VALVE SEALANTS & COMPONENTS
valgasket division
CARRARA
CARRARA Global Sealing Solutions, committed to Partnership

Operational Divisions

- Sealing systems and components for valves
- Industrial sealing systems
- Environmental services
- Engineered yarns for industry

Carrara is a partner to principal manufacturers of process components for controlling fluids and is authorised both at the main International EPCs, as well as with principle oil and gas players, for the supply of sealing and Environmental Services systems.

- 20,000 m² of protected area
- 160 employees
- Patented products
- Frame Agreements with International Clients
Mission

• Undertake to establish Partnerships with commercial Clients over a long period and cooperate with them in pursuing continuous improvement.
• Supply our Clients with the best technical and logistics solutions at the best price
• Satisfy our Clients by producing efficient Sealing systems.

Assets

To carry out our Mission, Carrara Global Sealing Solutions has equipped itself with spaces for logistics, equipment, management and human resources software, all tailored to the requirements of an ever increasingly competitive and exacting market.

• The large surface area over which the establishment extends allows for an extremely rational flow of raw materials, semi processed materials and of goods, guaranteeing maximum efficiency.
• The equipment for moving, processing, quality control and packaging are all integrated into a process which allows for the management of high volumes of product while preserving their traceability and adherence to standards of quality, and of the consignment times agreed with the Client.
• The use of advanced order management software allows for minimizing manual handling of data in order to guarantee the integrity of every phase of the process.
• The proficiencies of the human resources are constantly verified and integrated within a structured plan with the aim of continuous improvement.

Sealing Solutions

The Valgasket division of Carrara Global Sealing Solutions, dedicated to the production of sealing systems for Industrial Valves. The product range is complete and extensive, including Seats, Balls and Retainers, Shut-offs for Ball Valves, Seats for Gate Valves, Expanding Gates and Through Conduit Gates. Also part of the product range are Ring Joints and Spiral Wound Gaskets, Kammprofiles and Flat Gaskets, O-Ring and Lip Seals together with the range of products in Valvograph Graphite for stems, Seats and Shut-offs, rated as Low Emission and Fire Safe, available in dimensions from 8 mm up to 2,000 mm.

Partnership

Carrara Global Sealing Solutions, Partner for winning together!
Carrara operates with Clients in a global and competitive market to win with them, and triumph together. For this, we offer competence and reliability in the modern role of Partner in the Supply Chain.
Co-Engineering

Carrara Global Sealing Solutions, value seals!
The Valgasket Division of Carrara Global Sealing Solutions makes available to Clients the decades of experience acquired by our Technical Staff for the joint development of sealing solutions with high added value.

Co-Design

Carrara Global Sealing Solutions, quality seals!
The selection of a number of seat details, and that of the sealing materials, at times requires supplementary analysis and discussions in order to ensure that all is in agreement with the project specifications, and with the fluids to be contained. The Technical Staff at Carrara Global Sealing Solutions will always offer you the best assistance with the right amount of support for a correct solution.
Ready to Install

**Client Oriented Strategy**
The Carrara Sealing Global Solutions Valgasket Division sales programme is oriented towards maximum flexibility in order to satisfy all Client requests.

**Seats**
The seats may be supplied with only the thermoplastic insert or, in the case of metal to metal seals, with elastomeric or fired inserts. Carrara has available the best materials and suppliers for thermoplastic substances (PTFE, RPTFE, DEVLOM, NYLON, PEEK and KEL-F), for FKM AED mixes and for the nickel plating, carburation and welding filling treatments.

**Equipped Seats**
The seats can also be supplied with secondary seating equipment and with energizing elements.

**Kit**
The supply of a kit complete with double seat and ball, is the Full supply option which permits optimization of the primary seal profiles.

**Adaptation of Seat - Ball**
For each supply option, the Seat - Ball Adaptation service is always advised as it allows for arriving at the highest level of precision and quality.

