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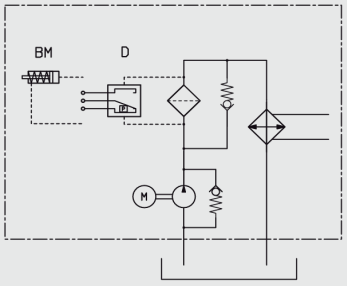
Pump-Transfer Cooler Filtration Unit
UKF

Symbol



General

The UKF unit is a compact, easy-to-install system for offline filtration cooling circuits. It consists of a low-noise feed pump, a filter and a plate heat exchanger.

Product features

Continuous cooling and offline filtration extend the service life of the oil and of the hydraulic system. The offline unit ensures constant oil temperature – regardless of the cycle times of the hydraulic systems. Furthermore, consistent flow rates prevent pressure spikes in the heat exchanger.

Area of application

- Plastic injection moulding machines
- Pressing / Stamping
- Machining centres
- Hydraulic systems
- Gears

Operating data

General	
Ambient temperature	+10 °C to +40 °C
Volumetric efficiency	>90 % at v = 40 mm²/s
Mounting position	UKF-1: Optional, but easier to maintain if filter below pump UKF-2 / UKF-3: vertical
Noise levels	UKF-1: <64 dB(A) at 1,500 1/min
	UKF-2 / UKF-3:

Pump [cm3/rev]	1 bar	6 bar
15	61	61
20	61	61
30	61	62
40	62	63
50	64	66
70	67	68
100	68	70
130	70	72

(Test medium: ISO VG46 at +40 °C)
The noise levels are only a guide as the acoustic properties of a room, connections, viscosity and reflections have an effect on the noise level.

Pump	
Suction pressure across the suction connection	max. -0.4 bar to 0.5 bar
Operating pressure (oil side)	max. 6 bar
Medium (oil side)	Mineral oil to DIN 51524 Part 1 and Part 2
Temperature range (oil side)	+10 °C to +80 °C
Permissible contamination (oil side)	≤NAS12 or ISO4406: 22/21/18
Max. viscosity	see viscosity-temperature graph
Drive	
Motor	Three-phase electric motor Insulation class: F Protection class: IP55
Speed	1,500 / 1,800 1/min (50/60 Hz)
Heat exchanger	
Heat exchanger connections:	Female thread (max. tightening torque 160 Nm) The pipes must be connected so that the connections are stress-free. Linear expansion and vibrations from the pipes to the heat exchanger must be avoided.
Medium (water side):	• Water glycol (HFC) Oils
Temperature range (water side)	+5 °C to +60 °C
Operating pressure (water side):	max. 30 bar
Permissible contamination (water side)	The level of particles in suspension should be less than 10 mg/l. Particle size <0.6 mm (spherical) Thread-like particles cause a rapid increase in pressure losses.
Water quality	The following ions are not corrosive under normal conditions: phosphate, nitrate, nitrite, manganese, sodium and potassium also see table on water quality

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Design

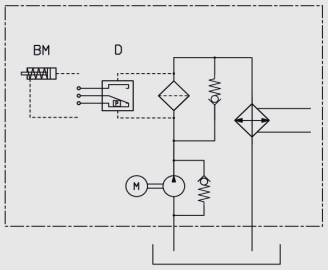
There are different versions possible depending on the requirements:

UF – Feed pump with filter
UK – Feed pump with plate heat exchanger
UKF – Feed pump with filter and plate heat exchanger

Offline unit consisting of:

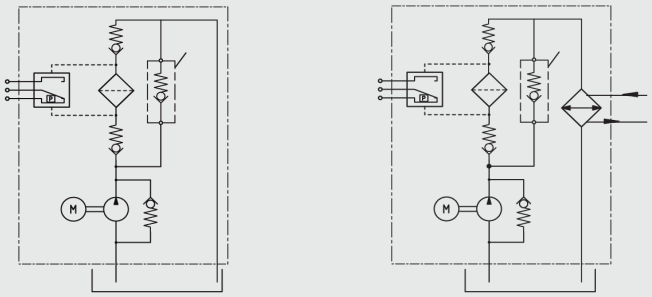
- Low-noise feed pump
- Filter
- Oil-water plate heat exchanger
- The circuit is fitted with check valves to isolate the filter when used with a positive head tank when changing the filter element

