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## 1 General

Pressure transmission fluids are used to transfer the process pressure from the diaphragm 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.

LABOM pressure transmission fluids can be used in vacuum conditions up to a process 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 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  $t_1$  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.

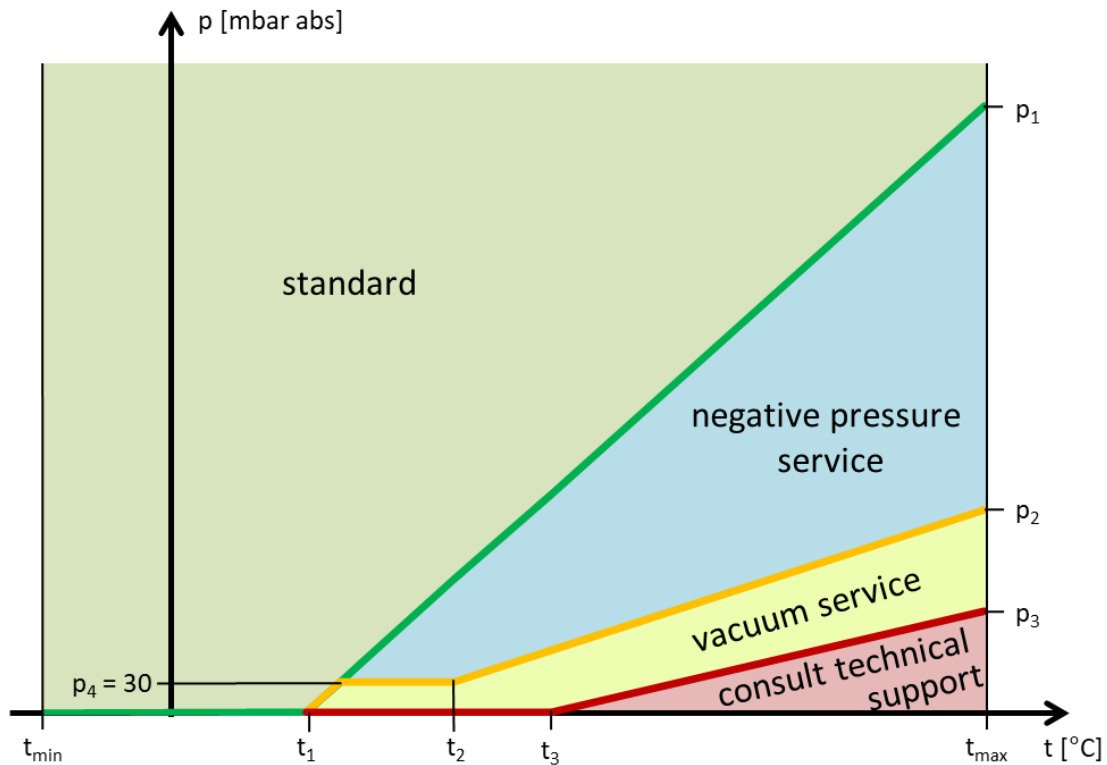


Fig. 1 Zones in the pressure/temperature chart

### 3 Technical data of fluids

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

| Code | Description/Application                               | Type                        | $t_{min}$ [°C] | $t_{max}$ [°C] | density [g/cm <sup>3</sup> ] | kin. viscosity @ 40°C [mm <sup>2</sup> /s] | Tk [%/10K] | compressibility [%/100 bar] |
|------|---|-----------------------------|----------------|----------------|------------------------------|--|------------|-----------------------------|
| FD1  | silicon-free oil suitable for food stuff applications | polyalphaolefine oil        | -40            | 230            | 0,82                         | 31   | 0,76       | 0,6                         |
| FV3H | vacuum and high temperature oil                       | highly refined mineral oil  | -10            | 400            | 0,87                         | 95   | 0,73       | 1                           |
| FC   | Halocarbon oil for oxygen applications                | halogenated carbon chains   | -30            | 190            | 1,92                         | 56   | 0,9        | 0,73                        |
| FM50 | silicone oil M50                                      | high viscosity silicone oil | -50            | 300            | 0,96                         | 40   | 0,95       | 1,02                        |
| FM5  | low temperature silicone oil M5                       | low viscosity silicone oil  | -90            | 160            | 0,92                         | 4  | 1,08       | 1,2                         |
| FW   | white oil for food stuff applications                 | low viscosity paraffin      | -10            | 170            | 0,85                         | 43   | 0,76       | 0,6                         |
| FGW  | glycerine/water mixture                               | glycerine/water 70/30       | -30            | 110            | 1,18                         | 8  | 0,57       | 0,29                        |
| FAW  | alcohol/water mixture for the paint industry          | isopropanol/water 40/60     | -20            | 75             | 0,95                         | 1,9  | 0,52       | 0,81                        |
| FMH1 | 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.

