



# gasket type & material overview



# gaskets

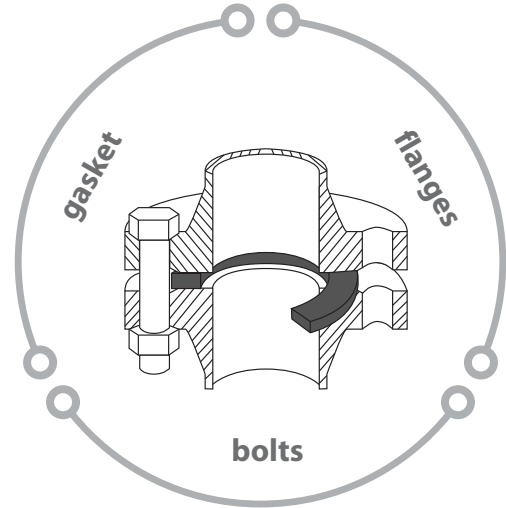
a gasket is placed in between two objects in order to prevent leakage of any kind of the pressurized or not pressurized media. most important is the compression set of a gasket to adapt to flange irregularities and to any dimensional changes of the flange system caused by temperature changes during operation. the gasket requires resistance against media and temperature within the range of the given application.

requirements for a gasket are:

- **good compressibility and face adaptability**
- **good recovery**
- **strength**
- **limited relaxation**
- **chemical resistance**
- **temperature resistance**

bench marks for excellent gasket properties:

- **chemical resistance of PTFE**
- **temperature resistance of mica**
- **mechanical property of steel**
- **compression set of soft rubber**



the flange connection is the widest spread gasket application. the flange connection is a sealing system, which consists of:

- **flanges**
- **gasket and**
- **bolts**

only the right choice and combination of this 3 individual parts will result in a leakage free operation with long service life.

gaskets can be classified into two main categories:








## metallic & semi-metallic gaskets

-  corrugated metal gaskets
-  camprofile (grooved) gaskets
-  metal jacketed gaskets
-  ring joints
-  spiral wound gaskets
-  others

metallic or semi-metallic gaskets consists of metal or a combination of metal parts and non metal parts. these gaskets are suitable for medium and high pressure applications. metallic gaskets require a much higher quality of the sealing surface than non-metallic gaskets.



## non-metallic gaskets

-  fibre reinforced gaskets
-  graphite gaskets
-  PTFE gaskets
-  rubber gaskets
-  others

non-metallic materials are used in low to medium pressure applications usually up to nominal pressures of 40 or 63 bars on the raised face and up to 200 bars in tongue grooved flanges.



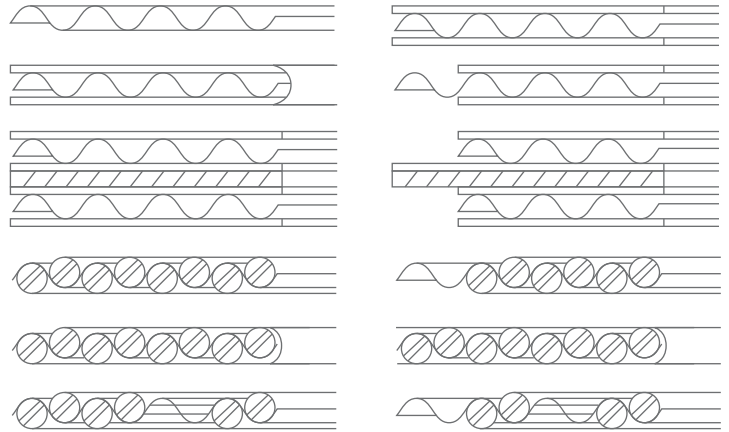
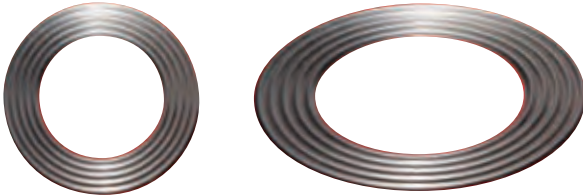
# metallic & semi-metallic gaskets



## corrugated metal gaskets

a metallic or semi-metallic gasket system.

