



Composite Sealing Washers





WARNING: These products can expose you to chemicals including carbon black (airborne and extracts), antimony trioxide, titanium dioxide, silica (crystalline), di(2-ethylhexyl)phthalate, ethylene thiourea, acrylonitrile, 1,3-butadiene, epichlorohydrin, toluenediisocyanate, tetrafluoroethylene, ethylbenzene, formaldehyde, furfuryl alcohol, glass fibers, methyl isobutyl ketone, nickel (metallic and compounds), lead and lead compounds which are known to the State of California to cause cancer; and 1,3-butadiene, epichlorohydrin, di(2-ethylhexyl)phthalate, di-isodecyl phthalate, ethylene thiourea, methyl isobutyl ketone, methanol, toluene, lead and lead compounds which are known to the State of California to cause birth defects and other reproductive harm. For more information go to www.P65Warnings.ca.gov

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Parker's safety programme

Warning - user responsibility

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalogue and in any materials provided by Parker or its subsidiaries or authorized distributors. To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and responsibly foreseeable uses of the components or systems.

Range of application

Our seals may only be used within the application parameters stated in our documents as regards compatibility with contact media, pressures, temperatures and time of storage. Application or use outside of the specified application parameters as well as the selection of different compounds by mistake may result in damage to life, the environment and/or equipment and facilities.

The information contained in our publications is based on know-how developed over decades of experience in the manufacturing and application of seals. Despite this experience, unknown factors arising out of the practical application of seals may considerably affect the overall applicability of this information in such a way that the recommendations provided herein are not to be considered generally binding.

The data for operating pressure, operating temperature, and surface speed stated in the columns represent maximum values and are interrelated. Under extreme working conditions it is recommended not to use all maximum values simultaneously.

For special requirements (pressure, temperature, speed, etc.) please contact our consultancy service, so that suitable materials and/or designs can be recommended.

Compatibility of seals and operating media / cleaning agents

Due to the great diversity of operational parameters affecting fluidic devices and their impact on seals, it is absolutely imperative that manufacturers of these devices approve seals for functional and operational suitability under field conditions.

Furthermore, in view of the consistent increase of newly available media used as hydraulic oils, lubricants, and cleaning agents, special attention is invited to the aspect of compatibility with sealing elastomers currently in use.

Additives contained in base media in order to enhance certain functional characteristics may affect compatibility characteristics of sealing materials.

For this reason, it is imperative that any product equipped with our seals be tested for compatibility with operational media or cleaning agents approved or specified by you either at your plant or by means of field tests prior to any field use.

We kindly ask you to comply with this notice since, as a manufacturer of seals, we are not in a position, as a matter of principle, to perform simulations of any and all conditions present in the final application nor of knowing the composition of the operational media and cleaning agents used.

Design modifications

We reserve the right to make design modifications without prior notification.

Prototypes and samples

Prototypes and samples are produced from experimental moulds. The subsequent series production may differ in terms of production techniques from the prototype production unless specific agreement to the contrary was reached beforehand.

Delivery and services

The delivery guarantee (availability of moulds) for individual dimensions of our range of products is limited to a period of 7 years.

Damaged moulds, including standard items, can only be replaced in case of sufficient demand. Most of the dimensions stated in this catalogue are normally (but not as a matter of course) available ex stock.

For the production of smaller quantities, special compounds, and in case of special production procedures, we reserve the right of charging a prorated share of set-up costs.

All deliveries and services are subject to our terms.

Quality systems

Our manufacturing sites are certified according to ISO 9001 and/or ISO/TS 16949 and/or EN9100.

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Validity

This edition supersedes all prior documents.

Introduction

Reliable sealing of screw connections

Parker's composite sealing washers perform two major functions. Firstly, they provide reliable sealing against various media (oils, coolants and gases) in technical components used in automotive and mechanical engineering, for example. Secondly, they consistently assure ideal compression conditions between the bolt and flange and thus prevent the destruction of the seal.

These versatile composite parts allow reliable sealing concepts to be achieved in a wide range of applications such as in air conditioning systems or gas regulators and fuel pumps. This makes composite sealing washers the preferred solution to quickly eliminate leakage problems on screw connections.

What are composite sealing washers?

Parker composite sealing washers consist of a metallic carrier and a vulcanised elastomer sealing lip. Depending on the requirements profile, various metals and elastomers can be combined with each other.

