KLINGER Australia

VCS/VCFS

Prevent future leaks and blowouts

For Zero Fugitive Emissions & Extreme Critical Sealing Applications

The VCS/VCFS systems use proprietary materials to address the regulations associated with fugitive emissions requirements that are closely monitored and highly sensitive to regulatory agencies today.

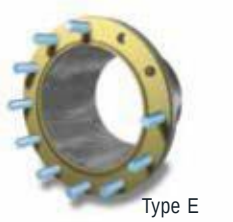
Patent # 2271866

INNOVATIVE ENGINEERING FOR CORROSION PROTECTION

VCS/VCFS Sealing & Isolation

FEATURES

- » Extreme, high-reliability sealing and electrical isolation solution for critical service applications
- » Seals and isolates all pressure ratings through ANSI 2500 class and API 10,000 psi service
- » Withstands severe service conditions including vibration, temperature and pressure fluctuations
- » Designed to withstand corrosive environments.
- » Good electrical isolation properties for cathodic protection
- » Pressure-activated seals provide high confidence sealing, eliminates costly leaks and provides a solution for fugitive emissions
- » Gasket is sized to the bore to protect flange faces from media-induced corrosion and flow-induced erosion
- » Prevents turbulent flow at flanged connections
- » Mitigates galvanic corrosion in dissimilar metal flanges
- » High-strength laminate material resists failure due to excessive compression
- » Available to match any flange specification (ANSI, ASME, API, MSS, BS, DIN, AS, others)
- » Can mate mismatched RTJ with raised-face flanges
- » Easy installation, make up and removal
- » Sealing system is not sensitive to low bolt loads - providing reliable sealing through a range of bolt stress
- » Gasket is self-aligning and centering - quick to install and no special tools are required
- » Maintenance-free corrosion-resistant design is resistant to deforming under load
- » Works in Ring Joint Flanges, reducing fluid entrapment, flow induced erosion and media induced corrosion between flanges
- » Reusable by simply replacing sealing ring

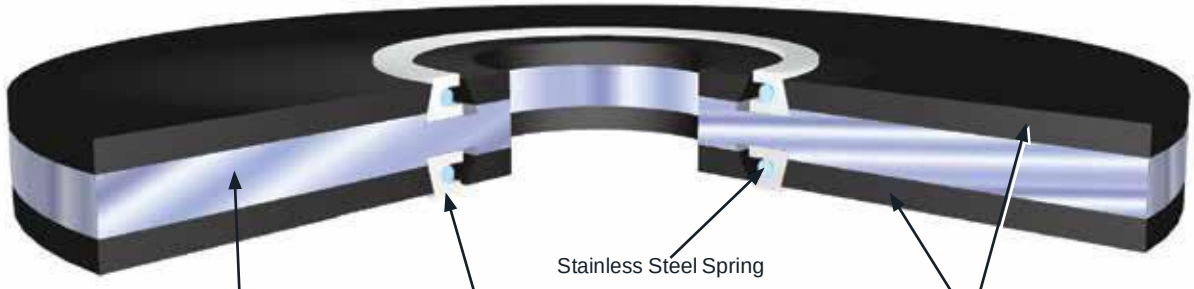


Type E

Type F

Sealing element may be positioned anywhere between the I.D. of the gasket and I.D. of the bolt circle depending on flange design.

NOTE:
Can be custom made to order



*NOTE:
STD thickness is .260" but .308" is also available.

APPLICATIONS

- » High pressure flanges
- » Critical service applications
- » High pH Service
- » Locations where one prefers an integral seal element
- » A more convenient spiral-wound type gasket replacement

Before Tightening

The flange faces come into contact with the sealing elements, which extend slightly above the surface of the retainer. As the flange is tightened the sealing elements are compressed into the machine groove, developing an initial high unit pressure against the flange faces.

NOTE:
Can work for ring joint flanges reducing fluid entrapment.

After Tightening

The flange faces come into firm contact with the retainer, thus compacting the sealing elements within grooves. At the same time, the unique VCS spring energized seal provides elastic memory for a polymer not normally associated with this characteristic - resulting in a simple flat gasket with extremely high loading and self energizing characteristics without adverse cold flow problems.

VCS/VCFS Sealing & Isolation

VCFS FIRESAFE

» Based upon proven VCS platform
» Provides complete flange electrical isolation
» Tandem seal technology
» PTFE sealing system has 30+ years successful track record
» E-Ring sealing systems 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

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.

