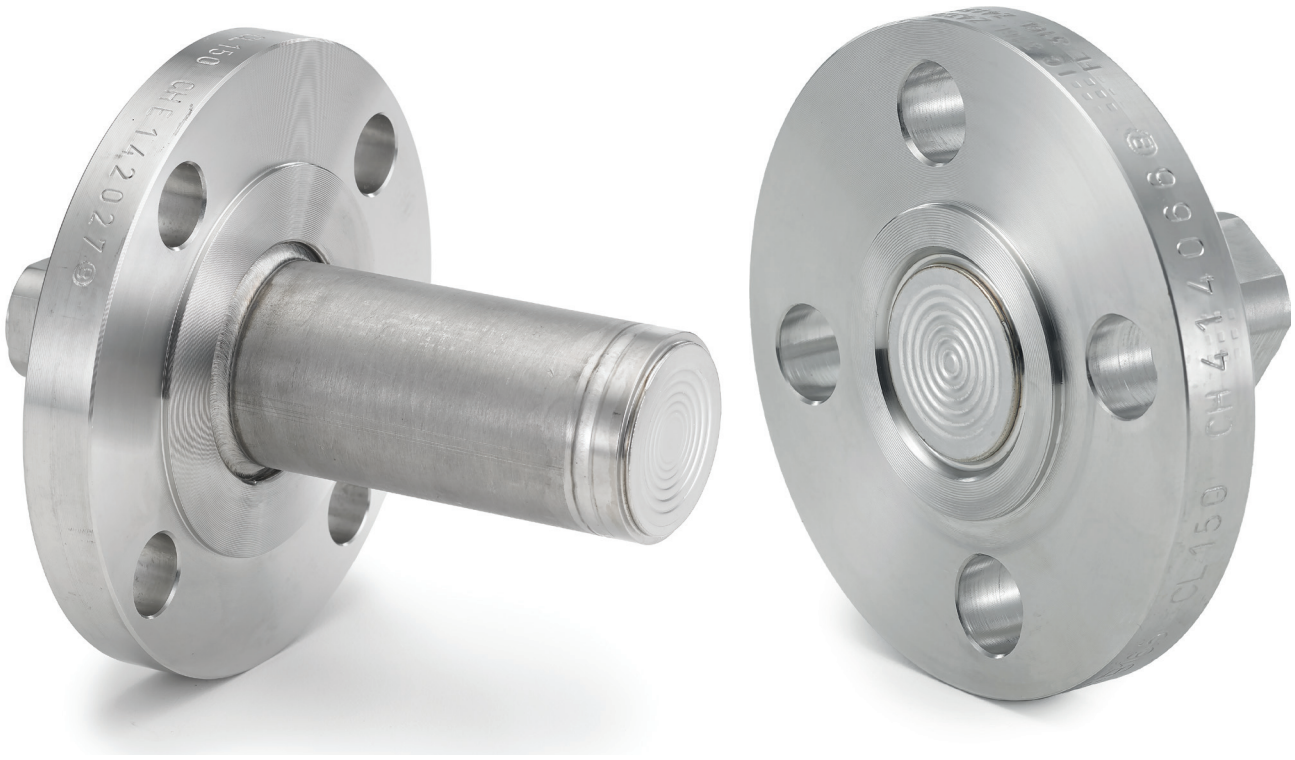
ASHCROFT®
Trust the shield.®

Diaphragm seals

High Precision Shield Series

For

Pressure Transmitters



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1 GENERAL INFORMATION ABOUT DIAPHRAGM SEALS

The ongoing increasing accuracy of today's (differential) pressure transmitters ask for high accurate sensing diaphragm seal systems. The Ashcroft High Precision Shield Series differ from standard executions on the following:

- Finite element method (FEM) engineered diaphragms
- Convolution differences and variations
- Individual configurated diaphragms
- Selected diaphragm material
- Minimalized displacement volumes
- Superior connection systems
- High tech welding
- Superior filling techniques

In order to take full advantage of the Ashcroft diaphragm seal technology and to ensure a perfect application into your processes, the right design configuration has to be chosen. This handbook will inform you on standards, material executions, measuring limits, connections and so much more.
The diaphragm seal is used to isolate the pressure transmitter from the process media for:

- High temperature applications
- Corrosive service
- Safety- double containment
- Suspended solids in process
- Sanitary connections
- Replacement of wet legs
- Ease of cleaning between batches
- Isolation of the instrument with a capillary line to avoid vibration / pulsation

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2 CONSTRUCTION

A diaphragm seal is a device mounted on the process side of a pressure measurement instrument and separating the instrument from the process fluid. All wetted parts of the diaphragm seal have to be compatible to the process media. The volume enclosed by the diaphragm, the top section of the diaphragm seal, the (optional) capillary line/cooling element and the measuring component of the measuring device is completely filled with a pressure transmission fluid suitable for the application. A change in pressure at the process connection causes a displacement of the filling fluid due to the deflection of the diaphragm, which transfers the change in pressure to the measuring component of the pressure measurement instrument.

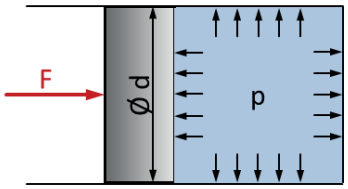
Ashcroft offers four basic constructions for a perfect solution for your application:

- Flush flanged diaphragm seal type TF
- Flanged type diaphragm seal with internal enlarged diaphragm type TE
- Flush flanged extended diaphragm seal type TT
- Flush flanged diaphragm seal cell type TS

All types are all welded constructions and can be ordered with a large variety of wetted parts materials.

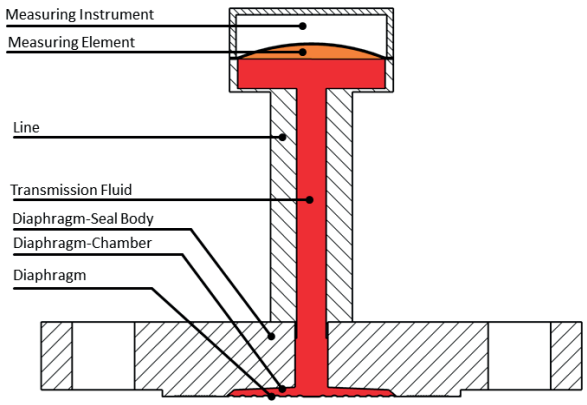
2.1 PRINCIPLE

Diaphragm seals form together with the measuring instrument one hermetic closed system, close coupled connected to each other or by means of a flexible capillary tube system. This hermetic closed system is vacuum filled with an appropriate non-compressible fluid, called transmission fluid, ensuring the pressure applied by the process medium to the diaphragm of the seal body is proportional transmitted to the pressure sensor element of the transmitter. Newton's law being applied:



$$p = \frac{F}{A}$$

The pressure applied to the diaphragm, which isolates the pressure instrument from the process media, is transmitted by the filling fluid (red) to the pressure measuring element.



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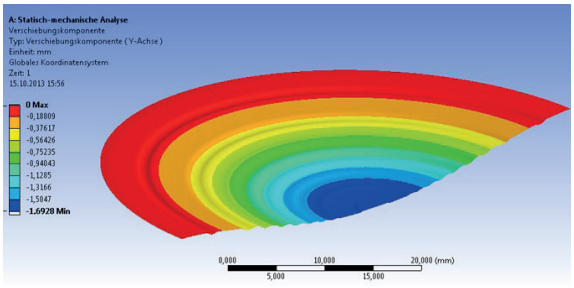
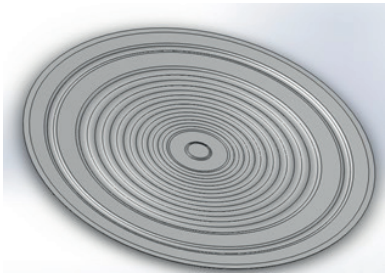
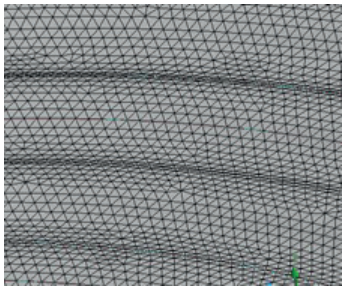
2.2 Diaphragm

All diaphragms are developed in house. They vary in material, diameter, thickness depending on the type of seal and the application. Their typical convolutions guarantee optimal displacement volumes and full deflection through well engineered stiffness and optimal use of the fill fluid volume. The welds are made by laser or are of resistant seam weld type that not distorts the grain structure of the thin material avoiding early corrosion reaction mainly when exotic materials are used.







2.3 Span Performance

With the above, the diaphragm of the seal has to ensure sufficient displacement to secure full reading. A relation between the diaphragm of the seal and the one of the transmitter is to be respected, including the aspects of the overall system construction: diaphragm type and material, capillary length and diameter, transmitter brand and type and seal configuration. Putting too much filling fluid into the system isn´t a good solution either as temperature influences will be more important, the overall accuracy lesser.
To start with a rule of thumb: the diameter of the diaphragm of the seal always needs to be larger than the diameter of the transmitter sensor. The table below shows indicating span limits. Based on:

- Ashcroft stainless steel diaphragms
- Sensor diaphragm diameter smaller than the diaphragm seal diameter
- Capillary lengths < 5m when single side

Unit: mbar	DP (symmetical sytem)		GP		AP	
Diaphragm Ø in mm	Cap ID Ø2.0 mm	Cap ID Ø1.5 mm	Cap ID Ø2.0 mm	Cap ID Ø1.5 mm	Cap ID Ø2.0 mm	Cap ID Ø1.5 mm
44	750	450	1400	1200	-	-
57	100	80	500	400	1100	750
61	80	60	400	350	1000	700
72	60	50	175	120	500	350
88	50	40	60	50	75	75
91	40	30	50	40	75	75

Parameters that influence the span (temperature influence, response time):

- Length & indise diameter of capillary
- Diaphragm material
- Diaphragm characteristics : convolutions, stiffness/springrate, thickness

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2.4 Transmission Fluids

As explained, in the operating principle, the measuring system is filled with a fluid that guarantees accurate transmission of the pressure. Ashcroft transmission fluids were selected upon various criteria in order to meet the requirements towards safety, accuracy and reading performances. So, compatibility is the essence and the main reason of the existence of a large choice of filling fluids.