- + high sealing pressure at the metal corrugation
- + high blow out resistance
- in case of metal to metal, a perfect flange surface ( $R_a < 3,2$ ) is required

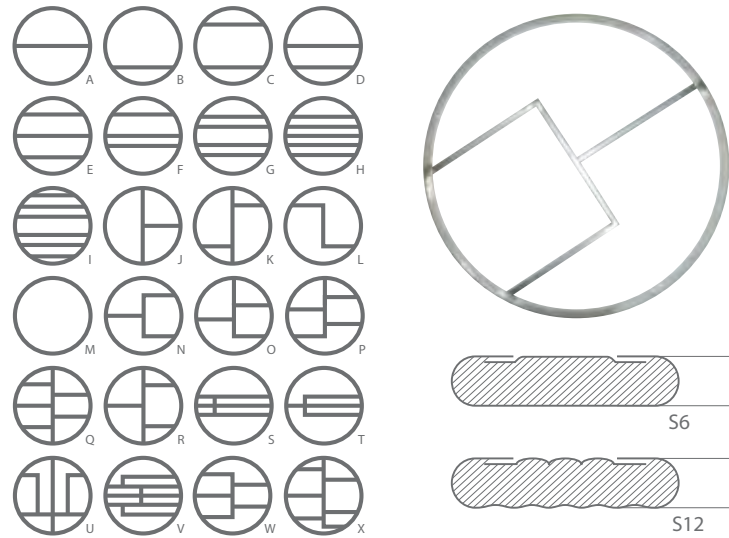


## metal jacketed gaskets

a semi-metallic gasket system. also called per tradition heat exchanger gaskets, which indicates the typical application. the gasket consists of a soft filler encapsulated with a metal cover. the metal jacket provides compressive strength and blow out resistance. the filler provides compressibility and resilience.

- + good shelf life
- + robust, can be handled and installed without special care
- + wide range of shapes
- requires a good flange surface ( $R_a < 1,6$ ) because of metal to metal sealing

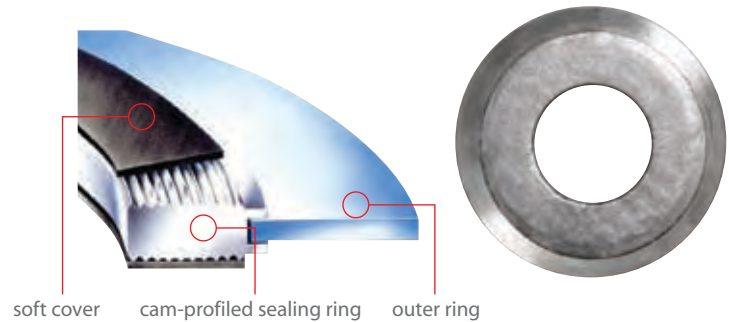
profile shapes: profile S6 or S12  
 metal cover: carbon steel, SS, monel, copper, etc.  
 fillers: CSF, expanded graphite etc  
 dimension: from 250 mm to 3000 mm



## camprofile (grooved) gaskets

a semi-metallic gasket system, which consist of:  
 centering (outer) ring made of special steel  
 cam-profiled (sealing) ring made of special steel  
 soft covering layer made of graphite, ptfе, ..  
 typical applications: pipelines, heat exchanger

- + the soft cover adapts flange surfaces with  $R_a < 6,3$
- + the soft covering layer (in most of the cases expanded graphite), is trapped in the tread and can not be extruded into the gap
- + the trapped graphite provides good compressibility and resilience
- + the cam profiled ring can be re-used again several times
- a good quality camprofile gasket can be very expensive



profile shapes: parallel (M18L, M20L, M21LM), or convex (M38L, M40L, M41LM)  
 standard material of core: carbon steel, SS 316L, SS 304, SS 321; other materials are on demand  
 material of soft cover: CSF, expanded graphite, PTFE  
 dimensions: from 250 mm to 5000 mm



