evolution®

THE FUTURE OF ISOLATION

GPT® Industries

Patented PCT/US2018/016011

INDUSTRY CHALLENGES

Despite renewable energy growth, consumer needs continue to drive oil and gas consumption. To meet these demands, oil and gas companies have implemented technologies such as EOR (enhanced oil recovery) and hydraulic fracturing to obtain oil and gas from fields once thought to be exhausted or too costly to access. These efforts have been very successful, but are now exposing pipelines and isolating gaskets to higher concentrations of H_2S, steam, CO_2 and CO as well as higher pressures and temperatures.

CHANGING TIMES

As oil and gas are extracted from deeper wells and with higher pressures, temperatures, steam, H_2S, CO_2 and CO, glass reinforced epoxy (GRE) isolation gaskets are being attacked. G-10 and G-11 are greatly affected by H_2S as the concentration increases. CO_2 and CO permeate through the matrix of the GRE.

Steam attack on GRE isolation gasket

Chemical (H_2S) attack on GRE isolation gasket

CHALLENGES

SOUR GAS

Sour gas makes up more than 40% of the world's gas reserves according to the IEA (International Energy Agency).

STEAM

Steam enhanced oil recovery (EOR) projects accounted for 417,675 barrels of oil per day (BOPD), or 56% of the total for all tertiary enhanced recovery methods.

TEMPERATURE & PRESSURE

HP/HT wells and UHP/UHT (High Pressure and High Temperature and Ultra High Pressure and Ultra High Temperature) are on the rise. This reduces the number of isolating products that can be used to isolate and seal the flanged connection.

TOTAL COST OF INSTALLATION

Doing more with less - 440,000 jobs have been cut globally throughout the oil and gas production industry. With fewer resources, getting it right the first time has never been more important. Installation errors account for 81% of gasket failures.

EMISSIONS

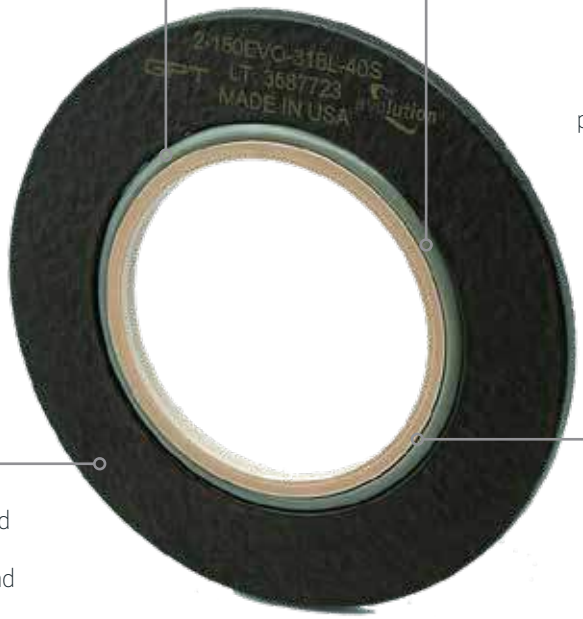
The Clean Air Act provides some of the most widespread regulatory authority that affects the industry. In recent years, revisions to the Ozone National Ambient Air Quality Standard, EPA methane regulations, and BLM venting/flaring regulations, have openly targeted oil and gas production.

This coupled with an increase trend for sustainable energy methods such as Hydrogen and Carbon Capture(CCUS).

EVOLUTION® COMES FROM A LONG LINE OF SUCCESS

PIKOTEK® VCS
PTFE spring-energized face seal, or an elastomeric O-ring, seated in an insulating laminate and permanently bonded to a **high-strength stainless steel core**.

PIKOTEK® VCFS
PTFE spring-energized primary sealing element and an E-ring secondary seal, seated in an insulating laminate and permanently bonded to a high-strength metal core, creating a **firesafe gasket**.



PIKOTEK® PGE™
Incorporates patented overlapping and offsetting seal grooves. The ⅛" (3mm) **design** allows for easier installation and removal.

PIKOTEK® VCS-ID™
Concave GYLON® Inside Diameter (ID) seal and a PTFE spring-energized face seal, or an elastomeric O-ring, seated in an insulating laminate and permanently bonded to a high-strength core.

THE FUTURE OF ISOLATION - 100 YEARS IN THE MAKING

Like most things, electrical isolation has evolved since 1909 when the first synthetic electrical isolator was developed. Various types of gasket designs, materials, and configurations have been brought forth that typically eliminated issues that prior products couldn't solve. The late seventies saw the greatest leap in isolating kit development with the introduction of the VCS gasket that provided higher pressure capabilities and strength over earlier LINEBACKER® phenolic and GRE isolating products. Since then, variations of the VCS have been developed to overcome limitations that were inherent within the VCS design.

