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GASKET DESIGN AND ASSEMBLY FOR LARGE DIAMETER GLASS LINED VESSEL FLANGES

A. Fitzgerald Waterland, III (Jerry)
VSP Technologies, Inc
Prince George, VA U.S.A.
jerry.waterland@vsptechnologies.com

ABSTRACT

Large glass lined vessel flanges pose unique sealing challenges that in many cases require non-conventional gasket designs and flange assembly procedures in order to provide high gasket tightness, and overall long term flanged connection reliability. Recent experiences with a large glass lined process vessel with a history of poor sealing performance are detailed in this paper.

INTRODUCTION

Glass lined process vessels and piping are used extensively within the Chemical Process and other industries where corrosion, purity and non-contamination rule out their economic construction with low or high-alloy metallurgy. These process vessels are robustly designed and manufactured to stand up to very harsh environments. The (typically) carbon-steel shell is designed and built to ASME code and then lined internally with glass. In the glass lining process the glass is sprayed onto the internal surfaces of the completed ASME code vessel, and then the entire vessel is placed in a furnace to melt and fuse the glass to the carbon steel vessel walls and flange surfaces[1].

The glass coating itself, and the high temperature glass fusing process result in unique flange surface and profile conditions that are very different from those that exist on un-cladded, metallic vessels. First, the glass typically is not a uniform thickness across the flange surface. During the fusing process the glass is melted and there will be some degree of flow. In a typical glassed steel flange the surface profile is rounded from the ID to the OD, with a high point somewhere along the surface. The surface is not flat and true as with a machined, metallic flange. Additionally, there is non-uniform flange surface topography as surface waviness also exists. Again, once melted and fused to the steel vessel, the glass surface cannot be further machined or processed to produce the flat, square sealing surfaces that exist in metallic flanges.

The glass surface is very smooth, with a low coefficient of friction, and again there are no flange serrations present to aid in gripping the gasket. Due to the extremely corrosive processes where glass-lined steel vessels are often employed, various PTFE based gasket materials are required. The resultant sealing arrangement results in compressing two very slick materials against one another. PTFE envelope gaskets which are commonly used to seal glass lined steel flanges employ a rigid, corrugated stainless steel insert to help reduce the opportunity for gasket extrusion.

Figure 1 Glass coating applied to process vessel[1]