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## 1 General

Pressure transmission fluids are used to transfer the process pressure from the diaphragm seal to the sensor element and therefore represent a fundamental component of a diaphragm seal system (see also TA\_031 General Information on Diaphragm Seals).

The following provides information on the properties and applications of the different pressure transmission fluids.

## 2 Process conditions

Important factors when selecting a pressure transmission fluid include the process conditions with regard to pressure and temperature. The temperature range is based on the physical properties of the pressure transmission fluid. The process pressure is also important, as a combination of high temperature and vacuum pressure is especially critical. Certain production steps may have to be performed to ensure the suitability of the diaphragm seal system, depending on the critical process point.

Some LABOM pressure transmission fluids can be used in vacuum conditions up to a unit temperature  $t_1$  without special treatment if the diaphragm seal is installed correctly. Special treatment during manufacturing is necessary for higher temperatures. A differentiation is made between negative pressure service and an especially high-grade vacuum service.

The different zones are separated by three straight lines. The range below 30 mbar abs represents a special case, which requires the vacuum service in all cases above the aforementioned limit temperature.

Consult Technical Support with regard to especially critical process points. Depending on the exact process and installation conditions, often special solutions can be found.

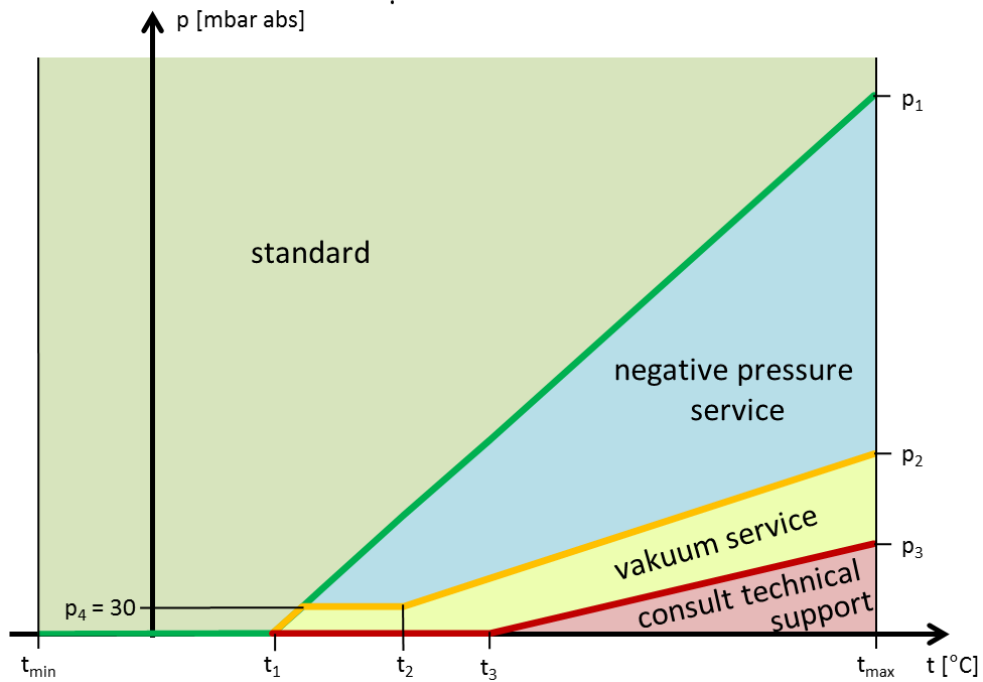


Fig. 1 Zones in the pressure/temperature chart

### 3 Technical data of fluids

The table below is intended to simplify selection. The following pages describe the pressure transmission fluids in more detail.

Code	Description/Application	Type	t <sub>min</sub> [°C]	t <sub>max</sub> [°C]	density [g/cm <sup>3</sup> ]	kin. viscosity @ 40°C [mm <sup>2</sup> /s]	Tk [%/10K]	compressibility [%/100 bar]
<b>FD1</b>	silicon-free oil suitable for food stuff applications	polyalphaolefine oil	-50	230	0,82	31	0,76	0,6
<b>FV3H</b>	vacuum and high temperature oil	highly refined mineral oil	-10	400	0,87	95	0,73	1
<b>FC</b>	Halocarbon oil for oxygen applications	halogenated carbon chains	-30	190	1,92	56	0,9	0,73
<b>FM50</b>	silicone oil M50	high viscosity silicone oil	-50	300	0,96	40	1,0	1,02
<b>FM5</b>	low temperature silicone oil M5	low viscosity silicone oil	-90	160	0,92	4	1,1	1,2
<b>FW</b>	white oil for food stuff applications	low viscosity paraffin	-10	170	0,85	43	0,76	0,6
<b>FGW</b>	glycerine/water mixture	glycerine/water 70/30	-30	110	1,18	8	0,57	0,29
<b>FAW</b>	alcohol/water mixture for the paint industry	isopropanol/water 40/60	-20	75	0,95	1,9	0,52	0,81
<b>FMH1</b>	metal liquid for high temperatures or pressures	low melting alloy	0	350	6,44	1,4	0,126	0,02

## 3.1 Standard and food-compliant oil FD1

### Properties/Applications

Silicone-free, synthetic oil with universal properties, especially suitable for applications in the food and pharmaceutical industry.