**Seat Equipment**

- **O-Ring** Are available for specific Oil & Gas applications, or HNBR and FKM, as well as special ones in FFKM and FKM with AED certificate.
- **Back-Up** Are made out of different thermoplastic materials and installed in some cases in endless form.
- **Springs and Spring Retainers**
The springs and spring retainers are available in all materials and the Carrara Technical Department may be consulted regarding their design.
- **Fire Safe Valvograph** The original Valvograph graphite rings are available in sizes from 10 up to 2,300 mm in the basic or energized versions.
- **Secondary seal in Chevron Shape thermo-polymer material** producible in all materials with Carrara design or custom made.
- **Lip Seal** Are available in different combinations of design, thermo-polymeric energizing materials to adapt to any configuration of seal.
- **Secondary seals in Valvograph Controller Back graphite**
The Controller Back line of seals is ideal for the range of pressures from 150 to 2500 psi.
Valve Seats and Components

**Standard seat design**

Design: this configuration, available in sizes from ½” up to 60”, has been developed on the basis of the standard dimensions of Ball Valve bodies. It is capable of absolving the seal, both in normal conditions, and in the most severe at high temperature and in aggressive environments. We have a vast stock of materials available in order to guarantee rapid consignment. It is possible to customize the design of the seat if the dimensions are within the standard of stock blanks.

Applications: These seats are used in Side Entry valves, in the Floating and Trunnion models.

**V-ring seat design**

Design: This design requires the use of a 98 shore elastomer for the seal between the seat and the ball. Ordinarily, this configuration was aimed at low pressure services, but recent progress has allowed for an extension of use to high pressure services also. We can supply all the necessary information for a correct selection of the elastomer on the basis of requested chemical compatibility.

**Cryogenic design**

Design: The main characteristic of this design is that of allowing a seal down to -196°C. A special procedure was developed to obtain the best performance from the material, through correct insertion of the soft element. Our technical department is able to offer support in the development of the critical sizes and to indicate the seat and ball finish to maximise the performance of the sealing system. The most common combination of materials is F316 + PCTFE + Lip Seal. We have successfully tested a new material named V10, applicable down to -260°C.

Applications: This particular design is specific for cryogenic services in applications with LNG at the plant and during transport.
Metal-to-metal design

Design: The metal to Metal Design consists in production of the primary seals through direct contact of seat and ball. The O-Ring, as well as Lip Seal or the graphite, may be used as secondary seals depending on the applications. The coatings on the part in contact are normally made with Tungsten or Chrome Carbide using the HVOF procedure. We are able to supply various designs to guarantee the best performance for every circumstance.

Applications: These seats are used for services at high pressure and with abrasive fluids, a circumstance in which the soft insert could easily be damaged. The product could be used up to 400°C depending on the grade of the material.

Top-entry seat design

Design: This configuration, which requires a higher seat, is made up of one or two distinct pieces and may be supplied with any soft insert from Nylon to Peek, and with special surface coatings depending on the specific applications. Normally, these seats, produced both with normal or exotic materials, are made with a connector to facilitate assembly and to guarantee the necessary space for movement of the ball.

Applications: The main characteristic of the Top Entry valve is that or allowing ordinary maintenance or the substitution of seats, and of the ball, without removing the valve from the line. These seats can be used for all pressure ratings.

Gate valve seat design

Design: The seat has a frontal seal section made up of 1 or 2 inserts of different materials. The seal may also be metallic using Stellite or TCC. To facilitate assembly and maintenance in line, the design normally includes “wings”. These seats can be made in sizes from ½” to 72” in all materials.

Applications: The Gate Valves are ordinarily used in oil and gas pipelines and in industrial plant.
Valve Seats and Components

Balls
The supply of balls, in ordinary or exotic materials and fashioned with ENP, Tungsten Carbide or Stellite, allows for supplying the complete seat-ball Kit, which directly releases the Carrara establishment from adaptation actions for the two parts. The balls may be standard, but also according to the Client’s design.

Bodies and closures
In order to offer a complete service, we carry out the mechanical processing of valve “Bodies and Closures” over the complete range of sizes from 8” to 36”.