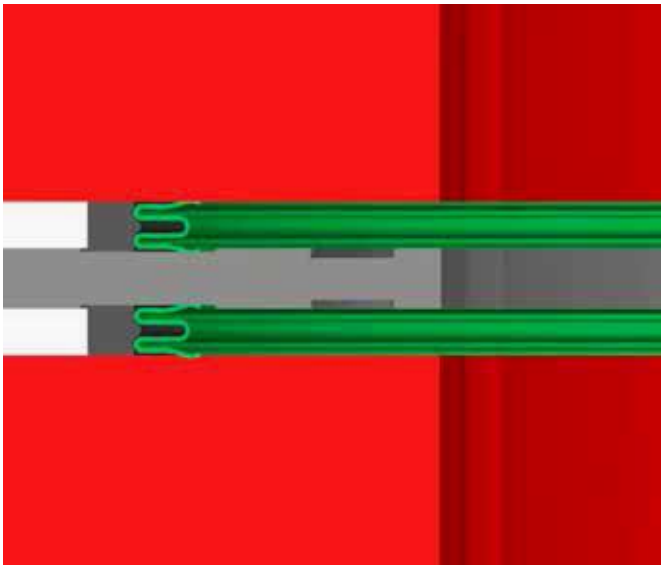
Another problem was that as metallic elements, neither the E-ring nor the back-up ring provided the required isolation properties. The solution was to employ a dielectric coating that would isolate and withstand compression of the flanges.

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.

Before Fire



After Fire

VCS/VCFS Sealing & Isolation

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.

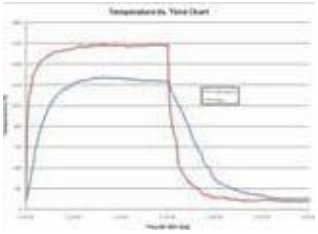


Chart 1: Temperature logging for the calorimeter blocks and thermocouples during the full 60 minute burn and cool down cycle.

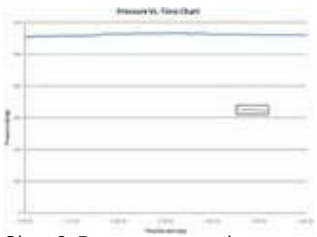


Chart 2: Pressure versus time curve for this test.

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 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 to 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 60 minutes 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 we have designed the single seal Firesafe isolating kit. The single seal utilizes the technology of the E ring to provide the seal and the DIAMOND-HYDE™ coating and the GRE laminate continues to give full isolation properties that are prevalent in the traditional 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

0.01% 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 we developed a non conductive metal free grease called Piko-Lube™ in order to minimize the potential of resistance loss. We would recommend this lubricant for use on isolating systems and it has a friction factor of 0.16.

Unlike some suppliers we 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.

*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.

COMMON VCS MATERIAL PHYSICAL PROPERTIES

ASTM	Test Method	G-10 Epoxy/ Glass	G-11 Exopy/ Glass
D149	Dielectric Strength Volts/ Mil (Short Time)	800	550
D695	Compressive Strength (psi)	65,000	50,000
D229	Water Absorption (%)	.01-.02	0.08
D257	Insulation Resistance Meg Ohms	300,000	225,000
D790	Flexural Strength (psi)	65,000	50,000
D256	IZOD Impact Strength (Ft-Lbs/Inch)	26.0	10.0
D638	Tensile Strength (psi)	51,000	41,000
D732	Shear Strength (psi)	21,000	21,000
	Temperature Range (°F)	-200 to 302	-50 to 392
	Temperature Range (°C)	-129 to 150	-46 to 200

NOTE:
G-10 for cryogenic services to -459°F / -273°C is also available.

VCS TEST RESULTS - TYPICAL

Test	VCS Value
Compression Test EN 13555 @ 150° C	140 Mpa Gasket Stress
Creep Relaxation EN 13555 @ 150° C	0.99 Relaxation Factor
Leakage Test EN 13555 @ 40 bar Helium @ 5 Mpa to 80 Mpa gasket stress	1.0×10^{-3} mg/m/s Leakage rate
Hot Blowout Test HOBT @ 151° C @ 165 bar	No Blowout
Shell Leakage Test T-2.232686 @ ambient @ 52 Mpa	4.2×10^{-7} pa-m^3/s/mm Leakage Rate
Shell Cycle Test T-2.232686 @ 150° C @ 45.6 Mpa	< 0.10 bar pressure loss

ELEMENT TEMPERATURE LIMITS

	PTFE	FKM
Degrees Fahrenheit	Cryogenic to + 450	-20 to +350
Degrees Celsius	Cryogenic to +232	-29 to +177

NOTE:
Consult with a specialist for cryogenic applications and/or extreme temperature variations, hazardous fluids or for extremes in temperatures and pressures.
All values derived from laboratory testing. Field values will vary.