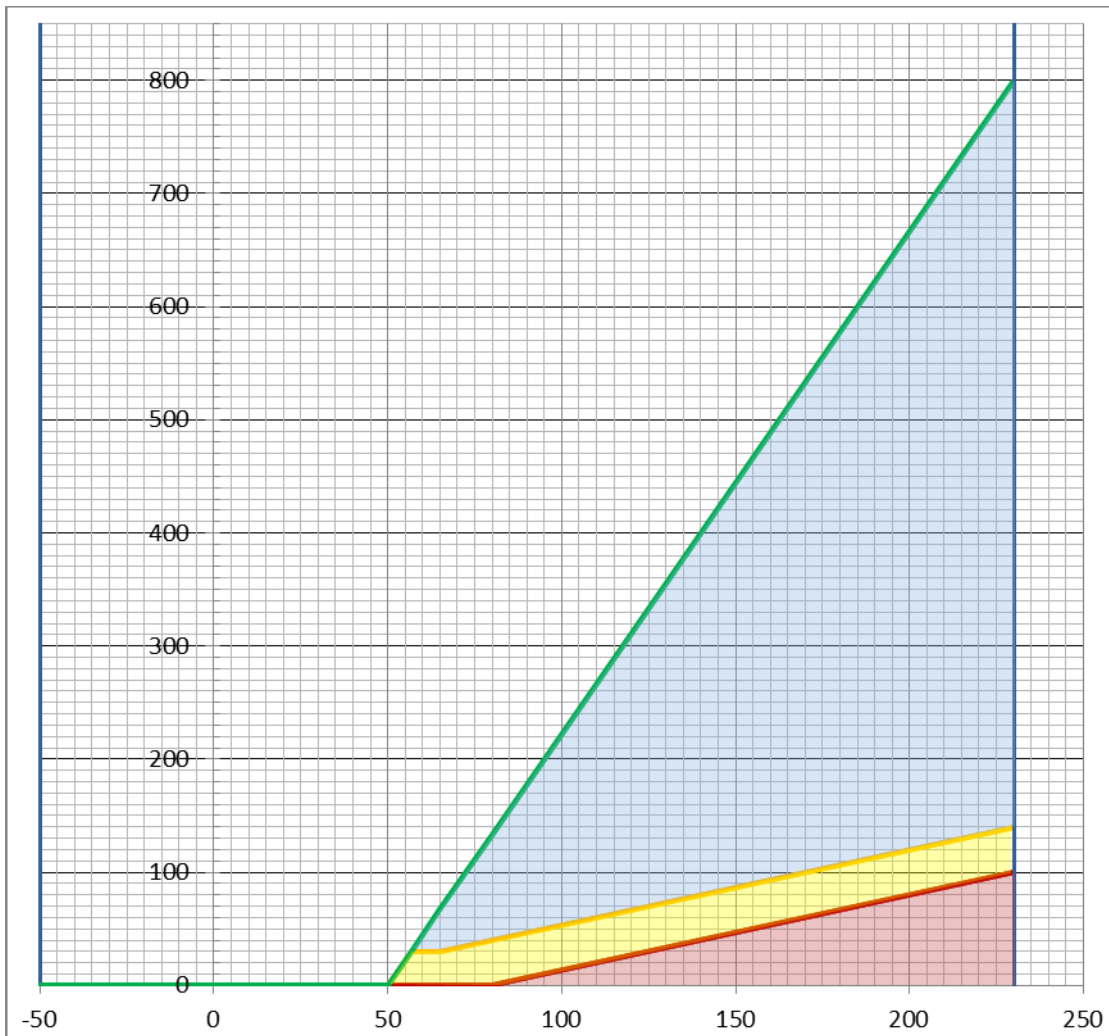
Meets the requirements of FDA 21 CFR 178.3570 concerning the use of lubricants with incidental contact with food and is H1 registered.

### Technical Data

Density	0.83 g/cm <sup>3</sup>	
Viscosity (at 40 °C)	31 mm <sup>2</sup> /s	
t <sub>min</sub>	-50 °C	minimum perm. temperature of pressure transmission fluid
t <sub>max</sub>	230 °C	maximum perm. temperature of pressure transmission fluid

### Data for pressure / temperature chart

t <sub>1</sub>	50 °C	max. temperature with vacuum + standard service
t <sub>2</sub>	65 °C	Intersection of vacuum and negative pressure service limit at 30 mbar abs
t <sub>3</sub>	80 °C	max. temperature with vacuum + vacuum service
p <sub>1</sub>	800 mbar abs	min. pressure at t <sub>max</sub> and standard service
p <sub>2</sub>	140 mbar abs	min. pressure at t <sub>max</sub> and negative pressure service
p <sub>3</sub>	100 mbar abs	min. pressure at t <sub>max</sub> and vacuum service



Data applies only if installed correctly for operation under vacuum (diaphragm seal above measuring instrument)!