The requirements profile determines the type of composite sealing washer to be used. The WO series, for example, is designed for sealing below the screw head whereas the WT series is particularly well suited for sealing in the threaded area.

What are the advantages of composite sealing washers?

- A single component provides the groove and seal
- Since the composite sealing washer is visible from the outside the presence of the seal can be visually checked
- After installation the sealing lip is protected against external influences and internal, mechanical overloading
- The self-centring option eliminates the need for readjustment
- No seal groove is required in the flanges
- Composite sealing washers deliver reliable and long service

How do composite sealing washers work?

The metallic carrier of the composite sealing washer prevents compression of the elastomer element beyond its elastic limit. As a result, the initial axial pressure acting on the seal is limited within the direct line of force and the sealing effect occurs in the indirect line of force. Since the metal carrier limits the sealing element on the inner diameter the elastomer seal is pushed forwards and pressed against the screw shaft and the other areas. This provides effective, reliable sealing for vacuum and high-pressure applications.

Where are composite sealing washers used?

Composite sealing washers are increasingly used in a wide range of applications and markets such as automotive engineering, air conditioning technology, energy, oil and gas (EOG) and general industrials. They are exclusively used for static sealing. The effectiveness of elastomer sealing elements can far exceed the sealing

effect of copper washers. Customers can choose between various elastomers and metals which can be combined with each other with respect to their media resistance, for example. Composite sealing washers allow quick and easy fitting and can be customised to suit specific requirements.

Application conditions

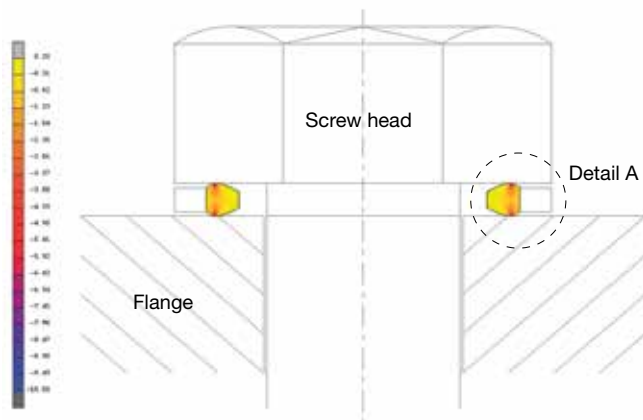
The plane surfaces to be sealed must be free of scratches and coarse machining marks. The recommended maximum surface roughness is less than R_{\max} 15 μm , the recommended average peak-to-valley height below R_z 6.3 μm . Parker composite sealing washers are suitable depending on the dimensions for applications up to an operating pressure of approx. 200 MPa (2000 bar). Depending on the elastomer material used, operating temperatures between 50 and +200 °C are possible. The bursting pressure depends on the seal geometry, dimensions and material selection.

Composite sealing washers Introduction

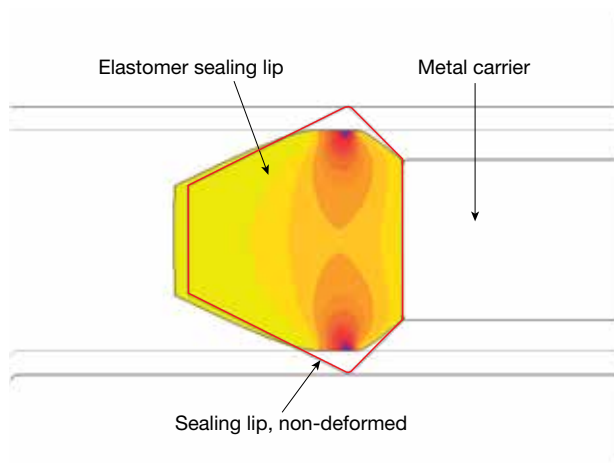
Finite Element Analysis

If desired by the customer, we subject composite sealing washers to a Finite Element Analysis, which allows us to assess the required compression forces, deformations or material stress in the elastomer profile before manufacturing the product.

The image shows a screw connection with a composite sealing washer. Displayed in detail is the stress distribution in the deformed sealing lip: the darker the colour the heavier the deformation. The red line shows the contour of the sealing lip in the non-deformed state.



Schematic drawing of a threaded connection



Detail A: composite sealing washer

Composite sealing washers Introduction

Design principle and types

Parker composite sealing washers consist of an elastomer sealing element which is chemically or mechanically bonded to a metallic carrier (washer). The metallic carrier prevents compression of the elastomer seal beyond its elastic limit and thus its destruction. It provides the groove for the elastomer part and transfers the torque through the primary force closure.