The VCFS was introduced to give all of the benefits of a VCS gasket, but to add fire safe operation to the isolation. The VCS-ID gave a PTFE barrier of protection to the traditional VCS design so that the GRE (glass reinforced epoxy) would be protected from the increasing number of chemicals and steam in oil and gas pipelines. High temperature isolation gaskets were developed for oil and gas pipelines where G-11 was not rated thermally. All products worked well, but forced users to potentially utilize a number of different products to successfully isolate their system.

EVOLUTION®, the best available technology for pipeline isolation, incorporates all of these benefits into one complete and robust package. EVOLUTION®is a patented product that is the first of its kind to be a fully encapsulated isolating gasket. The thinner, ⅛" (3mm) design minimizes the difficulties often encountered while attempting to install thicker isolating gaskets. The total encapsulation allows the gasket to be hydro-tested and kept in the pipeline with virtually no loss in isolation properties. The coating is a GPT proprietary material that is extremely abrasion and impact resistant. The coating is also chemically resistant to attack by H_2S, steam, CO, CO_2 and other chemicals often found in oil and gas pipelines.

EVOLUTION® has passed API 6FB fire testing in multiple sizes and pressures and has a considerable increase in operating temperature over GRE products.

It also has a number of other advantages over traditional GRE laminated products. Since EVOLUTION® has no laminations, it's able to withstand high pressures with no ill effects unlike GRE gaskets which are prone to delamination. Furthermore, EVOLUTION® does not have the permeation issues that plague GRE gaskets.

FEATURES AND BENEFITS

ID Seal

» **Chemical resistance** - remarkable resistance to typical oil and gas chemicals, in particular H_2S, CO & CO_2
» **Isolates after hydro-testing** - eliminates the need to replace the gaskets following hydro-testing, EVOLUTION™ will isolate after hydro-testing

Fully Encapsulated (⅛" (3mm) Retainer)

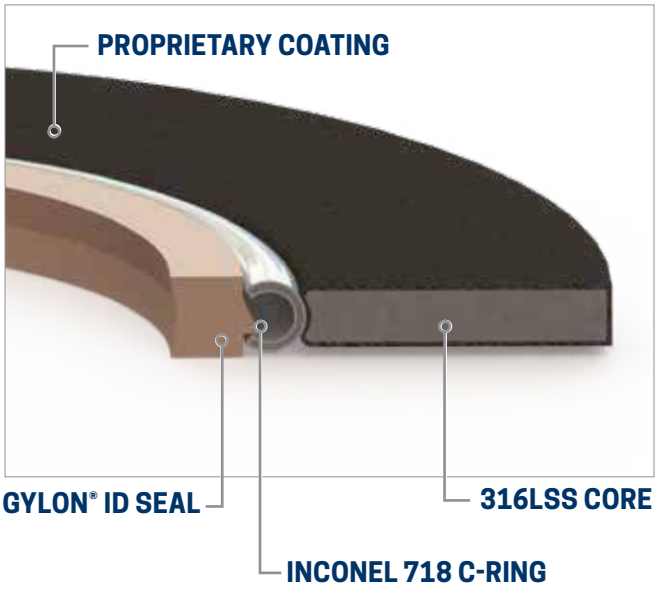
» **No permeation** - the unique design results in no permeation, a problem that plagues conventional glass reinforced epoxy (GRE) isolations gaskets
» **Easy installation** - thinner design (⅛" (3mm)), minimizing the difficulties often encountered when attempting to install thicker isolating gaskets

Proprietary Coating

» **High dielectric strength**
» **1,400 volts/mil min**
» **Eliminates exotic cores** - fully encapsulated coating prevents the need for expensive exotic cores
» **Extreme temperature**- rated to Minimum -300°F/-184°C Maximum 500°F/260°C*

Inconel C-ring

» **Fire safe** - provides the added security of knowing that the gasket has passed the API 6FB, 3rd Edition Fire Test
» **High pressure** - highest pressure rating of any isolating gasket



» **Pressure classes available:** 150# - 2500# and up to API 15K
» **Size range available:** ½"NPS to 36" NPS
» * Some smaller diameter sizes, EVOLUTION® may be supplied with C-ring only

*NOTE: Temperature rating is for gasket only or when used with Mica sleeves/washers.