## 3.2 High-temperature oil FV3H

### Properties/Applications

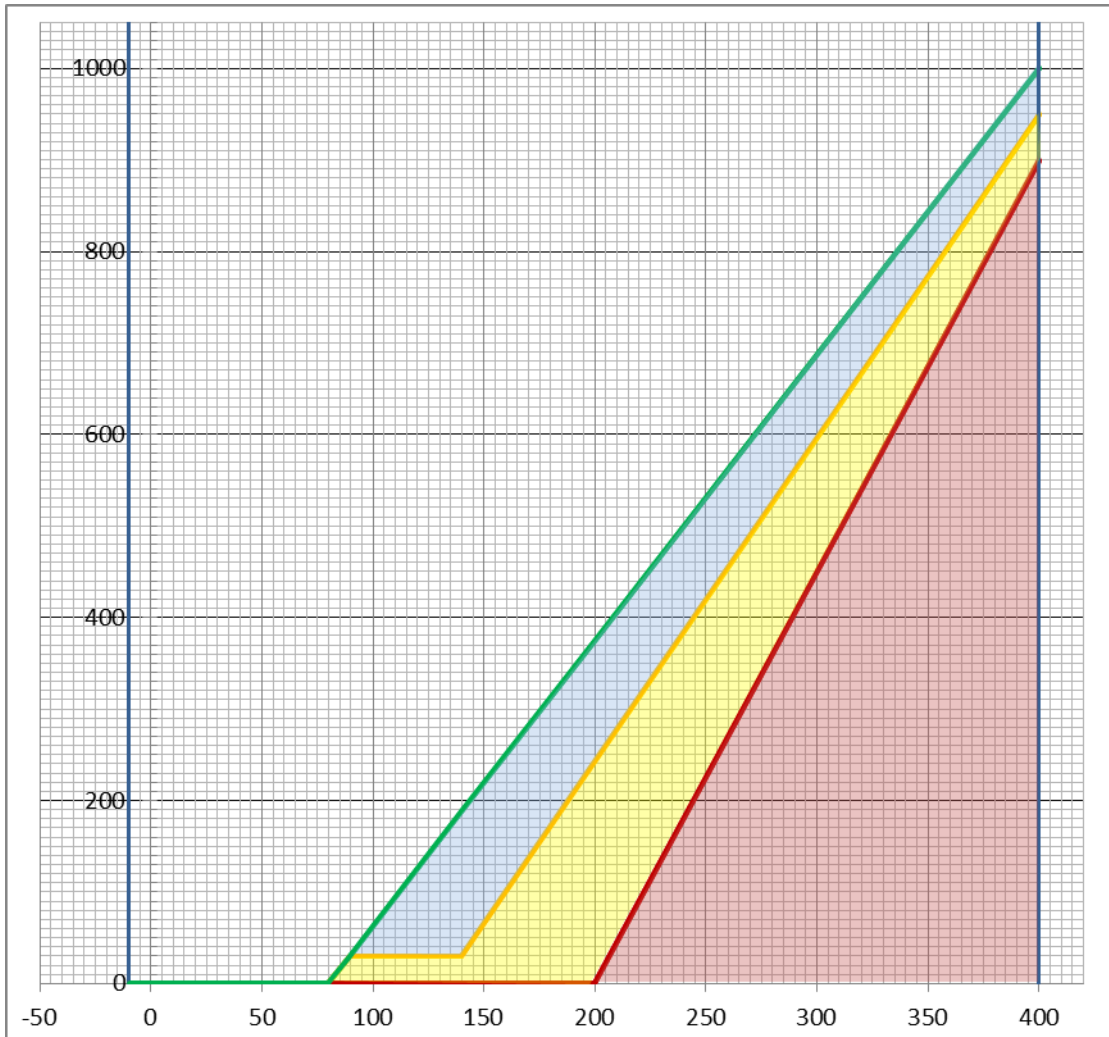
Silicone-free mineral oil especially suitable with high temperatures and vacuum applications under temperature.

### Technical Data

Density		0.87 g/cm <sup>3</sup>
Viscosity (at 40 °C) <sup>^</sup>		94 mm <sup>2</sup> /s
t <sub>min</sub>	-10 °C	minimum perm. temperature of pressure transmission fluid
t <sub>max</sub>	400 °C	maximum perm. temperature of pressure transmission fluid

### Data for pressure / temperature chart

t <sub>1</sub>	80 °C	max. temperature with vacuum + standard service
t <sub>2</sub>	140 °C	Intersection of vacuum and negative pressure service limit at 30 mbar abs
t <sub>3</sub>	200 °C	max. temperature with vacuum + vacuum service
p <sub>1</sub>	1000 mbar abs	min. pressure at t <sub>max</sub> and standard service
p <sub>2</sub>	950 mbar abs	min. pressure at t <sub>max</sub> and negative pressure service
p <sub>3</sub>	900 mbar abs	min. pressure at t <sub>max</sub> and vacuum service



Data applies only if installed correctly for operation under vacuum (diaphragm seal above measuring instrument)!