WZ composite sealing washer



Parker WZ series composite sealing washers are a further development of the WZ series. They have an additional self-centring function on the inner diameter, which retains the seal in a concentric position during assembly.

WU diamond-shaped composite sealing washer



Parker WU series composite sealing washers are a further development of the WX/WZ series, with optimised seal compression behaviour compared to WX.

WO composite sealing washer



Parker WO series composite sealing washers are designed for radial sealing below the screw head in the area of the smooth (non-threaded) screw shaft. This provides three functionally relevant sealing areas. The elastomer sealing lip is chemically and mechanically connected to the metal carrier. The WO series is self-centring.

WT composite sealing washer



Parker WT series composite sealing washers are designed for direct sealing on the thread. The lips seal the leakage path of the threads. The sealing washers have a self-centring function. The elastomer sealing lip is chemically and mechanically connected to the metal carrier.

Additional designs are available for special fastening applications. Please contact our consultancy service who will adapt the material and design to suit your specific application.

Materials and selection aids

Elastomers

Acryl nitrile butadien rubber (NBR)

NBR exhibits good resistance to petrol and mineral oils, possesses high abrasion resistance and can be used at operating temperatures between 30 and +100 °C. NBR is the most commonly used polymer in the sealing industry.

Hydrogenated acryl nitrile butadien rubber (HNBR)

HNBR has a similar properties profile as NBR materials but better ozone resistance and suitability for temperatures of up to +150 °C. HNBR exhibits good resistance to oils and greases plus good wear resistance. HNBR is frequently used with central hydraulics fluids.

Fluoroelastomers (FKM)

FKM materials possess outstanding temperature and chemical resistance as well as exhibiting outstanding ozone, weather and age resistance. They may be used at temperatures from 20 up to +200 °C (and higher for short-term exposure).

Ethylen propylene dien momomers (EPDM)

EPDM materials offer good ozone and weather resistance but are not resistant to mineral oil products. They are well suited for use with phosphate ester based hydraulic fluids, glycol based brake fluids and hot water as well as steam. EPDM are frequently used in conjunction with foodstuffs and in pneumatics.

Carrier materials

Structural steel, e.g. 1.0330 (DC01)

Structural steel possesses sufficient tensile strength for composite sealing washers. This version corresponds to the standard one and is heavy-build passivated for corrosion protection.

Stainless steel, e.g. 1.4401

High-grade version using stainless steels which do not exhibit corrosion even in case of damage to the surface. Very good chemical resistance to various media.

Quenched and tempered steel, e.g. 1.0503 (C45)

This steel exhibits high strength, tenacity and tensile strength. Quenched and tempered steel withstands even extreme loads and sudden shocks. Corrosion protection is also achieved through heavy-build passivation.

Aluminium, e.g. 3.2315 (EN AW-6082 T6, AlSi1MgMn)

This aluminium alloy has relatively high strength and tenacity even at low temperatures plus good sea water and weather resistance.

Hydraulic pressure fluid		Polymer base			
		NBR (30 to 100 °C)	HNBR (20 to 150 °C)	FKM (20 to 200 °C)	EPDM (50 to 150 °C)
mineral oil	H, HL, HLP, HVLP	+	+	+	-
polyalphaolefins	PAO	+	+	+	-
synthetic hydrocarbons	HEPR	+	+	+	-
polyalkylene glycol	HEPG	+ ¹⁾	+ ¹⁾	+ ^{3)/-⁴⁾}	+ ²⁾
triglycerides	HETG	+	+	+	-
synthetic ester	HEES	+ ¹⁾	+ ¹⁾	+	-
brake fluid	DOT-3 / -4	-	-	- ¹⁾	+
water-in-oil emulsion	HFAE HFAS, HFB	+	+	+	-
water glycol mixture	HFC	+	+	+ ¹⁾	- ¹⁾
organophosphate	HFD	-	-	+	- ¹⁾

¹⁾ With limitations, testing required

²⁾ Absolutely mineral oil-free

³⁾ Peroxidically crosslinked materials

⁴⁾ Bisphenolically crosslinked materials



Corrosion and corrosion protection

Corrosion is the “reaction of a metallic material with its environment that causes a measurable change of the material and may lead to an impairment of the function of a metallic component or an entire system” (DIN 50900-1).