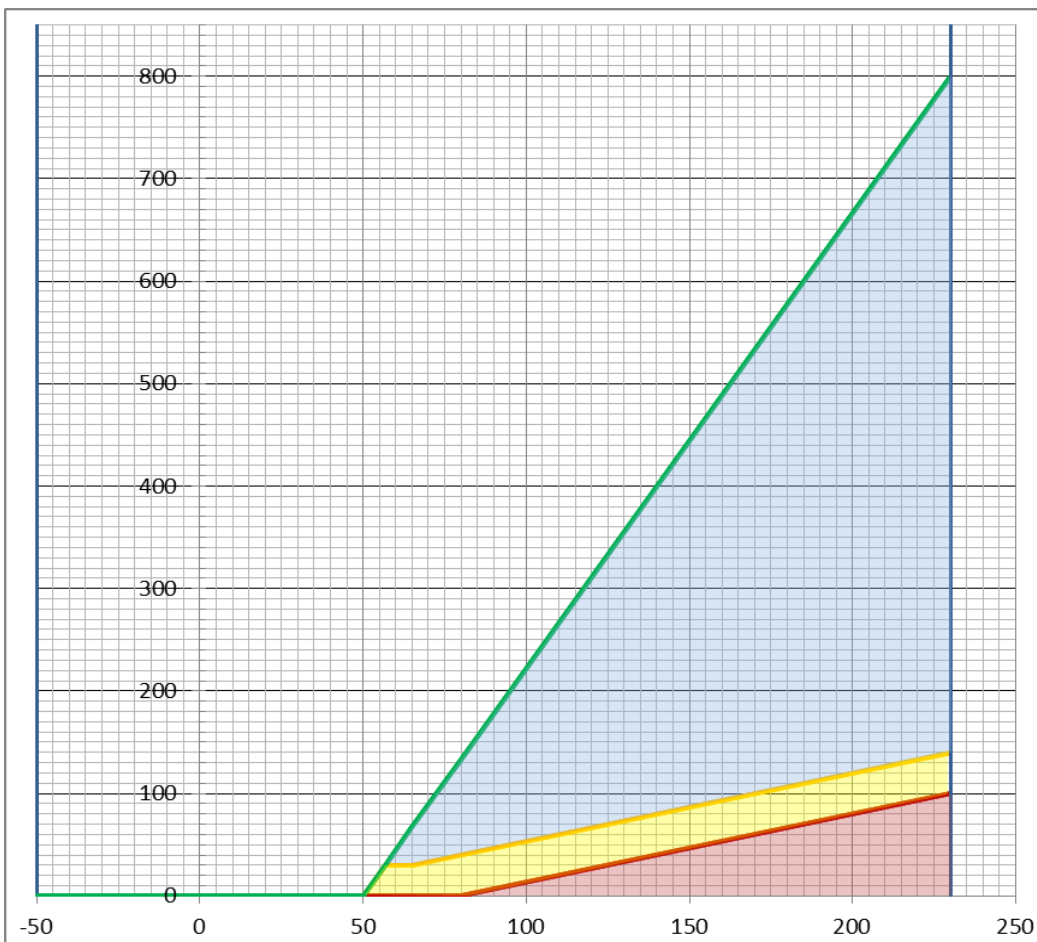
Meets the requirements of FDA 21 CFR 178.3570 concerning the use of lubricants with incidental contact with food and is H1 registered.