### 3.3 Halocarbon oil FC

#### Properties/Applications

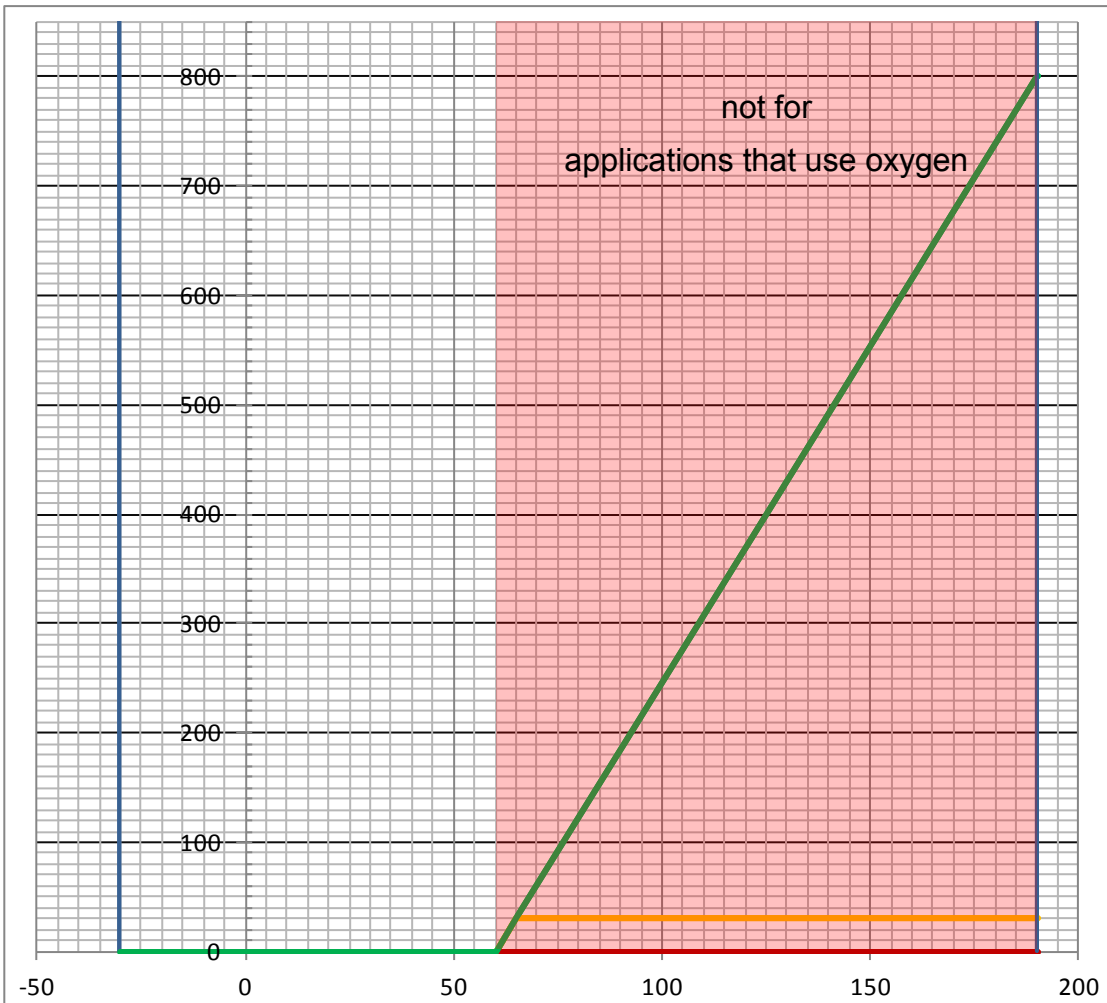
Inert, silicone-free halocarbon oil, especially suitable for applications that use oxygen. BAM approval up to 60°C at 80 bar obtained.

#### Technical Data

Density	1.92 g/cm <sup>3</sup>	
Viscosity (at 40 °C)	56 mm <sup>2</sup> /s	
t <sub>min</sub>	-30 °C	minimum perm. temperature of pressure transmission fluid
t <sub>max</sub>	60 °C	maximum perm. temperature with applications that use oxygen
t <sub>max</sub>	190 °C	maximum perm. temperature with applications that use oxygen

#### Data for pressure / temperature chart

t <sub>1</sub>	60 °C	max. temperature with vacuum + standard service
t <sub>2</sub>	n/a	
t <sub>3</sub>	190 °C	max. temperature with vacuum + vacuum service
p <sub>1</sub>	800 mbar abs	min. pressure at t <sub>max</sub> and standard service
p <sub>2</sub>	30 mbar abs	min. pressure at t <sub>max</sub> and negative pressure service
p <sub>3</sub>	0 mbar abs	min. pressure at t <sub>max</sub> and vacuum service



Data applies only if installed correctly for operation under vacuum (diaphragm seal above measuring instrument)!

### 3.4 Silicone oil FM50

#### Properties/Applications

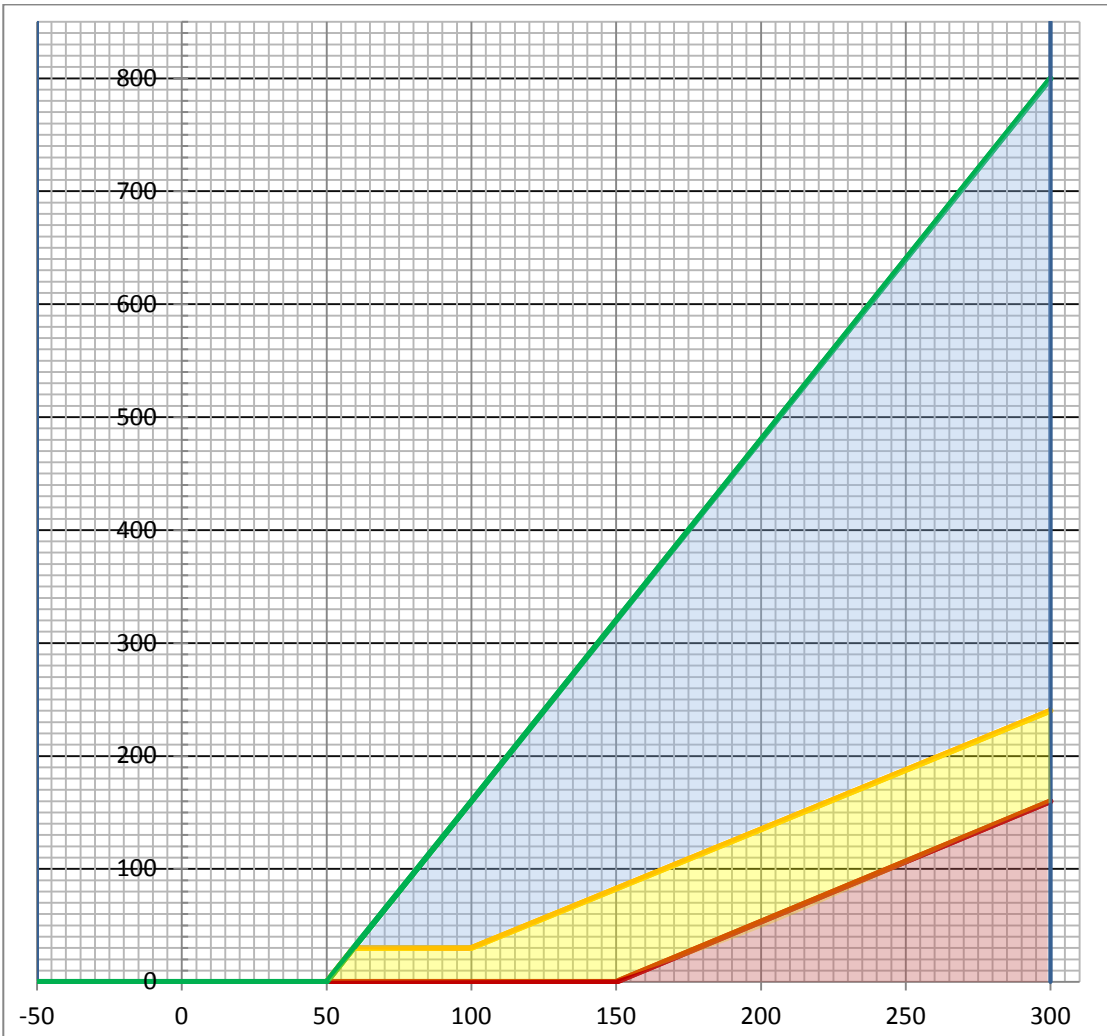
All-purpose silicone oil. Alternative to FD1 if enhanced suitability for high temperatures is required.