Corrosion cannot be prevented. However, a suitable coating can significantly reduce the extent of corrosion. The designer specifies suitable corrosion protection measures.

The most important corrosion protection measures for composite sealing washers are described in DIN 50979. In this case, the corrosion protection consists of a metallic coating, additional passivation and optional topcoat.

Metallic coatings

Zinc coating

Zinc coating is a standard process that has been in industrial use for many years. Zinc coatings offer good corrosion protection against parent material corrosion (red rust) for a minimum of 96 hours (incl. passivation).

Zinc-nickel coating

Zinc-nickel coatings exhibit clearly better corrosion behaviour compared to coatings using only zinc. The addition of 12 to 15 % nickel can significantly increase corrosion resistance against red rust to a minimum of 600 hours (incl. passivation) in salt spray mist. Many components withstand this exposure by more than 1,000 hours without corroding. Therefore, zinc-nickel has been established as the standard in the automotive industry.

Passivation / chromating

Transparent (thin-layer) passivation

Transparent passivation offers good corrosion protection without the use of prohibited chromium (VI).

Iridescent (heavy-layer) passivation

Iridescent passivation offers very good corrosion protection. Instead of chromium (VI) this process uses harmless chromium (III).

Yellow chromate conversion coating (no longer available)

This technique became widely used due to its outstanding corrosion protection and economy. However, the coating contains hazardous chromium (VI) and has been prohibited in the automotive industry since the publication of the EU End-of-Life Vehicles Directive (Directive 2000/E53/EC) and the restrictions of hazardous substances in electrical and electronic equipment (Directive 2002/95/EC). Therefore, it is no longer available for composite sealing washers.

Topcoat

Topcoat enhance corrosion resistance. They consist of organic and / or inorganic chemical compounds, with coating thickness up to 2 µm.

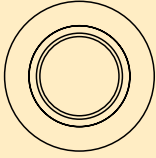
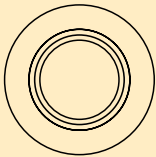
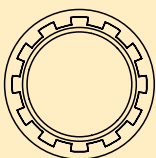
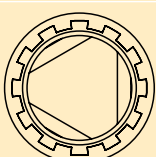
Testing of the surface protection

The salt spray test is a testing procedure standardized according to DIN EN ISO 9227 to determine the corrosion protection of coatings.

A saline solution (PH-value 6.5 to 7.2) is sprayed inside a chamber (min. volume 400 litres) at 35 °C or 50 °C chamber temperature. The NaCl solution can be mixed with acetic acid and copper chloride to intensify the effective mechanisms during the process that induces the corrosion.

The fine salt fog deposits on the samples and causes the surface to corrode. The quality of the coating is determined by the duration for which the samples withstand this medium without forming white rust (destruction of the chromium coating) or even red rust (basic metal corrosion). The samples are visually evaluated.

Composite sealing washers: technical data and dimensions

Top view	Profile reference	Page
Composite sealing washers		
	WZ	12
	WU	14
	WO	16
	WT	18



The WZ composite sealing washer consists of a metal washer with a rectangular cross section and an elastomer sealing lip with a trapezoidal cross section that is vulcanized to the inside. It is a further development of the WX series and has an additional self-centering function. The WZ composite sealing washer has been designed to replace copper washers in high-pressure systems and is a time-tested and low-cost solution for screw head and flange sealing areas. The elastomer sealing lip is chemically bonded to the metal carrier.

The seal has been designed for use in high-pressure applications and can far exceed the sealing effect of copper washers or similar metal seals. Assembly is self-centering and directionally independent.

Range of application

Static sealing of flanges or screw heads.

