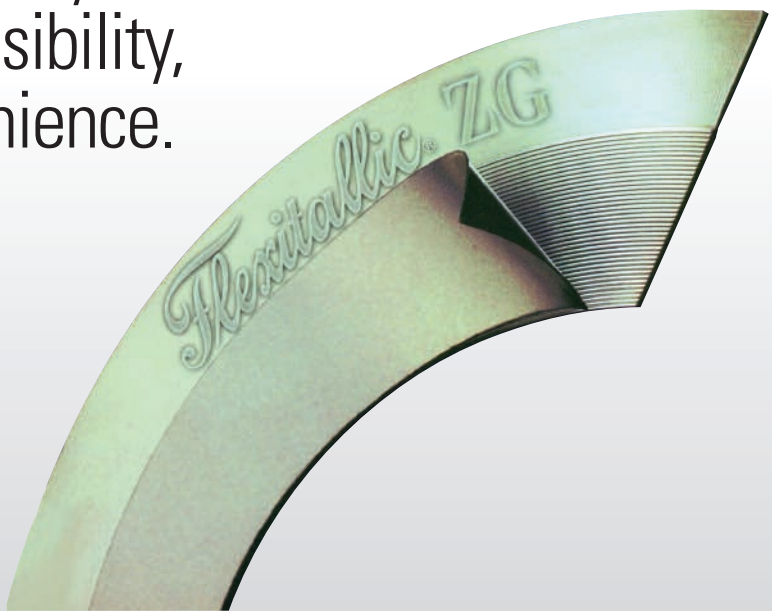
Flexitallic

# FLEXPRO™ KAMMPROFILES

Flexpro™- The versatile gasket with three key features: compressibility, low stress, convenience.



Flexitallic®

# FLEXITALLIC

## The Flexitallic Group is the international market leader in the manufacture and supply of high quality, high value industrial static sealing products, delivering industrial gaskets on a global scale.

**About us**

As the developer of the spiral wound gasket in 1912, we have built on this legacy of innovation with revolutionary products including Thermiculite® and Sigma®, The Flange Rescue Gasket winner of the NACE and Dupont Plunkett Awards, and most recently the Change™ Gasket, set to transform the global sealing industry.

We have a global network of Allied Distributors across 30 countries. This ensures local demand is met quickly, providing a combination of the highest product quality and outstanding customer service.

Our extensive and varied product offering includes spiral wound gaskets, RTJ gaskets, Flexpro™ Kammprofiles, sheet materials, dynamic and static packings, pipe support and custom rubber products. Drawing upon the group's rich history and present day values of leadership, quality, service and technology, we are at the forefront of developing sealing solutions for industries around the world.

In addition to a wide range of products, we also deliver world-class technical support and Joint Integrity training.


# Based on sales and geographic reach, the Flexitallic Group has become *the* global supplier of industrial gaskets.

**Innovative Product Range**
We have a rich history of innovation, which has seen us lead the industry with many new products.

Over the years, our products have gained a reputation for quality, reliability and technology that is second to none.

**Customised Engineering Solutions**
Our Application Engineering, Production Engineering and R&D teams work closely together to design, develop and manufacture bespoke sealing solutions.

We have been responsible for a number of truly revolutionary products, including Thermiculite®, Sigma® and the Flange Rescue Gasket, which ensure we are able to continually meet the ever more stringent requirements of our customers.

**Flexitallic® Safe**
Over the last century, our aggressive R&D efforts have helped customers become Flexitallic® Safe. From the first Spiral Wound Gasket in 1912 to the ever evolving applications for Thermiculite®, our goal is to develop materials that push the parameters of heat, pressure and chemical resistance.

**Our Commitment to Quality**
We place great emphasis on maintaining international quality standards, and are approved to ISO 9001:2008, ISO 14001:2004 and OHSAS 18001:2007, API 6A and API 17D, to ensure we meet the highest possible standards for all our products and services.

We also invest heavily in test and quality assurance equipment to maintain our reputation for the highest quality products.

Our materials are subjected to a wide range of tests as specified by statutory regulations and customer requirements. These approvals enable our customers to make informed choices as to the suitability of a product for each and every application.

**Inside Industry**
We pride ourselves on not simply supplying products, but by supporting customers with a detailed knowledge of their industry and applications, so that products and services are tailored to their specific needs.

This unique approach means that we focus on providing more than just a product, but also a complete solution that adds genuine value to our clients.

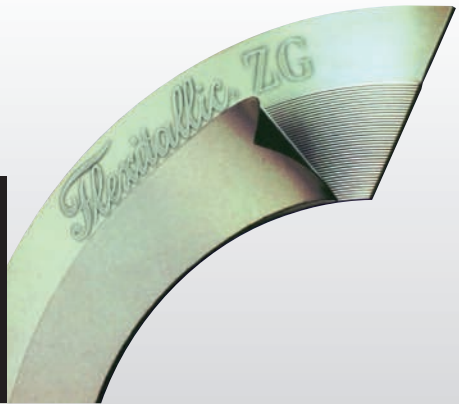
**Global Distribution... Local Support**
Our products are distributed through a global network of Allied Distributors.

These carefully selected distribution partners are strategically located within their territory to deliver the best possible service and products to our customers. This approach means our products and know-how are available to the global industries we service.

Allied Distributor

Licensee Manufacturer

# FLEXPRO™ KAMMPROFILES




## Flexpro™ - The versatile gasket with three key features: compressibility, low stress, convenience.

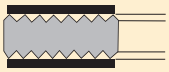
Flexpro™

The FLEXPRO™ gasket has been providing an extremely tight, reliable seal in a wide range of applications globally since its development in Germany over 50 years ago.

The FLEXPRO™ gasket is comprised of a concentrically serrated solid metal core with a soft, conformable sealing material bonded to each face. The soft facing material provides low stress gasket seating, while the serrated geometry of the metal core enhances sealing performance by inducing stress concentrations on the sealing surfaces. The serrations minimise lateral movement of the facing material, while the metal core provides rigidity and blowout resistance.

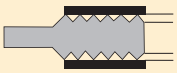
The FLEXPRO™ gasket exhibits excellent compressibility and recovery characteristics, maintaining joint tightness under pressure and temperature fluctuations, temperature differential across the flange face, flange rotation, bolt stress relaxation, and creep. Suitable for vacuum to extremely high pressure applications.

### STYLE PN



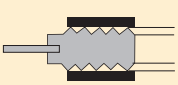
**Style PN FLEXPRO™ gaskets** are selected for use in confined locations, including male and female, tongue and groove, spigotted and/or recessed flange arrangements.

### STYLE ZG



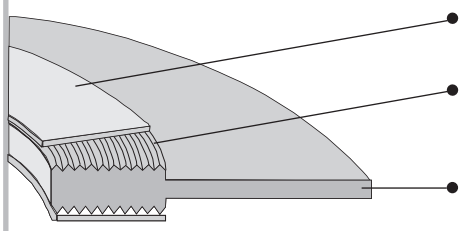
Variation of the PN FLEXPRO™, utilises an integral outer locating ring for correct gasket positioning within the flange assembly bolt circle. **Style ZG FLEXPRO™ gaskets** are recommended for use in standard raised face and flat face flange assemblies.

### STYLE ZA



**The Style ZA FLEXPRO™** is a slight variation of the Style ZG. The integral outer locating ring is replaced by a loose fitting independent ring which is preferred in applications where differential radial thermal expansion may be encountered.