#### Technical Data

Density	0.96 g/cm <sup>3</sup>	
Viscosity (at 25 °C)	50 mm <sup>2</sup> /s	
t <sub>min</sub>	-50 °C	minimum perm. temperature of pressure transmission fluid
t <sub>max</sub>	300 °C	maximum perm. temperature of pressure transmission fluid

#### Data for pressure / temperature chart

t <sub>1</sub>	50 °C	max. temperature with vacuum + standard service
t <sub>2</sub>	100 °C	Intersection of vacuum and negative pressure service limit at 30 mbar abs
t <sub>3</sub>	150 °C	max. temperature with vacuum + vacuum service
p <sub>1</sub>	800 mbar abs	min. pressure at t <sub>max</sub> and standard service
p <sub>2</sub>	240 mbar abs	min. pressure at t <sub>max</sub> and negative pressure service
p <sub>3</sub>	160 mbar abs	min. pressure at t <sub>max</sub> and vacuum service



Data applies only if installed correctly for operation under vacuum (diaphragm seal above measuring instrument)!

### 3.5 Low-temperature oil FM5

#### Properties/Applications

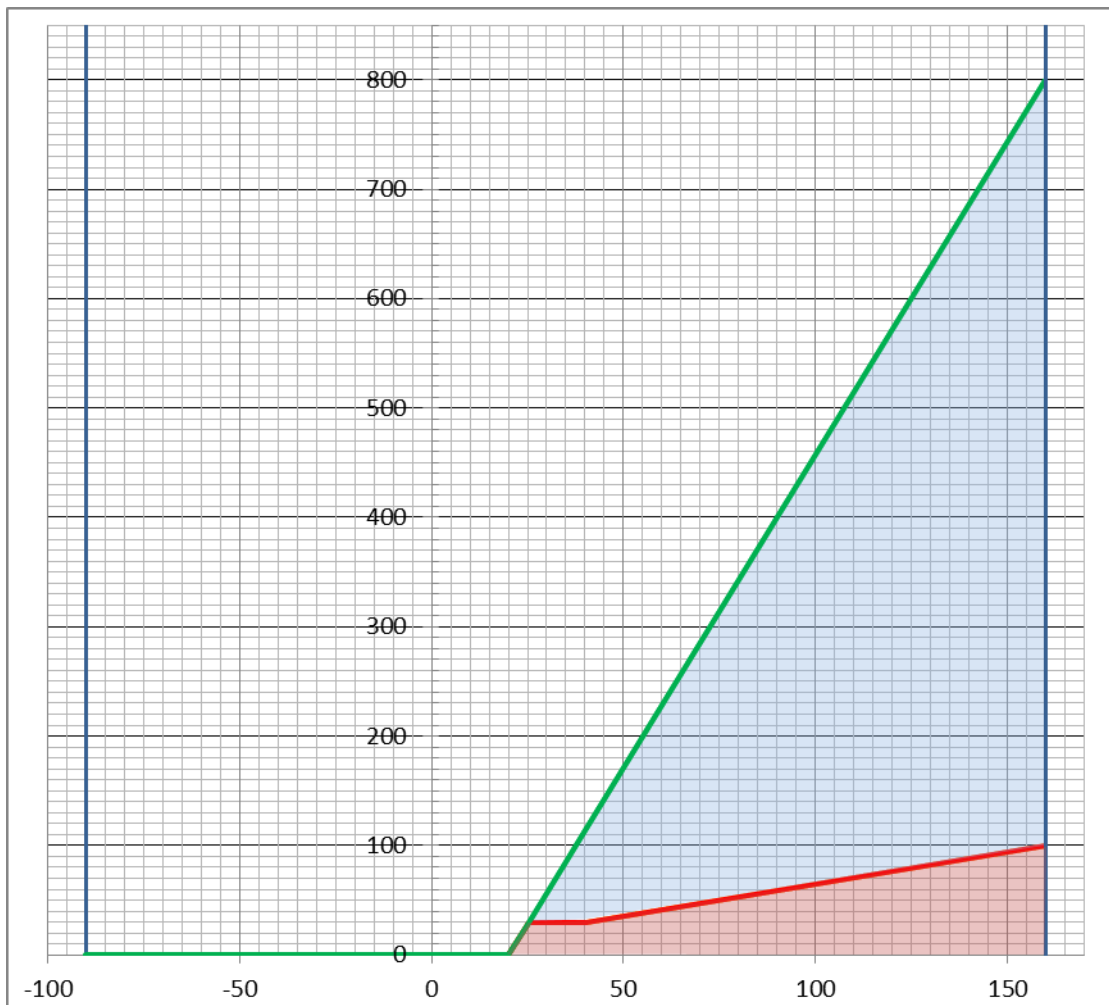
Low-viscosity silicone oil, especially suitable for low temperatures down to -90 °C.  
No vacuum service is offered for this oil.

