Metallic Gaskets
Welding and profiling

High technology and high performance welding and profiling machines provide quality and integrity through all our metallic product range.

Manufacturing

The fabrication of metallic products is subject to stringent quality control and test procedures.

Specification

The specifications for each order are continually checked on every product. Accuracy and precision in every application ensures that quality standards are second to none.

Creating an effective, safe and sustainable environment exceeding the needs of industry

Over the years we have enhanced our technical facilities to develop new products and provide guidance and training programmes for some of the world’s largest chemical and petrochemical plants, expanding our operations into the Middle East and Kazakhstan.

We have a dedicated Research & Development team who ensure high quality technical support for all our products. We constantly look to provide a balanced mix of quality sealing product with a warmth of service.

This brochure outlines our metallic range of products and provides guidelines on their correct selection, storage and assembly.

For more information on any of the areas covered please contact our sales or technical team, or visit www.novussealing.co.za.

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Novus Select Software
Many factors affect the suitability of a gasket in a given application making it difficult to determine which is the correct one for the duty. In heat exchanger applications, factors such as relative flange movement can complicate gasket selection still further and it is important that the attributes of each gasket type are fully understood.

To help you make an informed choice on gasket selection the table below lists the advantages and disadvantages of each gasket under various conditions. This table should be used as a general guide for selection only.

### Camprofile Gaskets
Camprofile Gaskets consist of a metal core, generally stainless steel, with concentric grooves on either side. A sealing layer is normally applied to both faces and depending on the service the material for this layer can be graphite, PTFE, Novus sheet material, Hi-temp or metal (e.g. aluminium or silver). Camprofile gaskets are ideal for both standard pipe and heat exchanger applications.

### Corrugated Gaskets
Corrugated Metal Gaskets consist of a corrugated metal core, normally stainless steel, with a soft facing layer applied to each face. The corrugations provide resilience and reduce the sealing surface area of the gasket while the soft layer ensures outstanding sealing, even at low loads. Particularly suited as a replacement to metal jacketed gaskets.

### Spiral Wound Gaskets
Spiral Wound Gaskets consist of a ‘V’ shaped metal strip spirally wound in combination with a soft filler material, normally graphite, PTFE or Hi-Temp. The metal strip provides outstanding recovery whilst the flexible filler ensures excellent sealing. Depending on the application the gasket can be specified with outer and/or inner rings.

### Metal Jacketed Gaskets
Metal Jacketed Gaskets consist of soft filler material encapsulated in a metallic material. The filler material provides the gasket with compressibility and resilience while the jacket confers compressive strength and blow out resistance.

### Ring Type Joints
Ring Type Joints are designed to concentrate the bolt load over a small area thus producing high seating stresses. As the ring type material should always be softer than the mating flanges, the high seating stress causes ‘plastic–flow’ of the ring joint in the flange faces creating the seal.

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<table>
<thead>
<tr>
<th>TIGHTNESS</th>
<th>EXCELLENT</th>
<th>EXCELLENT</th>
<th>EXCELLENT</th>
<th>AVERAGE</th>
<th>EXCELLENT</th>
</tr>
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<tr>
<td>HANDLING</td>
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<td>EXCELLENT</td>
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<td>EXCELLENT</td>
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<td>EXCELLENT</td>
<td>AVERAGE</td>
<td>AVERAGE</td>
<td>AVERAGE</td>
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<td>GOOD</td>
<td>AVERAGE</td>
<td>EXCELLENT</td>
<td>AVERAGE</td>
</tr>
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<td>NARROW FLANGE WIDTH</td>
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<td>AVERAGE</td>
<td>AVERAGE</td>
<td>EXCELLENT</td>
<td>AVERAGE</td>
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<tr>
<td>RECYCLING</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

---

Metallic Gaskets
Camprofile Gaskets

Camprofile Gasket Characteristics
Camprofile gaskets consist of a metal core, generally stainless steel, with concentric grooves on either side. A sealing layer is usually applied on both sides and depending on the service the material for this layer can be graphite, PTFE (Teflon), Novus sheeting material, Hi-temp or metal (e.g. aluminium or silver). Camprofiles can be used without sealing layers to provide an excellent seal but there is a risk of flange surface damage especially at high seating stresses. The sealing layers protect the flange surface from damage in addition to providing an excellent seal at low bolt stress.

Core Thickness
Core thickness depends on the assembly circumstances. Generally a 3mm core is recommended but for large diameter gaskets above 1.5m it is advisable to use a 4mm core for purposes of stability. Styles M21LM and M41LM are available in 4mm thickness only due to their construction.

Seating Stress Range
The camprofile gasket offers reliable sealing performance when seated within the seating stress ranges. The below are based on parallel form gaskets. The values have slight variations for convex forms of camprofiles.

<table>
<thead>
<tr>
<th>Layer Material</th>
<th>Seating Stress Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min (N/mm²)</td>
</tr>
<tr>
<td>Graphite</td>
<td>20</td>
</tr>
<tr>
<td>PTFE</td>
<td>20</td>
</tr>
<tr>
<td>Novus Sheet</td>
<td>40</td>
</tr>
<tr>
<td>Silver</td>
<td>125</td>
</tr>
<tr>
<td>Hi-Temp</td>
<td>40</td>
</tr>
</tbody>
</table>

Gasket Profiles
All profiles feature as standard a 1mm cam pitch and a maximum groove depth of 0.5mm. Alternative profiles are available on request e.g. 1.5mm cam pitch and a maximum groove depth of 0.7mm (DIN profile).