### COMPOSITE CONSTRUCTION WITH SERRATED CORE



# FLEXPRO™ KAMMPROFILES

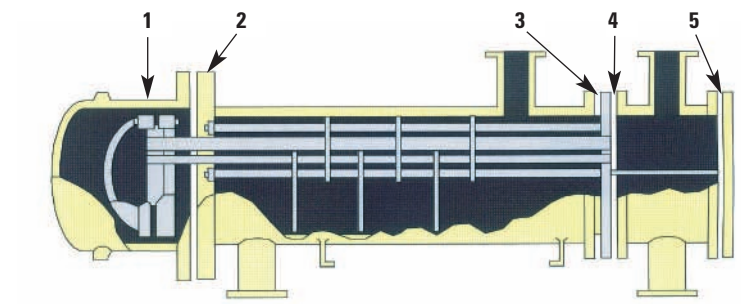
**Ideal for Shell and Tube style Heat Exchanger Flanges.**

Although suitable for use on all standard pipeline flanges in a wide range of difficult applications, the FLEXPRO™ gasket is proving to be reliable, as a cost effective alternative to metal jacketed gaskets, that are commonly used in heat exchanger applications.

Use of the Flexitallic FLEXPRO™ gasket will ensure a reliable seal, from initial hydrotest through difficult operating conditions.

FLEXPRO™ gaskets are suitable for use on TEMA flanges, and when required,pass partition ribs can be supplied in any configuration.

The FLEXPRO™ gasket provides a high integrity, low seating stress seal, and is ideal for heat exchanger applications with limited bolt load or less rigid flanges.




**GASKET LOCATIONS**

**1.** Floating Head **2.** Shell Cover **3.** Shell to Tubesheet **4.** Tubesheet to Channel Box **5.** Channel Box Cover

**Standard Core Materials**

Standard core thickness is 3.0mm; other thicknesses and materials are readily available to suit specific applications.

**Standard Facing Materials**

Standard facing thickness is 0.5mm or 0.75mm (material dependent); other thicknesses and materials are readily available to suit specific applications.

**Flange Surface Finish Requirements**

The ideal flange surface finish for use with Flexitallic FLEXPRO™ gaskets is 3.2 – 6.4µ – metre Ra (125 – 250 µ – inch Ra).

| CORE MATERIAL | MAX. TEMPERATURE |
|---|---|
| Stainless Steel | 535 - 870°C |
| Carbon Steel | 535°C |
| Aluminium | 425°C |
| Monel® | 815°C |
| Nickel | 650°C |
| Inconel® | 1100°C |
| Titanium Gr.2 | 1095°C |
| Duplex 2205* (UNS S31803) | 300°C |

*Duplex is subject to embrittlement between 350°C and 500°C

| FACING MATERIAL | MAX. TEMPERATURE | SEATING STRESS AT ROOM TEMP | |
|---|---|---|---|
| | | MIN. PSI (MPa) | MAX. PSI (MPa) |
| Thermiculite® | 1000°C | 2500 (17) | 72500 (500)* |
| Flexicarb® Flexible Graphite | 450°C | 2500 (17) | 72500 (500)* |
| Sigma® | 260°C | 2500 (17) | 72500 (500)* |
| Virgin PTFE | 260°C | 2500 (17) | 72500 (500)* |
| Soft Metals | Per material | Per material | Per material |

*While high stresses have been utilised, Flexitallic Engineering should be contacted for operating stresses above 40,000 psi.

# FLEXPRO™ KAMMPROFILES

## Independent PVRC testing confirms superior tightness, room temperature tightness (ROTT), behaviour characterisation.

### ROTT test procedure

The ROTT test includes a gasket load sequence (5 stress levels, S1 to S5), called Part A, which represents the initial joint tightening and gasket seating. The maximum stress level (S5) is 15160 psi for semi-metallic gaskets. Part A is interrupted at its three highest stress levels to run unload-reload sequences, called Parts B1, B2, B3 which simulate joint relaxation and re-tightening. At each stress level, helium leakage is measured (for two pressures in Part A and one pressure in Part B).

ROTT test data are plotted in the form of Gasket Stress, Sg, vs. Tightness Parameter, Tp, on a log-log scale. The tightness parameter, Tp, is a measure of the ability of an installed gasket to control its leakage performance in a pressurised flange joint. Tp is proportional to the pressure causing a small leak and inversely proportional to the square of the leak. Higher the Tp value, the tighter the joint. A joint that is 10 times tighter than another leaks 100 times less (at the same pressure).

### Gaskets constants

The calculated gasket constants are reported in the table below, along with computed values of S100, S1000 and the maximum Tp value obtained in the ROTT tests.

The ROTT behavior characterisation of a gasket consists of:

- Performing a minimum of two ROTT tests on NPS 4" samples
- Treating and reporting ROTT data on the basis of the Tightness Parameter concept
- Calculating the PVRC Gasket constants, Gb, "a" and Gs, according to the proposed ASTM Standard
- Reporting the gasket constants and characteristics

### Constants Gb, "a", and Gs

The PVRC tightness based gasket constants are determined from the results of two or more ROTT tests. Constants Gb and "a" together define an initial seating performance line. The combined effect of Gb, and "a" is best represented by the value of STp = Tp x Gb x "a" calculated for typical values of Tp such as 100 or 1000. For example S100 = Gb (100)a. Constant Gs independently represents operation. Low values of Gb, "a", Gs, S100 and S1000 are favourable.

### Performance in ROTT tests

The results of two ROTT tests conducted at TTRL[1] on Flexitallic FLEXPRO™ gaskets are shown in Figure 1.

At the highest Part A stress level (S5 - 15160 psi), Tp values above 55000 were obtained. A Tp of 55000 corresponds to a Helium leak rate of approximately 1 x $10^{-6}$ mg/s at a test pressure of 800 psi.

Part B test data indicates that this gasket maintains superior tightness during stress cycling.

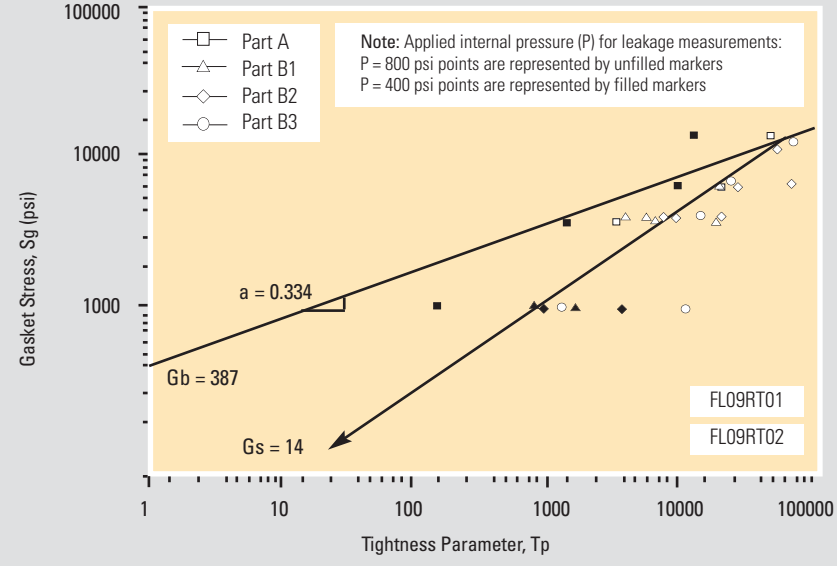
**TABLE 1: PVRC CONSTANTS**

| Gb | a | Gs | $^{S}100$ | $^{S}1000$ | Tp MAX |
|---|---|---|---|---|---|
| 387 psi | 0.334 | 14 psi | 1802 psi | 3888 psi | 55000 |

