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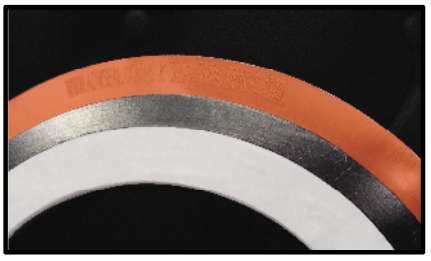

Topic: ALKY-ONE Corrosion Sealability Test

Rev. Date: 8/20/2013

Background: The ALKY-ONE flange gasket is specifically designed for Hydrofluoric Acid environments and for other extremely corrosive services. It has both an inner seal to prevent flange corrosion at the pipe ID and an outer seal that is specially designed to develop effectively high gasket seating loads. Furthermore – and very critically – the balance between these two sealing areas is maintained so that both can perform efficiently together, utilizing the bolt force available with standard raised-face flanges.

Anhydrous Hydrogen Fluorine is used as a chemical catalyst in the formation of key hydrocarbon compounds used in gasoline. The anhydrous form is not corrosive, and is easily contained by carbon steel piping and flanges. However, with the introduction of water, Hydrogen Fluorine immediately forms Hydrofluoric (HF) Acid which is extraordinarily corrosive, and frequently results in the corrosion of the inner flange faces. These corroded flanges must be cut off and replaced – often at great cost to HF Acid Alkylation operators – as failure to do so could eventually allow the acid to eat through the flange.

The ALKY-ONE Corrosion Sealability Test was designed to determine the depth of existing flange corrosion against which the ALKY-ONE gasket could provide an effective seal, thereby preventing further corrosion. It is hoped that the test results can for the first time allow HF Operators to develop objective criteria for replacing damaged flanges.

Since no other gasket manufacturer has attempted to develop this information to date, and since other gaskets with dual sealing zones have been introduced to the HF Acid market, we opted to perform this test as a side-by-side comparison of the ALKY-ONE gasket and another commonly used HF Acid gasket; a spiral wound gasket with an inner cam-profile sealing ring (referred to below as SW-IS).

Test Protocol

To simulate existing corrosion we utilized machine-chamfered flanges. (Figure 1) The test fixture contained two sets of chamfered flanges, and two sets of unmodified raised face flanges, allowing both a test gasket and a control gasket for each type tested. (Figure 2) To ensure that all gaskets were subjected to identical test conditions, we stacked the components

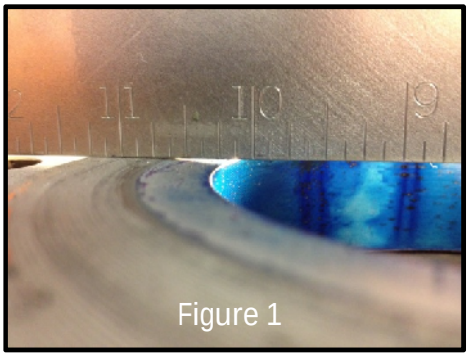

Figure 1

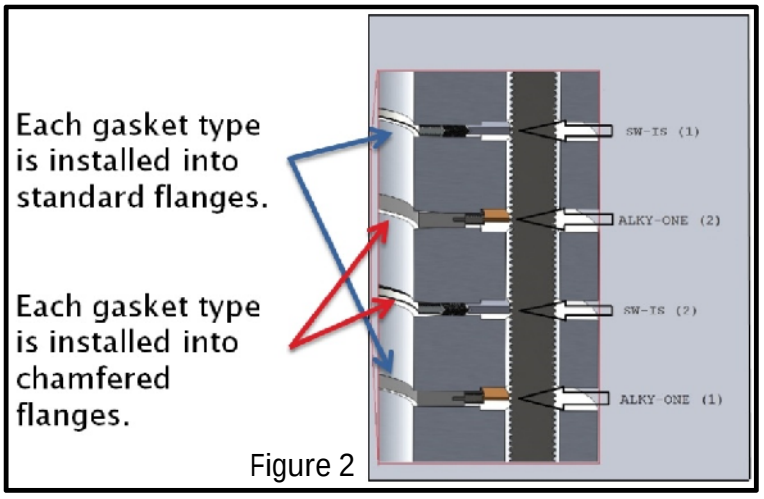

Figure 2

so that they were compressed simultaneously by a common set of studs, and were pressurized as a single unit. (Figure 3)

Once assembled, the test fixture was charged with blue ink and pressurized to 350-psi to simulate the upper limits of process operating pressure. (Figures 4 and 5) Of primary interest was the distance the ink penetrated between the chamfered flanges and the gasket.

