How to prevent leaks in pipe joints at HMA plants

This document is intended as a guide for installing pipe joints on Heatec products at HMA (hot mix asphalt) plants. **(See Figure 1.)**

Figure 1. Typical flanged joints used in piping.

Leaks in pipe joints at HMA plants are common-place. However, the goal of zero leaks is achievable and is a worthwhile goal. But it can be achieved only when joints are properly designed, properly manufactured and properly installed.

Zero leaks is Heatec's goal in designing and manufacturing piping for our products. We use jigs to maintain precise alignment while we fabricate piping at our factory. This ensures the best possible fit-up of the piping after it is disassembled, shipped and reassembled in the field. **(See Figure 2.)**

Figure 2. Piping is held by jigs to maintain precise alignment.

However, we cannot control how the piping is installed in the field by others. Accordingly, we strongly recommend that field installation crews follow the recommendations in this document. Zero leaks should be their goal too.

Gaskets are frequently blamed for leakage at pipe joints. However, gaskets are not usually the cause of leakage. Leakage at gaskets is usually always a sign of other problems. Blaming the gasket ignores other critical factors that may be the *real* cause of leakage.

All of the following factors are critical in installing pipe joints so they do not leak:

1. Cleaning and inspection
2. Alignment
3. Use of proper gasket material
4. Proper tightening of nuts

Cleaning and inspection

If you fail to clean the surfaces of pipe flanges that will contact gasket material, they are apt to leak

Figure 3. Cleaning surface that mates with gasket.

after you mate them. It is very important that you thoroughly clean paint, rust, grease or any other foreign material from the flange areas that will contact the gasket. **(See Figure 3.)**

After the mating surfaces have been cleaned, closely inspect them to ensure there is no damage from shipment or mishandling. Large dents or score marks are unacceptable. Moreover, flanges with warped or pitted surfaces are unacceptable.

Alignment

Perhaps the biggest problem in mating pipe flanges so joints don't leak is related to *pipe length* and *alignment*.

This problem occurs mainly with large tanks and piping that were fabricated and preassembled at the factory and then reassembled at the job site. Such tanks are fixed components. **If they are not positioned at the job site precisely the same as they were at the factory, there are bound to be alignment problems. (See Figure 2.)**

So, leak-free piping depends to a large extent on how close the positions of large equipment match the drawings that depict our factory setup. **Give special attention to leveling concrete foundations and to positioning tanks (and other equipment) on their foundations!**

Flanges properly aligned. Piping must be aligned so that mating flanges are perfectly parallel with each other or nearly so. **(See Figure 4.)**

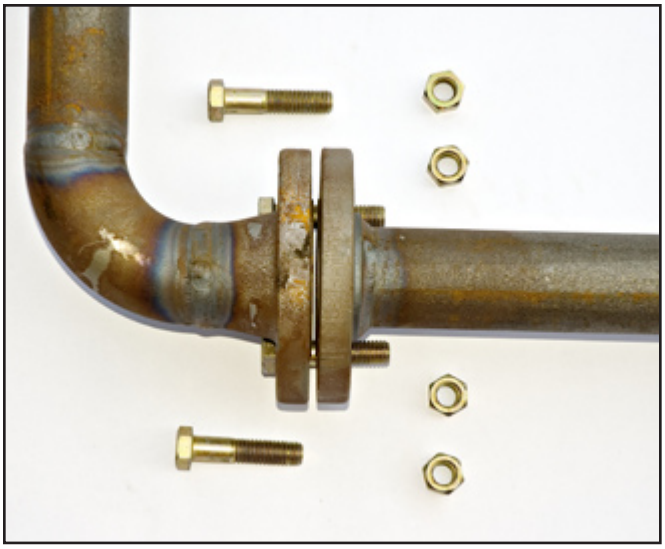

Figure 4. Flanges properly positioned before bolting.

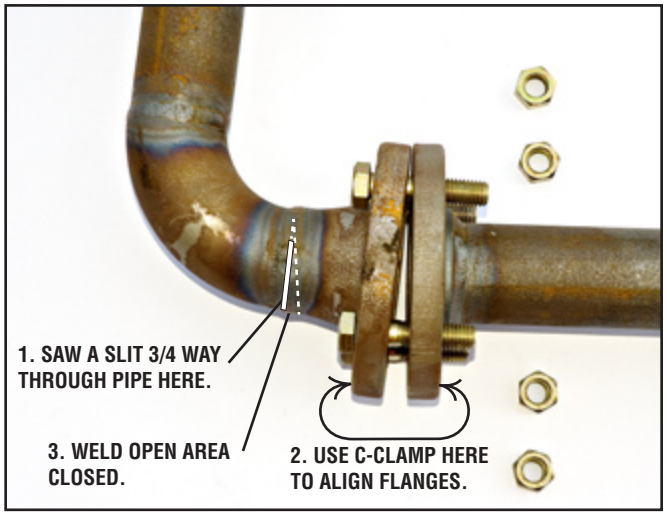

Figure 5. Flanges have unacceptable closed angle alignment.