**TABLE 2: ASME CONSTANTS**

| m | y |
|---|---|
| 2 | 2500 psi |

**FIGURE 1: ROTT TEST RESULTS**




[1] *Tightness Testing and Research Laboratory - Ecole Polytechnique of Montreal*

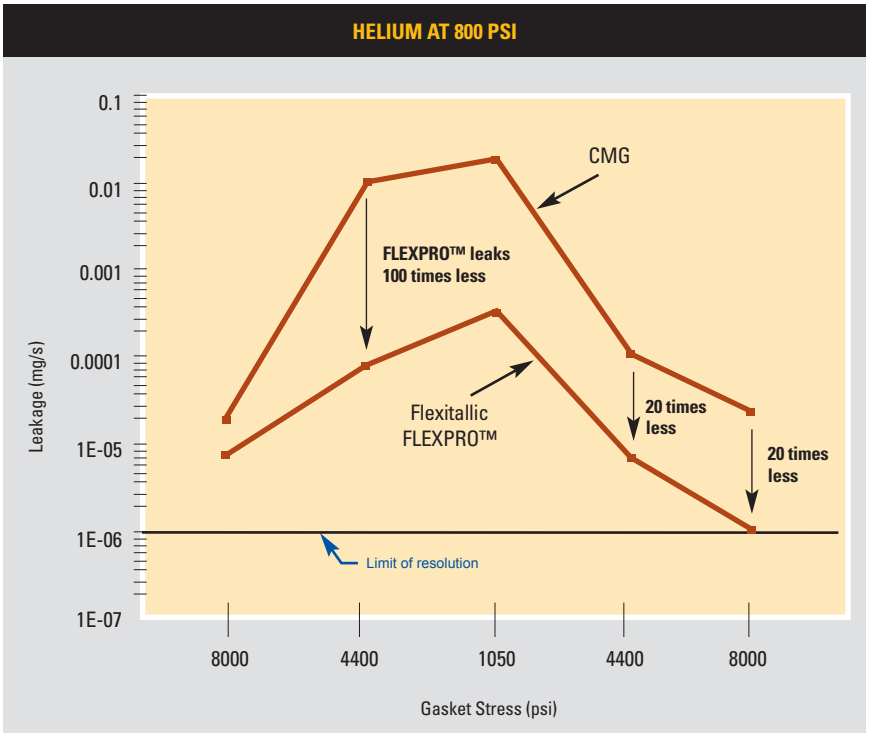
# FLEXPRO™ KAMMPROFILES

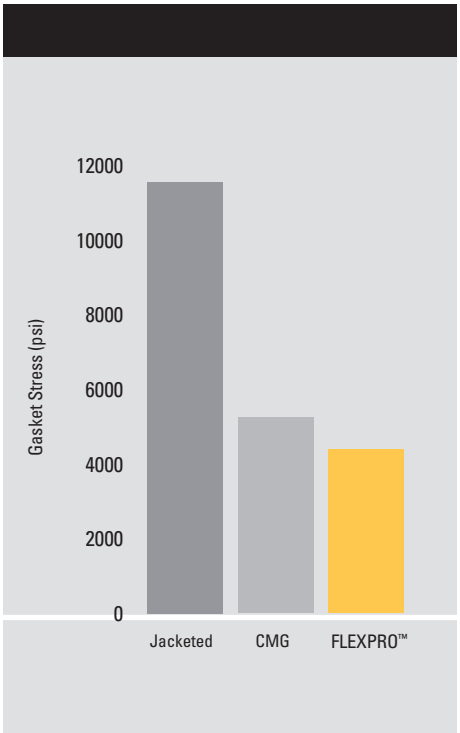
### Cyclic Service Comparison

During operation, unloading of a bolted-gasketed joint can occur due to pressurisation, fluctuation in pressure and temperature, thermal effects, joint relaxation, etc. PVRC test data confirms the superior ability of the FLEXPRO™ gasket to maintain tightness under these cyclic loading conditions. As shown in the graph, when gasket stress is reduced from 8000 psi to 4400 psi, the FLEXPRO™ gasket leaks 100 times less than a comparable corrugated metal graphite gasket (CMG).
**A tighter joint is a safer joint!**

### T3 Tightness

The PVRC developed method for characterising gasket performance specifies three classes of tightness. T1 (economy), T2 (standard), and T3 (tight). A tightness class of T3 represents a mass leak rate of helium per unit diameter, of 0.00002 mg/sec-mm. This graph shows that the Flexitallic FLEXPRO™ gasket achieves a tightness class of T3 at the lowest seating stress when compared to other types of gaskets. Results are based on PVRC test data, using a gasket with dimensions of 20" ID x 20.5" OD, with 20 x 1" diameter bolts and an assembly efficiency of 0.75. The Flexitallic FLEXPRO™ gasket is ideal for use in applications where limited bolt load and/or light weight flanges are used.



# FLEXPRO™ KAMMPROFILES

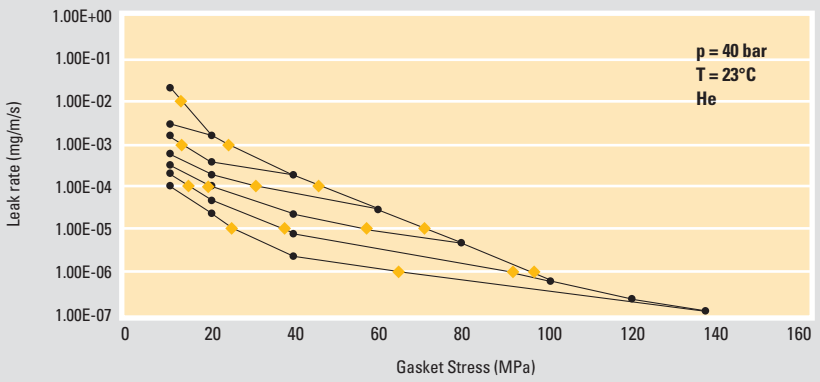
**Flange Calculations and Gasket Parameters – EN 1591-1 and EN 13555**

Driven by national requirements within the European Union for increasing plant efficiency and reducing fugitive emissions the European Standard EN 1591-1 was first published in 2001. The Standard outlines a calculation method in which strength criteria of the individual mechanical components in a bolted joint namely; flanges, bolts and gasket, and importantly leakage criteria are satisfied for a particular application. The calculation method adopts the premise that all gasketed bolted flanged connections leak and requires the user to specify what a permissible level of leakage is for a particular application. This is done via the introduction of the concept of the tightness class. At the time of writing EN 1591-1 is the only stand alone standardised calculation method that includes both stress analysis and tightness proof of a bolted connection.

The calculation requires the input of data specific to the particular application in question. The required gasket characteristics are generated in accordance with the European standard EN 13555. The test protocol outlined in EN 13555 is complex and requires the use of costly sophisticated test equipment.

As the leading supplier of technical solutions in the field of industrial sealing Flexitallic makes use of the latest innovative materials technologies and calculation methodologies to ensure the highest levels of joint integrity. Gasket characteristics in accordance with EN13555 are available for wide selection of Flexitallic static sealing products. Alternatively Flexitallic can undertake flange calculations in accordance with EN1591-1 on behalf of the end user.

