

ORIGRAF®

High-performance sealing solution for
all industries

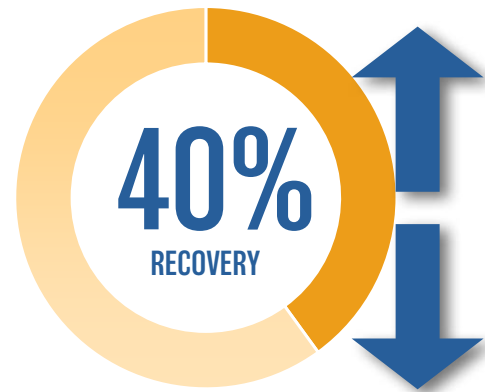
Technetics
GROUP

ORIGRAF® graphite seal provides a long lasting high-performance sealing solution for all industries and can be specifically designed for extreme thermal & pressure cycles ensuring higher safety in operation while optimizing total cost of ownership.

www.technetics.com

ORIGRAF® SEAL BENEFITS

- Excellent elastic recovery, capable of reaching 40% of compression recovery (spring back effect)
- Graphite spring-back effect serves the sealing function
- Integrated compression limiters (metal-to-metal concept) allow for the protection of the seal from asymmetric tightening or torquing bolts of assembly
- Adaptability to extreme thermal and pressure changes (relative movement between the sealing contact areas)
- Chemical inertness: flexible graphite, which contains no binders, withstands most chemicals (mineral acids and solvents).
- Monobloc seal, easy to ensure that seal continues contact with hardware in thermal and pressure cycling (no risk of breakage during installation and handling)
- The natural lubrication of the graphite provides excellent resistance to radial movements of the flanges
- Can be adapted to damaged flanges such as troughs, surface waviness, surface scorings or other imperfections
- Flexible graphite does not bond to the contact surfaces, so that it can be easily removed



Handling - Installation - Maintenance

The ORIGRAF® seal offers safety and performance in all use environments, due in part to a metal-metal contact and a repeatable elastic recovery. This reliable and sustainable solution allows the **optimization of overall operating costs, increasing the Mean Time Between Failure (MTBF).**

ORIGRAF® SEAL CHARACTERISTICS

- Effective in high service pressure (up to 200 bar / 2900 psi) and extreme temperature ranges -196 to 450°C * (-320 to 842 °F).
- ORIGRAF® ON 002 gaskets have been designed for adaption to flat surfaced flanges (type FF) or raised flanges (type RF) and single insertion (type SE), following flange standards NF-EN 1092-1 and NF-EN 1759-1 (ASME/ANSI B16-5).
- Standard sizes: DN (mm) 15 to 600 - NPS (in) ½" to 24" and CLASS (lbs.) 150 to 2500 - PN (bar) 20 to 420 *.
- The ORIGRAF® seal can be PMUC certified by EDF (No. PMUC 17-0174) and BAM when using specific graphite ranges.

(*) Please consult for all your standard and non-standard seal requirements.