Profile Selection
With or without centering ring
Camprofile gaskets with centering rings ensure optimum gasket positioning between the bolts.

Loose or integral centering rings
Thermal shock conditions may damage camprofiles with integral centering rings. (Thermal tension may cause cracks in the core). This is prevented by using camprofile gaskets with loose or floating guide rings.

Camprofile Gasket shapes
In addition to the round profiles, gaskets can be made in a variety of shapes, oval, rectangular and exchanger with pass bars.

Flange Surface Finish
The recommended flange surface finish for camprofiles with sealing layers is from 3.2 to 6.3µm Ra (125-250 RMS), this is also referred to as a smooth finish.
Camprofile Gaskets

Core Material Selection

Core Material

The core material is generally fabricated in material identical to the piping system to prevent corrosion problems.

Stainless Steel 316L camprofile cores are generally used with carbon steel pipe systems to prevent gasket corrosion.

The recommended camprofile metal cores are shown in the table below.

The M21LM and M41LM styles offer the following advantages:

- The floating centering ring is stable and free from expansion stresses.
- No distortion of the centering ring by the threads of the bolts, as sometimes occurs in vertical assemblies, causing the camprofile to be positioned eccentrically.
- This also increases the possibility of re-use, reducing costs.
- User friendly - the 1.5mm thick guide ring reduces the risk of operator injury during handling.
- The floating guide ring allows for expansion without applying mechanical stress to the camprofile core.

<table>
<thead>
<tr>
<th>MATERIAL (Trade name)</th>
<th>IDENTIFICATION</th>
<th>DIN SPECIFICATION</th>
<th>DIN MATERIAL NO.</th>
<th>B.S.</th>
<th>ASA ATM UNITS</th>
<th>TEMPERATURE (°C) MIN</th>
<th>MAX</th>
<th>DENSITY (G/CM³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Carbon Steel</td>
<td>S014</td>
<td>X5 Cr Ni 18</td>
<td>1.4301</td>
<td></td>
<td>304/15/16/13</td>
<td>-250 550 7.90</td>
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<td></td>
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<td>Stainless Steel 304</td>
<td>S04</td>
<td>X5 Cr Ni 18</td>
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<td></td>
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<td>X5 Cr Ni 18</td>
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<td>316/15</td>
<td>-100 150 7.90</td>
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<td>Stainless Steel 316J</td>
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<td>Stainless Steel 347</td>
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<td>-125 600 8.80</td>
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<td>Ni 22 Mo 9 Mb</td>
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<td>-100 450 8.14</td>
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<td>Ni825</td>
<td>Ni 21 Mo</td>
<td>2.4858</td>
<td></td>
<td>3072/76/14 /16</td>
<td>-100 450 8.14</td>
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<td></td>
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<td>Hastelloy C276</td>
<td>C276</td>
<td>Ni Mo 16 Cr 15 W</td>
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<td>N01676</td>
<td>-200 450 9.20</td>
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<td>Titanium</td>
<td>T2</td>
<td>T9 9 8</td>
<td>3.7025</td>
<td></td>
<td>T2</td>
<td>-250 750 4.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Standard Material for Camprofile Gaskets

Layer Material Selection

The table above may be used to determine the appropriate sealing layer material. We recommend the use of graphite layers for most applications. Only in cases where graphite may cause media contamination, or is not chemically resistant, should an alternative material layer be chosen.

Graphite

Graphite is a universal, high quality, non asbestos sealing material featuring:

- Very good chemical resistance
- Resistance to high fluctuating temperatures and pressures
- Non ageing properties
- Excellent gas tightness qualities

Graphite APX 2

Inhibited grade for oxidation resistance. Ideal for use at temperatures above the limit recommended for standard graphite grades. Often used in combination with Novus Hi-Temp for high temperature applications.

PTFE

PTFE is a high quality synthetic material featuring:

- Excellent chemical resistance
- Temperature resistant up to 260°C
- Good ageing resistance
- Excellent gas tightness

Novus Sheet

Novus sheet materials consist of synthetic fibre compounds with rubber binders and material fillers.

Silver

Silver is a precious metal combining excellent gas tightness and chemical resistance properties. Generally used in applications requiring gas tightness at elevated temperatures.

Hi-Temp

Hi-Temp is a mica-based material suitable for high temperature applications, often used in combination with graphite up to temperatures of 800°C.

HOW TO ORDER

Please specify the following when ordering camprofile gaskets:

- Style of camprofile gasket
- Nominal pipe bore, pressure rating and flange standard
- Materials of core and sealing layer

EXAMPLE:

The following example illustrates how to order a camprofile gasket (information in bold print is stamped on the centering ring - if present; otherwise the information is printed on the packaging).