**LEAKAGE CURVE - KAMM 316L FG 154x124x4.78mm. Test number 07-133**

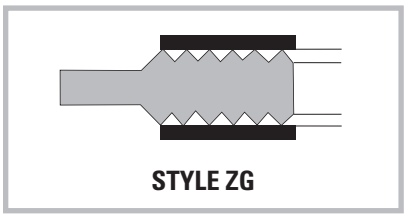



**GASKET CHARACTERISTICS ACROSS A RANGE OF TEMPERATURES, STRESSES AND PRESSURES, RELATING TO THE FOLLOWING PROPERTIES ARE GENERATED:**

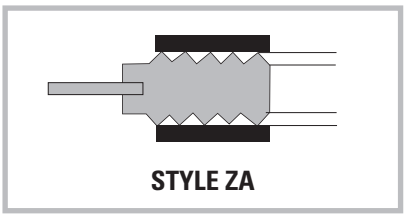
| | | | | |
|---|---|---|---|---|
| $Q_{Smax}$ | Maximum surface pressure that can be imposed on a gasket before failure occurs | | | |
| $Q_{min(L)}$ | Minimum gasket surface pressure required for leakage class (L) on initial loading | | | |
| $Q_{Smin(L)}$ | Minimum gasket surface pressure required for leakage class (L) after off-loading | | | |
| $L_N$ | Leakage tightness classes: | | | |
| | Tightness Class LN: | $L_{1.0}$ | $L_{0.1}$ | $L_{0.01}$ |
| | Specific Leakage Rate ($mg.s^{-1}.m^{-1}$): | ≤ **1.0** | ≤ **0.1** | ≤ **0.01** |
| $P_{QR}$ | Creep relaxation factor. Ratio of the original and final surface pressures | | | |
| $\Delta_{eGc}$ | Change in gasket thickness due to creep | | | |
| $E_G$ | Elastic unloading modulus | | | |
| $\alpha_G$ | Coefficient of axial thermal expansion | | | |
| $\mu_G$ | Static friction factor between the gasket and contacting flange face. | | | |

# DIMENSIONAL DATA

## FLEXPRO™ KAMMPROFILES
ASME B16.20



STYLE ZG



STYLE ZA

| NOMINAL BORE | | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | CENTERING RING OUTER DIAMETER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| INCHES | MM | | | 150 Class | 300 Class | 400 Class | 600 Class | 900 Class | 1500 Class | 2500 Class |
| ½ | 15 | 23.1 | 33.3 | 47.8 | 54.1 | Note (2) | 54.1 | Note (3) | 63.5 | 69.9 |
| ¾ | 20 | 28.7 | 39.6 | 57.2 | 66.8 | Note (2) | 66.8 | Note (3) | 69.9 | 76.2 |
| 1 | 25 | 36.6 | 47.5 | 66.8 | 73.2 | Note (2) | 73.2 | Note (3) | 79.5 | 85.9 |
| 1 1/4 | 32 | 44.5 | 60.2 | 76.2 | 82.6 | Note (2) | 82.6 | Note (3) | 88.9 | 104.9 |
| 1 1/2 | 40 | 52.3 | 69.9 | 85.9 | 95.3 | Note (2) | 95.3 | Note (3) | 98.6 | 117.6 |
| 2 | 50 | 69.9 | 88.9 | 104.9 | 111.3 | Note (2) | 111.3 | Note (3) | 143.0 | 146.1 |
| 2 1/2 | 65 | 82.6 | 101.6 | 124.0 | 130.3 | Note (2) | 130.3 | Note (3) | 165.1 | 168.4 |
| 3 | 80 | 98.3 | 123.7 | 136.7 | 149.4 | Note (2) | 149.4 | 168.4 | 174.8 | 196.9 |
| 4 | 100 | 123.7 | 153.9 | 174.8 | 181.1 | 177.8 | 193.8 | 206.5 | 209.6 | 235.0 |
| 5 | 125 | 150.9 | 182.6 | 196.9 | 215.9 | 212.9 | 241.3 | 247.7 | 254.0 | 279.4 |
| 6 | 150 | 177.8 | 212.6 | 222.3 | 251.0 | 247.7 | 266.7 | 289.1 | 282.7 | 317.5 |
| 8 | 200 | 228.6 | 266.7 | 279.4 | 308.1 | 304.8 | 320.8 | 358.9 | 352.6 | 387.4 |
| 10 | 250 | 282.7 | 320.8 | 339.9 | 362.0 | 358.9 | 400.1 | 435.1 | 435.1 | 476.3 |
| 12 | 300 | 339.6 | 377.7 | 409.7 | 422.4 | 419.1 | 457.2 | 498.6 | 520.7 | 549.4 |
| 14 | 350 | 371.6 | 409.7 | 450.9 | 485.9 | 482.6 | 492.3 | 520.7 | 577.9 | Note (4) |
| 16 | 400 | 422.4 | 466.6 | 514.4 | 539.8 | 536.7 | 565.2 | 574.8 | 641.4 | Note (4) |
| 18 | 450 | 479.3 | 530.1 | 549.4 | 596.9 | 593.9 | 612.9 | 638.3 | 704.9 | Note (4) |
| 20 | 500 | 530.1 | 580.9 | 606.6 | 654.1 | 647.7 | 682.8 | 698.5 | 755.7 | Note (4) |
| 24 | 600 | 631.7 | 682.5 | 717.6 | 774.7 | 768.4 | 790.7 | 838.2 | 901.7 | Note (4) |

*GENERAL NOTES*

*Dimensions in mm. Tolerances in mm.*

*Figures stated are for information only. Please refer to the current version of the original standards for dimensional information.*

*NOTES*

*1) Tolerances +/- 0.8mm for all diameters*

*2) There is no Class 400 flanges in NPS ½" through NPS 3" (use Class 600)*

*3) There is no Class 900 flanges in NPS ½" through NPS 2.½" (use Class 1500)*

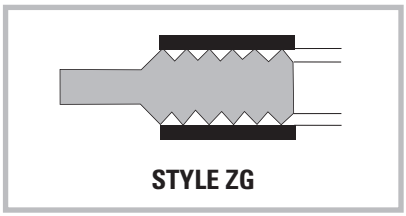
*4) There is no Class 2500 flanges in NPS 14" and larger*