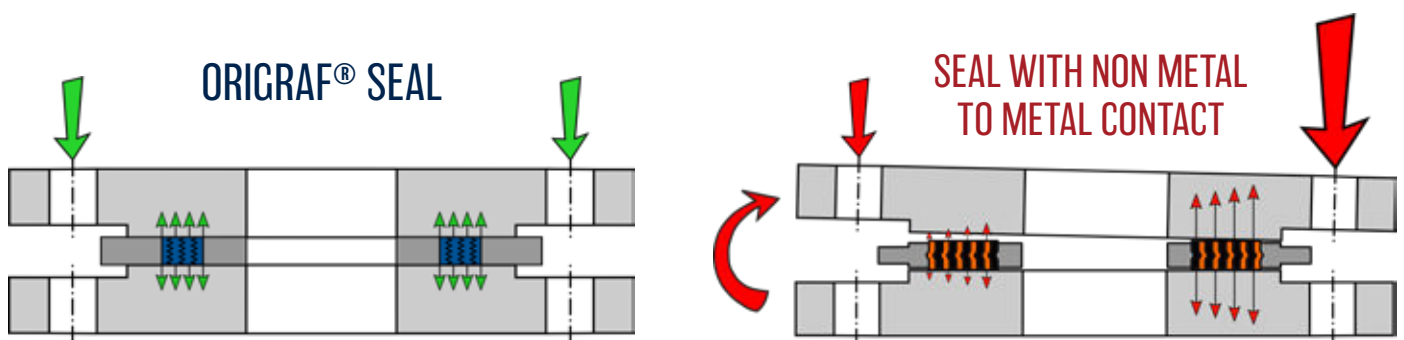
CONCEPT AND DESIGN

ORIGRAF® seals are made from strips of flexible graphite grades without binder, densified under pressure using die-forming processes ensuring manufacturing performance consistency. The leak-tight interface is created by installation compression and final densification of the seal when metal to metal touch with a mechanical stop made by groove or limiter (compliant with Flanges Standard ASME/ANSI B16-5). ORIGRAF® seals are designed to be compressed by 15 to 20%.

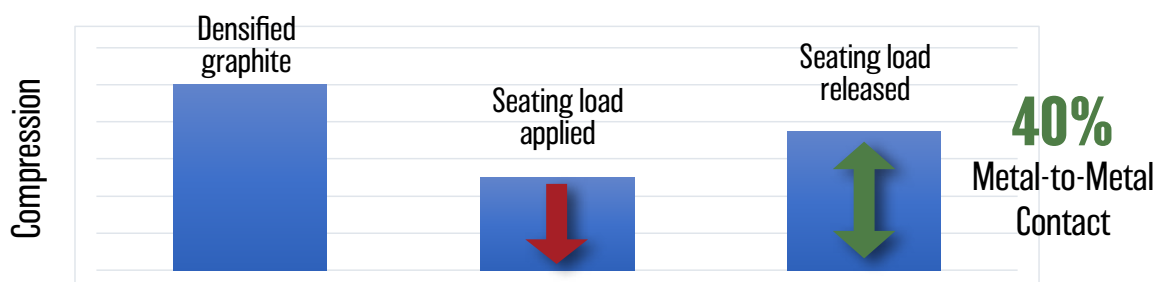
Graphite range

Technetics Group Product Name	Specifications	Max. Temp. °C/ °F (in oxidizing environment)	Carbon %
I 980	Standard grade for industrial applications	500°C/932°F	98.0%
N 998	High purity for specific applications	500°C/932°F	99.8%
NP 998	High purity grade with an oxidation inhibitor	550°C /1,022°F	98.5%
NS 200	Low sulfur and halogens content for nuclear application (< 200 ppm)	420°C / 788°F	99.5%

Metal to metal concept applied to ORIGRAF® Seal aims to protect from over-tightening or inaccurate torquing bolts causing imprecise relative positioning of the flanges, such as non-parallelism or asymmetric seating loads. In comparison, a spiral wound gasket (SWG) will not provide metal-to-metal contact in the assembly and in some conditions the sealing performance could decrease.



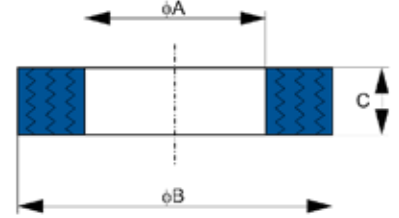
Recovery/Spring-back effect gives to the ORIGRAF® Seal a high level of self-energizing effect also identified as having high recovery (up to 40%) that serves as an enhancement to sealing performance.



Gasket dimensions and tolerances:

C		Tolerances	
mm	in	mm	in
$0 \leq C < 5$	$0 \leq C < 0.197$	+0 / +0.50	+0 / +0.020
$5 \leq C < 8$	$0.197 \leq C < 0.315$	+0 / +0.60	+0 / +0.024
$8 \leq C < 12$	$0.315 \leq C < 0.472$	+0 / +0.75	+0 / +0.030