#### Technical Data

Density		0.92 g/cm <sup>3</sup>
Viscosity (at 25 °C)		5 mm <sup>2</sup> /s
t <sub>min</sub>	-90 °C	minimum perm. temperature of pressure transmission fluid
t <sub>max</sub>	160 °C	maximum perm. temperature of pressure transmission fluid

#### Data for pressure / temperature chart

t <sub>1</sub>	20 °C	max. temperature with vacuum + standard service
t <sub>2</sub>	40 °C	Intersection of vacuum and negative pressure service limit at 30 mbar abs
t <sub>3</sub>	n/a	
p <sub>1</sub>	800 mbar abs	min. pressure at t <sub>max</sub> and standard service
p <sub>2</sub>	100 mbar abs	min. pressure at t <sub>max</sub> and negative pressure service
p <sub>3</sub>	n/a	



Data applies only if installed correctly for operation under vacuum (diaphragm seal above measuring instrument)!

### 3.6 Medical white oil FW

#### Properties/Applications

Medical white oil (highly liquid paraffin) can be used as an alternative to FD1. However, the temperature limits are worse than with FD1. No negative pressure or vacuum service is available either.

#### Technical Data

Density		0.85 g/cm <sup>3</sup>
Viscosity (at 40 °C)		43 mm <sup>2</sup> /s
t <sub>min</sub>	-10 °C	minimum perm. temperature of pressure transmission fluid
t <sub>max</sub>	170 °C	maximum perm. temperature of pressure transmission fluid

#### Data for pressure / temperature chart

t <sub>1</sub>	50 °C	max. temperature with vacuum + standard service
t <sub>2</sub>		n/a
t <sub>3</sub>		n/a
p <sub>1</sub>	800 mbar abs	min. pressure at t <sub>max</sub> and standard service
p <sub>2</sub>		n/a
p <sub>3</sub>		n/a



Data applies only if installed correctly for operation under vacuum (diaphragm seal above measuring instrument)!



### 3.7 Glycerine/water mixture FGW

#### Properties/Applications

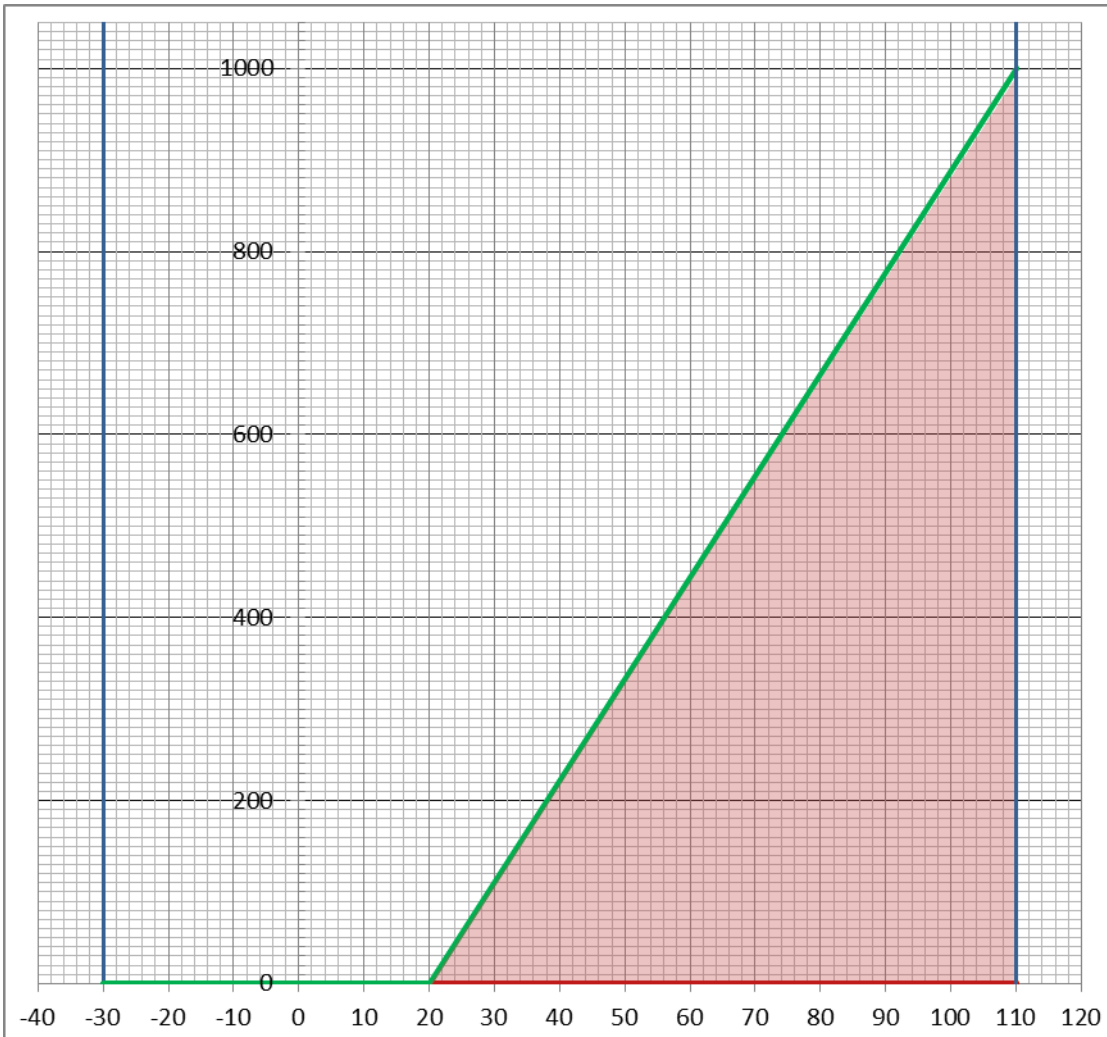
Glycerine/water mixtures have good physical properties (very low compressibility, low thermal expansion and viscosity). However, the temperature range ends at 110 °C.