Flexitallic®

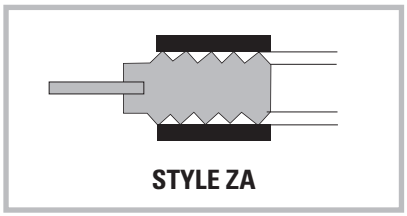
# DIMENSIONAL DATA

## FLEXPRO™ KAMMPROFILES

Covered Serrated Metal Gaskets for Type A and Type B Flanges.
EN1514-6



STYLE ZG



STYLE ZA

| OUTER DIAMETER | | | | | CENTERING RING OUTER DIAMETER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NOMINAL BORE | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | | | | | | | | | | | | |
| DN | | PN10/40 | PN64/160 | PN250/400 | PN10 | PN16 | PN25 | PN40 | PN64 | PN100 | PN160 | PN250 | PN320 | PN400 |
| 10 | 22 | - | See | 36 | 46 | 46 | 46 | 46 | 56 | 56 | 56 | 67 | 67 | 67 |
| 15 | 26 | - | PN250 | 42 | 51 | 51 | 51 | 51 | 61 | 61 | 61 | 72 | 72 | - |
| 20 | 31 | - | to | 47 | 61 | 61 | 61 | 61 | - | - | - | - | - | - |
| 25 | 36 | - | PN400 | 52 | 71 | 71 | 71 | 71 | 82 | 82 | 82 | 83 | 92 | 104 |
| 32 | 46 | See | 62 | 66 | 82 | 82 | 82 | 82 | - | - | - | - | - | - |
| 40 | 53 | PN64 | 69 | 73 | 92 | 92 | 92 | 92 | 103 | 103 | 103 | 109 | 119 | 135 |
| 50 | 65 | to | 81 | 87 | 107 | 107 | 107 | 107 | 113 | 119 | 119 | 124 | 134 | 150 |
| 65 | 81 | PN160 | 100 | 103 | 127 | 127 | 127 | 127 | 137 | 143 | 143 | 153 | 170 | 192 |
| 80 | 95 | - | 115 | 121 | 142 | 142 | 142 | 142 | 148 | 154 | 154 | 170 | 190 | 207 |
| 100 | 118 | - | 138 | 146 | 162 | 162 | 168 | 168 | 174 | 180 | 180 | 202 | 229 | 256 |
| 125 | 142 | - | 162 | 178 | 192 | 192 | 194 | 194 | 210 | 217 | 217 | 242 | 274 | 301 |
| 150 | 170 | - | 190 | 212 | 217 | 217 | 224 | 224 | 247 | 257 | 257 | 284 | 311 | 348 |
| 175 | 195 | - | 215 | 245 | 247 | 247 | 254 | 265 | 277 | 287 | 284 | 316 | 358 | 402 |
| 200 | 220 | 240 | 248 | 280 | 272 | 272 | 284 | 290 | 309 | 324 | 324 | 358 | 398 | 442 |
| 250 | 270 | 290 | 300 | 340 | 327 | 328 | 340 | 352 | 364 | 391 | 388 | 442 | 488 | - |
| 300 | 320 | 340 | 356 | 400 | 377 | 383 | 400 | 417 | 424 | 458 | 458 | 536 | - | - |
| 350 | 375 | 395 | 415 | - | 437 | 443 | 457 | 474 | 486 | 512 | - | - | - | - |
| 400 | 426 | 450 | 474 | - | 489 | 495 | 514 | 546 | 543 | 572 | - | - | - | - |
| 450 | 480 | 506 | - | - | 539 | 555 | - | 571 | - | - | - | - | - | - |
| 500 | 530 | 560 | 588 | - | 594 | 617 | 624 | 628 | 657 | 704 | - | - | - | - |
| 600 | 630 | 664 | 700 | - | 695 | 734 | 731 | 747 | 764 | 813 | - | - | - | - |
| 700 | 730 | 770 | 812 | - | 810 | 804 | 833 | 852 | 879 | 950 | - | - | - | - |
| 800 | 830 | 876 | 886 | - | 917 | 911 | 942 | 974 | 988 | - | - | - | - | - |
| 900 | 930 | 982 | 994 | - | 1017 | 1011 | 1042 | 1084 | 1108 | - | - | - | - | - |
| 1000 | 1040 | 1098 | 1110 | - | 1124 | 1128 | 1154 | 1194 | 1220 | - | - | - | - | - |
| 1200 | 1250 | 1320 | 1334 | - | 1341 | 1342 | 1364 | 1398 | 1452 | - | - | - | - | - |
| 1400 | 1440 | 1522 | - | - | 1548 | 1542 | 1578 | 1618 | - | - | - | - | - | - |
| 1600 | 1650 | 1742 | - | - | 1772 | 1764 | 1798 | 1830 | - | - | - | - | - | - |
| 1800 | 1850 | 1914 | - | - | 1972 | 1964 | 2000 | - | - | - | - | - | - | - |
| 2000 | 2050 | 2120 | - | - | 2182 | 2168 | 2230 | - | - | - | - | - | - | - |
| 2200 | 2250 | 2328 | - | - | 2384 | 2378 | - | - | - | - | - | - | - | - |
| 2400 | 2460 | 2512 | - | - | 2594 | - | - | - | - | - | - | - | - | - |
| 2600 | 2670 | 2728 | - | - | 2794 | - | - | - | - | - | - | - | - | - |
| 2800 | 2890 | 2952 | - | - | 3014 | - | - | - | - | - | - | - | - | - |
| 3000 | 3100 | 3166 | - | - | 3228 | - | - | - | - | - | - | - | - | - |

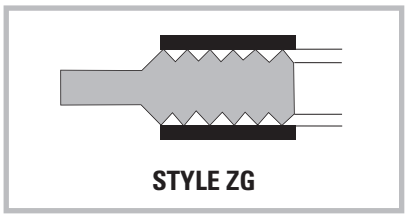
*GENERAL NOTES*

*Diameter tolerances for Table 1.* ***Up to DN 1000:*** *OD +/- 0.4mm. ID +/- 0.4 mm/-0.* ***Above DN 1000:*** *OD +/- 1.0mm. ID +/- 1.0 mm/-0*

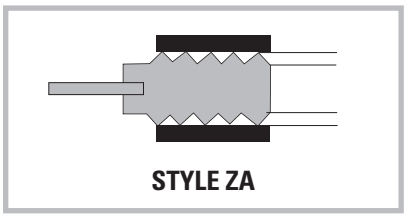
*Figures stated are for information only. Please refer to the current version of the original standards for dimensional information.*

# DIMENSIONAL DATA

## FLEXPRO™ KAMMPROFILES
ASME B16.20 Series A



STYLE ZG



STYLE ZA

| NOMINAL BORE | | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | CENTERING RING OUTER DIAMETER | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INCHES | MM | 150 | 150 | 300 | 300 | 400 | 400 | 600 | 600 | 900 | 900 | 150 | 300 | 400 | 600 | 900 |
| 26 | 650 | 673.1 | 704.9 | 685.8 | 736.6 | 685.8 | 736.6 | 685.8 | 736.6 | 685.8 | 736.6 | 774.7 | 835.2 | 831.9 | 866.9 | 882.7 |
| 28 | 700 | 723.9 | 755.7 | 736.6 | 787.4 | 736.6 | 787.4 | 736.6 | 787.4 | 736.6 | 787.4 | 831.9 | 898.7 | 892.3 | 914.4 | 946.2 |
| 30 | 750 | 774.7 | 806.5 | 793.8 | 844.6 | 793.8 | 844.6 | 793.8 | 844.6 | 793.8 | 844.6 | 882.7 | 952.5 | 946.2 | 971.6 | 1009.7 |
| 32 | 800 | 825.5 | 860.6 | 850.9 | 901.7 | 850.9 | 901.7 | 850.9 | 901.7 | 850.9 | 901.7 | 939.8 | 1006.6 | 1003.3 | 1022.4 | 1073.2 |
| 34 | 850 | 876.3 | 911.4 | 901.7 | 952.5 | 901.7 | 952.5 | 901.7 | 952.5 | 901.7 | 925.5 | 990.6 | 1057.4 | 1054.1 | 1073.2 | 1136.7 |
| 36 | 900 | 927.1 | 968.5 | 955.8 | 1006.6 | 955.8 | 1006.6 | 955.8 | 1006.6 | 958.9 | 1009.7 | 1047.8 | 1117.6 | 1117.6 | 1130.3 | 1200.2 |
| 38 | 950 | 977.9 | 1019.3 | 977.9 | 1016.0 | 971.6 | 1022.4 | 990.6 | 1041.4 | 1035.1 | 1085.9 | 1111.3 | 1054.1 | 1073.2 | 1104.9 | 1200.2 |
| 40 | 1000 | 1028.7 | 1070.1 | 1022.4 | 1070.1 | 1025.7 | 1076.5 | 1047.8 | 1098.6 | 1098.6 | 1149.4 | 1162.1 | 1114.6 | 1127.3 | 1155.7 | 1251.0 |
| 42 | 1050 | 1079.5 | 1124.0 | 1073.2 | 1120.9 | 1076.5 | 1127.3 | 1104.9 | 1155.7 | 1149.4 | 1200.2 | 1219.2 | 1165.4 | 1178.1 | 1219.2 | 1301.8 |
| 44 | 1100 | 1130.3 | 1178.1 | 1130.3 | 1181.1 | 1130.3 | 1181.1 | 1162.1 | 1212.9 | 1206.5 | 1257.3 | 1276.4 | 1219.2 | 1231.9 | 1270.0 | 1368.6 |
| 46 | 1150 | 1181.1 | 1228.9 | 1178.1 | 1228.9 | 1193.8 | 1244.6 | 1212.9 | 1263.7 | 1270.0 | 1320.8 | 1327.2 | 1273.3 | 1289.1 | 1327.2 | 1435.1 |
| 48 | 1200 | 1231.9 | 1279.7 | 1235.2 | 1286.0 | 1244.6 | 1295.4 | 1270.0 | 1320.8 | 1320.8 | 1371.6 | 1384.3 | 1324.1 | 1346.2 | 1390.7 | 1485.9 |
| 50 | 1250 | 1282.7 | 1333.5 | 1295.4 | 1346.2 | 1295.4 | 1346.2 | 1320.8 | 1371.6 | Note (4) | Note (4) | 1435.1 | 1378.0 | 1403.4 | 1447.8 | Note (4) |
| 52 | 1300 | 1333.5 | 1384.3 | 1346.2 | 1397.0 | 1346.2 | 1397.0 | 1371.6 | 1422.4 | Note (4) | Note (4) | 1492.3 | 1428.8 | 1454.2 | 1498.6 | Note (4) |
| 54 | 1350 | 1384.3 | 1435.1 | 1403.4 | 1454.2 | 1403.4 | 1454.2 | 1428.8 | 1479.6 | Note (4) | Note (4) | 1549.4 | 1492.3 | 1517.7 | 1555.8 | Note (4) |
| 56 | 1400 | 1435.1 | 1485.9 | 1454.2 | 1505.0 | 1454.2 | 1505.0 | 1479.6 | 1530.4 | Note (4) | Note (4) | 1606.6 | 1543.1 | 1568.5 | 1612.9 | Note (4) |
| 58 | 1450 | 1485.9 | 1536.7 | 1511.3 | 1562.1 | 1505.0 | 1555.8 | 1536.7 | 1587.5 | Note (4) | Note (4) | 1663.7 | 1593.9 | 1619.3 | 1663.7 | Note (4) |
| 60 | 1500 | 1536.7 | 1587.5 | 1562.1 | 1612.9 | 1568.5 | 1619.3 | 1593.9 | 1644.7 | Note (4) | Note (4) | 1714.5 | 1644.7 | 1682.8 | 1733.6 | Note (4) |