#### Technical Data

|                      |        |                        |
|----------------------|--------|------------------------|
| Density              |        | 0.82 g/cm <sup>3</sup> |
| Viscosity (at 40 °C) |        | 31 mm <sup>2</sup> /s  |
| t <sub>min</sub>     | -40 °C | minimum temperature    |
| t <sub>max</sub>     | 230 °C | maximum temperature    |

#### 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

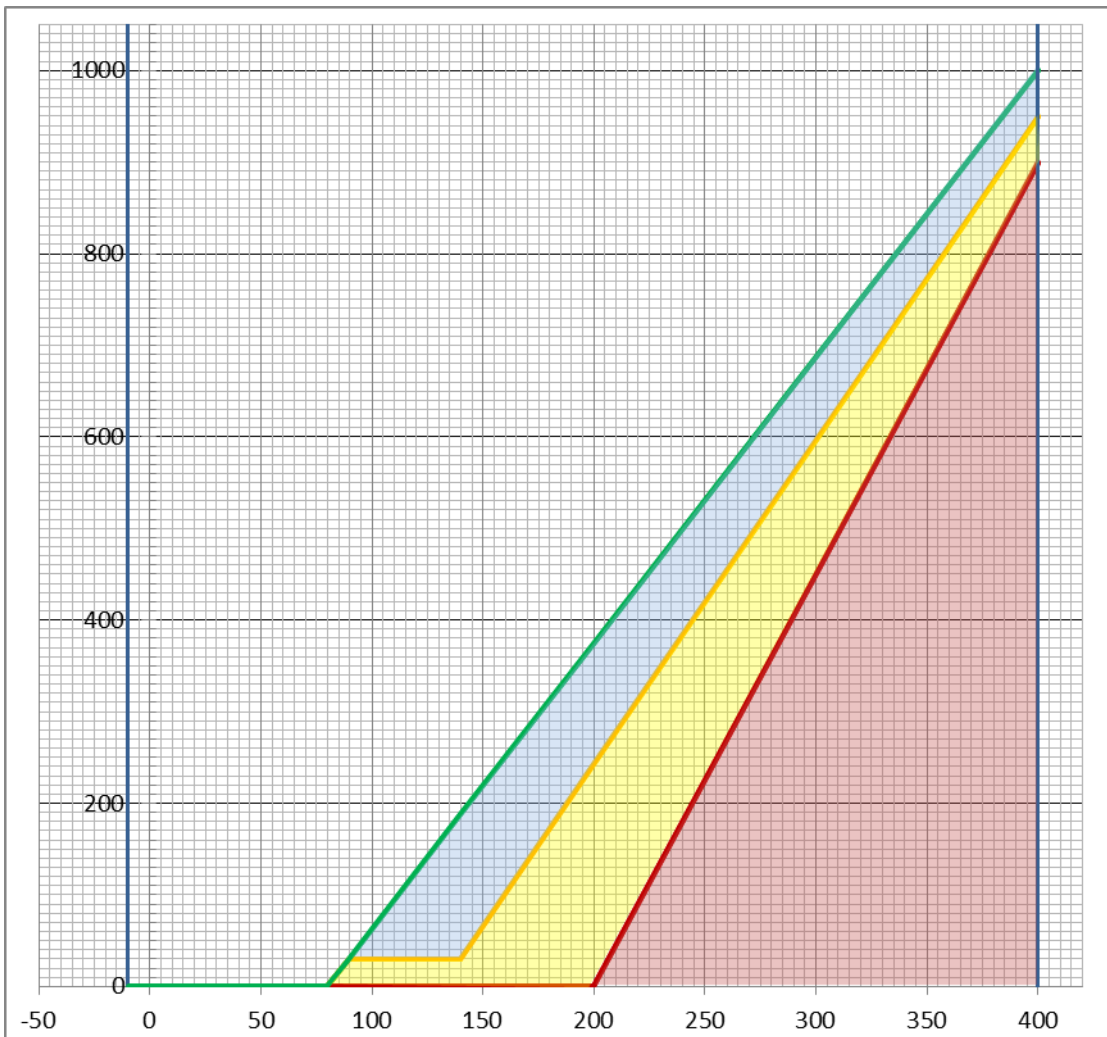
Silicone-free mineral oil especially suitable for high temperatures and vacuum applications under temperature.