Operating temperature

NBR	-30 °C to +100 °C
FKM	-20 °C to +200 °C

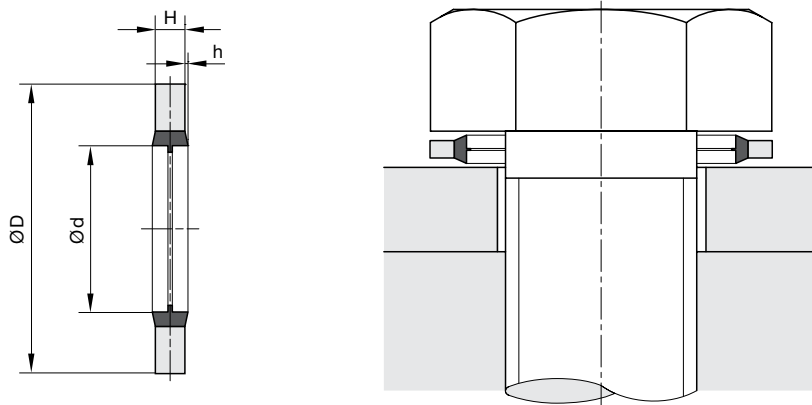
Compounds

Z5419	steel (1.0330)	zinc nickel	NBR	85 Shore A
Z5421	steel (1.0330)	zinc nickel	FKM	80 Shore A
Z5399	stainless steel (1.4401)	-	NBR	85 Shore A
Z5401	stainless steel (1.4401)	-	FKM	80 Shore A

Other materials on request.

For special media such as HFO 1234yf, CO₂ and natural gas elastomer materials with special approvals are available.

In case of special operating conditions please contact our consultancy service for a selection of the material and design best suiting your particular application requirements.



Metric dimensions

Screw	Elastomer	D (mm)	d (mm)	H (mm)	h (mm)	Bersting pressure _{min.} (bar)	Order code
M 10	NBR	16	10.7	1.5	0.4	1350	WZ 1016 Z5419
M 10	FKM	16	10.7	1.5	0.4	1350	WZ 1016 Z5421
M 14	NBR	22	14.7	1.5	0.4	1510	WZ 1422 Z5419
M 14	FKM	22	14.7	1.5	0.4	1510	WZ 1422 Z5421
M 16	NBR	24	16.7	1.5	0.4	1400	WZ 1624 Z5419
M 16	FKM	24	16.7	1.5	0.4	1400	WZ 1624 Z5421
M 18	FKM	26	18.7	1.5	0.4	1275	WZ 1826 Z5421
M 20	NBR	28	20.7	1.5	0.4	1150	WZ 2028 Z5419
M 20	FKM	28	20.7	1.5	0.4	1150	WZ 2028 Z5421
M 24	NBR	32	24.7	2	0.4	1050	WZ 2432 Z5419
M 24	FKM	32	24.7	2	0.4	1050	WZ 2432 Z5421

Further sizes on request.



The WU composite sealing washer consists of a metal washer with a rectangular cross section and an elastomer sealing lip with a diamond-shaped cross section that is vulcanized to the inside. It is a further development of the WX series, with optimized compression distribution in the seal cross section. The seal has been designed for use in high-pressure applications and can far exceed the sealing effect of copper washers or similar metal seals.

Range of application

Static sealing of flanges or screw heads.

Operating temperature

NBR	-30 °C to +100 °C
FKM	-20 °C to +200 °C

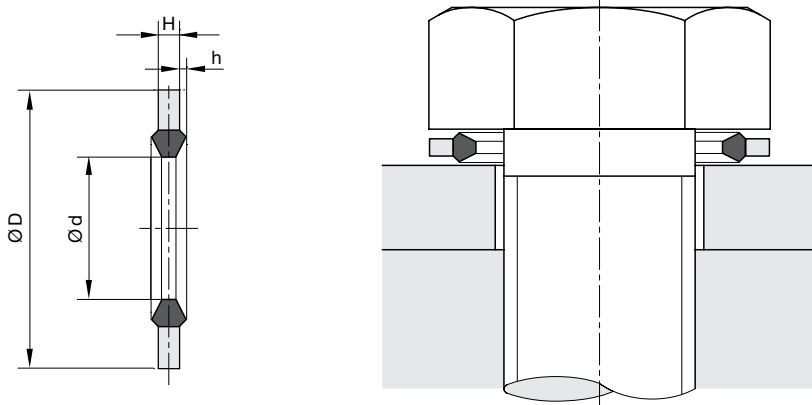
Compounds

Materialcode	Metal compound	Coating	Elastomer	Hardness
Z5419	steel (1.0330)	zinc nickel	NBR	85 Shore A
Z5421	steel (1.0330)	zinc nickel	FKM	80 Shore A
Z5399	stainless steel (1.4401) -		NBR	85 Shore A
Z5401	stainless steel (1.4401)-		FKM	80 Shore A

Other materials on request.

For special media such as HFO 1234yf, CO₂ and natural gas elastomer materials with special approvals are available.

In case of special operating conditions please contact our consultancy service for a selection of the material and design best suiting your particular application requirements.