Expanding gates and through conduit gates
The expanding gates design allows for a seal between the seats and the gate, be that at low or high pressures. The excellence of the seal is guaranteed by the perfect contact between the parts, allowing for its use in the most severe conditions.

The through conduit cut off is the perfect solution for downstream pipe applications. It floats towards the second seat making the seal. It normally works with a soft insert seat to guarantee a perfect seal even at low pressure.
Setting Valve

seals for valves

The stamping division for Valvograph graphite seals of Carrara Global Sealing Solutions combines a large production capacity with a high level of flexibility and includes in its range seals certified for stems, closures and seats, which meet the most stringent requirements regarding runaway emission controls and of purity of the materials.
**PGT3 GR8622**

**PGT4 GR8622**

**PGT3 GR8622** is the full braided graphite rings stem seal certified API 622 which guarantees a maintenance of the low emission profile of the valve, even under maintenance with the GR8622 braid.

**PGT4 GR8622** is the certified low emission stem seal complying with API 622 e ISO 15848 Standards which makes a valid solution for reducing the type of seal used for the first use on new valves. Indeed, it can be used as much in the context of Oil & Gas and Chemicals, as in high pressure and temperature steam applications.

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**Full low emission approvals**

- ISO 15848 C01 BH
- ISO 15848 C02 BH
- API 622 2nd Edition
- Fire Test API 589
- Corrosion Test
- Weight Loss Test EN 14772, section 6.7

**Applications**

**PGT3 GR8622** e **PGT4 GR8622** are the Valvograph graphite seal sets for Gate, Globe, Butterfly, Ball and Oil & Gas e Chemical Service Control valves, yet applicable with all industrial fluids compatible with graphite, allowing for the use of a single seal for all applications.

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**Temperature**

-200°C up to 650°C, having limitations at 450°C with weakly oxidizing fluids and hot air

**Pressure range**

All Pressure Classes are covered up to API 10000 psi

**Ph Range**

0 ÷ 14 except for strong oxidants
CONTROLLER EVOLUTION.
The CONTROLLER family seal sets EVOLUTION are designed to meet the demand for reliable products conforming with the TA LUFT Low Emission requirements.

CONTROLLER ONE EVOLUTION
Is the seal set with “Cup & Cone” configuration having rings at diversified densities, specifically for valves undergoing frequent movement but usable for all applications.

CONTROLLER 2 EVOLUTION
Is the seal set, the rings of which, with a squared section, are made in the W configuration at controlled densities, usable for all critical applications.

Temperature
-200°C up to 650°C, having limitations at 450°C with weakly oxidizing fluids and hot air

Pressure range
All Pressure Classes are covered up to API 10000 psi

Ph Range
0 ÷ 14 except for strong oxidants

Approvals
- TA LUFT VDI 2440
- Weight Loss Test EN 14772, section 6.7

Low Emission Design
Low Emission reliability over time
The CONTROLLER EVOLUTION seal sets are made with GR80SGR packing and Valvograph graphite rings with a high level of purity. Both the products are treated with oxidation and corrosion inhibitors, and show a very low Sulphur and Halogen content. The high quality level of the materials selected for production of the CONTROLLER EVOLUTION range is the main requisite for guaranteeing low emission reliability over time.

Differing densities
Thanks to the stamping technique at differing densities and to the W shape, jointly with the use of the special GR80SGR packing, the CONTROLLER EVOLUTION sets have a modest wear coefficient, cause of the reduction of gasket compression during activation of the valve, delaying the need for resealing during operation.
**GR80SGR OXY**

Oxygen service

**GR80SGR OXY** is the Valvograph packing in graphite, BAM approved for Industrial Valve Oxygen applications.

The packing is made with spun expanded graphite yarn of the maximum purity and enriched with oxidation retardant.

It is this very characteristic, along with the care with which it is made, which confers on GR80SGR OXY the exceptional resistance to contact with oxygen, both in liquid and in gaseous form.

Each production batch can be evaluated according to ASTM G136 to determine the quantity of residual soluble compounds, and to guarantee the extreme cleanliness of the products.