As with many GPT high pressure isolation gaskets, EVOLUTION®

- » Has pressure energized seals
- » Has a patent pending ID seal
- » Has a built in fire safe metal seal
- » Mating mismatched ring-joint to raised-face flanges (EVOLUTION® will seal in ring-joint, raised-face and flat face/slip-on flanges)
- » Works in Ring Joint Flanges, reducing fluid entrapment, flow induced erosion and media induced corrosion between flanges
- » Is built to match pipe bore
- » Is unaffected by moisture or humidity
- » Has zero creep relaxation

COATED C-RING TECHNOLOGY

The high level of recovery for a metallic c-ring is designed to give EVOLUTION® the ability to withstand extreme temperature swings in the flange. C-rings are proven to offer greater sealing capabilities than any other seal offered in an isolation gasket to date.

FIRE SAFETY

With the focus on improving and increasing joint integrity the importance of fire safety has become a standard requirement across elements of the oil and gas industry. EVOLUTION® will provide a fire safe seal that is tested comprehensively to API6FB as a standard in all our isolation kits.

ZERO PERMEATION

The standard GRE operates using a leak to seal technology and has provided a high level of isolation and sealing. However, as operators drill deeper and enhanced recovery techniques become the norm, more aggressive medias in pipelines will result in GRE becoming increasingly vulnerable to attack and faster rates of degradation over time. We have encountered examples of attack on joints from higher H_2S and CO_2 applications, which drove the imperative of meeting the needs of the future with EVOLUTION®. This product has been tested exhaustively in sour media tests that have resulted in no permeability and no degradation which will meet the industry needs.

EMISSIONS

The EVOLUTION® gasket has the lowest emission values for any pipeline seal available in the market today. With the demands being placed on the oil and gas industry to improve leakage rates, the increased levels of tightness achieved will exceed those demands and give greater joint integrity.

Due to its extreme tightness, EVOLUTION® is a viable sealing solution for the transportation of GHG's (Methane, Halogens & CO2) hydrogen, and LNG applications.

THINNER SEAL

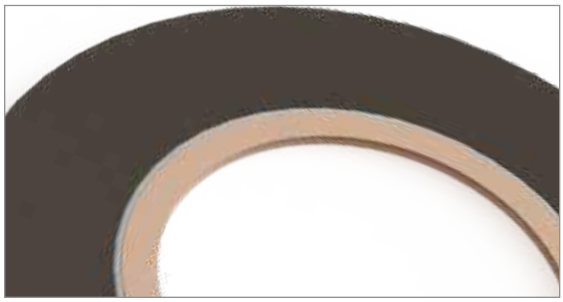
To date, most isolation products above Class 600 pressures are a minimum of .250"/6mm thick. This causes issues for installation where pipeline systems are designed for .125"/3mm make up distances or have misaligned flanges with little gap. Regularly, thicker gaskets can be damaged by the gasket being forced into the thinner gap. We designed EVOLUTION® to be a .125"/3mm gasket to meet your requirements and be installed into pipeline systems with greater ease.

EXOTIC METAL USAGE

The presence of aggressive medias often require exotic materials of construction for pipelines and associated equipment. Existing metal cored isolation kits are therefore requested with exotic metallurgy cores which has a negative impact on the purchasing and shipping cost. EVOLUTION® is fully coated and does not require an exotic core because there is no exposed metal. Therefore, the medias will never come into contact with any metal, making EVOLUTION® a lower cost, fire safe alternative to exotic cored isolation kits.

PROPRIETARY COATING

The proprietary coating has been formulated by GPT specifically for use in tough pipeline installations and is unique to the pipeline industry. Successful abrasion, scratch, and impact testing has confirmed that this product can handle the rigors of a typical installation. Chemical exposure testing of the coating in H_2S, steam, and CO_2 prove that this material is a significant technological leap versus traditional GRE type isolation gaskets.



COMMON EVOLUTION® MATERIAL PHYSICAL PROPERTIES

ASTM	Test Method	Typical Values
D149	Dielectric Strength Volts/Mil (Short Time)	1,400
D229/D570	Water Absorption (%)	0.03%
ASTM D4060	Taber Abrasion	> 1 G Ohm @ 1000 VDC
Abrasive Wheel: CS-17 Load: 1000 g Number of Cycles: 5000 Platform Rotation: 72 RPM	Mass Loss [mg]	56
	Taber Wear Index	11.3
	Tensile Strength gasket (psi)	70,000
	Tensile Strength Dielectric Material (psi)	24,000
	*Temperature Range °F/°C	
	Minimum	-300°F/-184°C **
	Maximum	500°F/260°C
B117	Salt Spray Resistance @ 5% salt solution with no red rust (hrs)	2,000

*NOTE: With mica sleeves/washers only. Standard kit is with G-11 sleeves and washers with a temperature rating of 392°F/200°C. For temperatures up to 770°F/410°C, please use our VCXT isolation gasket.
** NOTE: All component materials are rated for -300F or lower. Assembly inert media exposure testing down to -277F. Assembly functional testing down to -50C.

