

**GPT**

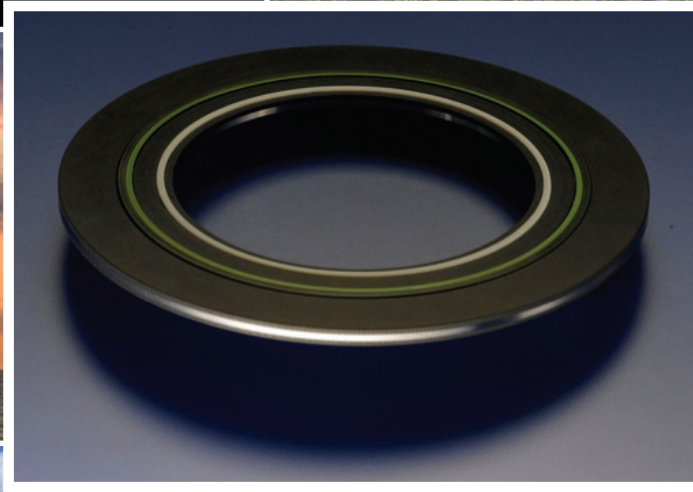
an EnPro Industries company

# VCFS

## Fire Isolation System



## THE WORLD'S ONLY FIRESAFE ISOLATION SYSTEM



*ENGINEERED SOLUTIONS*

## INTRODUCTION

The creation of the VCFS was driven by the demands of our customers who needed to electrically isolate their flanges but worried about the performance of non-metallic components in the event of a fire. This was especially a concern in the offshore market where the consequences of a fire on platforms are very hazardous and costly.

Additionally, the needs of users in piping and LNG applications, where the risk of a fire would greatly threaten life and property, drove the need for an electrical isolation seal that is fire safe per API 6FB.

## DEVELOPMENT

Development of the patented VCFS took over three years in overcoming the many challenges involved. One major challenge was how to maintain bolt load during the event of a fire. This involved addressing the sealing mechanism itself as well as the isolating washers.

Extensive testing led to the use of a hardened Inconel E-ring to perform the secondary sealing after the PTFE seal had been melted by the fire. However, the E-ring compression was quite critical, and had to be mitigated to prevent excessive compression during the burn. This led to use of the back-up ring to precisely manage E-ring compression.

Another problem was that as metallic elements, neither the E-ring nor the back-up ring provided the required isolation properties. The solution was to employ a dielectric coating that would isolate and withstand compression of the flanges.

The result was the formulation of the proprietary X37 coating which performed admirably during testing and provided isolation even after three bolt-up operations to full torque levels.

The next challenge came due to the fact that standard G-10 Glass Reinforced Epoxy (GRE) washers degraded in a fire and lost bolt load, which resulted in the release of media in a fire. This led to the development of tandem Hardened Coated Steel washers that electrically isolate, yet retain bolt load in a fire.

The combination of these elements created a system that would both electrically isolate the flanges and pass the API 6FB Fire Test.

## THE API 6FB FIRE TEST

The API 6FB test requires that any sealing end connection hold for 30 minutes in a flame condition and then for a 60 minute cool down period. After the assembly is cooled to room temperature the line is de-pressurized and then re-pressurized. During all facets of the test the gasket must not exceed an API prescribed leakage rate.

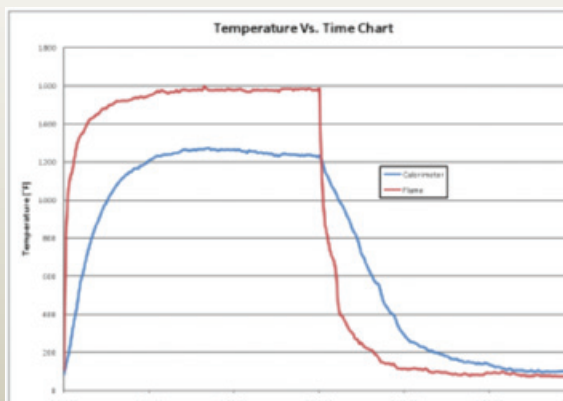


Chart 1: Temperature logging for the calorimeter blocks and thermocouples during the full 60 minute burn and cool down cycle.

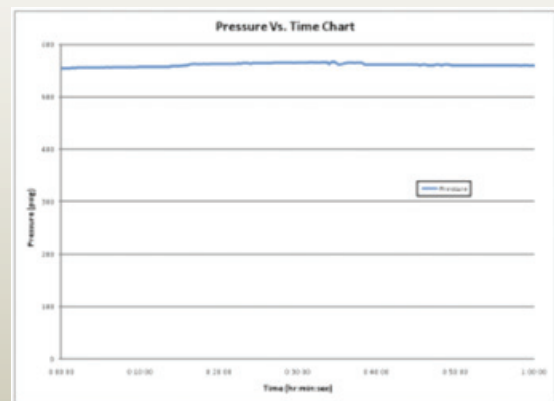


Chart 2: Pressure versus time curve for this test.



The testing assembly included 6" Class 300 VCFS kits complete with sleeves and HCS washers, 6" carbon steel flanged blinds with a 2" bore and 1" pipe welded to the outside of the flanges at the bore complete with 1" end caps. Studs and nuts for the flanges, Grade A193-B7 and 2H respectively and two high capacity propane burners, six thermocouples and six calorimeter blocks.

After the 1" pipe was welded to each of the steel flange blinds, end caps were threaded onto each pipe end. Ports were created in one of the end caps to accommodate the necessary pressure equipment. The PSI/Pikotek VCFS gasket was installed between the flanges and the flanged assembly was made up with a torque value of 200ft-lbs using the appropriate star pattern.