### Technical Data

|                      |                        |                     |
|----------------------|------------------------|---------------------|
| Density              | 0.87 g/cm <sup>3</sup> |                     |
| Viscosity (at 40 °C) | 94 mm <sup>2</sup> /s  |                     |
| t <sub>min</sub>     | -10 °C                 | minimum temperature |
| t <sub>max</sub>     | 400 °C                 | maximum temperature |

### 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

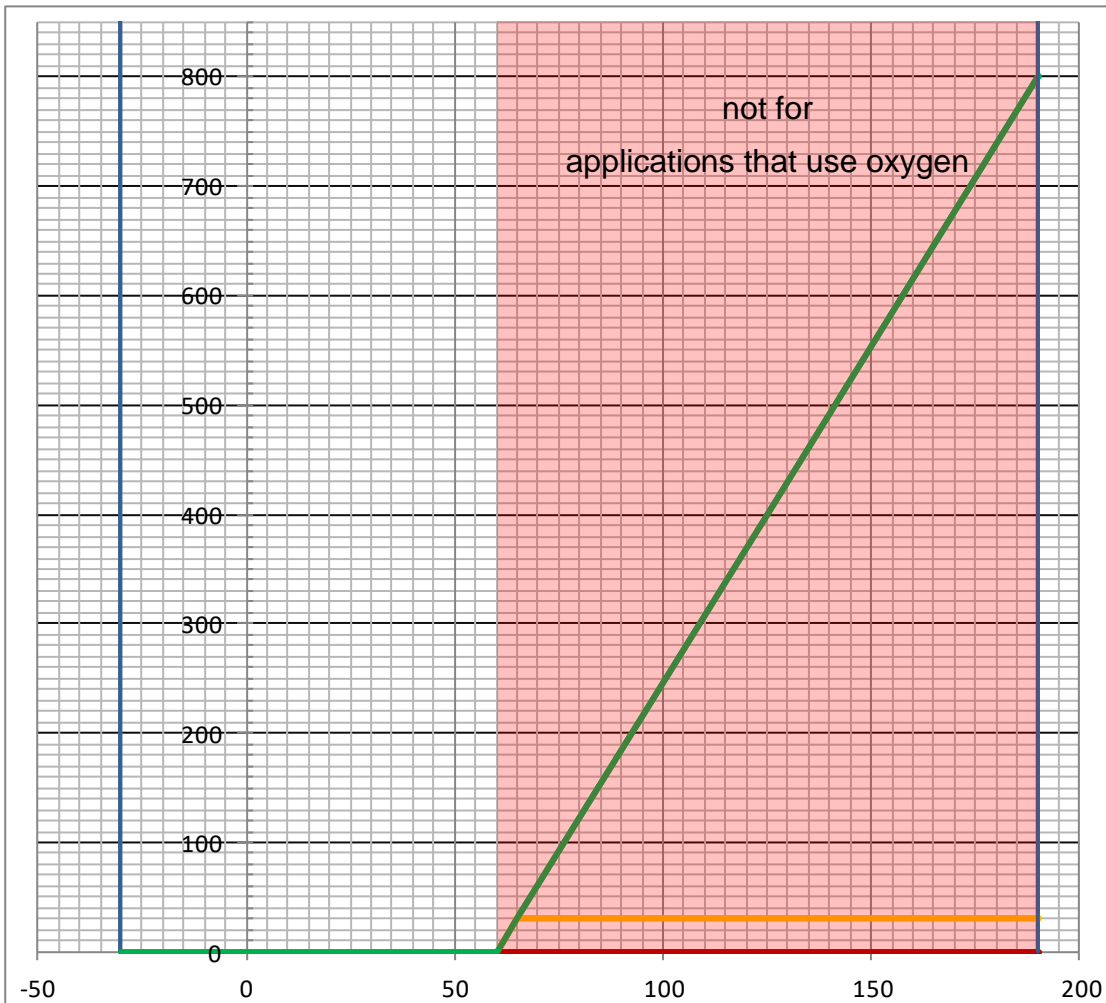
Inert, silicone-free halocarbon oil, especially suitable for applications that use oxygen.  
BAM approval up to 60°C at 80 bar.