M41LM – Style M41LM – convex root form camprofile with floating externally attached centering ring

4”-300lbs – The gasket is suitably dimensioned for 4” flanges, 300lbs pressure rating

316L – Camprofile core of 316L stainless steel

Graphite – Graphite sealing layer
Corrugated Gaskets

Heat Exchanger Applications
Novus corrugated gaskets comprise a corrugated metallic core, normally stainless steel, with a soft facing layer applied to each face. The corrugations provide resilience and reduce the sealing contact surface area of the gasket while the soft layer ensures outstanding sealing, even at low loads. These gaskets are particularly suited for heat exchanger applications as a replacement to metal jacketed gaskets.

Properties
- Excellent resistance to radical shear
- Creates a tight seal at low bolt loads
- Can be used when there is insufficient bolt load to seal spiral wound gaskets
- Outstanding resistance to thermal cycling
- Safe to handle and fit
- Excellent thermal and chemical stability
- Tolerant to flange imperfections

Practical Benefits
- No sharp edges for safe handling
- Excellent rigidity ensures easy posting between flanges
- Does not stick to flanges

Seating Stress Range
Corrugated gaskets offer reliable sealing performance when seated within the following seating stress ranges.

<table>
<thead>
<tr>
<th>SEATING STRESS (20°C)</th>
<th>MINIMUM (N/mm²)</th>
<th>OPTIMUM (N/mm²)</th>
<th>MAXIMUM (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>90</td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>

Thickness
Available in 1.5mm, 2mm and 3mm.

Flange Surface Finish
The recommended flange surface finish for corrugated gaskets with sealing layers is from 3.2 to 6.3 μm Ra (125-250 RMS), this is also referred to as a smooth finish.

Sizing Guidelines
DIN Sizes 10, 16, 25, 40 bar
ANSI Sizes Class 150 and 300lb
Other sizes available on request. Also available for vessel and non-standard applications.

Chemical Suitability
PH Range 0-14.

Layer Material Selection
The table (below) may be used to determine the appropriate sealing layer material. We recommend the use of graphite layers for most applications. Only in cases where graphite may cause media contamination, or is not chemically resistant, should an alternative layer material be chosen.

<table>
<thead>
<tr>
<th>LAYER MATERIAL</th>
<th>TEMPERATURE (°C)</th>
<th>MAXIMUM OPERATING PRESSURE</th>
<th>GAS TIGHTNESS</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphite</td>
<td>-200</td>
<td>450</td>
<td>150</td>
<td>Good</td>
</tr>
<tr>
<td>Graphite APX2</td>
<td>-200</td>
<td>500</td>
<td>150</td>
<td>Good</td>
</tr>
<tr>
<td>PTFE</td>
<td>-200</td>
<td>260</td>
<td>50</td>
<td>Good</td>
</tr>
<tr>
<td>Hi-Temp + APX2</td>
<td>-200</td>
<td>800</td>
<td>100</td>
<td>Good</td>
</tr>
</tbody>
</table>

PTFE
PTFE is a high quality synthetic material featuring excellent chemical resistance, temperature resistant up to 260°C, good ageing resistance and excellent gas tightness.

Hi-Temp
Hi-Temp is a mica based material suitable for high temperature applications, often used in combination with graphite up to temperatures of 800°C.

How to Order
Please specify the following when ordering corrugated gaskets.
- Standard of the gasket (flange standard)
- Nominal size and pressure class
- Materials - core filler

EXAMPLE:
Novus CMG
Dimensions – ASME B16.20
2” * 500lbs
SS316 Core
Graphite coating layer

Corrugated Gasket
Characteristics
Novus corrugated gaskets have a proven record in problematic exchanger applications, offering low relaxation, high resistance to radial shear and high levels of tightness. For this reason these gaskets are replacing more traditional gasket styles such as metal jacketed particularly on these applications.

Corrugated Gasket
Characteristics
Novus corrugated gaskets have a proven record in problematic exchanger applications, offering low relaxation, high resistance to radial shear and high levels of tightness. For this reason these gaskets are replacing more traditional gasket styles such as metal jacketed particularly on these applications.

Corrugated Gasket
Characteristics
Novus corrugated gaskets are characterized by their corrugated metallic core, normally stainless steel, and a facing layer applied to each face. This corrugation design provides improved resilience and reduces the contact surface area of the gasket, allowing for better sealing performance at lower bolt loads.

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Spiral Wound Gaskets

Properties

- Spiral wound gaskets are suitable for use across a wide gasket stress range.
- Spiral Wound gaskets can be used to seal fluid pressures up to 400 bar and from cryogenic temperatures up to 1000°C.
- Spiral Wound gaskets are robust and simple to install.
- The outer guide ring simplifies assembly and prevents blow-out of the gasket.
- By combining different winding materials and metals, the gasket can be tailored to suit a wide variety of operating conditions.
- The gasket is easy to remove after service and does not cause any damage to the flange faces.

Gasket Stress Range

Novus spiral wound gaskets should preferably be mounted within the gasket stress ranges shown in this chart to ensure leak-free connections.

Flange Surface Finish

The recommended surface roughness of the flange faces, between which a spiral wound gasket is to be mounted, is 3.2 – 6.3μm Ra (125 – 250 RMS), also referred to as smooth finish.