- Compatibility towards safety :

In the event of a mechanical rupture of the diaphragm, the process can be contaminated by the fluid. Process media containing a.o. particles of oxygen, or chlorines in dry, moist, vapor, dioxide or trifluoride conditions, fluorine, hydrogen impose the use of a non-flammable inert fluids. In case of food processing, non-toxic transmission fluids are required like Neobee-M20 or Energol WM2 to avoid contamination. Paint industries dislike silicone oil based fluids.

- Compatibility towards temperature influence :

Process- and ambient temperature have their influence on the fluid and are responsible for a change in volume in the hermetic closed system, creating an error in the instrument reading. Within our range of technical fluids, we have a variety of synthetic oils covering ranges from -75°C up to 400°C. However, attention is to be taken to the pressure-temperature relation of the medium as the transmission fluid needs to remain at all times in a liquid state. Vacuum process conditions will bring the temperature down in which a fluid remains liquid. Consult our vapor-pressure curves when selecting the fluid.

- Compatibility towards response time :

The viscosity of the system fluid is of great importance towards applications using long capillaries, as the response time increases with the length of the capillary used. Using capillary with a larger inside diameter can offer significant savings although this might increase the temperature influence on the measurement. Selection of a low viscous filling fluid is than to be considered.

- Compatibility towards pressure/vacuum :

Vacuum applications have their effect on the thermal resistance of the fluids and reduce their temperature application limits significantly.

Although already during manufacturing and filling precautions are taken to prevent influence on the measurement system, special care in the selection of a compatible system fluid is also here of great importance. The transmission fluid must withstand the highest temperature applications against the lowest pressure conditions. Vacuum process conditions will bring the temperature limit down in which a fill fluid remains liquid. Consult our vapor-pressure curves when selecting the fluid.

In practice:

- most common used in general industry are the standard silicone oils Silicone 50 , Ashcroft code CK
- most common used in food & pharma: Neobee M20 Ashcroft code CP
- imperative use on oxygen and chlorine media : Halocarbon, Ashcroft code CF
  (also for paint industry and other silicone free environments)
- High process temperatures : Sylltherm, Ashcroft code HA

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Overview and technical data of common filling fluids:

Code	System filling fluid	Use	Temperature resitance p_{abs} > 1 bar	Density g/cm³	Viscosity cSt	Thermal expansion coefficient cc/cc/C
CK	Silicone 50 oil	Standard	-40 ... +315 °C	0,95 at 25 °C	50 at 25 °C	0,00108
HA	Syltherm 800	High temperature	-40 ... +400 °C	0,93 at 25 °C	9,1 at 25 °C	0,001428
CC	Silicone oil Syltherm XLT	Low temperature	-75 ... +145 °C	0,85 at 25 °C	1,6 at 25 °C	0,001198
EJ	Silicone 10 oil	Fast response time	-40 ... +315 °C	0,95 at 25 °C	3,0 at 25 °C	0,00108
KG	Silicone oil 704	High temp and high vacuum	0 ... +300 °C	1,07 at 25 °C	39 at 25 °C	0,00095
KJ	Silicone oil 705	High vacuum	+20 ... +215 °C	1,04 at 25 °C	175 at 25 °C	0,00077
CF	Halocarbon 4.2 oil	Inert	-56 ... +149 °C	1,85 at 25 °C	5,5 at 25 °C	0,000864
HO	Halocarbon 6.3 oil	Inert	-45 ... +149 °C	1,87 at 25 °C	9,5 at 25 °C	0,000864
GQ	White oil silicone free BP Energol EM2	Food	-10 ... +205 °C	0,851 at 15°C	30 at 25 °C	
CP	Neobee M-20	Food & Pharma	-15 ... +205 °C	0,94 at 25 °C	9,80 at 25 °C	0,001008

Transmission fluid preparation

Before the transmission fluid is put into the diaphragm seal system, it has received a degasing treatment in order to bring the fluid in a non-compressible status. It is one of the reasons why diaphragm seals are never “refilled”, that additionally ruin the expensive filters of the vacuum pumps. It explains also why a filled diaphragm seal may never be disconnected from its measuring instrument.

Coefficient of Thermal Expansion

The coefficient of thermal expansion expressed in cc/cc/°C units is equal to the temperature coefficient of density g/cc/°C when density equals 1 g/cc. The coefficient of thermal expansion for liquids is usually much larger than for solids. Expansion must be considered if the liquid will be in a sealed portion of the system. An expansion cavity might be considered. At all times, the filling fluid has to remain in liquid form for accurate pressure measurement.

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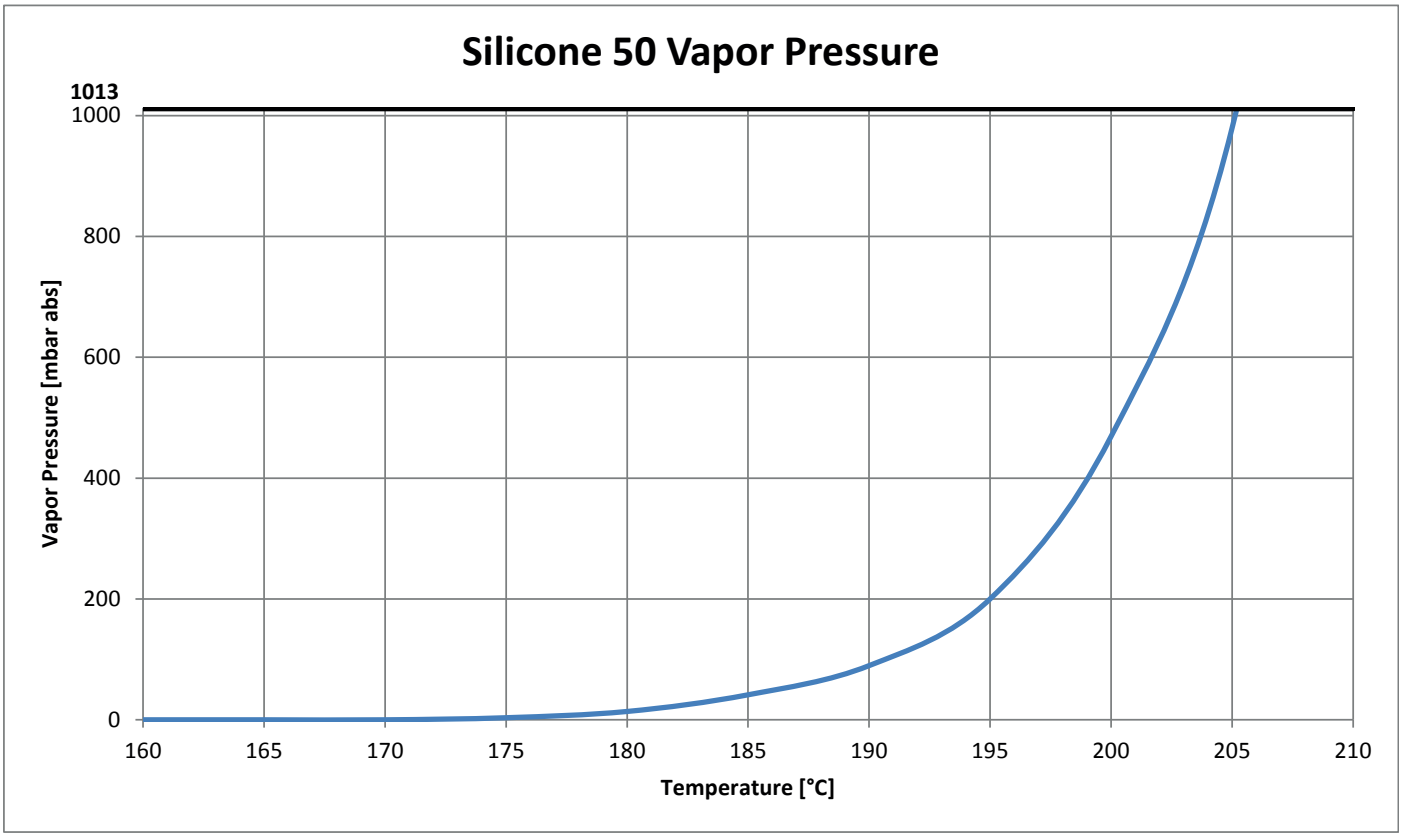
2.6.1 Silicone 50 (CK)

Silicone fill fluid for general purpose with a viscosity of 50 cs offering good response time.