## ring joints

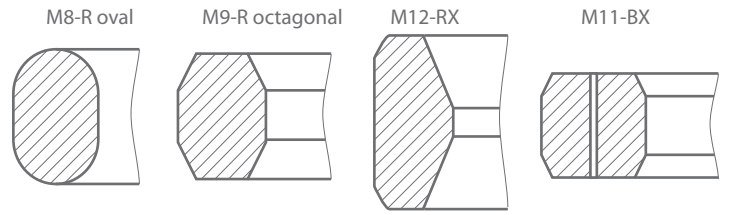
metallic gaskets, which are manufactured from a variety of metals and alloys, usually oval or octagonal in cross-section, depending on the flange design.

ring joints are designed to serve at high pressure (up to 1500 bar) and high temperature (up to 1000°C) applications.

- ⊕ very safe and reliable sealing system; will be always applied, when aggressive media or explosive gases are involved;
- ⊖ risk in the choice of ring joint material: the ring joint material must be softer than the flange material but the hardness of the flange material is normally not indicated
- ⊖ metal to metal sealing; requires therefore good ( $R_a < 1,6$ ) flange surface

profile shapes: R oval, R octagonal, RX, BX

standard metals: soft iron, LC carbon, range of SS; other materials on demand

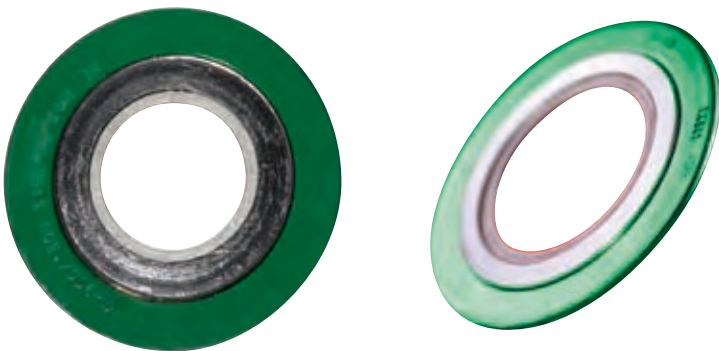
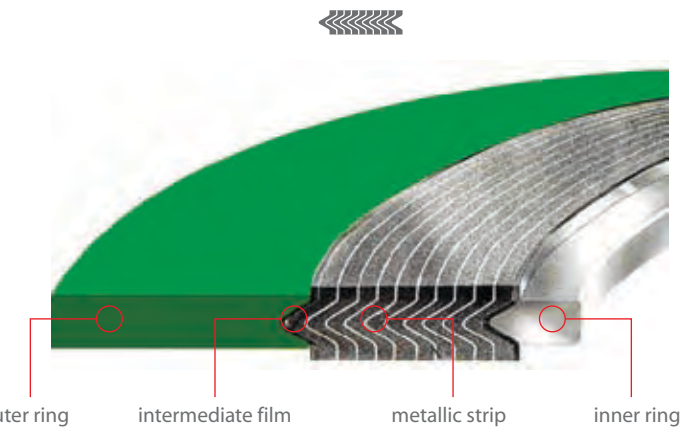
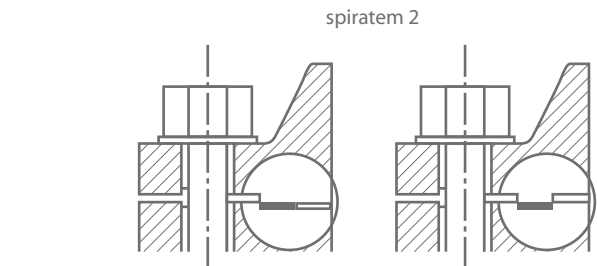
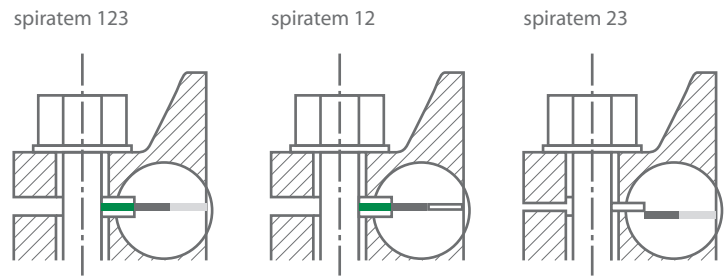