#### 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 temperature                                  |
| t <sub>max</sub>     | 60 °C  | maximum temperature for applications that use oxygen |
| t <sub>max</sub>     | 190 °C | maximum temperature for other applications           |

#### 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

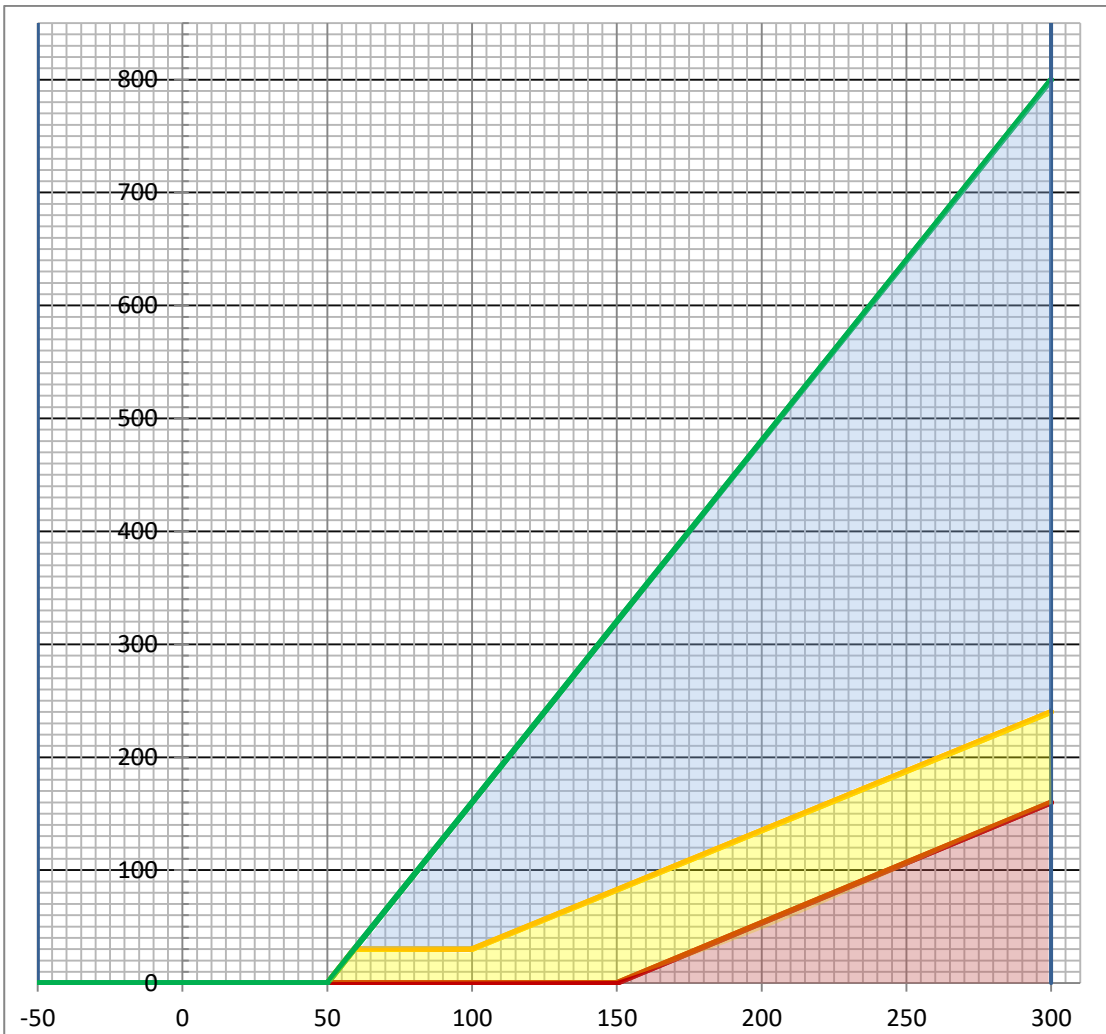
All-purpose silicone oil. Alternative to FD1 if extended temperature range is required.