UKF-1



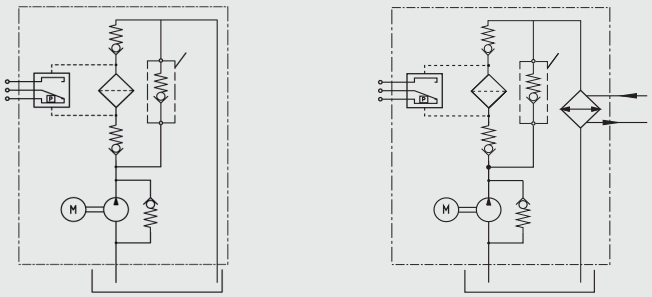
Flow rate:	5 – 15 l/min
Motor rating:	0.37 – 0.55 kW
Cooling capacity*:	up to 10 kW

UKF-2



Flow rate:	15 – 60 l/min
Motor rating:	0.75 – 1.5 kW
Cooling capacity*:	up to 30 kW

UKF-3



Flow rate:	20 – 200 l/min
Motor rating:	1.5 – 4 kW
Cooling capacity*:	up to 90 kW

* Dependent on temperature difference and flow rate of the cold and warm medium (see also “Pump-Transfer Cooler Filtration Unit Selection”).

Water quality

The following limits are based on a water temperature of +60 °C.

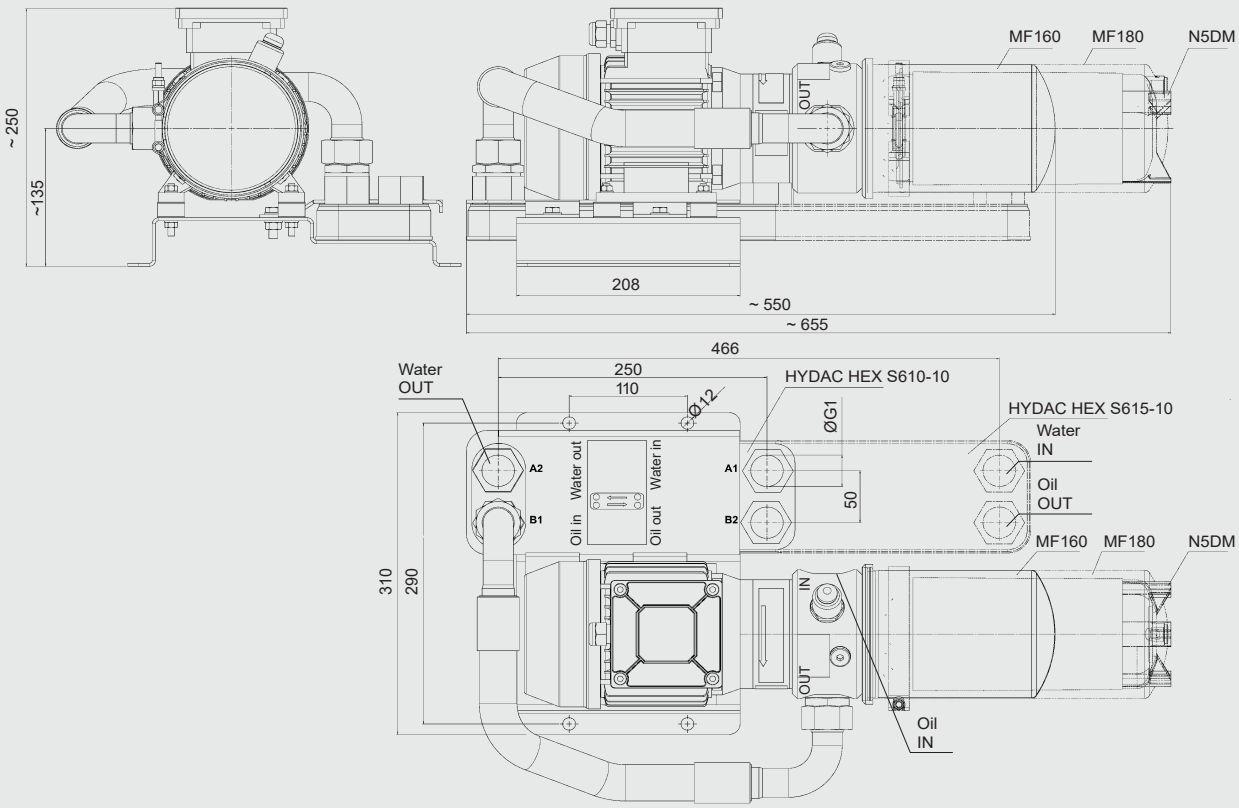
Substances dissolved in water	Concentration	Stainless steel	Copper
pH value	<6.0	0	0
	6.0 – 9.0	0/+	+
	>9.0	+	0
Electrical conductivity	<500 [µ S/cm]	+	+
	>500 [µ S/cm]	+	0
-Cl	<300	+	+
		0	0
SO_{4}^{-2}	<50	+	+
	50 – 300	+	0
	>300	0	0
$CaCO_3$	<50	+	+
	>50	0	0
Fe	<0.3	+	+
	>0.3	+	0
NH_3	<2	+	+
	2 – 20	+	0
	>20	+	0
NO_3	<100	+	+
	>100	+	0
S^{-2}		Not suitable	
SiO_2	<30	+	+
NH_4^+	<0.1	+	+
Free chlorine	<0.1	+	+
CO_3^{-2}	<0.4	+	+