Standard Gasket Profiles

We produce the following types of spiral wound gaskets.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF1</td>
<td>A standard spiral wound gasket (RF Type) with dimensions tailored to tongue/groove flanges.</td>
<td></td>
</tr>
<tr>
<td>SG-IR</td>
<td>Identical to Novus SG but also fitted with an inner ring to prevent inward buckling at the windings.</td>
<td></td>
</tr>
<tr>
<td>SG-RTJ</td>
<td>A standard spiral wound gasket (SG Type) with dimensions tailored to Ring Joints (RTJ) flanges.</td>
<td></td>
</tr>
<tr>
<td>HX-R</td>
<td>This type of gasket consists of a wound component fitted with a narrow wound centering ring. Centering windings ensure correct centering in flush flanges (e.g. in heat exchangers).</td>
<td></td>
</tr>
<tr>
<td>HX-RIR</td>
<td>This gasket is identical to HX-R but also fitted with an inner ring, rendering this gasket type suitable for mounting in male and female flanges.</td>
<td></td>
</tr>
<tr>
<td>RF-IR</td>
<td>Spiral wound gasket for male/female flanges consisting of a wound component fitted with an inner ring to bring the gasket flush with the pipe bore to prevent inward buckling.</td>
<td></td>
</tr>
<tr>
<td>SG-RTJ</td>
<td>A standard spiral wound gasket (SG Type) with dimensions tailored to Ring Joints (RTJ) flanges.</td>
<td></td>
</tr>
<tr>
<td>HX-R</td>
<td>This type of gasket consists of a wound component fitted with a narrow wound centering ring. Centering windings ensure correct centering in flush flanges (e.g. in heat exchangers).</td>
<td></td>
</tr>
<tr>
<td>HX-RIR</td>
<td>This gasket is identical to HX-R but also fitted with an inner ring, rendering this gasket type suitable for mounting in male and female flanges.</td>
<td></td>
</tr>
</tbody>
</table>

Gasket Stress Range:

<table>
<thead>
<tr>
<th>Filler</th>
<th>SINGLE SIDE CONFINED</th>
<th>BOTH SIDES CONFINED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIN (N/mm²)</td>
<td>OPT (N/mm²)</td>
</tr>
<tr>
<td>Graphite</td>
<td>50</td>
<td>95</td>
</tr>
<tr>
<td>PTFE</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>Hi-Temp + APX2</td>
<td>55</td>
<td>95</td>
</tr>
</tbody>
</table>

**Spiral Wound Gasket Characteristics**

The sealing element of the spiral wound gasket consists of a V-shaped metal strip spirally wound in combination with a soft sealing material filler. The metal strip provides outstanding resilience, while the flexible sealing filler guarantees excellent sealing.

Due to this combination of materials, the spiral wound gasket is suitable for sealing under severely fluctuating temperature and pressure conditions. Depending on the application the spiral wound gasket can be specified with outer and/or inner rings.
Spiral Wound Gaskets

**Special Profiles**
Profile with a GT - Zone
In the event of a graphite filled spiral wound gasket possibly causing an undesirable reaction between the graphite and the medium to be sealed, or of possible medium contamination, the problem can be solved by using a spiral wound gasket with a GT - Zone.

**Special Shapes**
Spiral wound gaskets can be produced in a wide variety of shapes, such as oval and pear shape, with pass partition bars and many other types. Generally, the pass partition bars on spiral wound gaskets are manufactured as metal-jacketed bars. A variety of alternatives are available.

**Type MH**
This spiral wound gasket is identical to the RF1 profile but oval shaped to fit manholes.

**Type TC/HH**
This type of gasket is for hand holes and special flange assemblies (tube cap and hand hole covers). They are manufactured as metal-jacketed bars.

**Type WL**
This gasket is identical to RF1 but fitted with an outer winding. Centering is achieved by positioning the winding over two bolts repositing each other.

**Type HE**
Fitted with pass partition bars for use on heat exchangers and vessels, this gasket type is otherwise identical to the RF1 profile. Metal - jacketed bars have a thinner design than that of spiral wound gasket material.

**Type HE-SG**
Fitted with an outer centering ring, the HE-SG is otherwise identical to the HE profile.

**Type HE-SG-IR**
Fitted with an outer centering ring and an inner ring, the HE-SG-IR is otherwise identical to the HE profile.

**Guide Rings and Material Selection**

**Benefits of the Centering Ring**
The spiral wound gasket outer centering ring provides the following benefits:
- **Optimum location between the bolts**
- **Protection of the spiral wound element**
- **Additional security against gasket blow-out**
- **Acts as a heat shield when the spiral wound gasket is subjected to high temperatures.**

Inner and outer rings are particularly recommended for use on spiral wound gaskets exceeding class 600lbs, but specifically recommended for high temperatures and pressures to optimise the operational reliability of the spiral wound sealing element. Inner rings are mandatory for PTFE filled spirals.

**Material Selection**
The material selected for the inner ring and winding metal is usually the same as the flange metal. This prevents corrosion and differential expansion problems. The outer centering ring is generally manufactured from carbon steel with an anti - corrosion treatment. However, the ring may also be manufactured in the same metal as the flange to prevent corrosion problems.