Metric dimensions

Screw	Elastomer	D (mm)	d (mm)	H (mm)	h (mm)	Bersting pressure _{min.} (bar)	Order code
M 6	NBR	10	6	1	0.4	1130	WU 0610 Z5419
M 6	FKM	10	6	1	0.4	1130	WU 0610 Z5421
M 8	NBR	14	8	1	0.4	1200	WU 0814 Z5419
M 8	FKM	14	8	1	0.4	1200	WU 0814 Z5421
M 10	NBR	17	10	1.5	0.5	1250	WU 1017 Z5419
M 10	FKM	17	10	1.5	0.5	1250	WU 1017 Z5421
M 12	NBR	19	12	1.5	0.5	1250	WU 1219 Z5419
M 12	FKM	19	12	1.5	0.5	1250	WU 1219 Z5421
M 14	NBR	22	14	1.5	0.5	1100	WU 1422 Z5419
M 14	FKM	22	14	1.5	0.5	1100	WU 1422 Z5421
M 16	NBR	24	16	1.5	0.5	1050	WU 1624 Z5419
M 16	FKM	24	16	1.5	0.5	1050	WU 1624 Z5421
M 18	NBR	27	18	2	0.5	1100	WU 1827 Z5419
M 18	FKM	27	18	2	0.5	1100	WU 1827 Z5421
M 20	NBR	30	20	2	0.5	1050	WU 2030 Z5419
M 20	FKM	30	20	2	0.5	1050	WU 2030 Z5421
M 24	NBR	36	24	2	0.5	1130	WU 2436 Z5419
M 24	FKM	36	24	2	0.5	1130	WU 2436 Z5421
M 26	NBR	35	26	2	0.5	850	WU 2635 Z5419
M 26	FKM	35	26	2	0.5	850	WU 2635 Z5421

Further sizes on request.



The WO composite sealing washer is designed for radial sealing below the screw head in the area of the smooth (non-threaded) screw shaft. This provides three functionally relevant sealing areas. WO consists of a metal washer and an elastomer sealing lip with a circular cross section and additional mechanical connection to the inside edge of the supporting washer. The serrations achieve a positive connection of the elastomer with the supporting washer and prevent the phenomenon of sheared sealing lips which is frequently encountered with composite sealing washers.

Range of application

Static sealing of flanges or screw heads.

Operating temperature

NBR

-30 °C to +100 °C

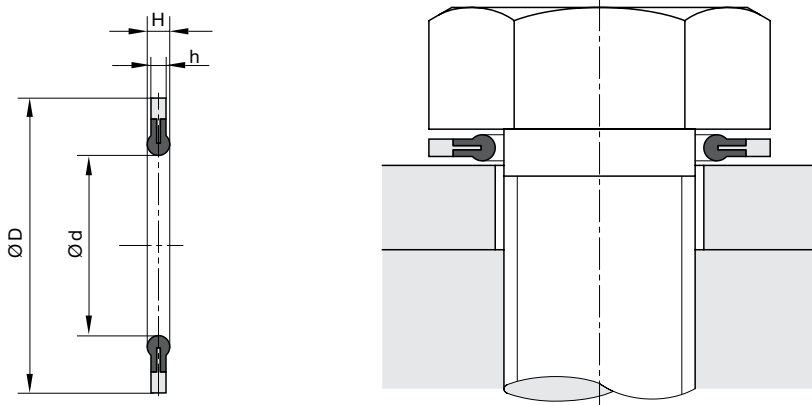
Compounds

Materialcode	Metal compound	Coating	Elastomer	Hardness
Z5413	steel (1.0402 / 1.0528)	zinc	NBR	60 Shore A

Other materials on request.

For special media such as HFO 1234yf, CO₂ and natural gas elastomer materials with special approvals are available.

In case of special operating conditions please contact our consultancy service for a selection of the material and design best suiting your particular application requirements.



Imperial dimensions

Screw (inch)	Elastomer	D (mm)	d (mm)	H (mm)	h (mm)	Berusting pressure _{min.} (bar)	Order code
#6	NBR	9.78	3.3	1.27	1.02	1350	WO 0610 Z5413
#8	NBR	9.78	3.96	1.27	1.02	1000	WO 0810 Z5413
#10	NBR	11.25	4.57	1.83	1.27	790	WO 1011 Z5413
1/4	NBR	12.83	6.1	1.83	1.27	655	WO 0013 Z5413
5/16	NBR	15.32	7.65	1.83	1.27	460	WO 0015 Z5413
3/8	NBR	16.92	9.25	1.83	1.27	440	WO 0017 Z5413
7/16	NBR	19.3	10.85	1.83	1.27	465	WO 0019 Z5413
1/2	NBR	22.35	12.45	1.83	1.27	545	WO 0122 Z5413
1	NBR	44.7	25.1	2.44	1.63	910	WO 0145 Z5413

Further sizes on request.