0: Corrosive
+: Suitable

Dimensions / Weight

UKF-1

Clearance for filter element removal approx. 50 mm

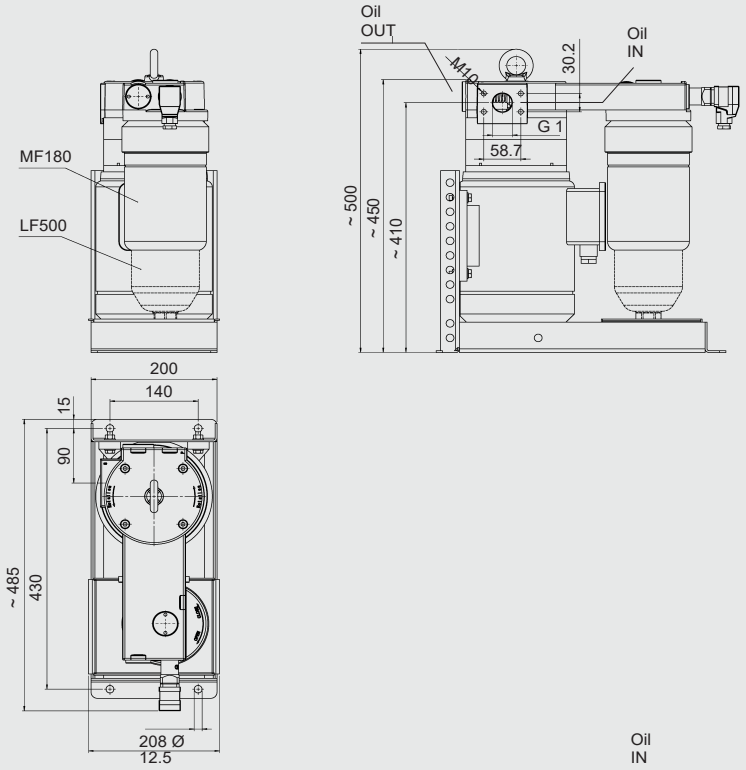


Weight (unfilled)
Basic unit (motor-pump unit + filter) + heat exchanger

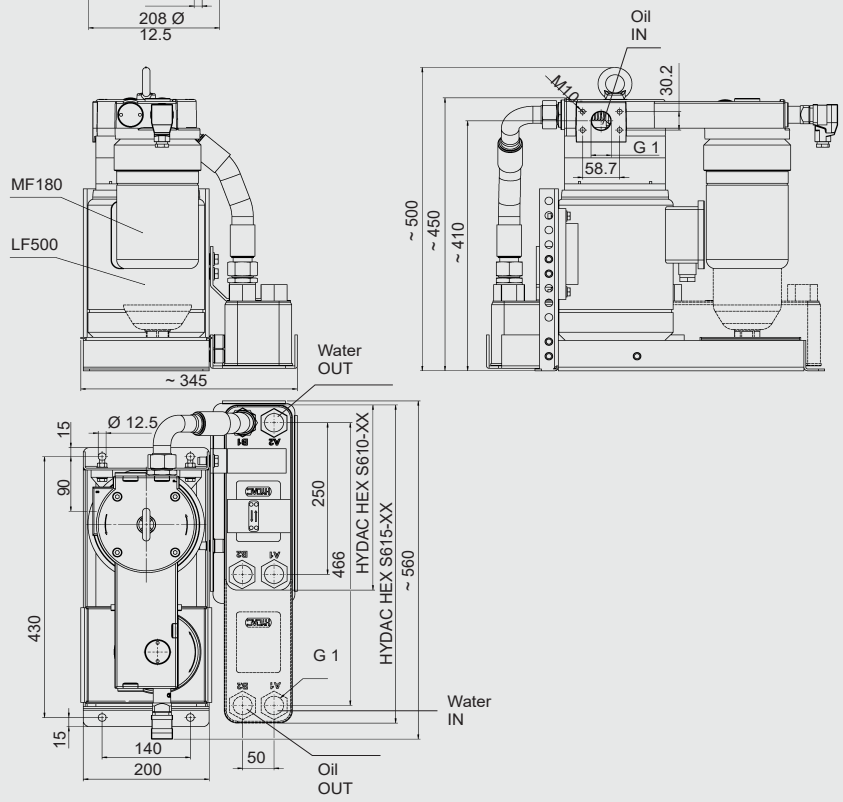