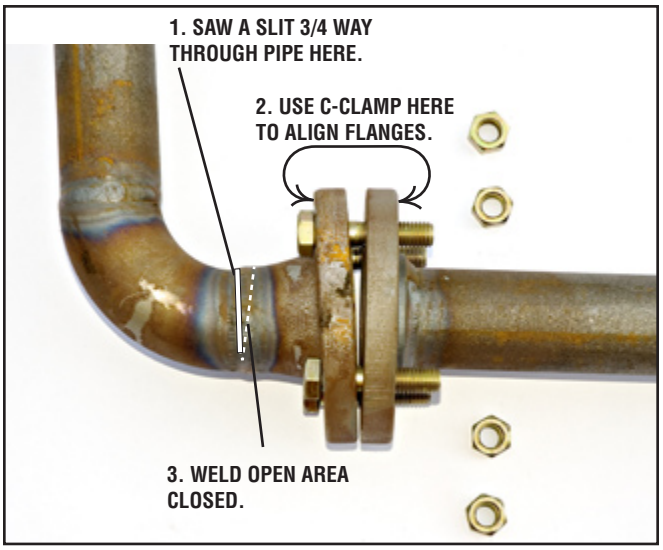

Figure 6. Flanges have unacceptable open angle alignment

Flanges at an angle. When a flanged pipe is being installed between two mating parts that are already in fixed positions, make sure the flanges are *not angled* to each other. **(See Figure 5 and 6.)** Again, *never* rely on the flange bolts to force the flanges into parallel alignment.

To make sure they are parallel, look at the gap between the flanges when the pipes are positioned, just before bolting them together. There should *not* be noticeable differences in the gap widths from one side to the other as shown in **Figures 5 and 6.**

Sometimes pipe with flanges that are not parallel can be fixed as shown in **Figures 5 and 6.**

Pipes that are too short. When a flanged pipe is being installed between two mating parts already in fixed positions, make sure there is only a *small gap* between the mating flanges. Unlike the gap shown in **Figure 7**, the gap should be barely large enough to slip the gasket into place.

Never rely on the flange bolts to pull the flanges together while stretching its pipe. And *never* use extra gaskets! If possible, move the tank or other component from its fixed position so as to close the gap.

If that is not possible, see if it is practical to correct the pipe length by cutting out a small section and replacing it with one long enough to close the gap. Otherwise, obtain a new pipe that fits properly.

Pipes that are too long. A similar problem is when the pipe is too long to fit between fixed components. Either move the component, replace a small section with a shorter one or obtain a new pipe that fits properly.

Pipes that are offset from each other. Make sure that one flange is not offset from the other as shown in **Figure 8**. Do not try to force the flanges into alignment with the flange bolts. Instead, try to reposition the pipe at some point along its length or its support. Or move the component at the other end of the pipe.

Use of proper gasket material

Heatec furnishes gaskets for mating our products in the field. The ones we furnish are nonmetallic and 1/16-inch thick. *Never* use extra gaskets!