The table below lists the application limits and specifications of alloys used in the manufacture of spiral wound gaskets.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>TRADE NAME</th>
<th>IDENTIFICATION</th>
<th>Dimensions</th>
<th>B.S.</th>
<th>ASA</th>
<th>TEMPERATURE</th>
<th>DENSITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Carbon Steel</td>
<td>S</td>
<td>R S T 3.72</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-40 500</td>
<td>7.85</td>
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<tr>
<td>Stainless Steel 304</td>
<td>S304</td>
<td>X5 Cr Ni 18</td>
<td>1.4301</td>
<td>304</td>
<td>304L</td>
<td>-250 550 7.90</td>
<td></td>
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<tr>
<td>Stainless Steel 321</td>
<td>S321</td>
<td>X10 Cr Ni Ti 18 9</td>
<td>1.4541</td>
<td>321</td>
<td>347</td>
<td>-250 550 7.90</td>
<td></td>
</tr>
<tr>
<td>Stainless Steel 347</td>
<td>S347</td>
<td>X10 Cr Ni 18 9</td>
<td>1.4550</td>
<td>347</td>
<td>347</td>
<td>-250 550 7.90</td>
<td></td>
</tr>
<tr>
<td>Stainless Steel 410</td>
<td>S410</td>
<td>X6 Cr 13</td>
<td>1.4000</td>
<td>410</td>
<td>40</td>
<td>-20 850 7.80</td>
<td></td>
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<tr>
<td>Duplex</td>
<td>2205</td>
<td>X2 Cr Ni Mo N 25 2.5 3</td>
<td>1.4462</td>
<td>2507</td>
<td>3185</td>
<td>-40 780 7.80</td>
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<td>2507</td>
<td>X2 Cr Ni Mo N 25 6.3</td>
<td>1.4410</td>
<td>2507</td>
<td>3185</td>
<td>-40 30 7.80</td>
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<td>Ni 99 2</td>
<td>2.066</td>
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<td>252</td>
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<tr>
<td>Monel 400</td>
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<tr>
<td>Inconel 600</td>
<td>600</td>
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<td>252</td>
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<td>252</td>
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<td>Ti-99 8</td>
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<td>Ti2</td>
<td>Ti2</td>
<td>-250 350 4.50</td>
<td></td>
</tr>
</tbody>
</table>

Standard Material for Spiral Wound Windings
Filler Material Selection
The table opposite may be used to select the correct filler. It should be pointed out that graphite will be the optimum filler in most cases. Only where graphite could cause media contamination, or is not chemically resistant, should the use of another type of filler material be recommended. In such cases, an alternative solution might be to select a gasket with a GT-zone.

Graphite
Graphite is universally chosen because of its good chemical resistance, resistance to ageing, good gas tightness and ability to operate at high temperatures.

APX2
APX2 is an oxidation resistant graphite which offers the same excellent sealing characteristics of graphite but can be used at higher service temperatures.

PTFE
PTFE is a high quality synthetic material with the following characteristics: excellent chemical resistance, resistance to 260°C, resistant to ageing, excellent gas tightness.

Hi-Temp
Hi-Temp is mica based material suitable for high temperature applications, often used in combination with graphite (GT-zone).

Standard Fillers

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>TEMPERATURE (°C) MIN</th>
<th>MAX</th>
<th>MAXIMUM OPERATING PRESSURE (BAR) MAX</th>
<th>GAS TIGHTNESS</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphite</td>
<td>-200</td>
<td>450</td>
<td>400</td>
<td>Good</td>
<td>Aggressive Media</td>
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<tr>
<td>Graphite APX2</td>
<td>-200</td>
<td>500</td>
<td>400</td>
<td>Good</td>
<td>Aggressive Media</td>
</tr>
<tr>
<td>PTFE</td>
<td>-200</td>
<td>260</td>
<td>150</td>
<td>Good</td>
<td>Aggressive Media</td>
</tr>
<tr>
<td>Hi-Temp</td>
<td>-200</td>
<td>1000</td>
<td>5</td>
<td>Average</td>
<td>Gases</td>
</tr>
<tr>
<td>Hi-Temp + APX2</td>
<td>-200</td>
<td>800</td>
<td>100</td>
<td>Good</td>
<td>Gases</td>
</tr>
</tbody>
</table>

Non standard materials are available on request.

HOW TO ORDER

Please specify the following when ordering Spiral Wound Gaskets:
- Type of Spiral wound gasket required
- Standard of the gasket (flange standard)
- Nominal size and pressure class
- Material:
  - Inner ring
  - Metal winding
  - Filler
  - Outer ring

EXAMPLE:
Novus SG-IR
Dimensions – ASME B16.20
2" 1500 lbs
SS316L
SS316L
Graphite
Carbon Steel

Metal Jacketed Gasket Characteristics
Metal jacketed gaskets consist of a metal cover and a ‘soft’ sealing material filler.

The sealing filler provides outstanding resilience, while the metal jacket guarantees good sealing and protects the filler against pressure conditions, fluctuating temperatures and corrosion.

A wide variety of materials are available to guarantee satisfactory sealing. The metals listed on the next page are standard, other metals are available on request.

This type of gasket is being replaced by either Camprofiles (see pages 4–7) or corrugated metal products (see pages 8–9).

Welded Metal Jacketed Gaskets
Welded metal jacketed gaskets are manufactured in a wide range of sizes and styles. Generally they are used in Heat Exchangers, Vessels, Pumps, Autoclaves, Engines, Valves, and Exhaust Systems.