#### 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 temperature    |
| t <sub>max</sub>     | 300 °C | maximum temperature    |

#### 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.

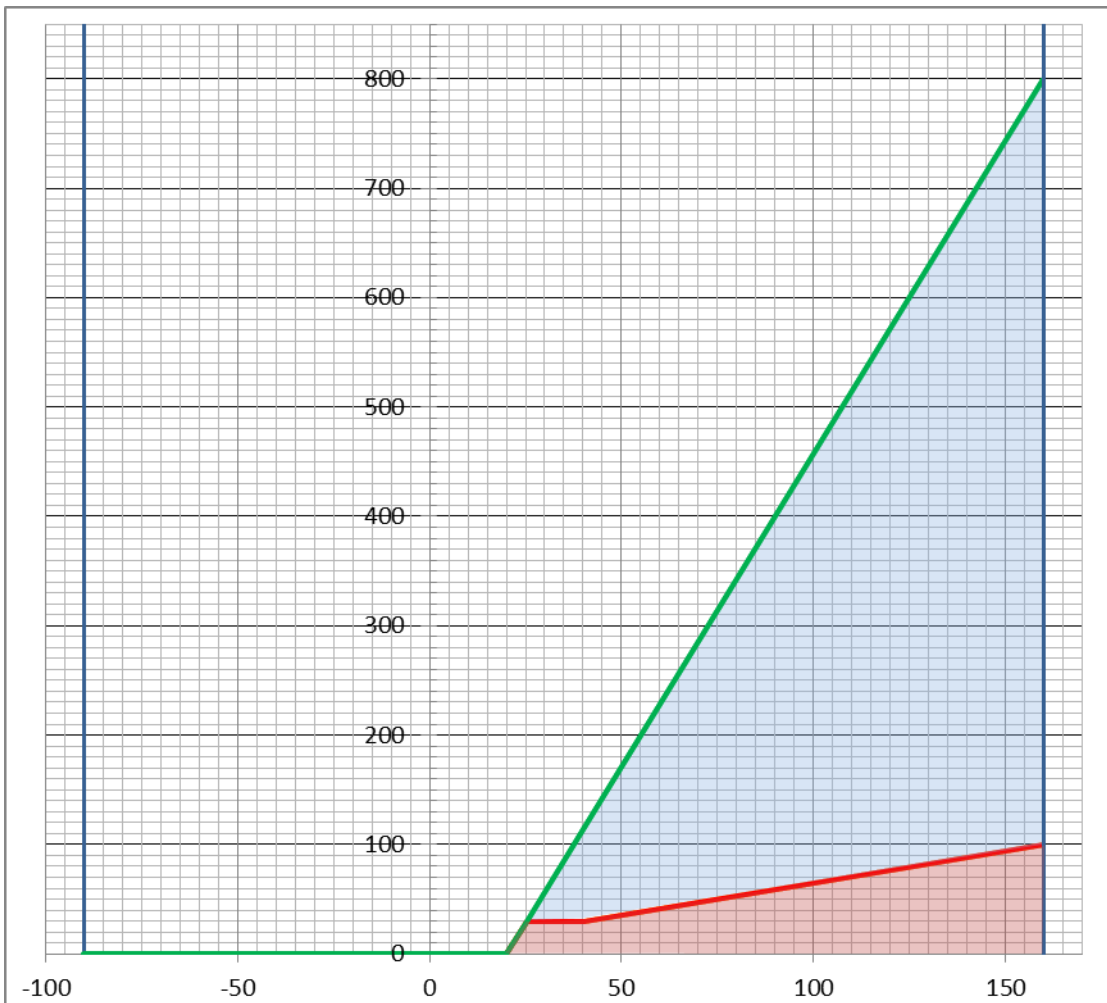
No vacuum service is offered for this oil.