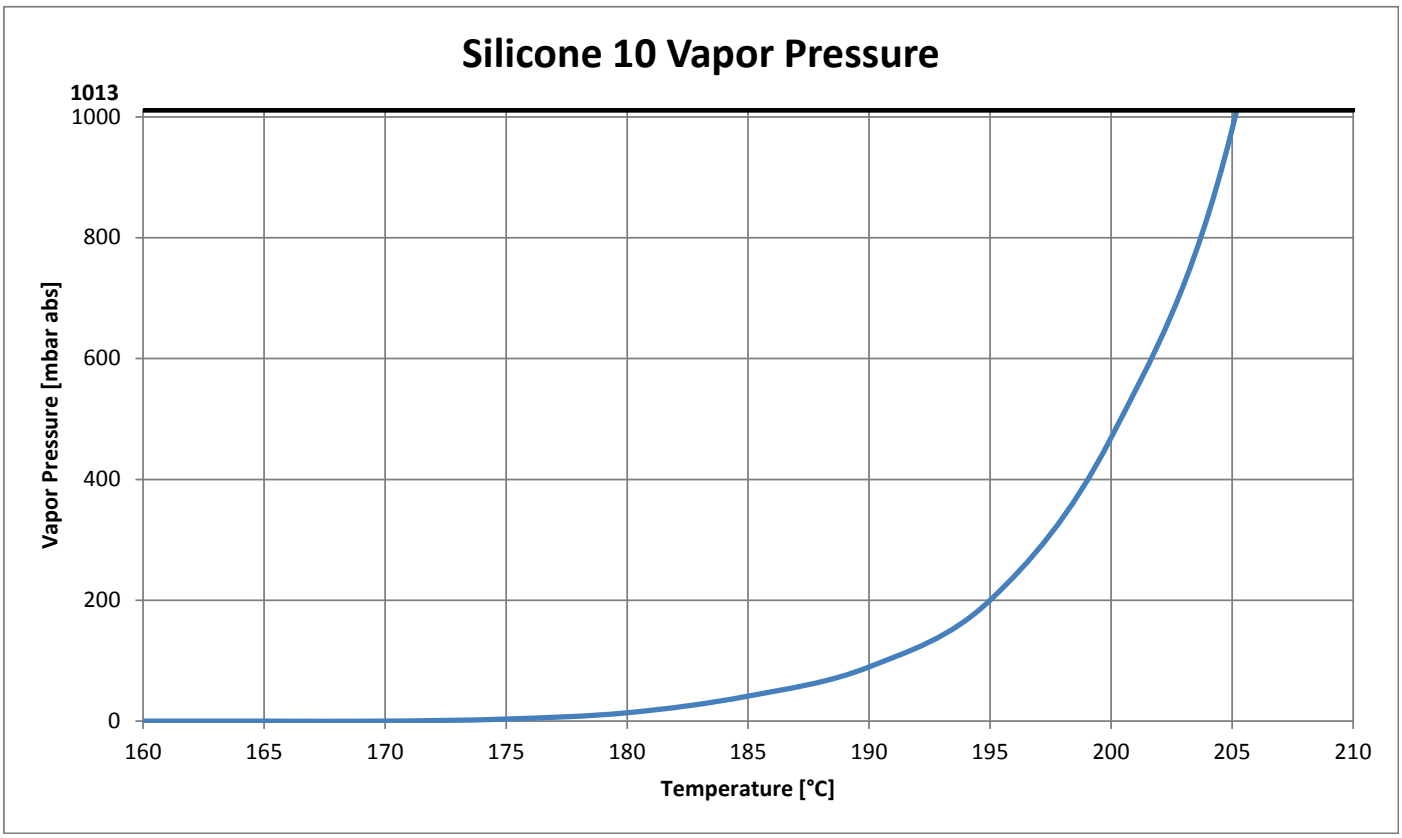
Temperature range at atmospheric pressure:	-40 … +315 °C
Viscosity at 25 °C:	50 cSt
Specific gravity at 25 °C:	0,93-0,98 g/cm³
Coefficient of thermal expansion:	0,00108 cc/cc/°C
CAS Number:	63148-62-9



2.6.2 Silicone 10 (EJ)

This low viscosity silicone oil is used for long capillary lengths to keep the response time down.

Temperature range at atmospheric pressure :	-40 … +315 °C
Viscosity at 25 °C:	10 cSt
Specific gravity at 25 °C:	0,93-0,98 g/cm³
Coefficient of thermal expansion:	0,00108 cc/cc/°C
CAS Number	63148-62-9



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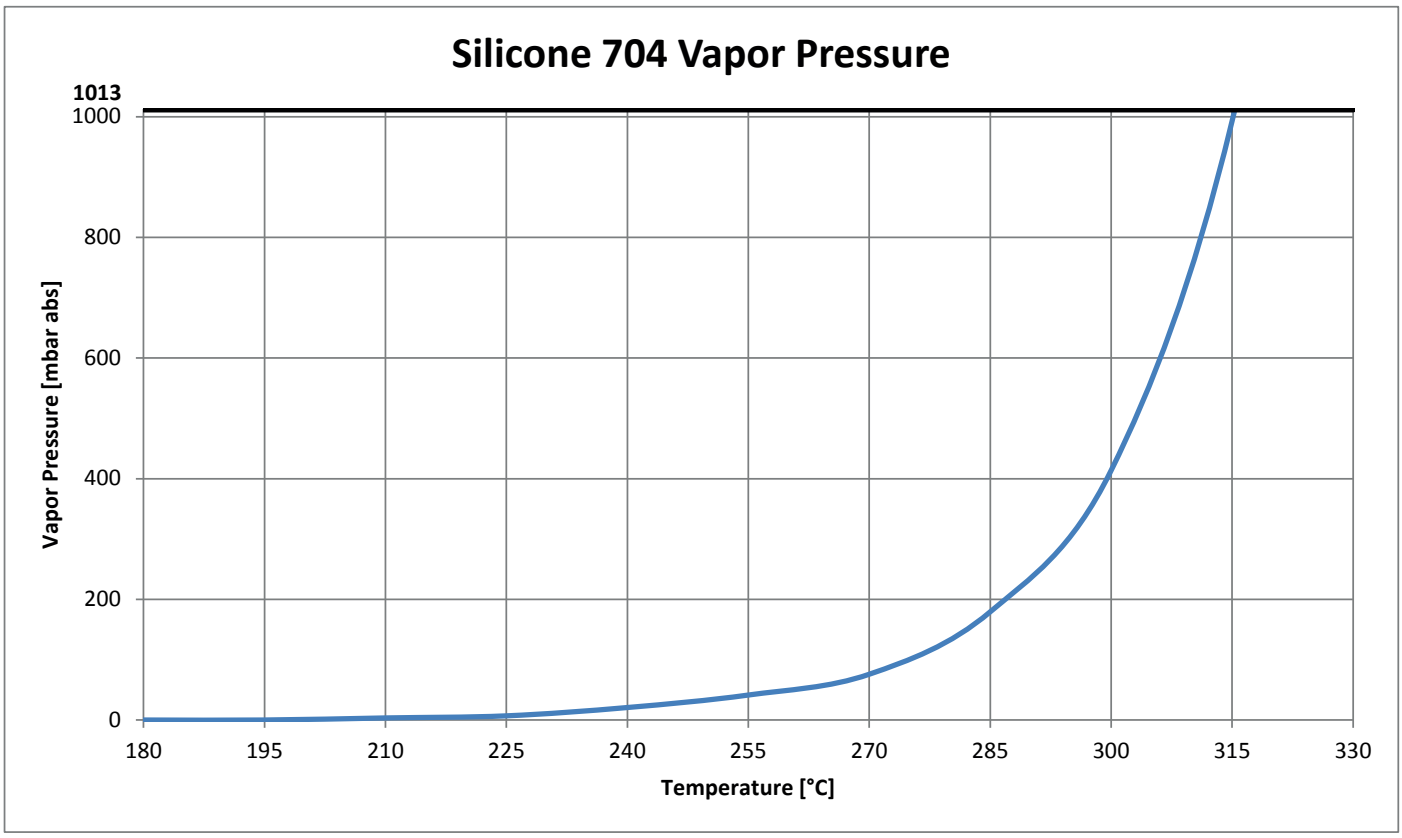
2.6.3 Silicone 704 (KG)

Silicone704 is a silicone diffusion pump fluid for vacuum and high temperature industrial applications. This specialty silicone fluid has a much higher molecular weight than Silicone50, which increases its operating temperature and lowers its vapour pressure. Its main limitation is its higher viscosity, and so heat tracing of capillaries is suggested for many outdoor applications.

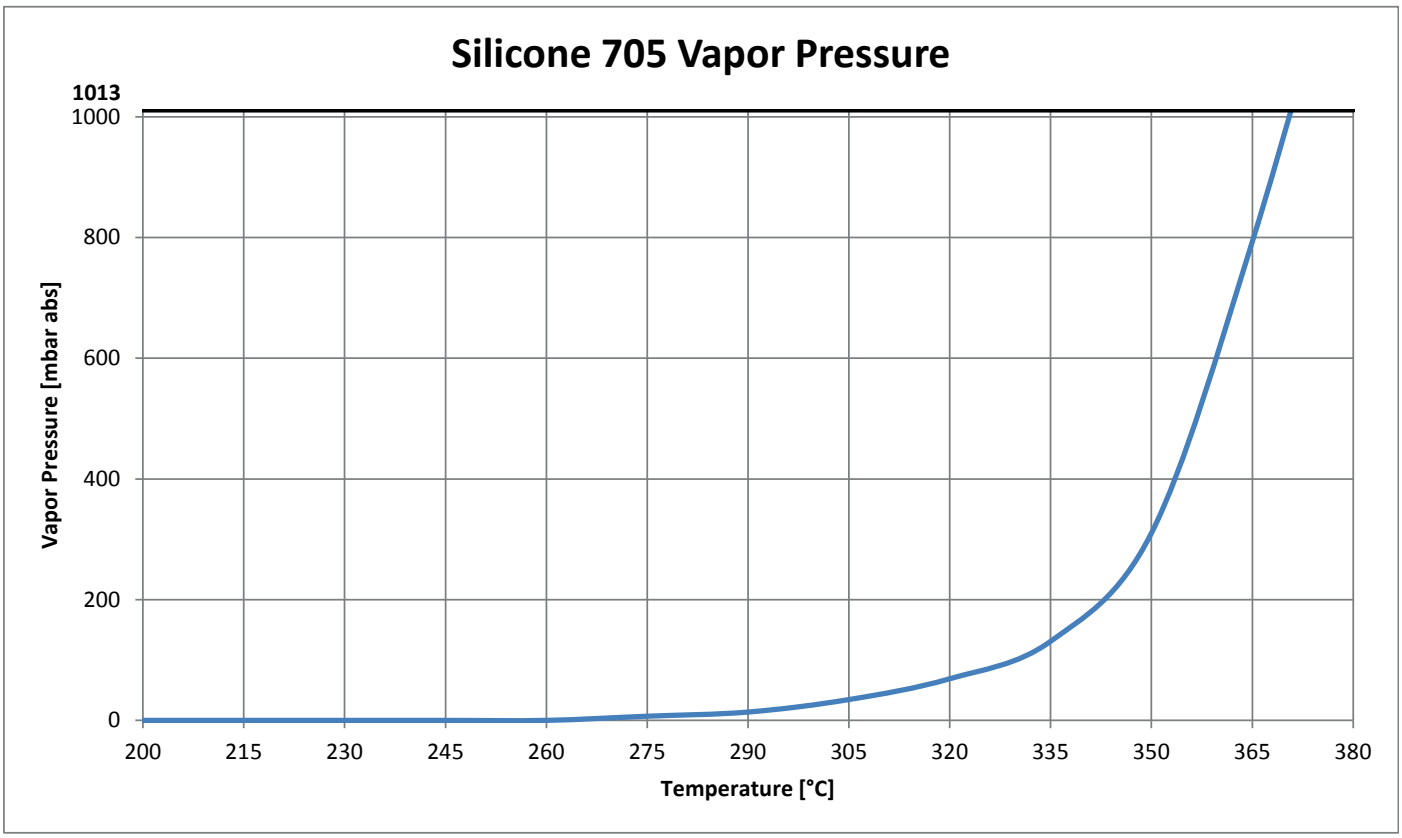
Temperature range at atmospheric pressure :	0 … 300 °C
Viscosity at 25 °C:	175 cSt
Specific gravity at 25 °C:	1,07 g/cm³
Coefficient of thermal expansion:	0,00095 cc/cc/°C
CAS Number	3982-82-9