*GENERAL NOTES*

*Dimensions in mm. Tolerances in mm.*

*Figures stated are for information only. Please refer to the current version of the original standards for dimensional information.*

*NOTES*

*1) Sealing ID Nom Bore 26 to 34 tolerances +/- 0.8mm and Nom Bore 36 to 60 +/- 1.5mm*

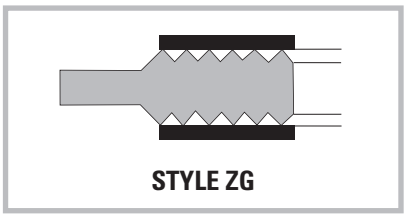
*2) Sealing OD Nom Bore 26 to 60 tolerances +/- 1.5mm*

*3) Centering Ring OD tolerances =/- 0.8mm*

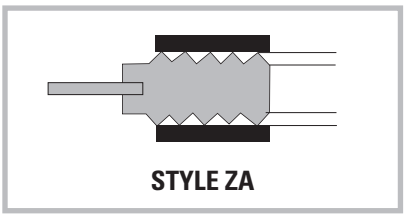
*4) There is no Class 900 Flange in NPS 50 and above.*

# DIMENSIONAL DATA

## FLEXPRO™ KAMMPROFILES
ASME B16.20 Series B



STYLE ZG



STYLE ZA

| NOMINAL BORE | | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | SEALING INNER DIAMETER | SEALING OUTER DIAMETER | CENTERING RING OUTER DIAMETER | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INCHES | MM | 150 | 150 | 300 | 300 | 400 | 400 | 600 | 600 | 900 | 900 | 150 | 300 | 400 | 600 | 900 |
| 26 | 650 | 673.1 | 698.5 | 673.1 | 711.2 | 666.8 | 698.5 | 663.7 | 714.5 | 692.2 | 749.3 | 725.4 | 771.7 | 746.3 | 765.3 | 838.2 |
| 28 | 700 | 723.9 | 749.3 | 723.9 | 762.0 | 714.5 | 749.3 | 704.9 | 755.7 | 743.0 | 800.1 | 776.2 | 825.5 | 800.1 | 819.2 | 901.7 |
| 30 | 750 | 774.7 | 800.1 | 774.7 | 812.8 | 765.3 | 806.5 | 778.0 | 828.8 | 806.5 | 857.3 | 827.0 | 886.0 | 857.3 | 879.6 | 958.9 |
| 32 | 800 | 825.5 | 850.9 | 825.5 | 863.6 | 812.8 | 860.6 | 831.9 | 882.7 | 863.6 | 914.4 | 881.1 | 939.8 | 911.4 | 933.5 | 1016.0 |
| 34 | 850 | 876.3 | 908.1 | 876.3 | 914.4 | 866.9 | 911.4 | 889.0 | 939.8 | 920.8 | 971.6 | 935.0 | 993.9 | 962.2 | 997.0 | 1073.2 |
| 36 | 900 | 927.1 | 958.9 | 927.1 | 965.2 | 917.7 | 965.2 | 939.8 | 990.6 | 946.2 | 997.0 | 987.6 | 1047.8 | 1022.4 | 1047.8 | 1124.0 |
| 38 | 950 | 974.9 | 1009.7 | 1009.7 | 1047.8 | 971.6 | 1022.4 | 990.6 | 1041.4 | 1035.1 | 1085.9 | 1044.7 | 1098.6 | 1073.2 | 1104.9 | 1200.2 |
| 40 | 1000 | 1022.4 | 1063.8 | 1060.5 | 1098.6 | 1025.7 | 1076.5 | 1047.8 | 1098.6 | 1098.6 | 1149.4 | 1095.5 | 1149.4 | 1127.3 | 1155.7 | 1251.0 |
| 42 | 1050 | 1079.5 | 1114.6 | 1111.3 | 1149.4 | 1076.5 | 1127.3 | 1104.9 | 1155.7 | 1149.4 | 1200.2 | 1146.3 | 1200.2 | 1178.1 | 1219.2 | 1301.8 |
| 44 | 1100 | 1124.0 | 1165.4 | 1162.1 | 1200.2 | 1130.3 | 1181.1 | 1162.1 | 1212.9 | 1206.5 | 1257.3 | 1197.1 | 1251.0 | 1231.9 | 1270.0 | 1368.6 |
| 46 | 1150 | 1181.1 | 1224.0 | 1216.2 | 1254.3 | 1193.8 | 1244.6 | 1212.9 | 1263.7 | 1270.0 | 1320.8 | 1255.8 | 1317.8 | 1289.1 | 1327.2 | 1435.1 |
| 48 | 1200 | 1231.9 | 1270.0 | 1263.7 | 1311.4 | 1244.6 | 1295.4 | 1270.0 | 1320.8 | 1320.8 | 1371.6 | 1306.6 | 1368.6 | 1346.2 | 1390.7 | 1485.9 |
| 50 | 1250 | 1282.7 | 1325.6 | 1317.8 | 1355.9 | 1295.4 | 1346.2 | 1320.8 | 1371.6 | Note (4) | Note (4) | 1357.4 | 1419.4 | 1403.4 | 1447.8 | Note (4) |
| 52 | 1300 | 1333.5 | 1376.4 | 1368.6 | 1406.7 | 1346.2 | 1397.0 | 1371.6 | 1422.4 | Note (4) | Note (4) | 1408.2 | 1470.2 | 1454.2 | 1498.6 | Note (4) |
| 54 | 1350 | 1384.3 | 1422.4 | 1403.4 | 1454.2 | 1403.4 | 1454.2 | 1428.8 | 1479.6 | Note (4) | Note (4) | 1463.8 | 1530.4 | 1517.7 | 1555.8 | Note (4) |
| 56 | 1400 | 1444.8 | 1478.0 | 1479.6 | 1524.0 | 1454.2 | 1505.0 | 1479.6 | 1530.4 | Note (4) | Note (4) | 1514.6 | 1593.9 | 1568.5 | 1612.9 | Note (4) |
| 58 | 1450 | 1500.6 | 1528.8 | 1535.2 | 1573.3 | 1505.0 | 1555.8 | 1536.7 | 1587.5 | Note (4) | Note (4) | 1579.6 | 1655.8 | 1619.3 | 1663.7 | Note (4) |
| 60 | 1500 | 1557.3 | 1586.0 | 1589.0 | 1630.4 | 1568.5 | 1619.3 | 1593.9 | 1644.7 | Note (4) | Note (4) | 1630.4 | 1706.6 | 1682.8 | 1733.6 | Note (4) |