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**Approvals**

- AIT greater than 500°C
- Artificial ageing: 100 hrs at 325°C and 250 Bar
- AIT of the aged sample greater than 500°C
- Impact with gaseous oxygen at 300°C
- Impact with liquid oxygen

**BAM approved for Oxygen Services**

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**Product range with BAM approval for oxygen applications**

**GR80SGR OXY**

GR80SGR OXY packing is available in packaging of 1.0, 2.5 and 5.0 kg in all the sections, for maintenance activities on oxygen application lines.

**CONTROLLER 2 EVO OXY**

The CONTROLLER 2 EVO OXY set in graphite is made up of packing rings such as Top & Bottom and of pressed graphite rings. The pressed rings also have BAM approval.

**CONTROLLER 3 OXY**

The CONTROLLER 3 OXY set in graphite is wholly made up of packing rings GR80SGR OXY stamped.

**V48Z OXY e V48ZN OXY**

Single rings in graphite and reinforces graphite such as static seals for valves.

**SW316G OXY**

Wound metal with filter in graphite for the valve bonnet and the line flange.

**HOCKDRUCK**

Gaskets in graphite for the valve bonnet and line flanges.
STEELGRAPH
for Pressure Seal Gates and Check Valves

The Steelgraph gaskets for pressure seal Gate and Check Valve are made of Valvograph graphite and steel in different combinations to offer elasticity and resistance. The graphite with oxidation retardants guarantee an exceptional service life thanks to their lack of sensitivity to thermal cycles.

Steelgraph G11
G11 is the gasket produced by stamping Valvograph graphite, supported by metal layers. An ultra-resistant solution.

Steelgraph G22
G22 is obtained by stamping Valvograph graphite simultaneously with metallic covers, sized in thickness and rounded edge corners as a function of the valve rating and its size, always to guarantee the maximum resistance to extrusion and an exceptional elasticity.

Steelgraph G33
G33 is a gasket obtained by stamping Valvograph graphite with the insertion of metallic rings at the corners. This solution, especially useful for rectangular and square section gaskets, is advised for high and medium pressure calorific power station heat exchangers.

Temperatura
-200°C up to 650°C, having limitations at 450°C with weakly oxidizing fluids and hot air

Pressure range
Up to 1,500 bar

Ph Range
0 ÷ 14 except for strong incompatible oxidants and fluids
The Valvograph graphite gaskets, made of graphite enriched with oxidation retardant and corrosion inhibitor, comply with EN14772, ASTM F2168 and BAM requirements for oxygen applications. The Valvograph gaskets are available in sizes from 10 to 2,300 mm in different densities depending on the technical requirements of the Client and the application.

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The Valvograph graphite gaskets, made of graphite enriched with oxidation retardant and corrosion inhibitor, comply with EN14772, ASTM F2168 and BAM requirements for oxygen applications. The Valvograph gaskets are available in sizes from 10 to 2,300 mm in different densities depending on the technical requirements of the Client and the application.
CONTROLLER BACK
for seats with HT applications

The Valvograph energized Controller Back graphite gaskets guarantee an exceptional service life thanks to their lack of sensitivity to thermal cycles. Suitable for all pressure ratings, the energized Controller Back gaskets are available as different models and designs.

Controller Back, full control of the seal.
The seals energized by the Controller Back line are designed with different profiles and different materials to meet the design requirements for ball valves operating at high temperatures.

Energization
The Controller Back seals are made of expanded mineral graphite, conforming with EN 14772, with energizing elements in different metallic materials.

Temperature
With weakly oxidising agents, hot air and combusted gas, the temperature must be limited to 450°C. The maximum operational service temperature is 600°C with a peak limit for brief exposures of 650°C.

Pressure range
The gamma Controller Back covers the entire range of pressure up to the 2500 psi class.

Range of Ph
The graphite is not compatible with strong oxidants. The metallic insert must be compatible with the service fluid. Carrara uses graphite which is suitable for cryogenic uses and oxygen applications.
Sour Gas is a gas with significant Hydrogen Sulphide H2S content. Depending on the concentration of H2S, very negative effects may arise on the elastomers if the selection of the compound has not been appropriate, causing embrittlement of the O-Ring which would lose its elastic properties and its sealing capacity. In these applications, the temperature has a significant effect on the overall seal. In general, it is estimated that for each 10°C increase in temperature, the chemical reaction rate doubles.