## spiral wound gaskets

a semi-metallic gasket system, consisting of:

- centering (outer) ring made of special steel
- a spiral wound V-shaped metal strip filled with graphite, ptfе, ceramic, mica, ....
- inner ring made of special steel

- ⊕ covers a wide pressure and temperature range and is therefore a real multi purpose (universal) gasket
- ⊕ the spiral wound gasket does not stick to the flange surface and can be easy removed
- ⊕ has a good shelf life and requires no special care during handling and installation
- ⊕ good resilience because of the V-shaped metal strips
- ⊕ very popular gasket system and therefore good availability
- ⊖ needs very parallel flange faces
- ⊖ quality control difficult, as the quality of winding and the welding can not be checked



standard sizes: acc. to EN, ASME/ANSI, BS, DIN, GOST; non standard sizes (from 15 mm to 3200 mm are also available with us)

standard fillers: expanded graphite, PTFE, ceramic, mica

thickness of fillers: from 2.5 mm up to 7.2 mm (standard thickness 4.8 mm)

standard metals: low carbon steel (paint or zinc plated finish), SS 316L, SS 304, SS 321, monel and other exotic materials are on demand



# non metallic gaskets



## fibre reinforced gaskets

fibre reinforced gaskets are either cut or punched to shape out of fiber reinforced sheet material. these sheet materials are kalandered products, basically consisting of fibres, fillers and binders. the quality and composition of this 3 components and the production process determine the gasket properties. most commonly NBR is used as a high quality binder for gasket materials. because of outstanding technical properties aramide is the most important fibre used in these kind of non-asbestos gaskets.

commonly used fibres in non-asbestos sheets

aramide fibre	aromatic amide fibre, offering high strength and stability, with medium temperature suitability. raw fibres can fibrillate
carbon fibre	high thermal conductivity ensures rapid heat dissipation and allows high temperature capability (except in oxidising atmospheres). wide chemical resistance, and may be used in the pH range 0 - 14, although must not be used in oxidising environments
cellulose fibre	natural fibre, suitable for low temperature and medium pressure applications. raw fibres can fibrillate
glass fibre	inorganic complex of metal silicates, which offers good strength and moderate chemical resistance. suitable for medium to high temperature applications. the fibres do not fibrillate.
mineral fibre	also referred to as "mineral wool". inorganic fibres consisting of metal silicates, with a wide range of diameters. suitable for medium to high temperature applications. fibres do not fibrillate.

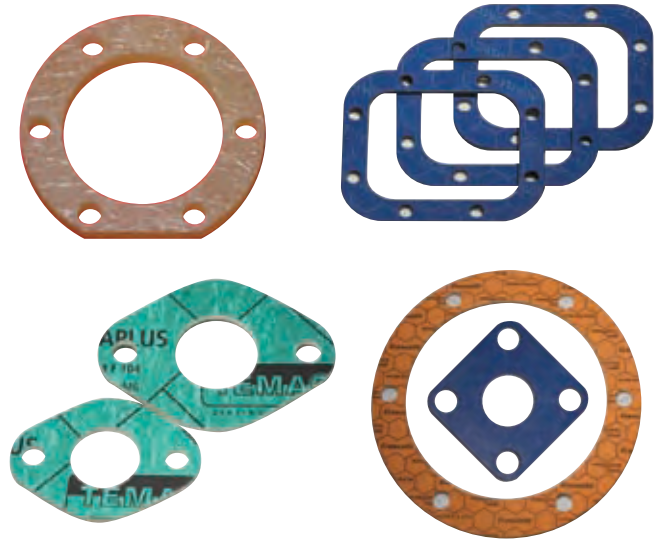
- ⊕ cheap and good availability
- ⊕ easy to cut/punch to size
- ⊖ limited in temperature resistance due to the rubber binder