A = seal inner diameter
B = seal outer diameter
C = seal depth

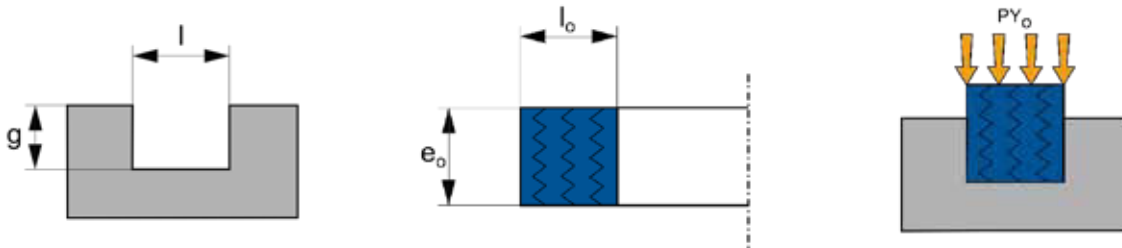


Range of \emptyset		$\emptyset A$		$\emptyset B$	
mm	in	mm	in	mm	in
$0 \leq \emptyset < 250$	$0 \leq \emptyset < 9.84$	+0 / +0.20	+0 / +0.008	-0 / -0.20	+0 / +0.008
$250 \leq \emptyset < 500$	$9.84 \leq \emptyset < 19.68$	+0 / +0.30	+0 / +0.012	-0 / -0.30	+0 / +0.012
$500 \leq \emptyset < 750$	$19.68 \leq \emptyset < 29.53$	+0 / +0.50	+0 / +0.020	-0 / -0.50	+0 / +0.020
$750 \leq \emptyset < 1000$	$29.53 \leq \emptyset < 39.37$	+0 / +0.65	+0 / +0.026	-0 / -0.65	+0 / +0.026
$1000 \leq \emptyset < 1250$	$39.37 \leq \emptyset < 49.21$	+0 / +0.80	+0 / +0.031	-0 / -0.80	+0 / +0.031

Please consult for all your standard and non-standard seals requirements.

Groove size:

The dimensioning of grooves has a direct impact on the sitting pressure to be developed on the seal in order to obtain the metal-to-metal contact. The chart below shows the influence of groove tolerances on the precision of the sitting pressure (PY0) defined for a seal with initial section $l_0 \times e_0$.



Groove Sizes Housing Tolerances				Seal Section of $l_0 \times e_0$ (mm ² /sq in)		
g		l		25/0.984	50/1.969	100/3.937
mm	inch	mm	inch			
±0.05	±0.002	±0.05	±0.002	PY0 ± 20%	PY0 ± 15%	PY0 ± 10%
±0.05	±0.002	±0.10	±0.004	PY0 ± 25%	PY0 ± 20%	PY0 ± 15%
±0.10	±0.004	±0.20	±0.008	PY0 ± 50%	PY0 ± 30%	PY0 ± 25%

Recommendations for use:

• Surface conditions :

The surface conditions of the contact areas should be:

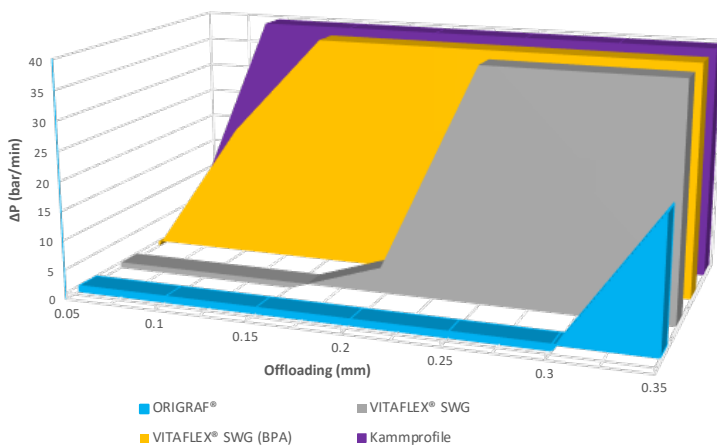
Ra (μm / μin) = 0.8/32 to 12.5/500 for circular seals (recommended Ra = 1.6/63 to 6.3/250)

Ra = 0.4/16 to 1.6/63 for shaped seals (recommended Ra = 0.8/32)

ORIGRAF® PERFORMANCE

Evaluation of gaskets elastic recovery:

Often a leakage occurs because of the offloading on the seal (can be due to the elongation of the fasteners, or rotation of the flange). ORIGRAF® seal, thanks to its excellent resiliency, can handle extreme variation of compression and still ensure the leak-tightness of the connection.