Different aspects must be taken into consideration for a correct selection of O-Rings:

- The primary fluids with which the seal will be in contact (primary chemical compatibility).
- The secondary fluids (lubricants or other) with which the seal will be in contact (secondary chemical compatibility).
- Suitability of the materials at extreme application temperatures, hot and cold.
- The presence of external contaminants such as abrasives.

For a correct life expectancy, excessive deterioration of the O-ring must be avoided, verifying that, amongst other things, conditions do not apply causing:

- Significant variation of volume
- Significant increase or decrease in hardness
- Significant variation of resistance to traction

The use of an O-ring at low temperature is governed by the Glass Transition Temperature TG, which is specific to the mixture. The effects of excessive cooling are normally to be considered as reversible when the temperature climbs back up beyond the TG, while the effects of excessive heating are irreversible. Whenever the O-ring is to be used beyond extreme temperatures, also in chemically severe environments such as Sour Gas and Amino environments, selection of the correct compound becomes of really essential importance.
Ring Joint Carrara Planisteel RJ, are produced in compliance to the standards API 6A and ASME B16.20 for applications at elevated temperature and pressure. The surfaces of contact between the gasket and the flange must be shaped carefully in order to guarantee the maximum performance of the gasket. Thanks to our modern equipments and the particular cure dedicated in the production, we succeed to guarantee hardness and tolerances truly perfect.

Ring Joint Carrara Planisteel RJ are available in all stainless steels and in all alloy.

### Standard materials

**ASME B16.20**

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Research and development: The search for new objectives

For us, technology is one of the best vehicles for working better and faster. For this reason, our Production Team uses the CAD-CAM system to minimize both errors and mechanical processing times.

This has already allowed us to achieve excellent results which have lately been improved with the introduction of a Wi-Fi connection in support of the engineering and production departments. Thanks to constant investment, both in software and in new machines, we are able to keep production constantly monitored as well as the state of advancement of orders, enabling us to comply with consignment terms and to offer an ever better service in meeting the requirements of our Clients.
Every process of the activity is controlled by the procedures, which guarantee traceability of data, of materials and of the finished product.

Carrara Global Sealing Solutions operates with its own qualified personnel complying with the Client Control Plan (ITP) carrying out non-destructive tests to guarantee the quality of our products.

- PMI Positive Material Identification
- VT Visual Testing
- PT Penetrating liquids
- UT Ultrasounds
- HT Hardness Test

Quality: our mission

Thanks to experienced built up over the years and a close collaboration with our Partners, Carrara Global Sealing Solutions is able to offer quality surface treatments.

- Nickel plating ENP, at thicknesses on request 25-80 μm and standard hardness 600-700 HV with maximum of 1,100 HV.
- Welded surfaces with thicknesses up to 5mm in AISI410 - AISI316 - INC625 - INY825 and STELLITE in all grades. As opposed to other surface treatments, the welded surfaces need mechanical preparation which takes into account possible warping and sufficient excess metal.
- Carburation, for metal to metal seals in thicknesses of 150-400 μm, in the TCC version with Tungsten Carbide (200-220°C) and CCC with Chromium Carbide at higher temperatures.

Surface treatments
Stock Policy Inventory Management

Carrara Global implements a Stock Policy Inventory in order always to offer the best Lead Time to its Clients. The team, permanently assigned to this activity, analyses the request, which is integrated by the Stock Frame Agreement entered into with the Clients, in order to determine the number of items and the quantity to retain in stock.

Traceability and Transfer Stamping

The management of high stock levels of metallic blanks, thermoplastic materials, O-rings and other valve components requires the team to keep to procedures which preserve the traceability of the products. For this reason, Carrara Global Sealing Solutions has chosen to certify these processes, already included in ISO9001, and to make them subject to surveillance by third parties.