glass fibre

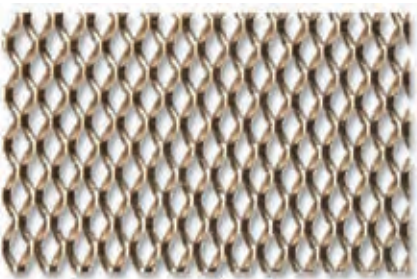


aramide fibre



## graphite gaskets

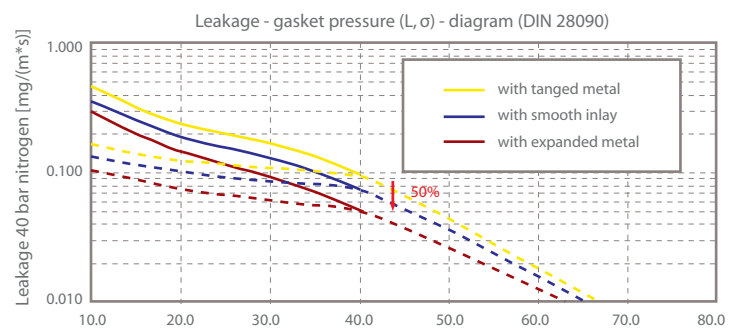
only graphite with a purity of > 99% elemental carbon can be used. not only purity but the composition of the ashes is of crucial importance for the performance of a graphite gasket. graphite gaskets usually are reinforced with a stainless steel insert. important is the design of the reinforcement. currently common are smooth metal, tanged metal and expanded metal inserts.



expanded metal insert



the graph below shows the influence of the metal insert of a graphite gasket on leak rates.



expanded metal optimizes the distribution of surface pressure. the exceptional compression set of graphite allows very good microsealing and flange adaptability. when replacing fibre reinforced gaskets by graphite gaskets, the gasket thickness can be reduced. graphite has got a superior chemical resistance against a wide range of media. it can be used up to 450-550°C application temperature. with expanded metal graphite gaskets even metallic gaskets can be replaced in many applications.

- ⊕ can follow easy any flange irregularity, Ra < 12,5
- ⊕ no creeping
- ⊖ no resistance in oxidizing environments

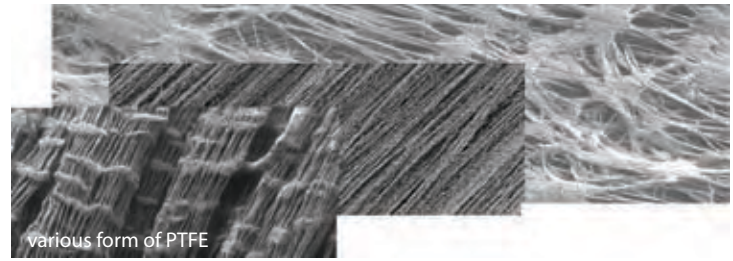


## PTFE gaskets

PTFE provides an outstanding chemical resistance. PTFE is attacked only by molten alkali metals and fluorine gas and has excellent anti-stick and dielectric properties. usually the leak rates of PTFE gaskets are remarkably low the only draw back of PTFE is creeping and poor mechanical properties.

- ⊕ very dense sealing material
- ⊕ adapts perfect to the flange
- ⊕ very good chemical resistance
- ⊖ limited temperature resistance
- ⊖ creeping

	temperature range	chemical resistance	mechanical properties
fibre reinforced gasket	ca. -100 to 150°C	*	****
graphite gasket	ca. -150 to 550°C	**	****
PTFE gasket	ca. -200 to 250°C	*****	**



## rubber gaskets

rubber gaskets are cut or punched to shape from industrial manufactured rubber sheets made from industrially produced rubber. the following rubber compounds are available in sheets:

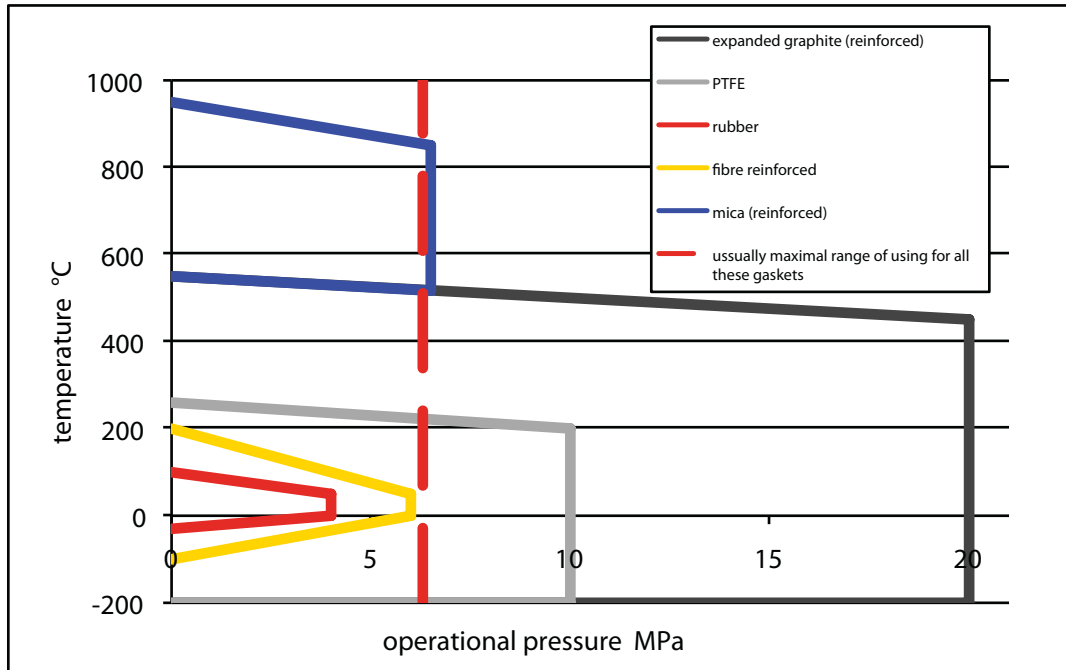
acrylonitrile-butadiene rubber	NBR	-30°C ....100° C	improved chemical resistance and temperature capabilities to neoprene. good resistance to hydrocarbons and oils. not suitable for chlorinated hydrocarbons, esters, ketones and strong oxidising agents.
silicone	VMQ, PVMQ	-60° C ....200° C	excellent temperature properties, and unaffected by ozone and sunlight. not suitable for many hydrocarbons and steam.
chlorbutadiene rubber	CR	-45° C ....100° C	excellent resistance to oils, ozone and weathering. suitable for moderate acids, alkalis, salt solutions, petroleum, solvents, oils and fuels. it is not recommended for strong acids or hydrocarbons
natural rubber	NR	-60° C ....80° C	excellent for recovery properties. good resistance to most inorganic salts, mild acids and alkalis. not recommended for oils and solvents, or where exposure to ozone, oxygen or sunlight is prominent.
ethylene propylene diene rubber	EPDM	-50° C ....150° C	elastomer which offers good resistance to ozone, steam, strong acids and alkalis, but is not suitable for solvents and aromatic hydrocarbons.
butyl rubber	IIR	-40° C ....150° C	an elastomer offering good resistance to ozone and gas permeation. suitable for mild acids, alkalis and esters, but little resistance to oils and fuels.
styrene butadiene rubber	SBR	-50° C ....100° C	suitable for use with weak organic acids and moderate chemicals. not suitable for strong acids, most hydrocarbons or ozone.
fluoroelastomer	FKM	-20° C ....200° C	excellent for oils and greases, fulls and aliphatic as well as aromatic hydrocarbons, some fire retardant hydraulic liquids and synthetic aviation engine oils.