#### 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 temperature    |
| t <sub>max</sub>     | 160 °C | maximum temperature    |

#### 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 temperature    |
| t <sub>max</sub>     | 170 °C | maximum temperature    |

#### 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

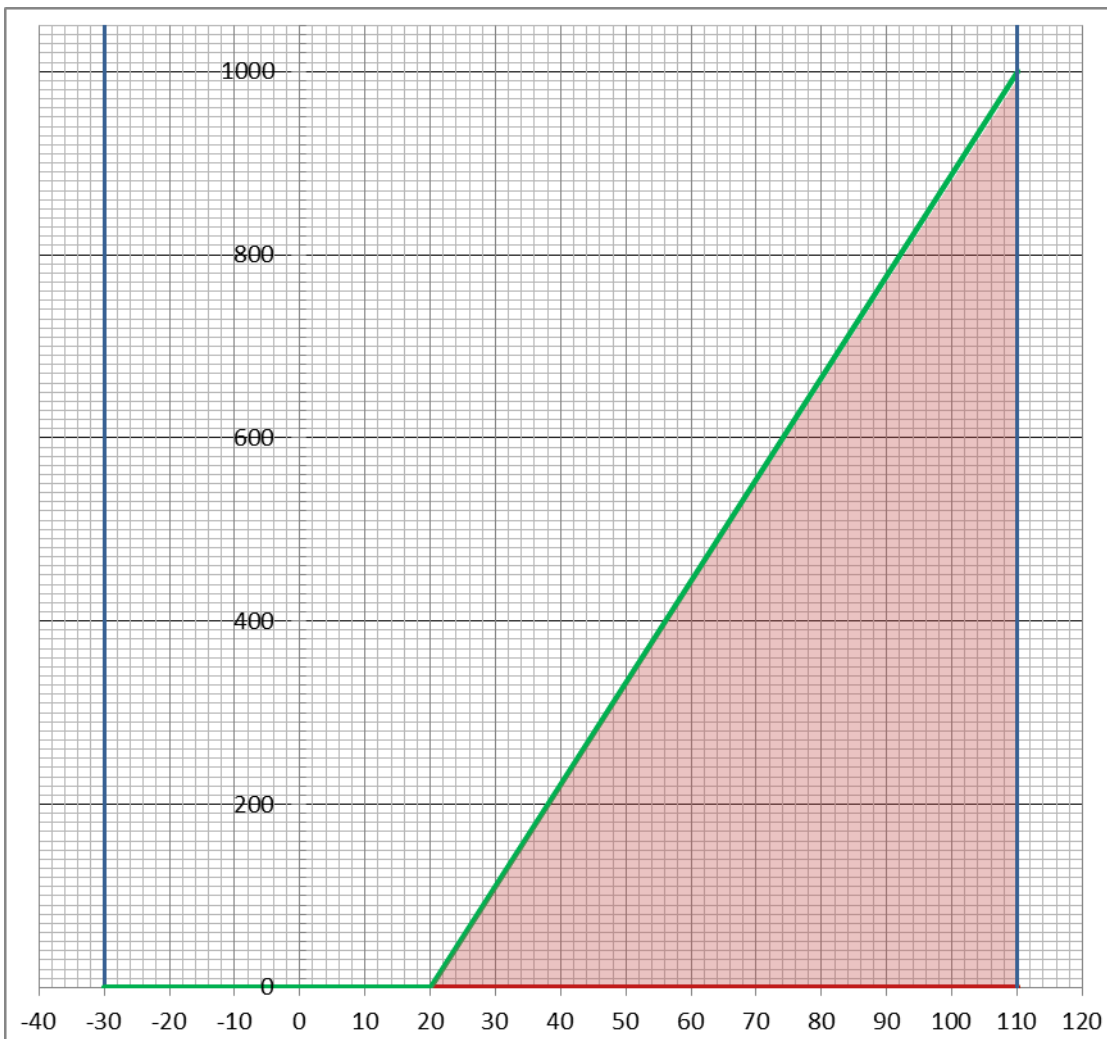
Glycerine/water mixtures have good physical properties (very low compressibility, low thermal expansion and viscosity). However, the temperature range ends at 110 °C.