Metal jacketed gaskets require machined flange faces, high bolt loads and exact flange alignment to ensure an effective seal. It is for this reason that we recommend the use of Camprofile or Corrugated Metal Gaskets for most applications.

One-piece
Welded

Welded bar metal jacketed gaskets offer the following benefits over one-piece gaskets with integral bars:
- Lower price - Typical cost savings 10% to 40% (depending on material)
- Quicker delivery - Less time to manufacture
- Technically superior and safer - Extra sealing safeguards give a better gasket
- Longer sealing life - Bars seal independently of the outer ring.
**How to Order**

Please specify the following when ordering metal jacketed gaskets.

- Material - Jacket and Filler
- Type of metal jacketed gasket required
- Standard of the gasket (flange standard)
- Nominal size and pressure class

**Example:**

Novus Metal Jacketed Type S6
Dimensions: ASME B16.20
2” 150lbs
SS316, Non-asbestos Millboard

**Metal Jacketed Gaskets**

Metal jacketed gaskets can be produced in a variety of styles. The diagram below shows the standard range of shapes for vessels and heat exchangers.

When ordering metal jacketed gaskets with pass-partition bars, a drawing with the exact dimensions and positions is required.

**Flange Surface Finish**

We recommend a maximum flange surface finish of 1.6μ m.

**Jacket material:**

- Stainless Steel
- Aluminium
- Copper
- Brass
- Titanium
- Silver
- Carbon Steel
- Soft Iron
- Monel
- Inconel
- Nickel
- Hastelloy

**Filler materials:**

- Non Asbestos
- Millboard
- PTFE
- Uniflon
- Graphite

**Type S6 Seating Stress**

<table>
<thead>
<tr>
<th>Material (N/mm²)</th>
<th>Minimum</th>
<th>Optimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>110</td>
<td>180</td>
<td></td>
</tr>
</tbody>
</table>

**Standard Vessel & Heat Exchanger Profiles**

The illustrations opposite represent standard Novus spiral wound gasket shapes for vessel and heat exchanger flanges.

**Standard Metals**

- Aluminium
- Copper
- Stainless Steel
- Monel
- Nickle
- Hastelloy
- Soft Iron
- Brass
- Inconel
- Nickel
- Silver
- Titanium

**Standard Fillers**

- PTFE
- Non-asbestos Millboard
- Graphite

**Installation Guide**

**Installation of Novus Metallic Gaskets**

In order to ensure the optimum service life of Novus metallic gasket materials it is not only important to choose the correct material for the application but to install and maintain it correctly.

The following guidelines are designed to assist the end user in the assembly of Novus metal jacketed gasket materials.

**Flange Condition**

- Remove the old gasket and check that the flange faces are clean and free from indentations and scoring. Radiial (cross face) scoring is a particular concern and can lead to joint leakage.
- For camprofiles, corrugated metal and spiral wound gaskets, a surface finish of between 0.8μ m and 3.2μ m Ra (125 to 250 micro inch) is recommended; for metal ring joints a surface finish of between 0.8μ m and 1.6μ m is recommended (dependent on style) and for metal jacketed gaskets a surface finish of 1.6μ m Ra is recommended. Use a surface finish comparator e.g. Novus comparator to check flange finish (right).
- Check that the flange faces are parallel or that the pipework is concentric without excessive bolt loads.

**Gasket**

- Always use a new gasket
- Check that the gasket is in good condition and that the dimensions are correct for the class and size of the flanges
- Do not use jointing compounds, grease or lubricants with Novus metallic gasket materials. These compounds can affect the contact friction between the gasket and the flange and can lead to creep and premature joint failure.
- If there is a requirement to fix the gasket to the flange prior to assembly (e.g. large vertical flanges) then a light dusting of spray adhesive e.g. 3M 77 spray may be used. The adhesive should be applied sparingly and in isolated areas, and must be compatible with the fluid medium.

**Bolting**

- Ensure the bolt and nut threads are clean. Apply bolt lubrication to the bolt and nut threads and to the face of the nut to be tightened. Do not apply grease or bolt lubricant to the joint face. After cleaning and lubrication it should be possible to run the nut along the full length of the bolt by hand. If this is not possible the bolts and nuts should be refurbished or replaced.
- Scrap, wire brush or file as necessary the back face of each flange where the bolt heads and nuts are to sit, ensuring that the surfaces are clean and flat.
- If possible use hardened flat washers to ensure even transfer of the load.

**Installation**

- Ensure that the gasket is installed concentrically.
- It is recommended that the bolts are tightened using a controlled method such as torque or tension. If using a torque wrench, ensure that it is accurately calibrated.
- Tighten bolts in a star-like crossing pattern in the following sequence.
- Finger tighten nuts.
- Tighten to 30% of the final load.
- Tighten to 60% of the final load.
- Tighten to full load.
- If possible use Novus Flange Gap Tool (below).

**After Installation**

Check that the flange faces are parallel using a suitable tool e.g. Novus Flange Gap Tool (below).
Ring Type Joints

Ring type joints are designed to concentrate the bolt load over a small area thus producing high seating stresses. As the ring type material should always be softer than the mating flanges, the high seating stress causes ‘plastic-flow’ of the ring joint in the flange faces creating the seal.