CERTIFICATE

The Certification Body of TÜV SÜD Industrie Service GmbH certifies that

CARRARA S.p.A.
Via Provinciale 1/E
I-25039 Adro (BS)

is a company of machining of products
implemented and operates a
Qualified Procedure in accordance with the Pressure Equipment Directive 2011/65/EU, Annex I, Paragraph 3.1.3 as well as AD 2000 MP 9, Paragraph 4.2.2.

Further details are described in the arrangement No. 72217403 dated 2016/10/20.

The certificate is valid through October 2019.

The validity of this certificate is connected to a valid certification in accordance with ISO 9001:2008.
8.0 VALVE SEALANTS & COMPONENTS

Metallic materials

The main metals for production of the retainers are low alloys and austenites, but are often made out of Duplex and nickel alloys. The main Standards of reference are the ASTMs:

- A350
- A182
- B564

A105/A105N  A182 F6A  A182 F44  INCOLOY 800  MONEL 400
A350 LF2  A182 F6NM  A182 F51  INCOLOY 825  MONEL 500K
A350 LF3  A469 F60  A182 F53  INCONEL 600  STELLITE GR6
AISI 410  A182 F316/L  A182 F55  INCONEL 625  STELLITE GR12
AISI 4130  A182 F316LN  A182 F60  INCONEL 718  BRONZO
AISI 4140  17-4-PH  XM19  HASTELLOY C276  TITANIO

 ASTM Tensile Properties

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<tr>
<th>Common Name</th>
<th>Forging Spec.</th>
<th>UNS</th>
<th>W.N.</th>
<th>Tensile Strength, min ksl [MPa]</th>
<th>Yield Strength, 0.2 % Offset, min ksl [MPa]</th>
<th>Elongation in 2 in. [%]</th>
<th>[50mm] or 4D, min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Steel</td>
<td>A350N</td>
<td>K03504</td>
<td>1.0460</td>
<td>70 [485]</td>
<td>36 [250]</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Incoloy 825</td>
<td>A182-F316</td>
<td>S31600</td>
<td>1.4401</td>
<td>75 [515]</td>
<td>30 [205]</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Incoloy 600</td>
<td>A182-F51</td>
<td>S31803</td>
<td>1.4462</td>
<td>90 [620]</td>
<td>65 [450]</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Monel 400</td>
<td>A182-F53</td>
<td>S32759</td>
<td>1.4419</td>
<td>116 [800]</td>
<td>80 [550]</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Titanium</td>
<td>B381-Gr12</td>
<td>H90400</td>
<td>3.7035</td>
<td>50 [345]</td>
<td>40 [275]</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

The values indicated in the table are obtainable from the ASTMs. The diagrams indicated below are illustrative of the behaviour of the material in the range P bar - T°C. These are completely approximate and must not replace a direct consultation of ASME B16.34.

On the basis of ASME B16.34, each group of materials may be used in specific ranges of P bar – T°C. The curves indicated in the diagrams show, for each class of valve pressure, the maximum pressure and temperature value which can be satisfied by the material (design conditions).
The Carrara Global Sealing Solutions Valgasket division has forged very strong partnerships with manufacturers of virgin and charged techno-polymers, always to offer the best material in accordance with the project specifications and the requirements of the Client. Thanks to the dedicated procedures, refined over the years, the preparation of the insert and its insertion are done with maximum care, always to guarantee maximum quality.

The values indicated are taken from the data sheets of techno-polymer manufacturers and from the applicative experience gained. These are to be considered as guidance only on the behaviour of techno-polymers indicated, and must not be used as a discriminatory element for selection of the product for a specific application without supplementary verification. Carrara Spa accepts no responsibility deriving from improper use of this data, which may be changed without obligation of forewarning.
Expanded graphite is of mineral origin. The product is obtained through lamination without addition of binders to the flakes deriving from the thermal expansion of the graphite grain.