2.6.4 Silicone 705 (KJ)

Silicone705 is a silicone diffusion pump fluid for vacuum and high temperature industrial applications. This specialty silicone fluid has a much higher molecular weight than Silicone 50, which increases its operating temperature and lowers its vapor pressure. Its main limitation is its higher viscosity, and so heat tracing of capillaries is suggested for many outdoor applications. Small ID capillary is not allowed for Silicone 705 because of its higher viscosity.

Temperature Limits at atmospheric pressure:	20… 370 °C
Viscosity at 25 °C:	39 cSt
Specific Gravity at 25 °C:	1,09
Coefficient of Thermal Expansion:	0,00077 cc/cc/C
CAS Number:	3390-61-2



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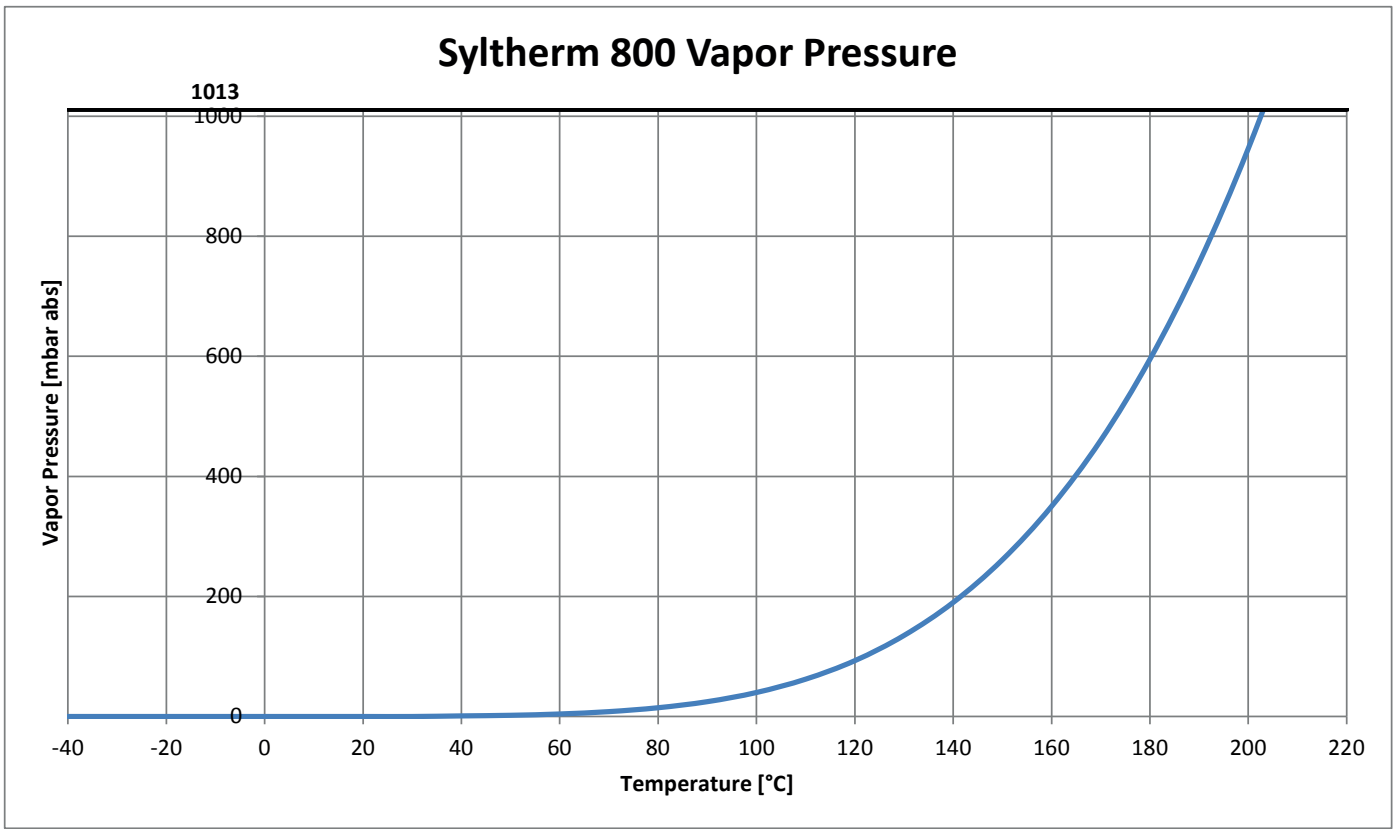
2.6.5 Syltherm 800 (HA)

Highly stable, long lasting silicone fluid designed for high temperature liquid phase operation. The low viscosity features an excellent response time. Additionally it has a relative low freeze point.

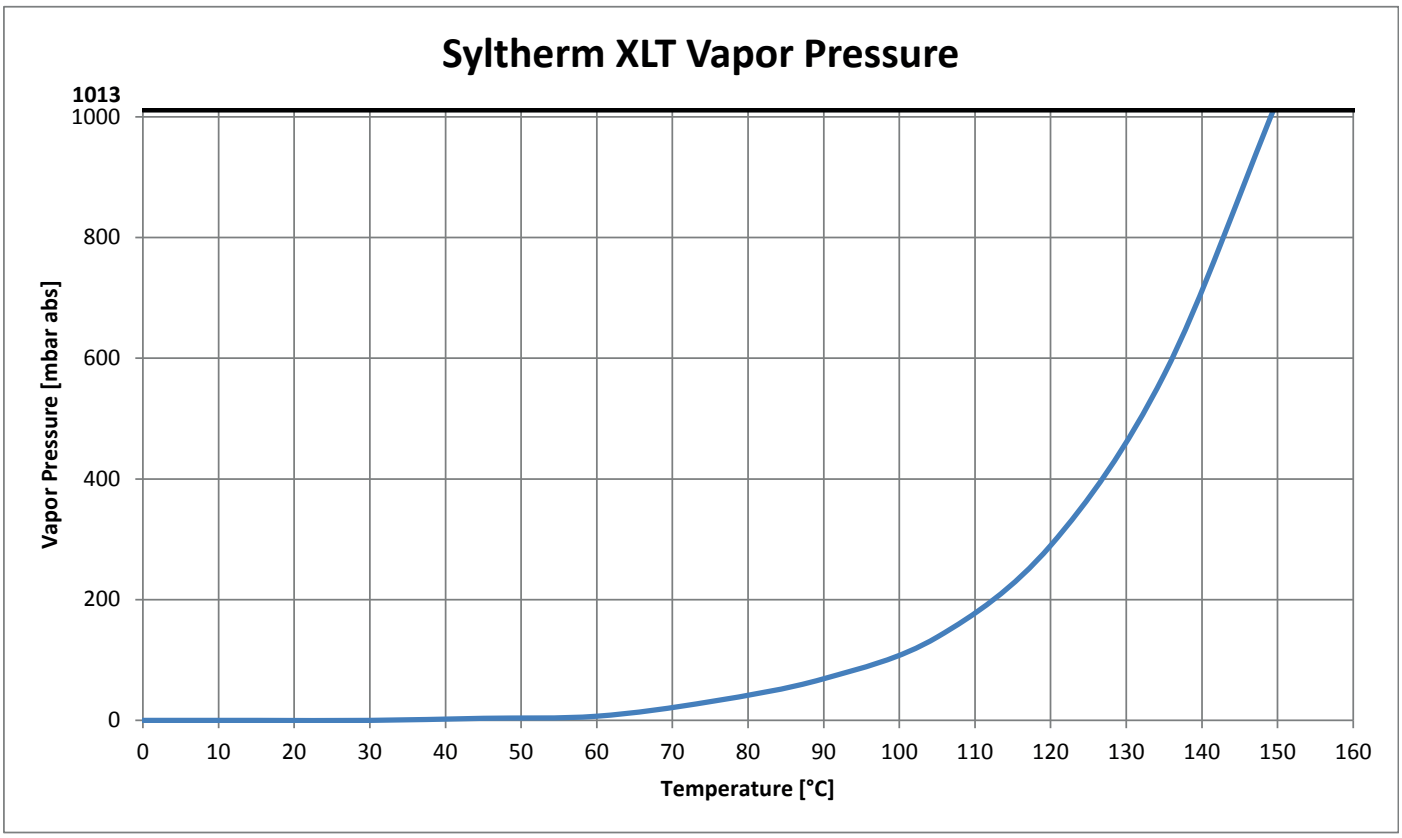
Temperature range at atmospheric pressure:	-40 … +400 °C
Viscosity at 25 °C:	9,1 cSt
Specific gravity at 25 °C:	0,93 g/cm³
Coefficient of thermal expansion:	0,001428 cc/cc/°C
CAS Number:	63148-62-9



2.6.6 Silicone XLT (CC)

Silicone fill fluid for low temperature application.