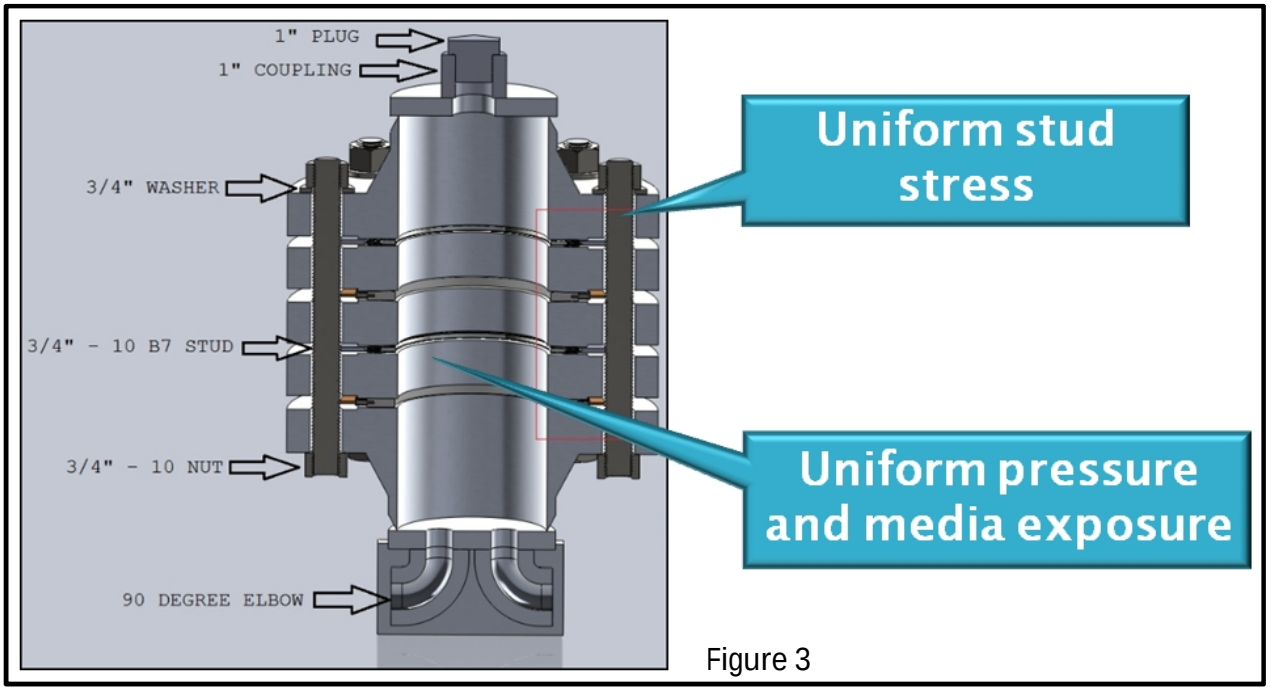

Figure 3


Figure 4


Figure 5

Following the test, the test rig was thoroughly dried and carefully disassembled. Photographs of the components and gaskets were taken, as were measurements of the ink-ring diameters, showing the distance up the chamfered flanges that the ink had been able to penetrate. Because the chamfer's slope was known, we were able to determine the depth of the flange irregularity against which the gasket could seal.

Test Results

The difference between the tested products is immediately apparent by a cursory comparison of the ink penetration as seen Figures 6 and 7, as well as in the side-by-side comparison of Figure 8. To quantify the results, the average ink ring diameter on each of the chamfered flanges was determined as an average of multiple diametrical readings. Those average values and the associated chamfer depth are shown in Table 1, and depicted visually in Figures 9 and 10.

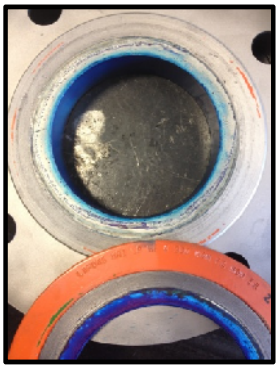

Figure 6

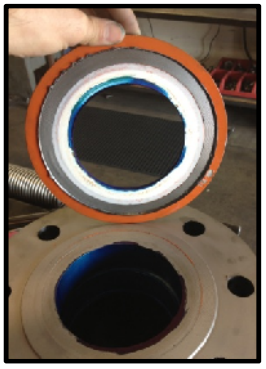

Figure 7

Figure 8

Product	Average Ink Ring Diameter (AIRD)			Chamfer Depth at AIRD		
	Top Side	Bottom Side	Average	Top Side	Bottom Side	Average
SW-IS	4.900	4.807	4.854	0.003”	0.005”	0.004”
ALKY-ONE	4.184	4.171	4.178	0.029”	0.032”	0.030”

Table 1

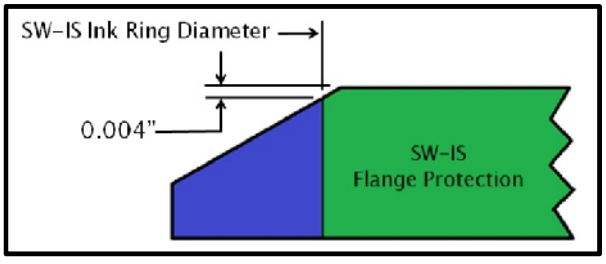

Figure 9

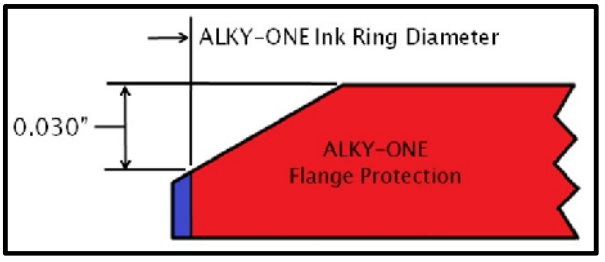

Figure 10

Conclusion

The ALKY-ONE gasket from Advanced Sealing can accommodate and seal against 7 times the depth of existing flange imperfections as the commonly used spiral wound gasket with a cam-profile inner ring. HF Acid Alkylation unit operators now have objective data upon which to base their standards for resurfacing or replacing eroded flanges, as well as a way to test and compare other HF gaskets that may be introduced into the market.