*GENERAL NOTES*

*Dimensions in mm. Tolerances in mm.*

*Figures stated are for information only. Please refer to the current version of the original standards for dimensional information.*

*NOTES*

*1) Sealing ID Nom Bore 26 to 34 tolerances +/- 0.8mm and Nom Bore 36 to 60 +/- 1.5mm*

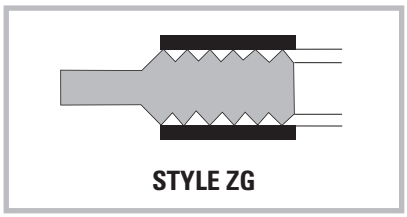
*2) Sealing OD Nom Bore 26 to 60 tolerances +/- 1.5mm*

*3) Centering Ring OD tolerances +/- 0.8mm*

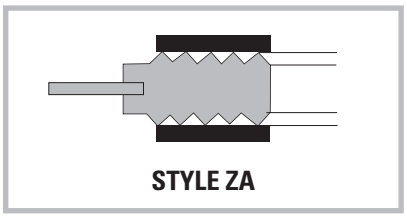
*4) There are no Class 900 flanges NPS 50" and above.*

# DIMENSIONAL DATA

## FLEXPRO™ KAMMPROFILES
EN 12560-6



STYLE ZG

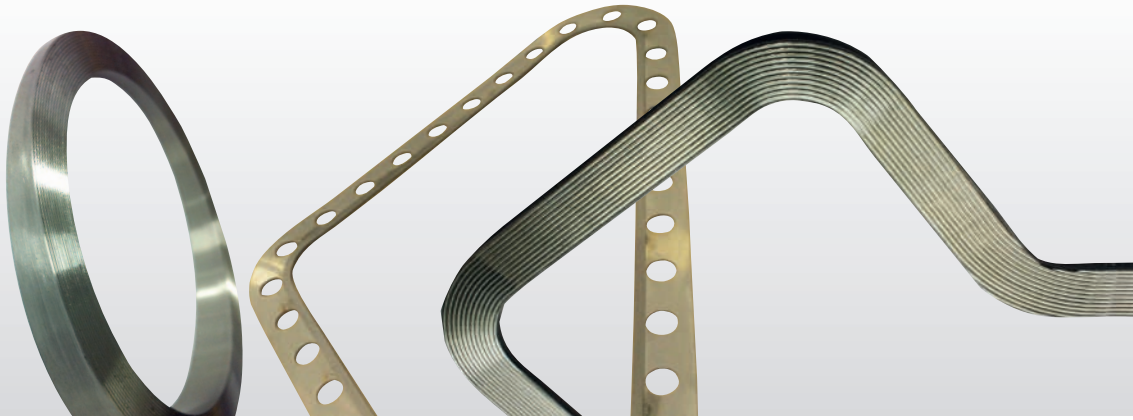


STYLE ZA

| NOMINAL PIPE SIZE | | SEALING ELEMENT | | CENTERING RING OUTER DIAMETER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| INCHES | MM | INNER DIAMETER | OUTER DIAMETER | 150 Class | 300 Class | 400 Class | 600 Class | 900 Class | 1500 Class | 2500 Class |
| ½ | 15 | 23.0 | 33.3 | 44.4 | 50.8 | 50.8 | 50.8 | 60.3 | 60.3 | 66.7 |
| ¾ | 20 | 28.6 | 39.7 | 53.9 | 63.5 | 63.5 | 63.5 | 66.7 | 66.7 | 73.0 |
| 1 | 25 | 36.5 | 47.6 | 63.5 | 69.8 | 69.8 | 69.8 | 76.2 | 76.2 | 82.5 |
| 1 1/4 | 32 | 44.4 | 60.3 | 73.0 | 79.4 | 79.4 | 79.4 | 85.7 | 85.7 | 101.6 |
| 1 1/2 | 40 | 52.4 | 69.8 | 82.5 | 92.1 | 92.1 | 92.1 | 95.2 | 95.2 | 114.3 |
| 2 | 50 | 69.8 | 88.9 | 101.6 | 108.0 | 108.0 | 108.0 | 139.7 | 139.7 | 142.8 |
| 2 1/2 | 65 | 82.5 | 101.6 | 120.6 | 127.0 | 127.0 | 127.0 | 161.9 | 161.9 | 165.1 |
| 3 | 80 | 98.4 | 123.8 | 133.4 | 146.1 | 146.1 | 146.1 | 165.1 | 171.5 | 193.7 |
| 3 1/2 | 90 | 111.1 | 136.5 | 158.8 | 161.9 | 158.7 | 158.7 | - | - | - |
| 4 | 100 | 123.8 | 154.0 | 171.5 | 177.8 | 174.6 | 190.5 | 203.2 | 206.4 | 231.7 |
| 5 | 125 | 150.8 | 182.6 | 193.7 | 212.7 | 209.5 | 238.1 | 244.5 | 250.8 | 276.2 |
| 6 | 150 | 177.8 | 212.7 | 219.1 | 247.7 | 244.5 | 263.5 | 285.8 | 279.4 | 314.3 |
| 8 | 200 | 228.6 | 266.7 | 276.2 | 304.8 | 301.6 | 317.5 | 355.6 | 349.3 | 384.1 |
| 10 | 250 | 282.6 | 320.7 | 336.5 | 358.8 | 355.6 | 396.9 | 431.8 | 431.8 | 473.0 |
| 12 | 300 | 339.7 | 377.8 | 406.4 | 419.1 | 415.9 | 454.0 | 495.3 | 517.5 | 546.1 |
| 14 | 350 | 371.5 | 409.6 | 447.7 | 482.6 | 479.4 | 488.9 | 517.5 | 574.7 | - |
| 16 | 400 | 422.3 | 466.7 | 511.2 | 536.6 | 533.4 | 561.9 | 571.5 | 638.1 | - |
| 18 | 450 | 479.4 | 530.2 | 546.1 | 593.7 | 590.5 | 609.6 | 635.0 | 701.7 | - |
| 20 | 500 | 530.2 | 581.0 | 603.2 | 650.9 | 644.5 | 679.5 | 695.3 | 752.4 | - |
| 22 | 550 | 581.0 | 631.8 | 657.2 | 701.7 | 698.5 | 730.3 | - | - | - |
| 24 | 600 | 631.8 | 682.6 | 714.4 | 771.5 | 765.2 | 787.4 | 835.0 | 898.5 | - |

*GENERAL NOTES*
*Diameter tolerances:*
*Up to 1000mm OD +0/-0.4mm*
*ID +0.4mm/-0*
*Above 1000mm OD +0/-10mm*
*ID +1.0mm/-0*

# HYBRID AND SPECIAL DESIGNS



### Standard Flexpro™ Design Profile

Whenever possible Flexitallic recommend the use of a single piece construction serrated core (no welds), however, in many instances the size of gasket required is larger than the standard commercially available sheet material. In these instances, strip material is ring rolled and welded together using the minimum number of welds possible. Flexitallic ensure that the ends of the ring-rolled metal strip are carefully aligned, both vertically and horizontally, before full penetration fusion welding. This process eliminates any potential leakage paths in the weld location and minimises the heat affected zone.