The WT composite sealing washer is designed for direct sealing on the thread. The lips seal the leakage path of the threads. The composite sealing washer consists of a metal washer and an elastomer sealing lip with a rectangular cross section and an additional mechanical connection to the inside edge of the supporting washer. The serrations achieve a positive connection of the elastomer with the supporting washer and prevent the phenomenon of sheared sealing lips which is frequently encountered with composite sealing washers.

WT composite sealing washers ensure reliable sealing of screws in the threaded area (only static, no dynamic threads). Assembly is self-centering and directionally independent.

Range of application

Static sealing of screw threads.

Operating temperature

NBR

-30 °C to +100 °C

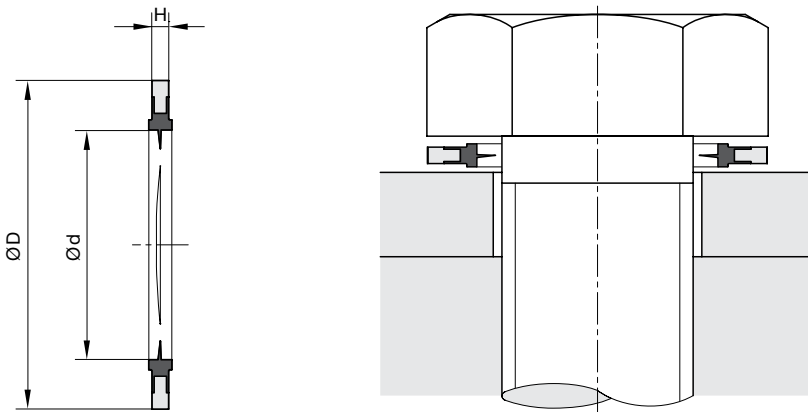
Compounds

Materialcode	Metal compound	Coating	Elastomer	Hardness
Z5413	steel (1.0402/1.0528)	Zinc	NBR	60 Shore A

Other materials on request.

For special media such as HFO 1234yf, CO₂ and natural gas elastomer materials with special approvals are available.

In case of special operating conditions please contact our consultancy service for a selection of the material and design best suiting your particular application requirements.



Imperial dimensions

Screw (inch)	Elastomer	D (mm)	d (mm)	H (mm)	Berusting pressure _{min.} (bar)	Order code
#6	NBR	10.31	3.58	1.27	65	WT 0310 Z5413
#8	NBR	10.31	4.24	1.27	65	WT 0410 Z5413
#10	NBR	11.91	4.93	1.27	65	WT 0512 Z5413
1/4	NBR	14.27	6.48	1.27	205	WT 0614 Z5413
5/16	NBR	17.45	8.1	1.63	205	WT 0817 Z5413
3/8	NBR	19.05	9.73	1.63	205	WT 1019 Z5413
7/16	NBR	23.01	11.35	1.98	205	WT 1123 Z5413
1/2	NBR	25.4	12.95	1.98	205	WT 1325 Z5413
1	NBR	44.45	25.91	3.05	205	WT 2544 Z5413

Further sizes on request.

Parker Prädifa worldwide

Europe, Middle East, Africa

AE – United Arab Emirates, Dubai
Tel: +971 4 8127100
parker.me@parker.com

AT – Austria, Wiener Neustadt
Tel: +43 (0)2622 23501-0
parker.austria@parker.com

AT – Eastern Europe, Wiener Neustadt
Tel: +43 (0)2622 23501 900
parker.easteurope@parker.com

AZ – Azerbaijan, Baku
Tel: +994 50 2233 458
parker.azerbaijan@parker.com

BE/LU – Belgium, Nivelles
Tel: +32 (0)67 280 900
parker.belgium@parker.com

BG – Bulgaria, Sofia
Tel: +359 2 980 1344
parker.bulgaria@parker.com

BY – Belarus, Minsk
Tel: +48 (0)22 573 24 00
parker.poland@parker.com

CH – Switzerland, Etoy
Tel: +41 (0)21 821 87 00
parker.switzerland@parker.com

CZ – Czech Republic, Klecany
Tel: +420 284 083 111
parker.czechrepublic@parker.com