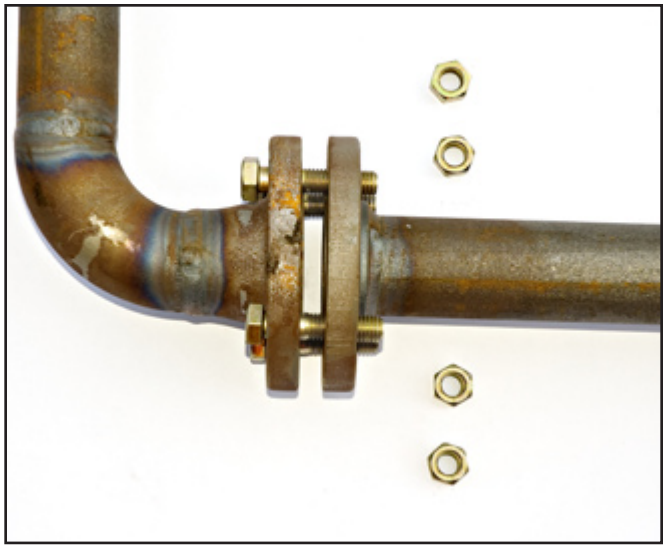

Figure 7. Flanges have too large a gap between them

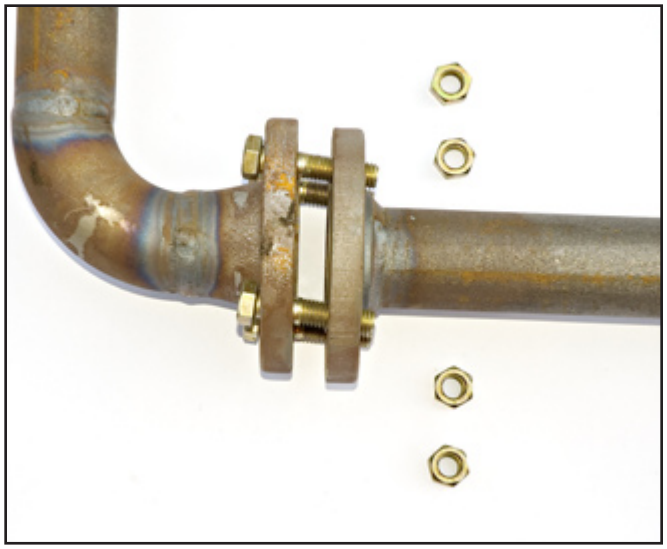

Figure 8. Flanges have unacceptable offset from each other.

And do not substitute thicker gaskets despite some opinions to the contrary. **(See Figure 9.)** It should be understood that thicker gaskets do not increase the integrity of a joint. Moreover, thicker gaskets should *never* be used to correct problems of alignment or improper gaps.

Authorities on gasket materials do not recommend thicker materials for the flanges with surfaces comparable to those we use on our products. One such expert is Gordon Britton, President, INTEGRA Technologies Limited, Sarnia, Ontario Canada. He is author of Chapter A7, entitled Bolted Joints

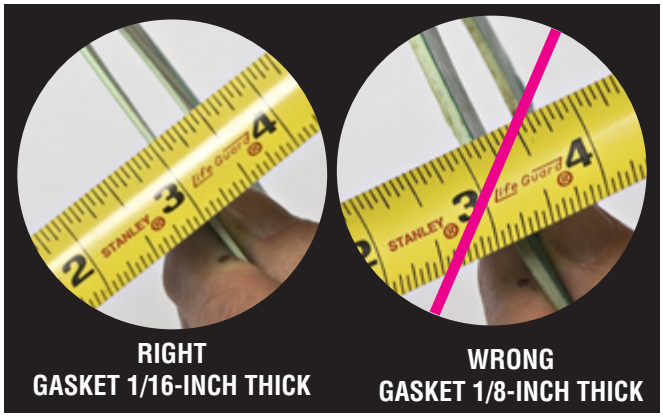

Figure 9. Right and wrong gaskets.

in "The Piping Handbook." Table A7.18 in this chapter specifies gasket material less than1.5 mm thick for flange surfaces with a finish of 3.2–6.3 micrometer Ra.

A thickness of 1.5 mm is equal to 0.0590-inch. The gasket we use is 1/16-inch, which is equal to 0.0625-inch. Accordingly we are using gaskets of the MAXIMUM recommended thickness! Heatec has also consulted our gasket supplier about gasket materials and thickness. They do not recommend gaskets thicker than the ones we presently use for our application.

The recommendations in our document are also in agreement with those by Klinger Gmbh, a foremost manufacturer of gaskets worldwide. Their website *http:www.klinger-gmbh.de* discusses thickness, alignment, clean surfaces, tightening procedure and retightening at low temperature. They also caution *against* re-tightening at high temperatures because it can cause failure of the sealing connection.

Handle gaskets carefully before installation. Do not toss them into boxes with other parts that could damage them. Inspect all gaskets before installation to make sure they have no damage or surface defects. **(See Figure 10.)** Do not use any gasket compounds to install the gasket to the flange as it affects the compressibility, resiliency and creep behavior of the gasket. Never reuse a gasket after the flanges have been tightened.

Proper Tightening of nuts

Proper tightening of nuts is critical to creating a joint that won't leak. Use a torque wrench to tighten the nuts. **(See Figure 11.)** Even then, the


Figure 10. Do not use damaged gaskets.


Figure 11. Using a torque wrench to tighten nuts at flanges.

variations in load or tightening vary plus or minus 30 to 50 percent giving an assembly efficiency of only 0.85 (according to Table A7.19 of the book cited above). Failure to use a torque wrench gives much greater variations.