After careful dressing of the weld concentric serrations are machined on the ring. This eliminates any potential high and/or low spots in the weld area.

Lower cost manufacturing routes involving ring-rolling and welding of pre-serrated metal strip, can result in the integrity of the gasket being compromised (leakage paths at weld locations).

### Serration Profiles

Flexitallic can manufacture Flexpro™ gaskets with various serration profiles. The standard Flexitallic shallow profile has been designed to effect a high integrity seal when covered with any one of a range of facing materials and thicknesses. Other serration profiles as defined by different international or customer standards are available.

### Special Shapes

Flexitallic have designed and built a number of serration profiling machine tools that provide the capability of machining complex shapes while maintaining the concentric serrations on the sealing faces. These shapes can include oval, obround, rectangular and irregular shapes which are often required for manholes, special access door seals and fin fan cooler box covers. The Flexpro™ core can be supplied in a wide range of thicknesses from 2.0mm upwards.

The Flexpro™ design is especially suited for use in connections with narrow radial widths commonly found in fin fan plug gaskets and other applications where space is limited such as floating head and valve body and bonnet locations.

In addition to complex shapes, Flexitallic have successfully provided Flexpro™ kammprofile gaskets for use on misaligned flanged connections. These 'wedge' shaped gasket are machined to meet a specific misalignment angle.

### Pass Bars

The Flexpro™ kammprofile section is commonly supplied in pass bar form and incorporated into the tube side of multi-pass heat exchanger gaskets.

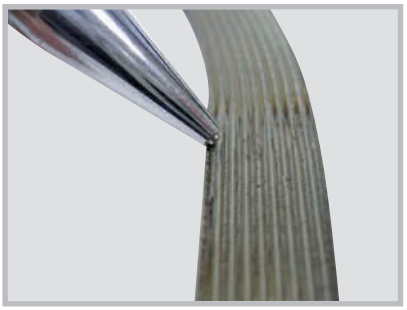
### Hybrid Designs

For difficult sealing applications, hybrid technology can be applied to provide a high integrity assembly. Flexitallic can provide sealing solutions where Flexpro™sealing technology is combined with other gasket styles such as spiral wound and Change gaskets. The metal core of the Flexpro™ section of the gasket provides additional seal integrity, compression limitation and rigidity.

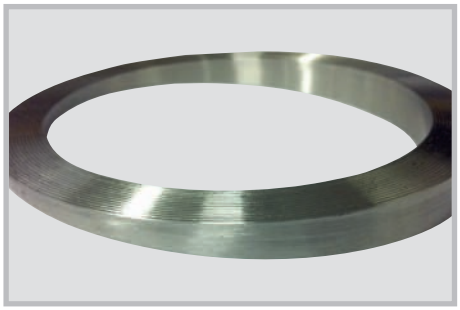
For difficult and special applications please contact the Flexitallic Applications Engineering team.

### Re-Facing Flexpro™ Gaskets

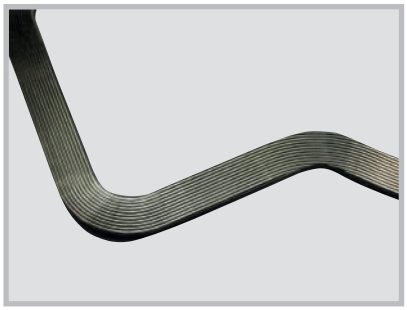
Typically a gasket is used only once, however, when using large diameter or expensive core material it may be cost effective to re-face and re-use the Flexpro™ gasket. This service can provided by Flexitallic or undertaken on site by suitable personnel following appropriate training.



*Flexitallic processes eliminate potential leakage paths at weld location.*

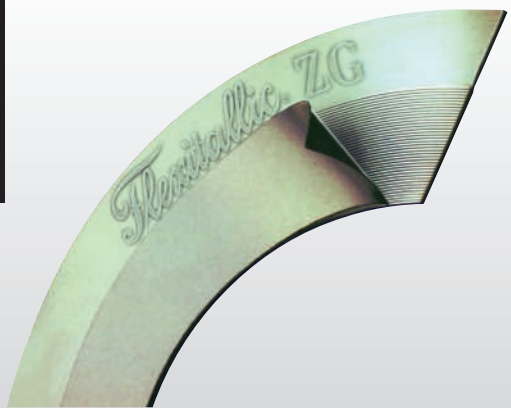


*Special shapes.*



*Special shapes.*

# SUPERIOR PERFORMANCE BY DESIGN




| WHY FLEXPRO™ KAMMPROFILE GASKETS? | |
|---|---|
| **Proven Design** | Many years of proven success in sealing difficult applications. |
| **Superior Sealing Tightness and Safety** | Correct material selection provides longer service life, no need to 'hot torque', reduced emissions and reduced maintenance requirements. |
| **Low Seating Stress** | Ideal for light flanges with limited bolt load, as well as highly loaded flanges. |
| **Different Shapes** | Flexitallic production methods provide the capability of manufacturing a wide range of sizes in circular and non-circular shapes to suit a wide range of flange types. |
| **Wide Range of Materials** | Flexpro™ gasket metal cores and soft facings are selected from a wide range of materials to suit specific applications. |
| **Wide Pressure Range** | Suitable for use on all standard flange pressure classes and norms. |
| **Wide Temperature Range** | Suitable for use in cryogenic service up to 1000°C |
| **Conformable Sealing Surfaces** | The soft conformable sealing faces of the Flexpro™ gaskets, are more tolerant to smooth and or damaged flange sealing faces. |
| **Reproducible Construction** | The Flexitallic manufacturing processes provide a highly repeatable process from one manufacturing batch to another. |
| **Easy to Handle and Install** | The rigid and stable core of the Flexpro™ gasket facilitates easy handling and installation, with reduced risk of damage to the gasket. |
| **Fire Safe** | Material specific, Flexpro™ gaskets are API-6FB Fire Safe. |
| **Re-usable** | Flexpro™ gaskets can be re-faced and re-used. |
| **Replaces Double Jacketed Gaskets** | Flexpro™ gaskets are a direct replacement for double jacketed gaskets. Note: Where Nubbins (stress raisers) are present, please check with Flexitallic Applications Engineering Team. |
| **Space Limitations** | Flexpro™ gaskets can be manufactured with narrow seal land widths |
| **Cost Effective** | Longer service life, less maintenance, reduced emissions. |

Flexitallic®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**About The Flexitallic Group**

The Flexitallic Group is a global leader in specialised sealing solutions and products serving the oil and gas, power generation, chemical and petrochemical industries in emerging and developed markets. Focused on the upstream, downstream and power generation sectors, it has operations in France, the United States, Canada, Mexico, the United Kingdom, Germany, the United Arab Emirates, Kazakhstan and China plus a network of worldwide licensing partners and distributors.

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