With graphite laminate, it is possible to produce the yarns for production of the packing and the rings preformed through pressing. The yarn, which can be reinforced with a single metallic thread or with a special cage, is obtained by applying a particular process on the graphite laminate. The packing made out of this material is extremely flexible and easy to use, and it can be used, depending on the model, in all pressure classes of industrial valves. The rings, pre-formed in different shapes and sizes can be produced at different densities and energized to withstand the highest pressures.

**The chemical characteristics**

Expanded mineral graphite is qualified by the mass content of carbon C and the ash residue (ash content) after combustion and by the limitation of the agents responsible for galvanic corrosion, in other words, sulphur and halogens. To obtain the values of limited detrimental materials, the graphite must undergo de-sulphuring and de-halogenic processes.

<table>
<thead>
<tr>
<th>Detrimental Materials</th>
<th>Element</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur</td>
<td>S</td>
<td>700 ppm</td>
</tr>
<tr>
<td>Total Halogens (Chlorine, Bromine and Fluorine)</td>
<td>Cl, Br, F</td>
<td>310 ppm, 50 ppm, 10 ppm</td>
</tr>
<tr>
<td>Chlorine</td>
<td>Cl</td>
<td>50 ppm</td>
</tr>
<tr>
<td>Bromine</td>
<td>Br</td>
<td>10 ppm</td>
</tr>
<tr>
<td>Fluorine</td>
<td>F</td>
<td>10 ppm</td>
</tr>
</tbody>
</table>

**Typical Detrimental Materials limitation table**

**Corrosion inhibitors and Oxidation Retardants**

Finally, in order to increase the quality further, the graphites can be enriched with passive corrosion inhibitors and oxidation retardants. The first further reduces the risk of galvanic corrosion when the gasket is installed, while the second influences the rate of weight loss (oxidation) of the graphite at high temperatures.

The use of oxidation retardants does not change the graphite use temperature limits but slows the process of oxidation, allowing a gasket to remain in service for a longer time, or to withstand brief thermal excursions up to 650°C with moderate damage. It should be noted, that as against elastomers, for which the temporary exceeding of the temperature limits causes irreversible damage to the gasket, the graphite reacts at peak temperature, temporarily increasing the rate of oxidation. When the temperature returns within the limits, the gasket is not compromised.

The resistance to oxidation is measured by the EN14772 test for combustion in air at a temperature of 670°C, to confirm that the rate of loss of weight does not exceed 4% per hour (TGA test).

<table>
<thead>
<tr>
<th>graphite service temperature range</th>
<th>cryogenic</th>
<th>oxygen</th>
<th>weak oxidizers</th>
<th>regular service</th>
<th>peak limit short time</th>
</tr>
</thead>
<tbody>
<tr>
<td>-196°C</td>
<td>300°C</td>
<td>450°C</td>
<td>600°C</td>
<td>650°C</td>
<td></td>
</tr>
</tbody>
</table>

**The Mechanical Characteristics**

Less attention on the other hand is paid to the mechanical characteristics of the graphite laminate, or in other words, to its tensile strength. The resistance of the graphite laminate to traction, other than to the process of lamination, is strictly correlated to the dimension and the consistency of the flakes which, in turn, depend on the mesh of the graphite grain. Graphite laminates, laminated to a higher quality, display a resistance to traction 2 to 4 times greater than industrial laminates commonly available on the market. Significant values of resistance to traction result in a greater elasticity of the products derived from them, be they yarns or pressed rings.
Mechanical behaviour of the graphite packings

Valvograph rings
The expanded graphite packings Carrara Valvograph, which can be manufactured with density 1.40 ÷ 1.80 g/cm³, show a compression line almost linear.
About the square section graphite rings, when the axial load is 45÷50 N/mm² the compression is around 15% of the unloaded ring height and the final recovery 10%.

The radial stress is lower than the axial stress and their relation isn’t linear. The radial conversion factors Co and Ci converge only when the axial stress is higher 25÷30 MPa.
These factors can be modified changing the rings design or giving them some energization.

The use of graphite packings
The graphite packings Valvograph are widely used in the industrial valves as stem seals, clozures and seats seals.
In these different applications the packing shows a standard behaviour which is an helpful guideline to design the sealing system.