Temperature range at atmospheric pressure :	-73 … 149 °C
Viscosity at 25 °C:	1,6 cSt
Specific gravity at 25 °C:	0,85 g/cm³
Coefficient of thermal expansion:	0,00066 cc/cc/°C
CAS Number:	063148-62-9



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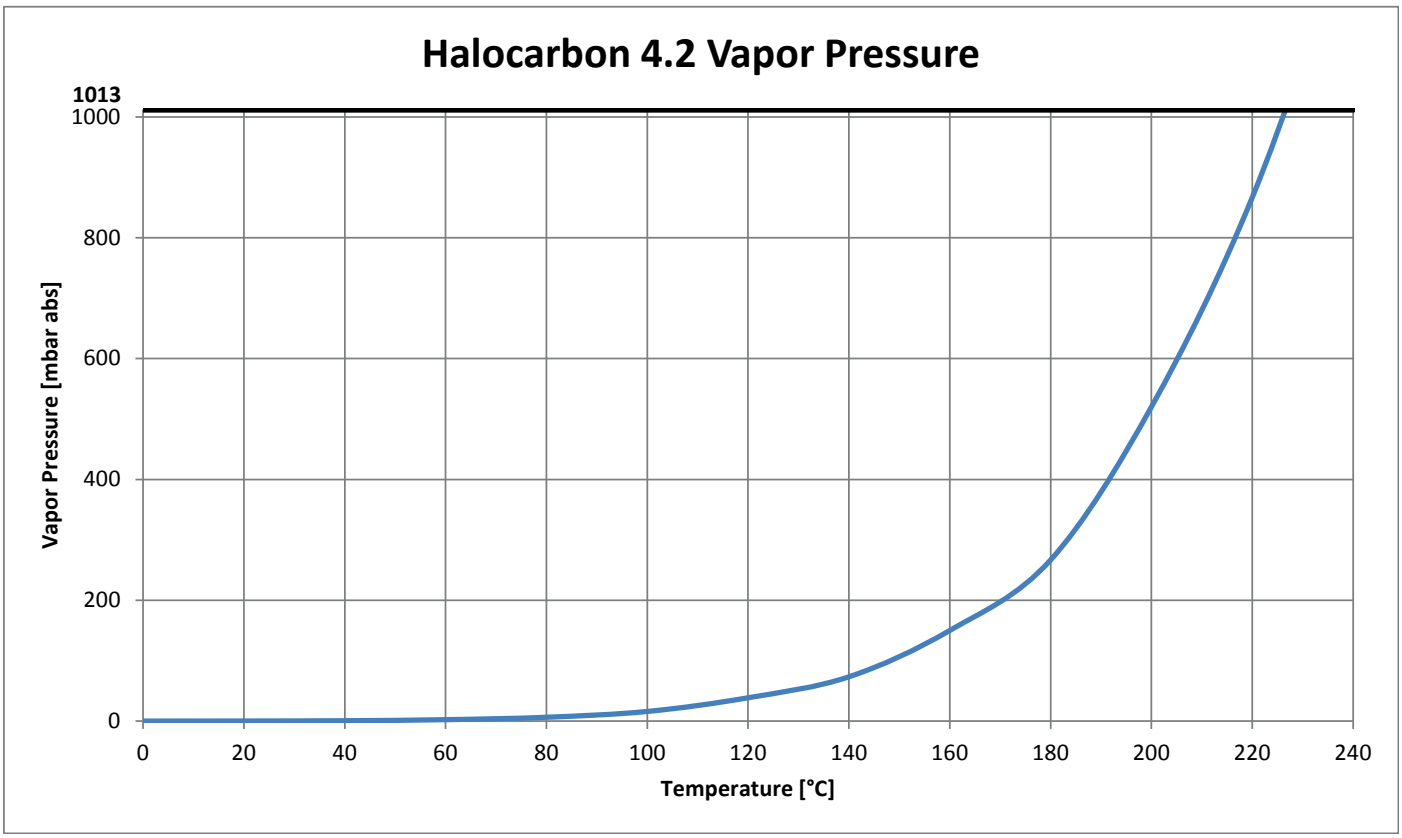
2.6.7 Halocarbon 4.2 (CF)

Halocarbon 4.2 oil is a low molecular weight polymer of Chlorotrifluoroethylene (PCTFE). This inert oil is manufactured by a controlled polymerization process and then is stabilized to give it some very unique properties. The oil is safe, chemically inert and non-flammable and is oxygen and chlorine compatible and is an excellent alternative for silicone oils for paint industry applications. It has high thermal stability and low compressibility.

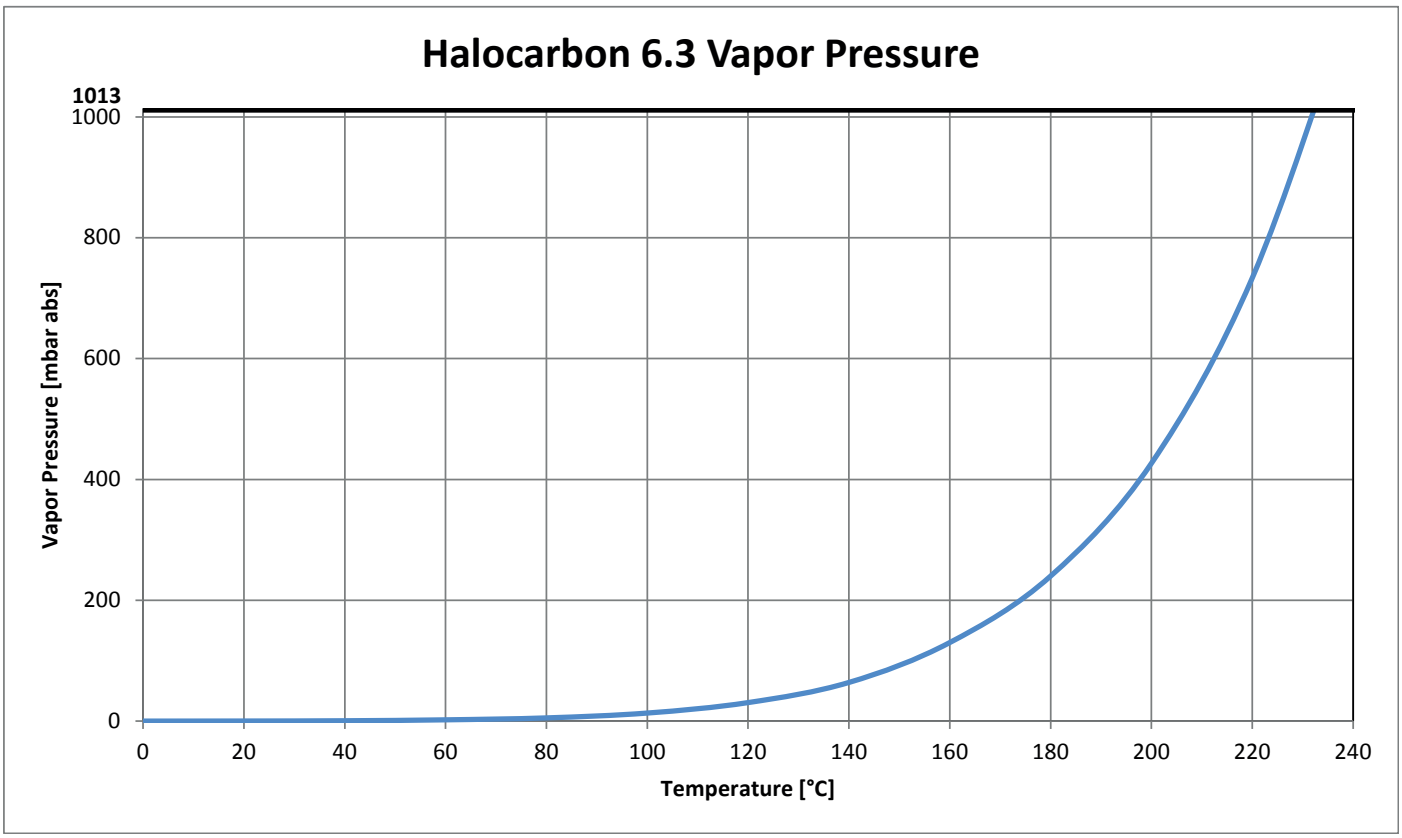
Temperature range at atmospheric pressure:	-45 … +160 °C
Viscosity at 25 °C:	6,5 cSt
Specific gravity at 25 °C:	1,85 g/cm³
Coefficient of thermal expansion:	0,000864 cc/cc/°C
CAS Number:	9002-83-9



2.6.8 Halocarbon 6.3 (HO)

Halocarbon oil 6.3 is a low molecular weight polymer of Chlorotrifluoroethylene (PCTFE). This inert oil is manufactured by a controlled polymerization process and then is stabilized to give it some very unique properties. The oil is safe, chemically inert and non-flammable and is oxygen and chlorine compatible and is an excellent alternative for silicone oils for paint industry applications. It has high thermal stability and low compressibility.

Temperature range at atmospheric pressure:	-45 … +150 °C
Viscosity at 25 °C:	6,5 cSt
Specific gravity at 25 °C:	1,85 g/cm³
Coefficient of thermal expansion:	0,000864 cc/cc/°C
CAS Number:	9002-83-9



2.6.9 White oil (GQ)

Energol WM2 meets the purity requirements of British Pharmacopeia and conform to the purity specifications given in the Minerals Hydrocarbons in Food regulations 1966.