#### Technical Data

Density	1.18 g/cm <sup>3</sup>	
Viscosity (at 40 °C)	8 mm <sup>2</sup> /s	
t <sub>min</sub>	-30 °C	minimum perm. temperature of pressure transmission fluid
t <sub>max</sub>	110 °C	maximum perm. temperature of pressure transmission fluid

#### Data for pressure / temperature chart

t <sub>1</sub>	20 °C	max. temperature with vacuum + standard service
t <sub>2</sub>		n/a
t <sub>3</sub>		n/a
p <sub>1</sub>	1000 mbar abs	min. pressure at t <sub>max</sub> and standard service
p <sub>2</sub>		n/a
p <sub>3</sub>		n/a



Data applies only if installed correctly for operation under vacuum (diaphragm seal above measuring instrument)!

### 3.8 Alcohol/water mixture FAW

#### Properties/Applications

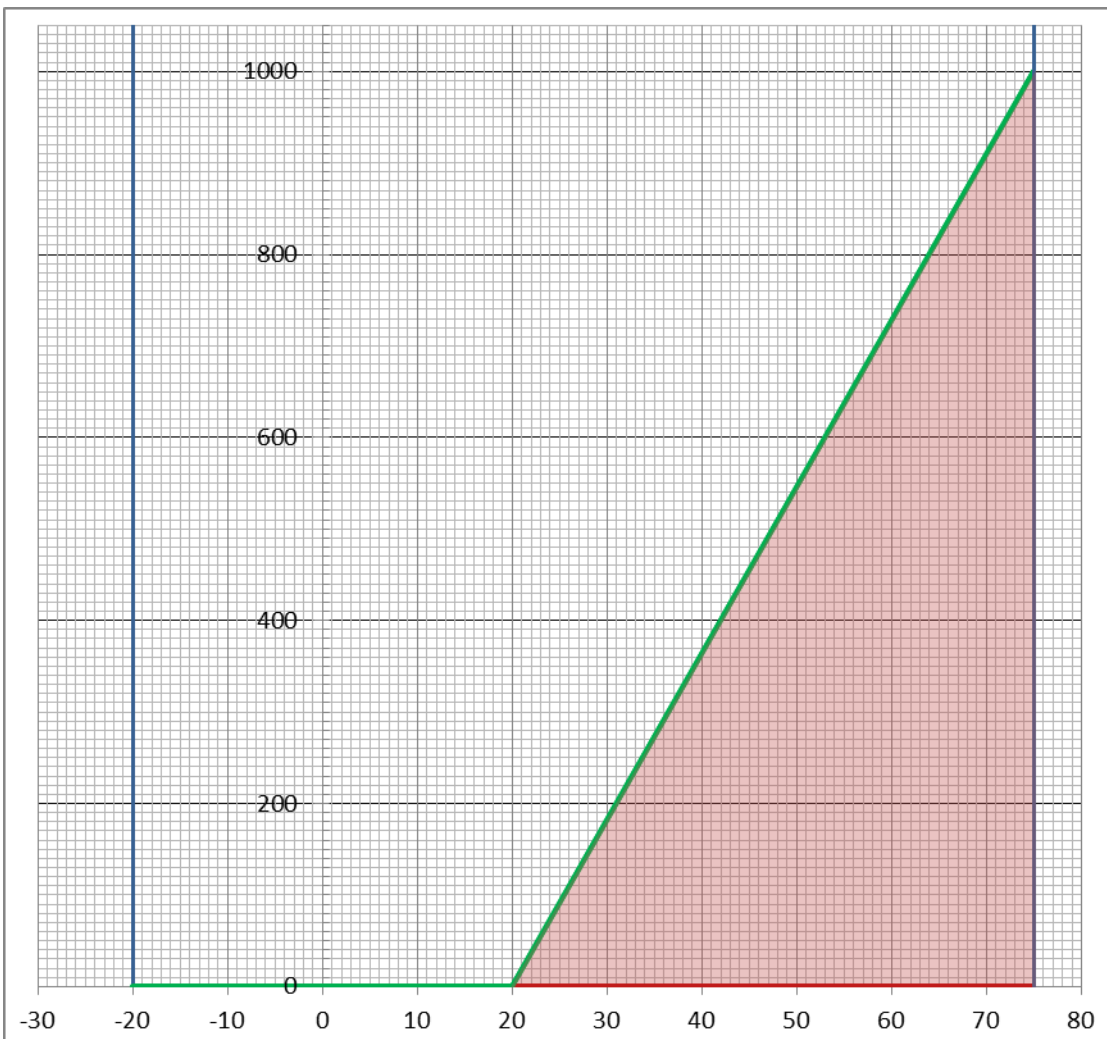
Alcohol/water mixtures are mainly used in the paint industry, as, in the event of a malfunction, paint wetting problems can be ruled out. Adding alcohol improves the lower temperature limit.