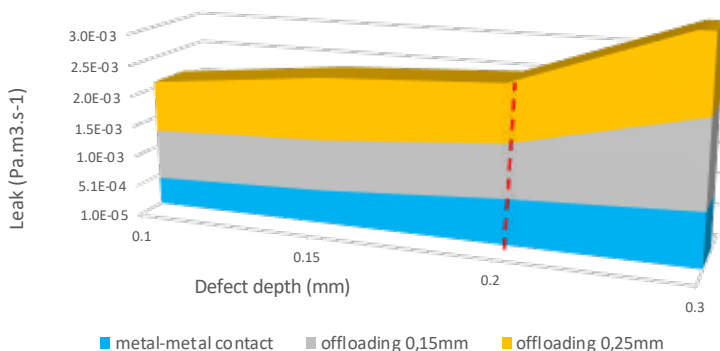
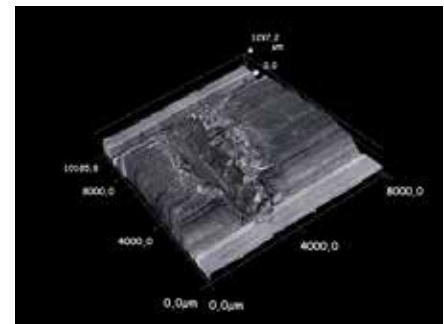
Seals: NPS 3" - 900 lbs tested under offloading condition (by 0.05mm opening step) - Water pressure test (175 bar/2538 psi) at RT after 350°C/662°F.
 Evaluation of gaskets elastic recovery at RT after 350°C/662°F (pressure drop test with different spring back values).
 Sealing Pressure:

- VITAFLEX® SWG / 70-85 MPa
- VITAFLEX® SWG (Low Stress) / 40-45 MPa
- Kammprofile / 35 MPa
- ORIGRAF® / 45 MPa (nuclear conditions)

Report #2015-034 - Comparison Kammprofile / VITAFLEX® SWG / ORIGRAF® - Maestral Lab - France

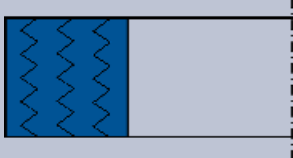
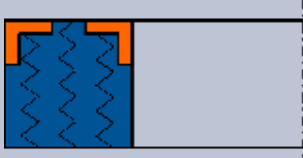
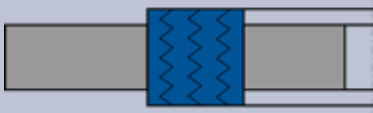
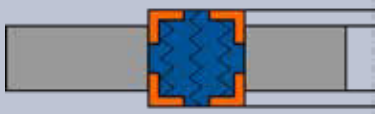
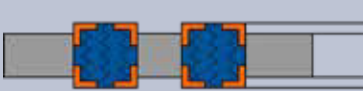


Evaluation of graphite surface defects' influence:

Thanks to graphite flexibility, ORIGRAF® seal can avoid influence of surface defects and still ensure the leak-tightness of the connection even in offloading conditions. Even through 0.25mm/3.62 inch defect depth performance still guaranteed to 0.20mm/2.90 inch offloading stage.



Seals: ORIGRAF® ON002 DN6" Class 150 tested at metal/metal contact and under offloading condition (0.15mm - 0.25mm/ 0.006" - 0.01") - helium pressure test (40 bar/580 psi) - Nuclear Visual control requirements -ESPN Std
 Report # 2017-060
 EVALUATION OF THE INFLUENCE OF GRAPHITE SURFACE DEFECTS ON THE ORIGRAF® Seal PERFORMANCE (21112017) by Maestral Lab