Novus Ring Type Joints

Type BX Ring Type Joints

Novus model M11/M11S
M11 model BX ring type joints are designed for pressures up to 20,000 psi, suitable only for use with API type BX flanges and grooves. The gasket has a square cross section with bevelled corners. The average diameter of the ring joint is slightly greater than that of the flange groove. This way, when the ring joint is seated, it stays pre-compressed by the outside diameter, creating high seating stress.

The M11S Model SBX ring type joint is the same design as the BX ring, however the suffix ‘S’ indicates that additional pressure equalisation holes have been drilled in accordance with API 17D for use on sub sea wellhead and christmas tree equipment.

Type RX Ring Type Joints

Novus model M12/M12S
M12 model RX ring type joints are designed for pressures up to 5,000 psi. A pressure activated ring joint, its shape is designed so that the fluid pressure increases sealability. The outside sealing surface of the ring joint makes the initial contact with the flange. As the internal pressure rises the contact pressure between ring joint and flange also increases. This is sometimes referred to as a pressure activated ring joint due to the shape of the gasket.

High seating pressures are created increasing the sealability. This design characteristic makes the RX ring joint more resistant to vibrations, pressure surges and shocks that occur during oil well drilling.

M12S Model SBX ring type joint is the same in design to the RX ring, however, the suffix ‘S’ indicates that additional pressure equalisation holes have been drilled in accordance with API 17D for use on sub sea wellhead and christmas tree equipment.

Cam-ORJ

The Cam-ORJ is a standard API 6A octagonal ring joint but with the four angled seating surfaces concentrically serrated and faced with oxidation inhibited graphite. The gasket offers the high sealing efficiency associated with the octagonal design but with the added benefit of being capable of sealing flanges with minor damage. Under compression the graphite flows into minor imperfections creating a tight seal.

The Cam-ORJ is available in a range of Alloy materials and in sizing to suit ASME B16.5 or API 6A flanges.

Blind Ring Type Joints

These specialised ring type joints are designed and manufactured for the customer who has a requirement to blank off flanges and pipe work. The joints are standard rings but with a machined metallic centre.

Blind ring type joints can be supplied in a variety of materials.

(Continued on page 20)
Novus Ring Type Joints

Ring Type Joint Profiles

Combination Ring Type Joints
This ring type joint consists of two different sizes having the same pitch diameter, used for sealing and flange joint where the mating flanges have different ring groove dimensions or profiles.

Lens Rings
This is a contact seal for use in high pressure piping systems and in pressure vessel heads. Lens rings have a spherical surface that requires special matching of the flanges. Effective sealing is obtained at relatively low bolt loads.

Delta Rings
This is a pressure actuated ring used primarily on pressure vessels and valve bonnets at pressures in excess of 5000 psi. Internal pressure forces the delta ring material to expand.

Seating Stress
To achieve a reliable seal, the ring type joint should be assembled within the seating stress parameters shown in the table above.

Flange Surface Finish
The ring type joint and the sealing face of the groove must be free of indentations, score marks, tool and chatter marks.

The maximum flange surface finish for M8, M9, model R, M12 model RX is 1.6μm RA (63RMS).

Seating Stress (20°C)

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>IDENTIFICATION</th>
<th>MINIMUM (N/mm²)</th>
<th>OPTIMUM (N/mm²)</th>
<th>MAXIMUM (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft Iron</td>
<td>D</td>
<td>235</td>
<td>350</td>
<td>525</td>
</tr>
<tr>
<td>Low Carbon Steel</td>
<td>S</td>
<td>265</td>
<td>400</td>
<td>600</td>
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<tr>
<td>A182FS</td>
<td>FS</td>
<td>400</td>
<td>600</td>
<td>900</td>
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<td>SS304</td>
<td>S304</td>
<td>335</td>
<td>500</td>
<td>750</td>
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<tr>
<td>SS316</td>
<td>S316</td>
<td>335</td>
<td>500</td>
<td>750</td>
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<td>SS321</td>
<td>S321</td>
<td>335</td>
<td>500</td>
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<tr>
<td>SS347</td>
<td>S347</td>
<td>335</td>
<td>500</td>
<td>750</td>
</tr>
</tbody>
</table>

For other materials please contact our technical department.

Seating Stress
- Ring type joint model
- Ring number/size & pressure rating
- Material/identification
- Flange standard

EXAMPLE:
M8 R Oval
R16/Class 1" 3/600lbs
Soft Iron or D
ASME/ANSI B16.5

HOW TO ORDER
- Flange standard
- Material/identification
- Ring number/size & pressure rating
- Ring type joint model

Hardness of Ring Type Joint Materials
On installation, the material of the ring joint has to be softer than that of the flange to avoid damage.

This table provides comparative data of ring type joint material hardness values.