After the flange assembly was completed a Megger® isolation testing device (model MIT 481) was used to validate the gasket's isolation properties. This isolation tester was set the highest setting of 1000V DC and the isolation between the flange-to-flange connections was measured. The isolation between the flanges and threaded stud connection was then measured using the same setting; four different isolation measurements were taken for this test at the 3, 6, 9, and 12 o'clock bolt positions.

The two large propane burners were then put into place according to API fire test protocol. These burners were ignited manually and were used to provide the flame for the thirty minute burn cycle. The flame was controlled by a valve at the central computer location; this valve was used to regulate the propane flow into the burners. Chart 1 contains the temperature logging for the calorimeter blocks and thermocouples during the full 60minutes burn and cool down cycle.

The leakage that occurred during the 120 minute burn and cool down cycle was calculated using readings that were taken by a differential pressure transducer. Water that was used for the testing media was stored in an 8 inch pipe with an inside diameter of 8.071 (20.5cm). Using basic volume calculations, volume loss per every inch (2.54cm) of water height was determined.

System pressure was another variable that was tracked during the API 6FB test. The protocol required that pressure be held constant during the 120 minute burn and cool down cycle. Since any water leakage in the system would result in an overall pressure loss, the pressure must be increased appropriately to maintain the average pressure specified by API 6Fb testing protocol. Chart 2 shows the pressure versus time curve for this test.

For sizes below 6" on RTJ flanges and 2" on raised face flanges PSI/Pikotek have designed the single seal Firesafe isolating kit. The single seal utilizes the technology of the E ring to provide the seal and the X37 coating and the GRE laminate continues to give full isolation properties that are prevalent in the traditional PSI/Pikotek VCS design.

The VCFS is also offered in a High Temperature design that utilizes G-11 Instead of G-10. This allows the seal to service higher operating temperatures up to 392°F.

**65,000psi Compressive Strength** gives the seal the ability to withstand the bolting and flange stresses

**750-800 VPM Dielectric Strength** shows that the kit has the capacity to meet the isolation demands

**0.05% Water Absorption** assures that the product will not suffer from the effects of ingress from media

**50,000psi Tensile Strength** gives the user the confidence that the seal has the ability to withstand the internal pressures

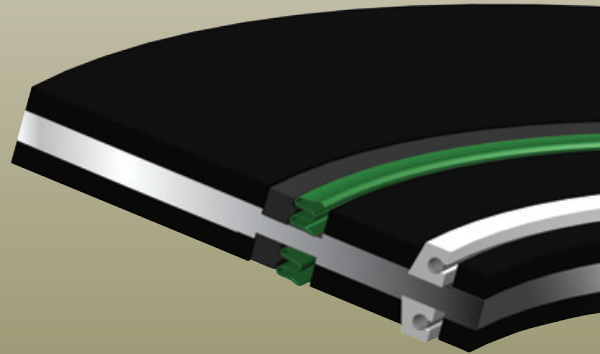
Most of the standard bolting lubricants are conductive so PSI/Pikotek have developed a non conductive metal free grease called Piko-Lube in order to minimize the potential of resistance loss. PSI/Pikotek would recommend this lubricant for use on isolating systems and it has a friction factor of 0.15.

Unlike some suppliers PSI/Pikotek will not offer a product that does not conform to the highest technical standards. We are proud of our achievements in design and technology and will give the support and back up necessary to provide the most suitable products. In this regard PSI/Pikotek are unique in this field.

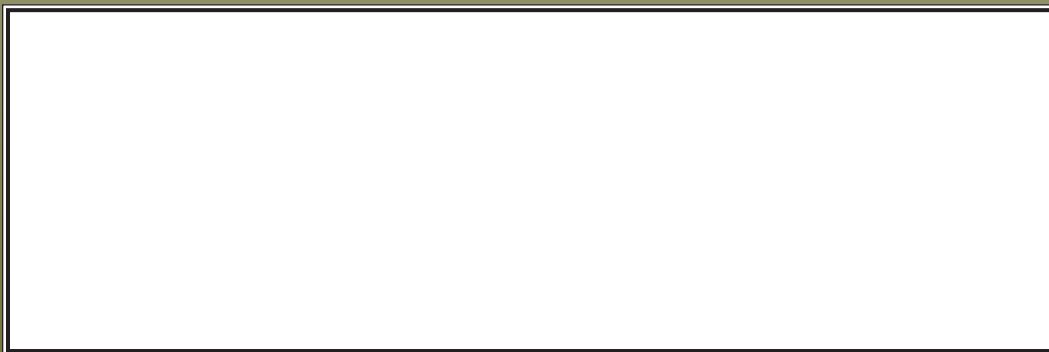
\* Note: The "FS" or "Fire Safe" designation denotes only that this gasket has successfully passed the API 6FB fire test. Due to the fact that every fire is unique and many uncontrolled variables are present, no other claims regarding suitability or performance in a fire are made. Each designer, user and/or operator will need to assess their individual situation when deciding to install FS style gaskets. Patent Pending.

## The VCFS\* (VCS FireSafe\*)

- Based upon proven PSI/Pikotek VCS platform
- Provides Complete Flange Electrical Isolation
- Tandem Seal Technology
- Primary Sealing System has 20+ years successful track record
- Secondary Sealing System is dual purpose fire safe and backup
- Passed API 6FB, 3rd Edition Fire Test
- Use in Conjunction with Cathodic Protection Systems
- Mitigates Potential Flange Rotation
- Provides a Tighter Seal Under Low Bolt Loads



*Represented by:*



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