Assembly Type

Assembly	Seal Type	Description	Characteristics
Groove	ON000 	Seal composed of a single graphite ring Minimum possible thickness 2 mm/0.078 in Minimum internal diameter 6 mm/0.236 in outside diameter up to 1500 mm/59.055 in	Section according to pressures to be sealed.
Groove	ON250 	Seal composed of a graphite ring and 2 anti-extrusion cups (huge gaps between parts, graphite anti-creeping, preservation of density high pressure or high temperature, highly corrosive or impurities charged fluid)	High pressure Adapted to large space between metallic assembly parts Fluids containing impurities or highly corrosive (cups to protect the core of the seal)
Flat/Raised Face	ON002 	Seal composed of a graphite ring and 2 metal inner and outer rings Following flange standards NF-EN 1092-1 and ASME/ANSI B16-5 (NF-EN 1759-1)	Metal-metal contact Adapted to flat surfaced flanges (FF type), raised flanges (RF type) or single insertion flange (SE type)
Flat/Raised Face	ON492 	ON002 seal with 4 anti-extrusion cups (see ON250 for cups details advantages)	Metal-metal contact Inner and/or outer rings which serve as tightening limitations and/or internal reinforcement Limited creep
Flat/Raised Face	OD494 	Seal made of 2 graphite rings and 3 metal inner, outer and intermediate rings, with 4 anti-extrusion cups (see ON250 for cups details advantages)	
Body/Bonnet Autoclave Assembly	OT280 	Seal made of metal rings and molded graphite rings (see ON250 for cups details advantages)	Metal-metal contact Replacement of main metallic seals without altering the assembly
Stem Packing	Set ON000 + ON250 	Packing of ORIGRAF® seals ON000 and ON250	Radial contact Limited creep

Successful Applications

ORIGRAF® seals are mainly used in applications servicing Nuclear, Chemical, Petrochemical, Aerospace, and Oil & Gas industries. The range of applications can be extensive, including steam equipment, heat exchangers/heaters, piping connection flanges, corrosive circuit, critical flange applications, boilers manways, fire safe requirements, alkylation units.

	<p>Atmospheric microwave plasma technology Dissociate carbon dioxide-CO₂ and methane-CH₄ into hydrogen-H₂ and carbon monoxide-CO (syngas). Two packings made of 4 rings ORIGRAF® ON250/ON000 are used to seal the reactor. Service conditions — Pressure: Air, Temperature: 700°C/1292°F</p>
	<p>Bleed air system The air conditioning system in commercial aircraft processes high pressure, high temperature air which is typically taken or “bled” directly from the engines. ORIGRAF® ON000 seal with thin cross section made of high purity graphite ensures sealing on pipe connections. Service conditions — Pressure: 20bar/290 psi, Temperature: 580°C/1076°F</p>
	<p>Chemical reactor systems Stirred pressure reactors, and high-pressure autoclave doors. Several type of ORIGRAF® OT007, OT280 or ON250 seals are made up of metal rings and molded graphite rings (straight or cone-shaped) which ensure radial sealing. Service conditions — Pressure: 350bar/5076 psi, Temperature: 500°C/932°F</p>
	<p>SEBIM® Main Steam Safety Valves Developed for overpressure protection of the steam generator or the main steam lines of all designs of nuclear reactor. ORIGRAF® ON492 seals are used to perform this key function. Service conditions — Pressure: 350bar/5076 psi, Temperature: 500°C/932°F</p>
	<p>Steam generator More than 30 ORIGRAF® ON002 designs are made of high purity PMUC graphite grade and are mounted on steam generators used to convert water into steam from heat produced in a nuclear reactor. Service conditions — Pressure: 155bar/2248 psi, Temperature: 320°C/608°F</p>
	<p>Heat Exchanger Equipment for heat transfer in duties with tough media, pressure or temperature demands. Sealing with flat panels is made by a frame of oxidation inhibitor NP998 graphite tight profile (up to 2 meters in length) seated into a groove. Service conditions - Pressure: 80 bar/1160 psi, Temperature: -40°C to 450°C/-40°F to 852°F</p>

Learn More at technetics.com/ORIGRAFApplications

For more information on how Technetics Group supports high performance sealing technology, visit technetics.com

Contact Us Today to Discuss Your Application

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