<table>
<thead>
<tr>
<th>MATERIAL (TRADE NAME)</th>
<th>IDENTIFICATION</th>
<th>DIN SPECIFICATION</th>
<th>DIN MATERIAL</th>
<th>B.S.</th>
<th>ASA-ASTM UNS</th>
<th>MAXIMUM BRIENELL</th>
<th>ROCKWELL &amp; VICKERS</th>
<th>TEMPERATURE (°C)</th>
<th>DENSITY (GR/CM³)</th>
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</thead>
<tbody>
<tr>
<td>Soft Iron</td>
<td>D</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Low Carbon Steel</td>
<td>S</td>
<td>R at 37.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>90</td>
<td>56</td>
<td>-40</td>
<td>500</td>
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<td>F5</td>
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<td>-250</td>
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<td>316</td>
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<td>-100</td>
<td>550</td>
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<td>X2 Cr Ni Mo 18.10</td>
<td>1.4404</td>
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<td>316L</td>
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<td>83</td>
<td>-100</td>
<td>550</td>
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<td>550</td>
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<td>1.4541</td>
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<td>321</td>
<td>160</td>
<td>83</td>
<td>-250</td>
<td>550</td>
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<td>SS347</td>
<td>S347</td>
<td>X10 Cr Ni Mo 18.9</td>
<td>1.4550</td>
<td>34731</td>
<td>347</td>
<td>160</td>
<td>83</td>
<td>-250</td>
<td>550</td>
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<td>S410</td>
<td>X6 Cr 13</td>
<td>1.4000</td>
<td>410</td>
<td>-</td>
<td>170</td>
<td>86</td>
<td>-20</td>
<td>850</td>
</tr>
<tr>
<td>254SMO</td>
<td>6Mo</td>
<td>X1Cr18 Mo N2 N0231.7</td>
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<td>S31254</td>
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<td>1.4462</td>
<td>31853</td>
<td>S31603/32205</td>
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<td>88</td>
<td>-</td>
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<td>-</td>
<td>S32750</td>
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<td>Aluminum</td>
<td>AL 1050</td>
<td>A1 99.5</td>
<td>0.3055</td>
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<tr>
<td>Silver</td>
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<td>28 (HV)</td>
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<td>750</td>
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<td>Copper</td>
<td>Cu</td>
<td>SF-Cu</td>
<td>2.0000</td>
<td>C106</td>
<td>C12200</td>
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<td>Brass</td>
<td>CuNi37</td>
<td>CuZn37 (M563)</td>
<td>20321</td>
<td>C2108</td>
<td>C27200</td>
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<td>Nickel 200</td>
<td>N 200</td>
<td>N 99.2</td>
<td>2.4066</td>
<td>3072-76 NA1</td>
<td>NO200</td>
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<td>Monel 400</td>
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<td>N5 Cu 30 Fe</td>
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<td>NO4000</td>
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<td>Inconel 600</td>
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<td>N5 Cu 15 Fe</td>
<td>2.4816</td>
<td>3072-76 NA14</td>
<td>NO6000</td>
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<td>N5 Cu 22 Mo 9 Mo</td>
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<td>X10 Cr Ni A1 Ti</td>
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<td>Hastelloy B2</td>
<td>82</td>
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* Brienell hardness measured with 3000kg, and 10mm diameter hardened steel ball. Softer materials i.e. copper & brass are measured with 500kg and 10mm diameter hardened steel ball.

* Rockwell B hardness is measured with 100kg and 1.60mm diameter steel ball.
Technical Support
Our product and service offering is underpinned by high quality technical support from a team of engineers acknowledged as one of the most experienced, knowledgeable and customer-focused in our industry.

We are active members of the European Sealing Association and our engineers contribute to international technical committees including ASME and European standards organisations. The knowledge and experience of our technical team allows us to provide rapid response to customer enquiries as well as provide innovative and practical solutions to even the most problematic sealing application.

Testing Service
We have dedicated test facilities for the development of new products, the control of quality and the solving of application problems. The range and breadth of equipment places the company at the forefront of sealing technology.

Our facilities allow us to replicate the conditions under which a flanged joint operates in service. The data gathered can be used to ensure that the most suitable gasket is being employed and that it is properly loaded to withstand the operating conditions.

Training Courses
The Academy of Joint Integrity offers Accredited and Awareness Training Courses to all personnel who are actively involved in the assembly and tightening of flanged bolted connections. Mentoring and assessment programmes complement the training provision. All training courses will be delivered by industry professionals with current and relevant experience in the field.

The Academy is a member of the Energy Institute and has contributed to the latest UK Oil and Gas best practice guidelines, specific to Joint Integrity Management. The Academy is also an active member of an ASME sub-committee, developing new initiatives for Pressure Boundary Bolted Flange Joint Assembly.

Academy training courses incorporate Energy Institute, European (EN1591 part 4) and ASME PCC-1-2010 methods and procedures.

Benefits
- Legislation compliance
- Motivated workforce with best practice skills
- Reduced costs with increased asset integrity
- Access to the latest technical standards and procedures
- Sealing and integrity modules providing greater knowledge
- Alliance and structured support from a world class technical / training team.

For further information on the range of courses available, visit www.academyofjointintegrity.com

Location
The Academy has dedicated facilities in Aberdeen, Teesside, Humberside and West Yorkshire.

Training is also offered within our overseas operations.

Courses
Training can be delivered in a variety of ways:
- At the clients premises, utilising mobile training rigs and equipment
- At the Academy, utilising our purpose built training centres
- Via ‘Blended Training’ using a web based learning portal with a unique E-Learning programme.

We offer exceptional technical support from a team of engineers acknowledged as one of the most experienced, knowledgeable and customer-focused in the industry.
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