DK – Denmark, Ballerup
Tel: +45 43 56 04 00
parker.denmark@parker.com

ES – Spain, Madrid
Tel: +34 902 330 001
parker.spain@parker.com

FI – Finland, Vantaa
Tel: +358 (0)20 753 2500
parker.finland@parker.com

FR – France, Contamine s/Arve
Tel: +33 (0)4 50 25 80 25
parker.france@parker.com

GR – Greece, Athens
Tel: +30 210 933 6450
parker.greece@parker.com

HU – Hungary, Budaörs
Tel: +36 23 885 470
parker.hungary@parker.com

IE – Ireland, Dublin
Tel: +353 (0)1 466 6370
parker.ireland@parker.com

IT – Italy, Corsico (MI)
Tel: +39 02 45 19 21
parker.italy@parker.com

KZ – Kazakhstan, Almaty
Tel: +7 7273 561 000
parker.easteurope@parker.com

NL – The Netherlands, Oldenzaal
Tel: +31 (0)541 585 000
parker.nl@parker.com

NO – Norway, Asker
Tel: +47 66 75 34 00
parker.norway@parker.com

PL – Poland, Warsaw
Tel: +48 (0)22 573 24 00
parker.poland@parker.com

PT – Portugal, Leca da Palmeira
Tel: +351 22 999 7360
parker.portugal@parker.com

RO – Romania, Bucharest
Tel: +40 21 252 1382
parker.romania@parker.com

RU – Russia, Moscow
Tel: +7 495 645-2156
parker.russia@parker.com

SE – Sweden, Spånga
Tel: +46 (0)8 59 79 50 00
parker.sweden@parker.com

SK – Slovakia, Banská Bystrica
Tel: +421 484 162 252
parker.slovakia@parker.com

SL – Slovenia, Novo Mesto
Tel: +386 7 337 6650
parker.slovenia@parker.com

TR – Turkey, Istanbul
Tel: +90 216 4997081
parker.turkey@parker.com

UA – Ukraine, Kiev
Tel: +48 (0)22 573 24 00
parker.poland@parker.com

UK – United Kingdom, Warwick
Tel: +44 (0)1926 317 878
parker.uk@parker.com

ZA – South Africa, Kempton Park
Tel: +27 (0)11 961 0700
parker.southafrica@parker.com

North America

CA – Canada, Milton, Ontario
Tel: +1 905 693 3000

US – USA, Cleveland
Tel: +1 216 896 3000

Asia Pacific

AU – Australia, Castle Hill
Tel: +61 (0)2-9634 7777

CN – China, Shanghai
Tel: +86 21 2899 5000

HK – Hong Kong
Tel: +852 2428 8008

IN – India, Mumbai
Tel: +91 22 6513 7081-85

JP – Japan, Tokyo
Tel: +81 (0)3 6408 3901

KR – South Korea, Seoul
Tel: +82 2 559 0400

MY – Malaysia, Shah Alam
Tel: +60 3 7849 0800

NZ – New Zealand, Mt Wellington
Tel: +64 9 574 1744

SG – Singapore
Tel: +65 6887 6300

TH – Thailand, Bangkok
Tel: +662 186 7000

TW – Taiwan, Taipei
Tel: +886 2 2298 8987

South America

AR – Argentina, Buenos Aires
Tel: +54 3327 44 4129

BR – Brazil, Sao Jose dos Campos
Tel: +55 800 727 5374

CL – Chile, Santiago
Tel: +56 2 623 1216

MX – Mexico, Toluca
Tel: +52 72 2275 4200



WARNING:

These products can expose you to chemicals including carbon black (airborne and extracts), antimony trioxide, titanium dioxide, silica (crystalline), di(2-ethylhexyl)phthalate, ethylene thiourea, acrylonitrile, 1,3-butadiene, epichlorohydrin, toluenediisocyanate, tetrafluoroethylene, ethylbenzene, formaldehyde, furfuryl alcohol, glass fibers, methyl isobutyl ketone, nickel (metallic and compounds), lead and lead compounds which are known to the State of California to cause cancer; and 1,3-butadiene, epichlorohydrin, di(2-ethylhexyl)phthalate, di-isodecyl phthalate, ethylene thiourea, methyl isobutyl ketone, methanol, toluene, lead and lead compounds which are known to the State of California to cause birth defects and other reproductive harm. For more information go to www.P65Warnings.ca.gov.