Stem Graphite Packings
The graphite sealing set for stem is usually composed by several rings and the best configuration includes 5 or 6 rings. In fact radial stress distribution along the stem is regressive and typically the first rings under the gland give the most part of this stress.

Clozure Graphite Seals
These gaskets are installed as single rings and the distribution of the radial stress is really homogeneous. These gaskets can be energized to improve the recovery and change the conversion factors Co and Ci.

Seat Graphite Seals
These packings are always energized and designed in different shape to meet the specific needs for high temperature and pressure services of the seats. The packings for seats offer a lower sealing surface than the stem sealing, but are able to guarantee the an effective sealing because their modified shapes influence positively the radial stress distribution.
CARRARA, Global Sealing Solutions!

Carrara offers in addition to the Valve Sealing & Components a large product range of seals for pumps, valves and flanges, together with all sealing accessories. Quality of the products, professional technical and commercial assistance, big stock availability and other customized services are the business guidelines to increase the value offered to customers.

Setting Compression Packings
Braided packing for Pumps and Valves

Carrara is one of the leading manufacturers of Braided Packings and Sealing Systems for pumps and valves, for all industrial applications. Through the use of high quality yarns and special manufacturing techniques developed by the R & D division, the Carrara packing are able to guarantee high performance for long time.

Setting Flange
Planisteel® Gaskets for Flanges

The Carrara Planisteel™ range includes Spiral Wound, Camprofile, Ring Joint and Jacketed gaskets. The STOCK LIST is available on www.carrara.it, to find and buy the gaskets ready to be shipped in 24 hours.
Setting Flange
Flat gaskets for Flanges

Carrara product range offers flat gasket sheets and gaskets of the following product families:
• PLANIFLEX® in CSF
• PLANIFLON® in virgin, filled, modified and expanded PTFE
• PLANIGRAPH® in graphite
• PLANIX® in rubber and Mica for high temperatures

Setting Flange
Insulating Sets for Flanges

The Insulating sets are used to prevent the flow of static electricity through the pipes. The product range offers a wide range of Carrara Insulating Sets made in high performance materials, suitable for all pressure classes.

Setting Mechanical Seals
Mechanical Seals for Pumps

Carrara offers a complete range of Mechanical Seals single stationary or rotating multiple springs cartridge, high temperature metal bellow seals cartridge and split. The Mechanical Seals Carrara are easy to install and very effective to reduce the maintenance cost.

FERP
Environmental Division

Since 2001 FERP Environmental Division of Carrara is one of the International Leaders in the monitoring of VOC, Steam and Technical Gases. Energy Saving Programs and other high value environmental services for Refining, Power Generation, Off Shore and Petrochemical fields are the core of FERP activities.
The data contained in the technical cards has been collected from tests carried out in the Carrara S.p.a laboratories, from tests carried out in third party laboratories and from the experience garnered from use of the products in industrial applications. The correct selection of the product and its appropriate installation, are determining factors for the efficiency of the said product. Carrara S.p.a accepts no responsibility for damages to property or persons caused by improper use, erroneous use or by use in a non-optimal configuration, of its products. Carrara S.p.a reserves the right to change the technical data published without the requirement of communicating the fact to third parties.
Braided Packings
A wide and certified product range of API 622, ISO 15848, BAM and FDA certified packing for all industrial applications.

Valve Components
Seats for soft or metallic sealing for ball and gate valves, seat/ball kit equipped with all gaskets.

Metallic Flange Gaskets
Planisteel is the range of Spirometallic, Kamprofile and Ring Joints gaskets in compliance with international standards or customised on demand.

Flat Gaskets for Flange
Planigraph, Planiflon and Planiflex gasket sheets and sealing gaskets for all applications.

Mechanical seals
The Single Stationary Multiples Springs Cartridge and Metal Bellows Single Cartridge mechanical seals are the main products in our range.

Insulation Kits
Flange insulation kits for cathodic protection are one of our specialities.

FERP Envir. Division
LDAR and SMART LDAR, monitoring of Tanks and steam systems, 3D environmental consulting.