#### 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 temperature    |
| t <sub>max</sub>     | 110 °C | maximum temperature    |

#### 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 temperature    |
| t <sub>max</sub>     | 75 °C  | maximum temperature    |

#### 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

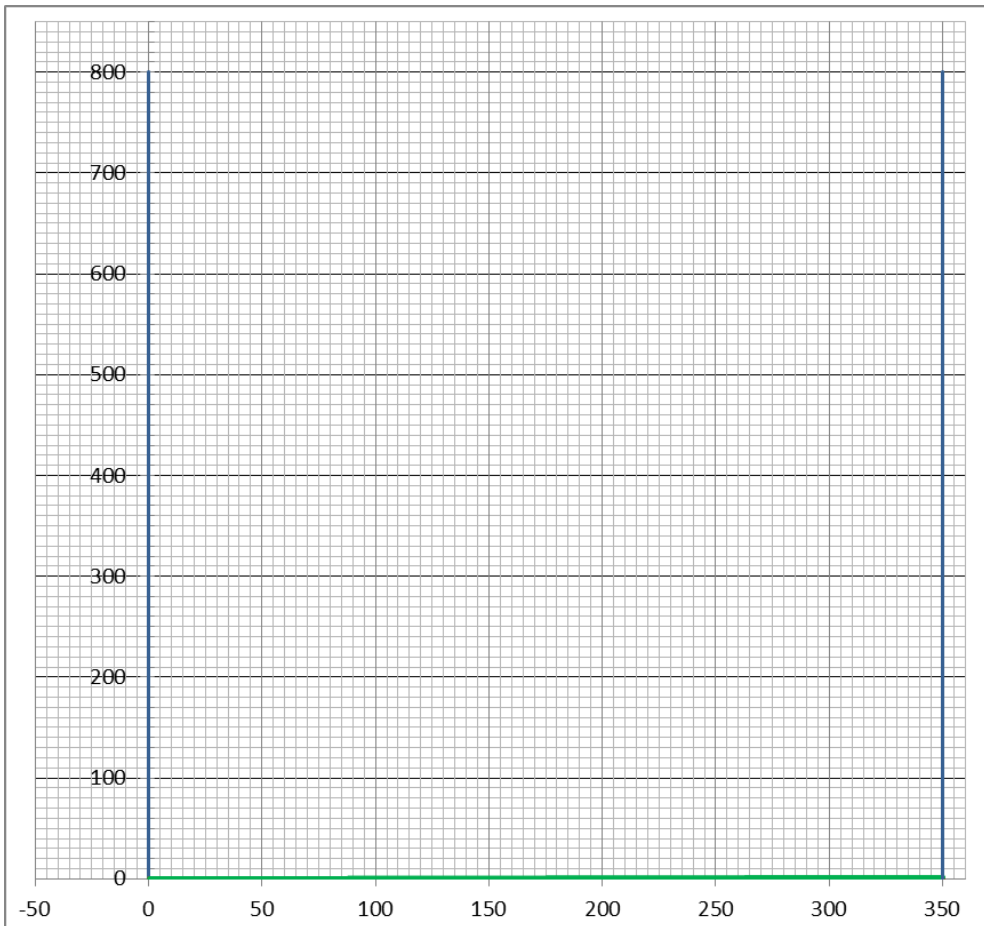
This special metal alloy is liquid at room temperature. Thermal expansion and compressibility are minimal. This liquid is vacuum-resistant without special treatment up to a maximum temperature, although the measuring instrument can be destroyed below 0 °C.

#### 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 temperature    |
| t <sub>max</sub>     | 350 °C | maximum temperature    |

#### 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)!