EVOLUTION® TEST RESULTS

Test	Value
Compression Test - EN 13555 @ 260°C	180 MPa (E_G)
Creep Relaxation Factor $P_{QR}(T_P)$ - EN 13555 @ 260°C	1.00
Hot Blowout Test - HOBT @ 260°C @ 62.3 bar	No Blowout
Shell Leakage Test - MESC SPE 85/300-3.3.2 @ ambient @ 81.9 MPa (gasket stress) @ 51 bar (test pressure)	6.48x10^-12 PA-m^3/s/mm Tightness Class A
Shell Leakage Test - MESC SPE 85/300-3.3.2 @ 260°C @ 81.9 MPa (gasket stress) @ 42 bar (test pressure)	3.08x10^-8 PA-m^3/s/mm Tightness Class B
Shell Cycle Test - MESC SPE 85/300-3.3.2 @ 260°C @ 81.9 MPa (gasket stress) @ <0.1 bar (pressure drop)	<0.1 bar (pressure drop)

EVOLUTION™ ISOLATION KITS & KITTING

SLEEVES - each kit contains one G-11 sleeve per bolt. The sleeve length is the combined thickness of the flange, plus raised face or RTJ height, plus gasket, plus three washers. The wall thickness is a nominal 1/32" (.08mm) thick.

G-11 is a higher temperature sleeve material meeting or exceeding NEMA G-11 requirements. The product is a high strength sleeve capable of withstanding moderate side-loading while resisting fractures during installation.

WASHERS - each kit includes four DIAMOND-HYDE™ coated HCS Stainless Steel Washers per stud which are more abrasion resistant and stronger dielectrically than the older generation isolation washers. Rated from -50°F/-46°C to +425°F/218°C, DIAMOND-HYDE™ provides long life and superior electrical performance. DIAMOND-HYDE™ coated HCS Washers provide a chemically resistant barrier. The isolating washer can be the weakest link in a flange isolating kit. By using DIAMOND-HYDE™ coated HCS Washers, the washer is extremely impervious to cracking, chipping, or scratching. The product has successfully passed API 6FB fire testing. The washer ID has a custom diameter to accommodate the sleeve wall thickness.

NOTE: FNOTE: For higher temperature applications up to 500F/260C, please order MICA sleeves and DH washers

Temperature rating:	392°F/200°C
Water absorption:	.2%
Flex strength:	80,000 psi
Tensile strength:	43,000 psi
Compressive strength:	(.5") : 63,000 psi
Breakdown voltage:	(.062") : 60,000 volts

NOTE: All values are for G-11 sleeves

To specify EVOLUTION® please find specification at www.gptindustries.com

EVOLUTION™ QUALITY ASSURED

PERFORMANCE TESTING

- API 6FB Fire
- API PR2
- Bend*
- Blowout - (Hydro)
- Chevron fugitive emissions
- Coating compression
- Explosive decompression*
- Sealability
- Sour gas aging*
- VDI 2200
- VDI 2440 - (TA Luft)

SHELL TAT TESTING

- DIN EN 13555
- HOTT
- HOBT
- 10 EN 13555
- ASTM F37 Part B
- ASTM F 607
- Electrical Isolation

COATING

- Abrasion
- Adhesion
- Cross-cut adhesion
- Scratch
- Taber abrasion

ELECTRICAL

- ASTM D149
- Electrical VAC breakdown
- Electrical VDC resistance

ENVIRONMENTAL

- Salt fog spray
- Steam immersion*
- Sweet & sour gas
- UV*

*NOTE: Tests are in progress

MADE IN USA

The EVOLUTION™ gasket, sleeves and washers are manufactured and assembled in the USA at our Denver, Colorado plant.

SAFETY CULTURE

Safety is the foundational objective of everything we do. Our products and services improve efficiency, reduce maintenance and increase profitability, but none of that matters if our products are not first keeping people safe. Safety is not just built into the products we engineer, either. As part of the EnPro family of companies, we are ranked as one of the safest workplaces in America. We practice what we preach, and our commitment to keeping our employees safe is just one of the ways you can trust our dedication to keeping your's safe, too.

OUR COMMITMENT TO YOU

Garlock Pipeline Technologies is dedicated to innovating and introducing the best products for sealing, connecting and protecting the world's pipelines. Our desire to be the supplier of choice for the pipeline industry is exhibited through our commitment to employing a technically proficient sales force, our large staff of R&D, process and application engineers, and our solid network of distributors.

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