#### Technical Data

Density		0.95 g/cm <sup>3</sup>
Viscosity (at 40 °C)		1.8 mm <sup>2</sup> /s
t <sub>min</sub>	-20 °C	minimum perm. temperature of pressure transmission fluid
t <sub>max</sub>	75 °C	maximum perm. temperature of pressure transmission fluid

#### Data for pressure / temperature chart

t <sub>1</sub>	20 °C	max. temperature with vacuum + standard service
t <sub>2</sub>		n/a
t <sub>3</sub>		n/a
p <sub>1</sub>	1000 mbar abs	min. pressure at t <sub>max</sub> and standard service
p <sub>2</sub>		n/a
p <sub>3</sub>		n/a



Data applies only if installed correctly for operation under vacuum (diaphragm seal above measuring instrument)!

## 3.9 Liquid metal FMH1

### Properties/Applications

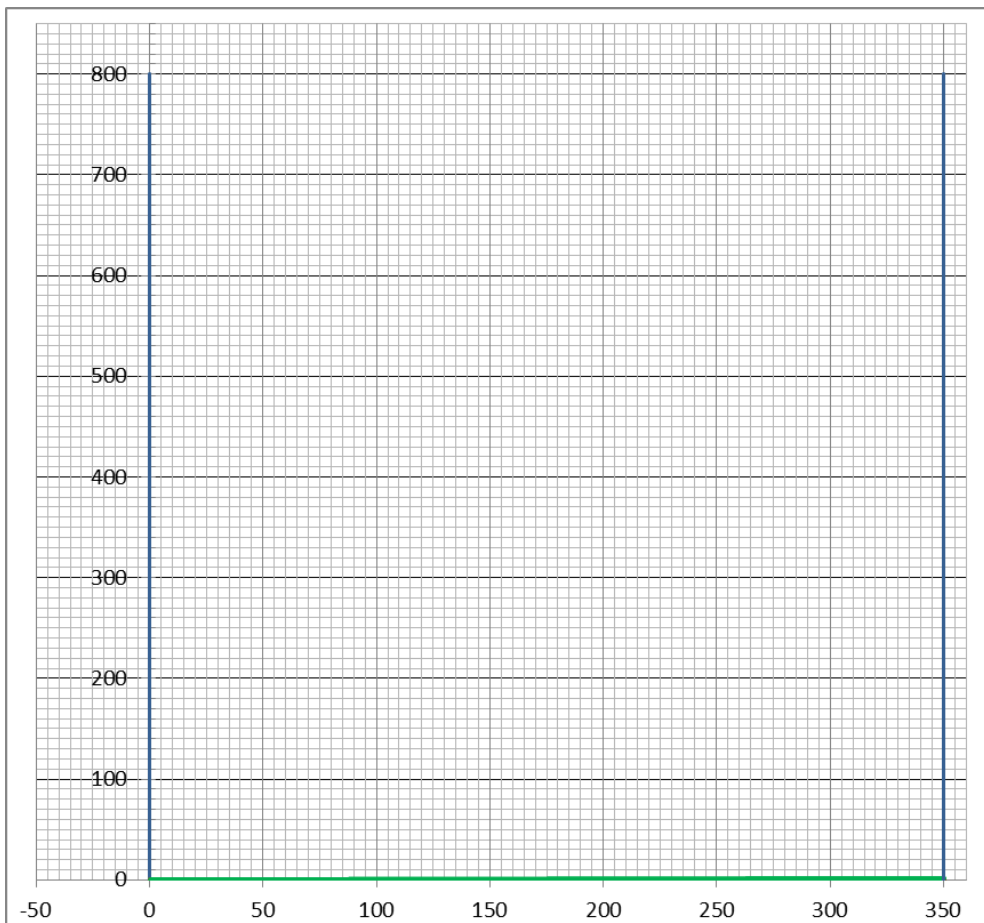
This special metal alloy is liquid at room temperature. Thermal expansion and compressibility are minimal. This liquid is vacuum-resistant without special treatment up to a maximum temperature, although the measuring instrument can be destroyed below 0 °C.

### Technical Data

Density		6.44 g/cm <sup>3</sup>
Viscosity (at 40 °C)		1.8 mm <sup>2</sup> /s
t <sub>min</sub>	0 °C	minimum perm. temperature of pressure transmission fluid
t <sub>max</sub>	350 °C	maximum perm. temperature of pressure transmission fluid

### Data for pressure / temperature chart

t <sub>1</sub>	20 °C	max. temperature with vacuum + standard service
t <sub>2</sub>		n/a
t <sub>3</sub>		n/a
p <sub>1</sub>	0 mbar abs	min. pressure at t <sub>max</sub> and standard service
p <sub>2</sub>		n/a
p <sub>3</sub>		n/a



Data applies only if installed correctly for operation under vacuum (diaphragm seal above measuring instrument)!