Temperature range at atmospheric pressure:	-10 … +260 °C
Viscosity at 25 °C:	3,4 cSt
Specific gravity at 15 °C:	0,851 g/cm³
CAS Number:	8042-47-5
FDA Regulation No 178.3620(a) SI No.1073;	

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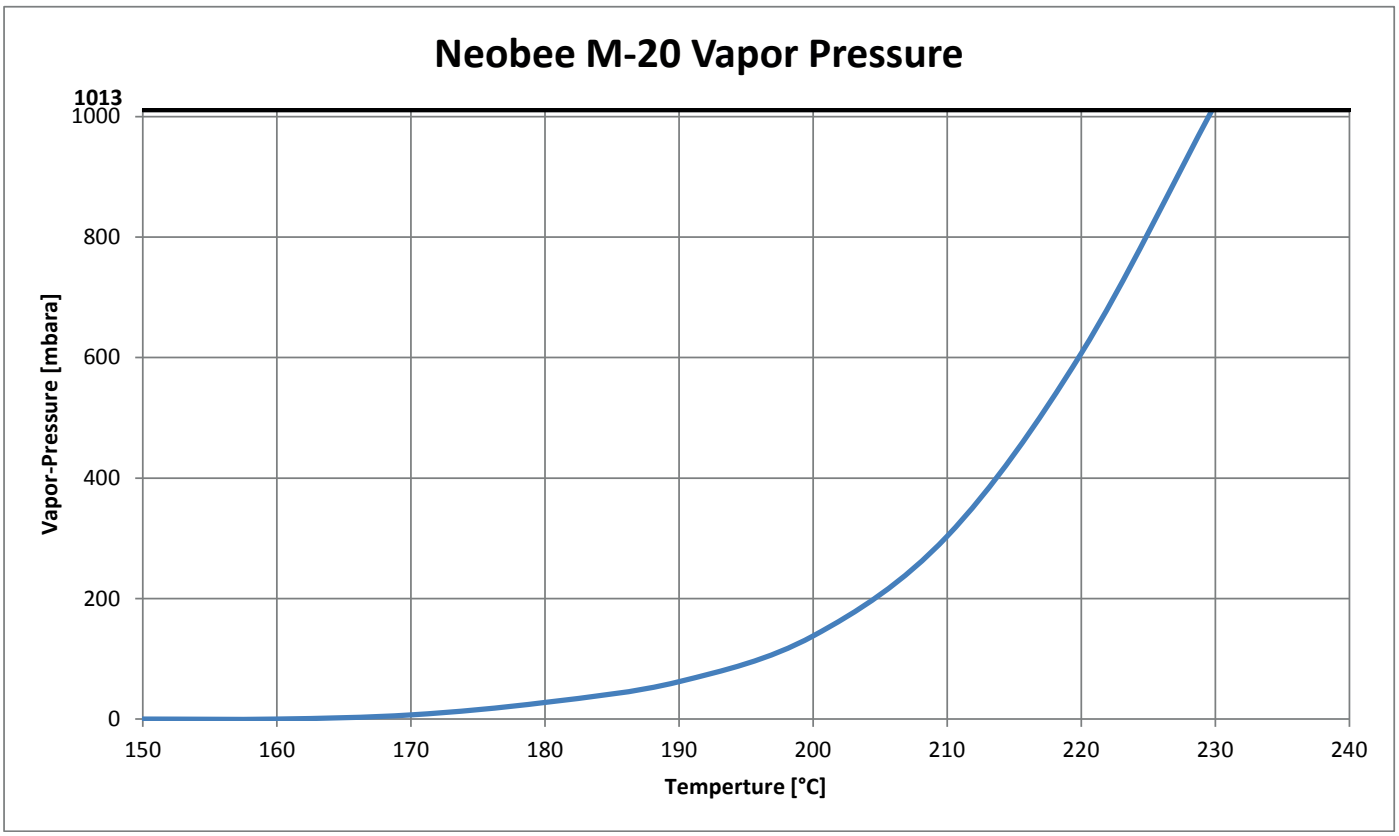
2.6.10 Neobee M-20 (CP)

Used as filling fluid for instruments used for food-, beverage- and pharmaceutical applications. Excellent thermal stability and low viscosity. A coconut extract.

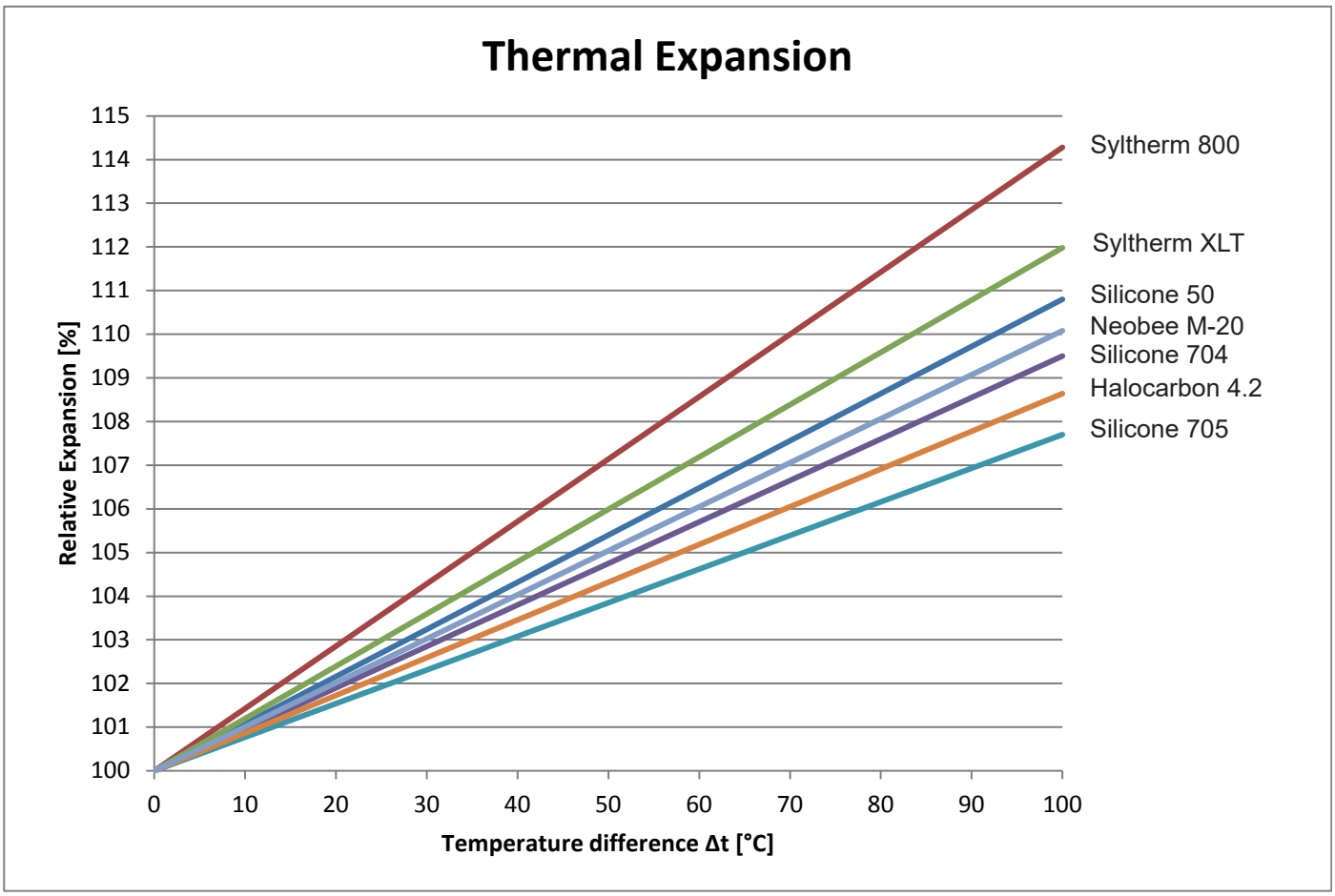
Temperature range at atmospheric pressure :	-15 to 205 °C
Viscosity at 25 °C:	9,8 cSt
Specific gravity at 25 °C:	0,94 g/cm³
Coefficient of thermal expansion:	0,001008 cc/cc/°C
CAS Number	68583-51-7

FDA Regulation No. 21CFR 172.856 (direct food additive) and No. 21CFR 174. (indirect food additive)
Halal und Kosher Certifikat



2.5 Temperature influence

The process- and ambient temperatures can play a significant role in the accuracy of the measurement as the transmission fluids have a thermal expansion coefficient creating volume variation as the resulting in pressure change into the system and a shift of the reading.
Keeping the filling fluid volume minimalized together with the selection of the most appropriate type of filling fluid will keep the temperature influence to a minimum



2.6 MATERIALS

All types are all welded constructions and can be ordered with a large variety of wetted parts materials.

2.6.1 Stainless Steel 316L (1.4404)

Stainless steel 316L is the standard flange and diaphragm material for Ashcroft diaphragm seals and belongs to the 300 Series defined by the SAE which encompasses a range of austenitic chrome-nickel alloys. Stainless steel 316L features a general corrosion resistance, good cryogenic toughness and excellent formability and weldability.