- ⊕ adapts very good to the flange
- ⊕ best resilience
- ⊕ good sealing material
- ⊖ very limited temperature resistance

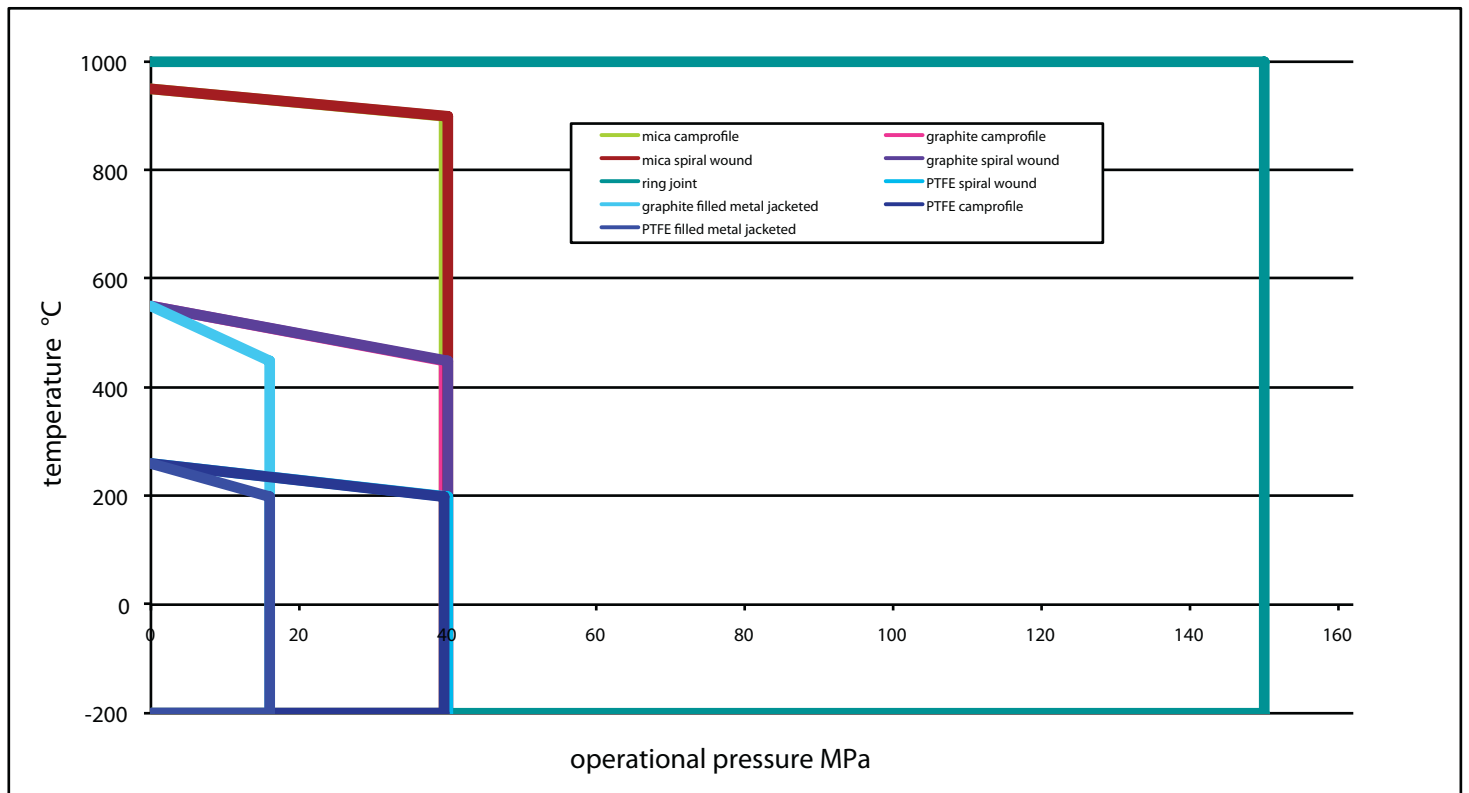


# selection criteria for industrial gasket

## pressure & temperature limits for non-metallic gaskets



## pressure & temperature limits for semi-metallic gaskets





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