The procedure for tightening the nuts is just as important as the other factors. The tightening should be done in four passes as indicted in **Figure 12.**

Figure 12. Tightening procedure.

Pass	Torque
1.	1/3 of final torque. Start at bolt number 1 and follow cross pattern
2.	2/3 of final torque following cross pattern.
3.	At final torque following cross pattern
4.	At final torque. Start at highest bolt number and tighten in a counterclockwise sequence.

Tightening patterns

Heatec piping uses a variety of flange sizes according to pipe size. Certain flange sizes have 4 bolt holes. Other sizes have 8 bolt holes. And others have 12 bolt holes. Accordingly there are only three tightening patterns. **(See Figure 13.)**

Tightening torques

Torque values for the various sizes of bolts used for Heatec flanged joints are shown in **Figure 14 .** We strongly recommend using a lubricant, such as moly-paste or grease, on the bolt threads. Accordingly be sure to use the torque values shown for the lubed threads.

Remember, if you attempt to correct for angled flanges or improper gaps by tightening the nuts, the torque values are *meaningless*! That's because your tightening effort must first stretch the pipe or bend the flange before it can begin to compress the pipe joint.

Re-tightening

You *must* retighten the nuts on flanged joints of asphalt piping and hot oil piping after the joints have been heated to operating temperatures and have cooled down to ambient air temperature.

When the piping is heated to 300 degrees F or more, the bolts and other components in all heated joints will expand. The expansion may upset the original seating of components and cause the bolts to loosen. Consequently, the flanged joints may lose their integrity, allowing the joints to leak when the system is re-heated.

Summary

Please remember, to achieve zero leaks you must comply with *all* of the factors discussed herein—not just one or two.

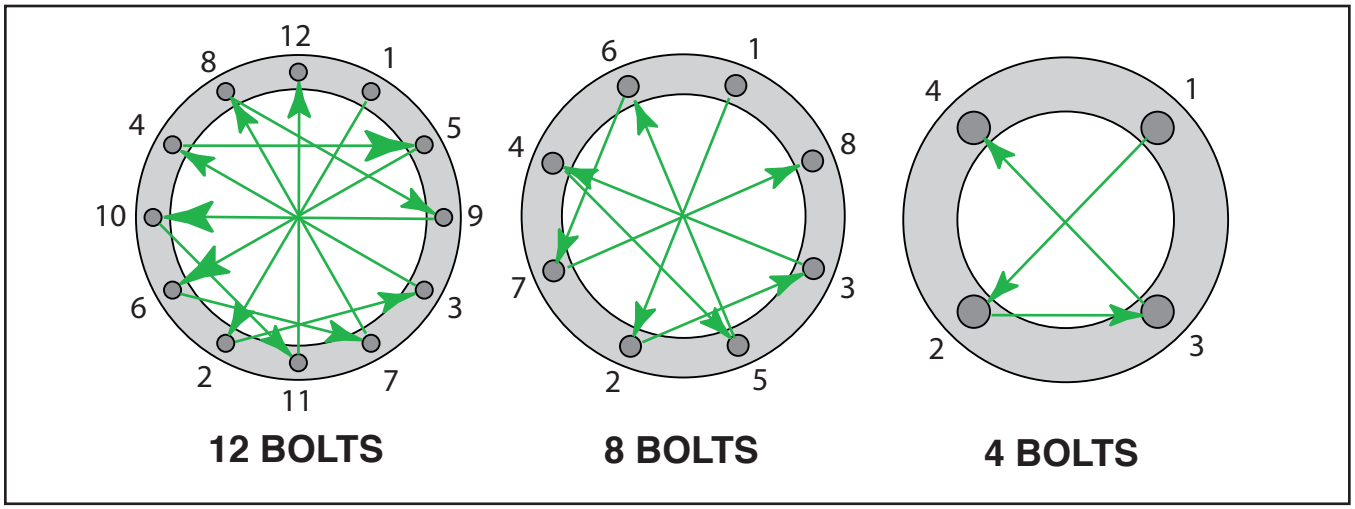

Figure 13. Tightening patterns.

Figure 14. Torque values for flanges.

Bolt size	1/3 final torque value (foot pounds)		2/3 final torque value (foot pounds)		Final Torque value (foot pounds)	
	Dry threads	Lubed threads	Dry threads	Lubed threads	Dry threads	Lubed threads
3/4-inch	87	67	173	133	260	200
5/8-inch	55	37	110	73	165	110
1/2-inch	25	18	50	37	75	55