Material Numbers and Names	
Material Number (EN)	1.4404
Material Name (EN)	X2CrNiMo17-12-2 / X2CrNiMo17-13-2
AISI	316L
UNS	S31603

Physical Specifications	
Density	8,0 kg/dm³
Thermal conductivity	15 W/mK (at 20°C)
Thermal expansion coefficient	500 J/kgK
Modulus Elasticity	200 GPa (at 20°C)
Material group	astenitic

Chemical Specifications		
Carbon	C	≤ 0,08 %
Silicium	Si	≤ 1,0 %
Manganese	Mn	≤ 2,0 %
Phosphorus	P	≤ 0,045 %
Sulfur	S	≤ 0,015 %
Chrome	Cr	17,0 - 19,0 %
Molybdenum	Mo	2,0 - 2,5 %
Nickel	Ni	10,0 - 13,0 %
Nitrogen	N	≤ 0,11 %

2.6.2 Stainless Steel 321 (1.4541)

Stainless steel 321 belongs to the chromium-nickel steels and features a good resistance to atmospheric corrosion and many organic and inorganic chemicals, excellent formability and weldability.

Material Numbers and Names	
Material Number (EN)	1.4541
Material Name (EN)	X6CrNiTi18-10
AISI	321
UNS	S32100

Physical Specifications	
Density	8,09 kg/dm³
Thermal conductivity	16,0 W/mK (at 100°C)
Thermal expansion coefficient	
Modulus Elasticity	193 GPa (at 20°C)
Material group	astenitic

Chemical Specifications		
Carbon	C	≤ 0,08 %
Silicium	Si	≤ 0,75 %
Manganese	Mn	≤ 2,0 %
Phosphorus	P	≤ 0,045 %
Sulfur	S	≤ 0,3 %
Chrome	Cr	17,0 - 19,0 %
Titanium	Ti	≤ 0,7 %
Nickel	Ni	9,0 - 12,0 %
Nitrogen	N	≤ 0,1 %
Molybdenum	Mo	4,0 - 5,0 %

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2.6.3 Stainless Steel 904L (1.4539)

Stainless steel 904L is a super austenitic, nickel-chromium-molybdenum-copper steel with extra low carbon content. The addition of copper gives it corrosion resistant properties to the conventional chrome-nickel steels.

Material Numbers and Names	
Material Number (EN)	1.4539
Material Name (EN)	X1NiCrMoCu25-20-5
AISI	904L
UNS	N08904

Physical Specifications	
Density	8,05 kg/dm³
Thermal conductivity	12 W/mK (at 20°C)
Thermal expansion coefficient	450 J/kgK
Modulus Elasticity	190 GPa (at 20°C)
Material group	austenitic

Chemical Specifications		
Carbon	C	≤ 0,02 %
Silicium	Si	≤ 0,7 %
Manganese	Mn	≤ 2,0 %
Phosphorus	P	≤ 0,03%
Sulfur	S	≤ 0,01 %
Chrome	Cr	19,0 - 21,0 %
Molybdenum	Mo	4,0 - 5,0 %
Nickel	Ni	24,0 - 26,0 %
Titanium	Ti	≤ 0,7 %
Copper	Cu	0,5 - 1,5 %
Nitrogen	N	≤ 0,11 %

2.6.4 Duplex 2205 (1.4462)

Duplex 2205 belong to the group of Duplex steels and can be compared with stainless steel 316L. It has the same corrosion resistance, but a 150% higher strength. Because of this high strength Duplex becomes more important for the constructional industry. Duplex have a mixed microstructure of austenite and ferrite.

Material Numbers and Names	
Material Number (EN)	1.4462
Material Name (EN)	X2CrNiMoN22-5-3
AISI	318L
UNS	S31803

Physical Specifications	
Density	7,8 kg/dm³
Thermal conductivity	14 W/mK (at 20°C)
Thermal expansion coefficient	500 J/kgK
Modulus Elasticity	190 GPa (at 20°C)
Material group	austenite / ferrite

Chemical Specifications		
Carbon	C	≤ 0,03 %
Silicium	Si	≤ 1,0 %
Manganese	Mn	≤ 2,0 %
Phosphorus	P	≤ 0,035 %
Sulfur	S	≤ 0,015 %
Chrome	Cr	21,0 - 23,0 %
Molybdenum	Mo	2,5 - 3,5 %
Nickel	Ni	4,5 - 6,5 %
Nitrogen	N	0,1 - 0,22 %

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2.6.5 Hastelloy C-276 (2.4819)

Hastelloy C-276 is a nickel-molybdenum-chromium alloy which has a perfect resistance to many media in chemical processes, including acids, wet chlorine gas and chlorine solutions. 2.4819 features good resistance against sulfide stress cracking, stress corrosion and pitting.

Material Numbers and Names	
Material Number (EN)	2.4819
Material Name (EN)	NiMo16Cr15W
AISI	Alloy 276
UNS	N10276

Physical Specifications	
Density	8,9 kg/dm³
Thermal conductivity	9,2 W/mK (at 20°C)
Thermal expansion coefficient	427 J/kgK
Modulus Elasticity	205 GPa (at 20°C)

Chemical Specifications		
Carbon	C	≤ 0,01 %
Silicium	Si	≤ 0,08 %
Manganese	Mn	≤ 1,0 %
Phosphorus	P	≤ 0,015%
Sulfur	S	≤ 0,01 %
Chrome	Cr	≤ 15,0 %
Molybdenum	Mo	≤ 15,0 %
Nickel	Ni	≥ 62,08 %
Wolfram	W	3,0 - 4,0 %
Vanadium	Co	≤ 2,5 %
Nickel	V	0,1 - 0,3 %

2.6.6 Inconel 625 (2.4856)

Inconel is a nickel-chromium alloy and is used for high strength and outstanding corrosion resistance. The outstanding and versatile corrosion resistance of Inconel 625 under a wide range of temperatures is a reason for chemical process applications.

Material Numbers and Names	
Material Number (EN)	2.4856
Material Name (EN)	NiCr22Mo9Nb
AISI	-
UNS	N06625

Physical Specifications	
Density	8,4 kg/dm³
Thermal conductivity	9,4 W/mK (at 20°C)
Thermal expansion coefficient	440 J/kgK
Modulus Elasticity	209 GPa (at 20°C)

Chemical Specifications		
Carbon	C	0,03 - 0,1 %
Silicium	Si	≤ 0,5 %
Manganese	Mn	≤ 0,5 %
Phosphorus	P	≤ 0,02 %
Sulfur	S	≤ 0,015%
Chromium	Cr	20,0 - 23,0 %
Molybdenum	Mo	8,0 - 10,0 %
Nickel	Ni	≥ 58,0 %
Cobalt	N	≤ 1,0 %
Iron	Fe	≤ 5,0 %
Aluminium	Al	≤ 0,4 %
Titanium	Ti	≤ 0,4 %
Copper	Cu	≤ 0,5 %
Niobium (plus Tantalum)	Nb	3,15 - 4,15 %
Nitrogen	N	0,1 - 0,22 %

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2.6.7 Inconel 825 (2.4858)

Inconel 825 is a nickel-iron-chromium alloy with additions of titanium, copper and molybdenum. Nickel as the main element is the reason for the excellent resistance to chloride-ion stress corrosion cracking. It gives an outstanding resistance to reducing environments with sulfuric and phosphoric acids. The element molybdenum adds an acids resistant to pitting and crevice corrosion. Inconel 825 is used in chemical processing, oil and gas recovery acid production and handling of radioactive wastes.

Material Numbers and Names	
Material Number (EN)	2.4858
Material Name (EN)	NiCr21Mo
AISI	-
UNS	UNS08825

Physical Specifications	
Density	8,1 kg/dm³
Thermal conductivity	11,1 W/mK (at 20°C)
Thermal expansion coefficient	440 J/kgK
Modulus Elasticity	209 GPa [at 20°C)

Chemical Specifications		
Carbon	C	≤ 0,025 %
Silicium	Si	≤ 0,5 %
Manganese	Mn	≤ 1,0 %
Phosphorus	P	≤ 0,02 %
Sulfur	S	≤ 0,015 %
Chromium	Cr	≤ 19,5 - 23,5 %
Molybdenum	Mo	2,5 - 3,5 %
Nickel	Ni	38,0 - 46,0 %
Cobalt	Co	≤ 1,0 %
Iron	Fe	rest %
Aluminum	Al	≤ 0,2 %
Titanium	Ti	0,6 - 1,2 %
Copper	Cu	1,5 - 3,0 %

2.6.8 Monel 400 (2.4360)

Monel 400, known as Alloy 400, is a solution for many corrosive environments over a large temperature range. Also, it can be used in contact with fluorine, hydraulic acids, hydrogen fluoride, sulfuric and hydrochloric acid. Monel 400 will be used in sea-water applications and chemical processing.

Material Numbers and Names	
Material Number (EN)	2.4360
Material Name (EN)	NiCu30Fe
AISI	-
UNS	N04400

Physical Specifications	
Density	8,8 kg/dm³
Thermal conductivity	23 W/mK (at 20°C)
Thermal expansion coefficient	430 J/kgK
Modulus Elasticity	180 GPa (at 20°C)

Chemical Specifications		
Carbon	C	≤ 0,3 %
Silicium	Si	≤ 0,5 %
Manganese	Mn	≤ 2,0 %
Sulfur	S	≤ 0,024 %
Nickel	Ni	≥ 63,0 %
Iron	Fe	≤ 2,5 %
Copper	Cu	28,0 - 34,0 %
Aluminum	Al	≤ 0,02 %
Phospor	P	≤ 0,005 %

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2.6.9 Tantalum

Tantalum is a transition metal and belongs to the group of vanadium alloys. The surface of Tantalum creates in contact with air a thin oxide layer which features a good chemical resistance for many acids.The maximum process temperature is limited to 300°C.

Physical Specifications	
Density	16,65 kg/dm³
Thermal conductivity	57,7 W/mK (at 20°C)
Thermal expansion coefficient	6,0 x 10^{-6} 1/K
Modulus Elasticity	185,7 GPa

2.6.10 Stainless Steel Gold plated

Ashcroft supplies 25 µm (optional 40 µm) thick gold plated wetted parts that prevents hydrogen H^+-ion diffusion. Also, gold belongs to the group of noble metals and features a minor response addiction.

2.6.11 Teflon coating

Teflon (PTFE - polyetrafluorethylene) is a 40 µm coating to protect the wetted parts against adhesive and abrasive media. Teflon has an extremely low coefficient of friction, that´s why it will be used in application with sticky process media. A protection against corrosion is limited., because of the thickness. The maximum medium temperature is 260 °C

2.6.12 Halar coating

The Halar coating is an effective solution to protect the stainless steel 316L diaphragm against strong acids, chlorine and caustic soda. The applied layer thickness is between 600 µm up to 1000 µm and the anti-stick quality is less than Teflon. The maximum medium temperature is 120 °C.

2.6.13 PFA coating

PFA is chemically inert and solvent resistant to virtually all chemicals, except molten alkali metals, gaseous fluorine, and certain compley halogenated compounds, such as chlorinetrifluoride at elevated temperatures and pressures. The average coated thickness on wetted parts is between 50 µm and 150 µm. The maximum temperature is 260 °C

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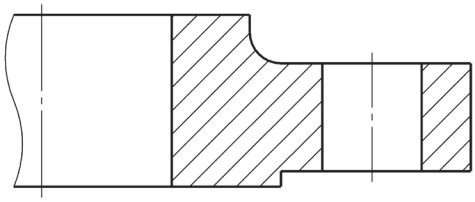
2.7 Flange facing

2.7.1 Form B (EN 1092-1)

Flange facing types B1 and B2 are raised face (type B) flanges with different specified surface roughness values. The diameters of the flange facings are mentioned in the standard EN 1092-1, table 8.

- B1: Standard flange facing for all PN numbers
  - Ra [µm]: 3,2 - 12,5
  - Rz [µm]: 12,5 - 50,0
- B2: Only if agreed between the purchaser and the flange manufacturer
  - Ra [µm]: 0,8 - 3,2
  - Rz [µm]: 3,2 - 12,5

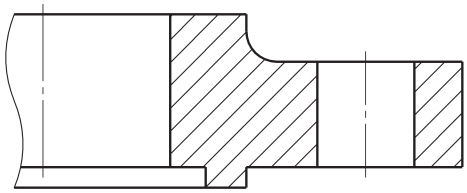
Notice: Ra and Rz are defined in EN ISO 4287



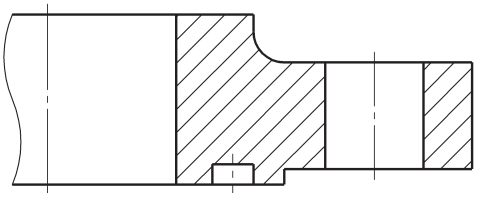
2.7.2 Raised face form C and D (EN 1092-1)

Form C and D faces of these flanges must be matched. Form C has a raised ring (Tongue) machined onto the flange face while the mating flange form D has a matching depression (Groove) machined into it´s face. Form C & D joints also have an advantage in that they are self-aligning and act as a reservoir for the adhesive. The scarf joint keeps the axis of loading in line with the joint and does not require a major machining operation.

Form C (Tongue)

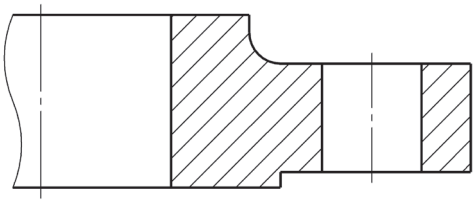


Form D (Groove)



2.7.2 Raised face RF (ASME B16.5)

The Raised Face flange is the most common type used in process plant applications, and easy to identify. It is referred to as a raised face because the gasket surface are raised above the bolting circle face. This face type allows the use of a wide combination of gasket designs.



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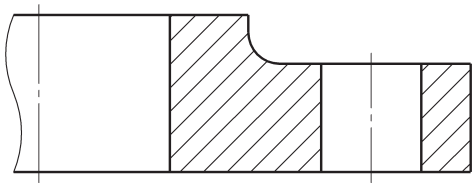
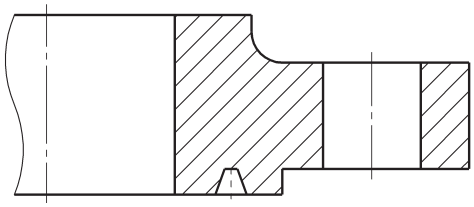
2.7.4 Flat Face (FF) (ASME B16.5)

The Flat Face flange has a gasket surface in the same plane as the bolting circle face. Applications using flat face flanges are frequently those in which the mating flange or flanged fitting is made from a casting.



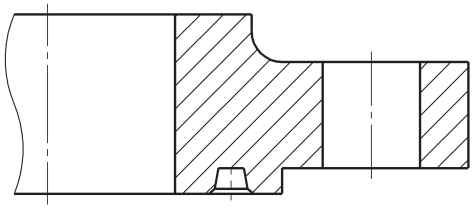
2.7.5 Ring (type) joint (ASME B16.5)

The Ring Type Joint flanges are typically used in high pressure (Class 600 and higher) and/or high temperature services above 400 °C. They have a groove cut into the faces for material ring gasket. The flange seals when tightended bolts compress the gasket between the flanges into the grooves, deforming the gasket to make intimate contact inside the grooves, creating a metal to metal seal.



2.7.6 API Type 6B / 6BX (API 6A)

6B flanges are designed of the ring joint type optional with a raised face. They have a groove cut into their faces with steel ring gaskets. The flanges seal when tightended bolts compress the gasket between the flanges into the grooves, deforming the gasket to make intimate contact inside the grooves, creating a metal to metal seal.



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2.8 DIAPHRAGM SEALS

DFC

Flush Flanged Diaphragm Seal

Flush design minimizes the use of expensive specialty wetted materials
Flush-mounted diaphragm prevents clogging of process media
Diaphragm welded to flange
Filling port in the instrument connection

Diaphragm Ø mm	Flang size	Flange Rating
44mm	1½"	150, 300,600,900,1500 and 2500 class
57mm	2"	150, 300,600,900,1500 and 2500 class
88mm	3"	150, 300,600,900,1500 and 2500 class
88mm	4"	150, 300,600,900,1500 and 2500 class

DTC

Truncated Flanged Diaphragm Seal

Wide selection of diaphragm materials
Diaphragm welded to flange extension
Filling port in the instrument connection

Diaphragm Ø mm	Flang size	Flange Rating
44mm	2"	150, 300,600,900 and 1500 class
72mm	3"	150, 300,600,900 and 1500 class
88mm	4"	150, 300,600,900 and 1500 class

102/103/202/203

Flanged Diaphragm Seals

316L stainless steel top housing (standard)
Wide selection of diaphragm and lower housing materials
Diaphragm welded (metallic) or bonded (elastomer) to top housing
Flush port provides easy cleaning / flushing due to process media prone to clogging

Diaphragm Ø mm	Flang size	Flange Rating
61mm	1/2"	150, 300,600,900 and 1500 class
	1"	
	1-½"	
	2"	
	3"	

702/703

Flanged High Displacement Diaphragm Seals

Wide selection of diaphragm and lower housing materials
Enlarged welded diaphragm
High displacement allows high sensitivity to pressure fluctuations
Flushing port provides easy cleaning / flushing due to process media prone to clogging

Diaphragm Ø mm	Flang size	Flange Rating
91mm	1/2"	150, 300 and 600 class
	1"	
	1-½"	
	2"	
	3"	

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3 ACCESSORIES

3.1 Capillary line

The Ashcroft® 1115A and 1115P capillary lines are used when instruments need to be removed from direct contact with the installation point due to elevated process temperature, pressure spikes, vibration or design specifications. Added between the measuring instrument and diaphragm seal.

Key Features:

- All-welded stainless steel construction
- 1,5 m length (standard); alternate lengths in 10 mm increments
- Available capillary lengths: 0,3 m up to 30 m

Specifications:

- Type:
  1115A: armored capillary (standard)
  1115P: armored capillary with Teflon sheath (optional); maximizes corrosion resistance
- Maximum working pressure: 689 bar
- Temperature limits: -185°C to 400°C

See data sheet G3.1115

3.2 Flushing Ring

The Ashcroft® Flushing ring are mainly used for cleaning of flanged diaphragm seal. This enables consistent readings from sensing instruments, and serves to extend service life. An ideal solution for satisfying applications with challenging requirements. Additionally they offer sampling and calibration service.

Key Features:

- Two flushing ports

Specifications:

- Standard according to DIN or ASME
- Size 2“ ... 4“ or DN50 ... DN100
- Pressure Ratings: PN400 or 2.500 lbs

See data sheet G3.FR

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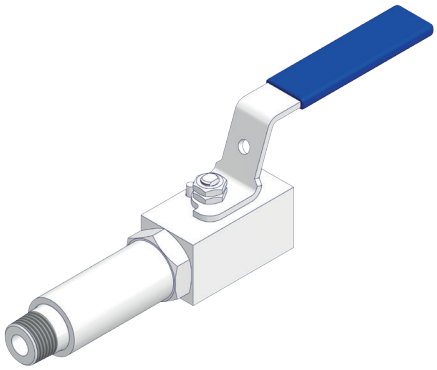
3 ACCESSORIES

3.3 Ball valve for flushing ring

The Ashcroft ball valve is a perfect add-on for the flushing rings. The ball valves allows an continuouse flushing connection.

Key Features:

- Stainless steel construction, other materials on request
- Variouse selection of sealings and connection sizes



3.2 Cooling device

The Ashcroft® finned cooling device protects pressure instruments from the effects of elevated temperatures. A reduced
orifice decreases the volume of the fill fluid in the finned cooling device allowing efficient heat transfer.
The cooling device metallic fins maximize exposure to the ambient temperature for effective dissipation.

Key Features:

- Temperature reduction approx. 100 °C
- Effectively protects instruments from elevated temperatures
- Cooling device and sensing instrument mount directly to the process
- Compatible with many process media

Specifications:

- PN: 1.000 bar / 15.000 psi
- Material Stainless steel 316L, others on request

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