Motor-pump unit	Heat exchanger
Basic unit: 12 kg	610-10: 3 kg
	610-20: 5 kg
	615-10: 6 kg
	615-20: 8 kg

UKF-2

UF-2



UKF-2

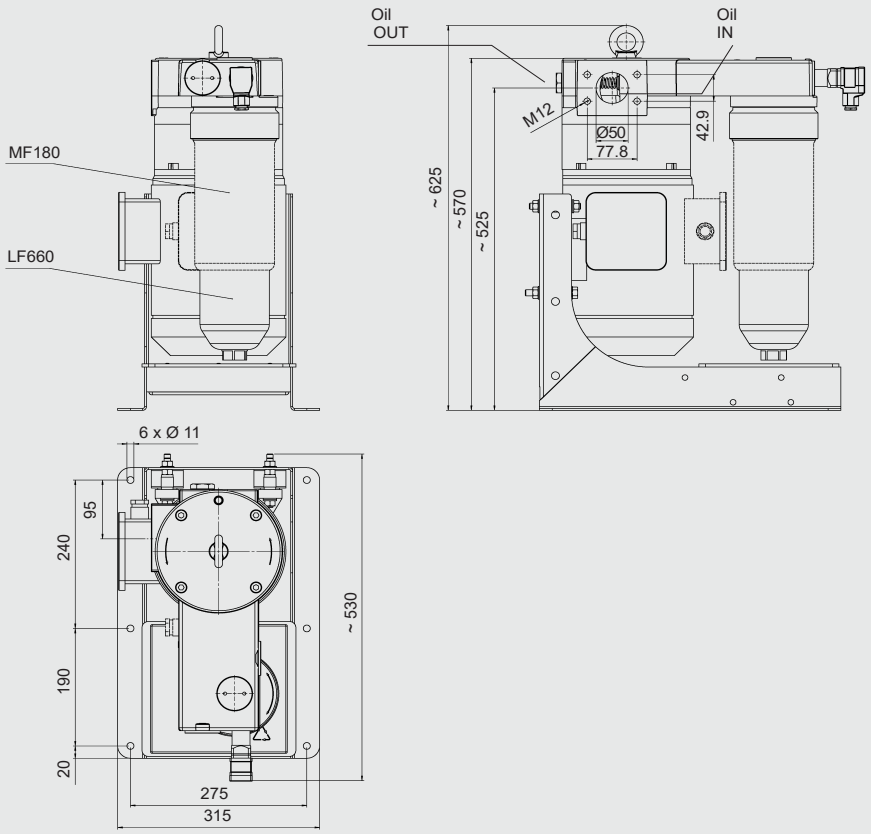


Weight (unfilled)
Motor-pump unit + heat exchanger + filter

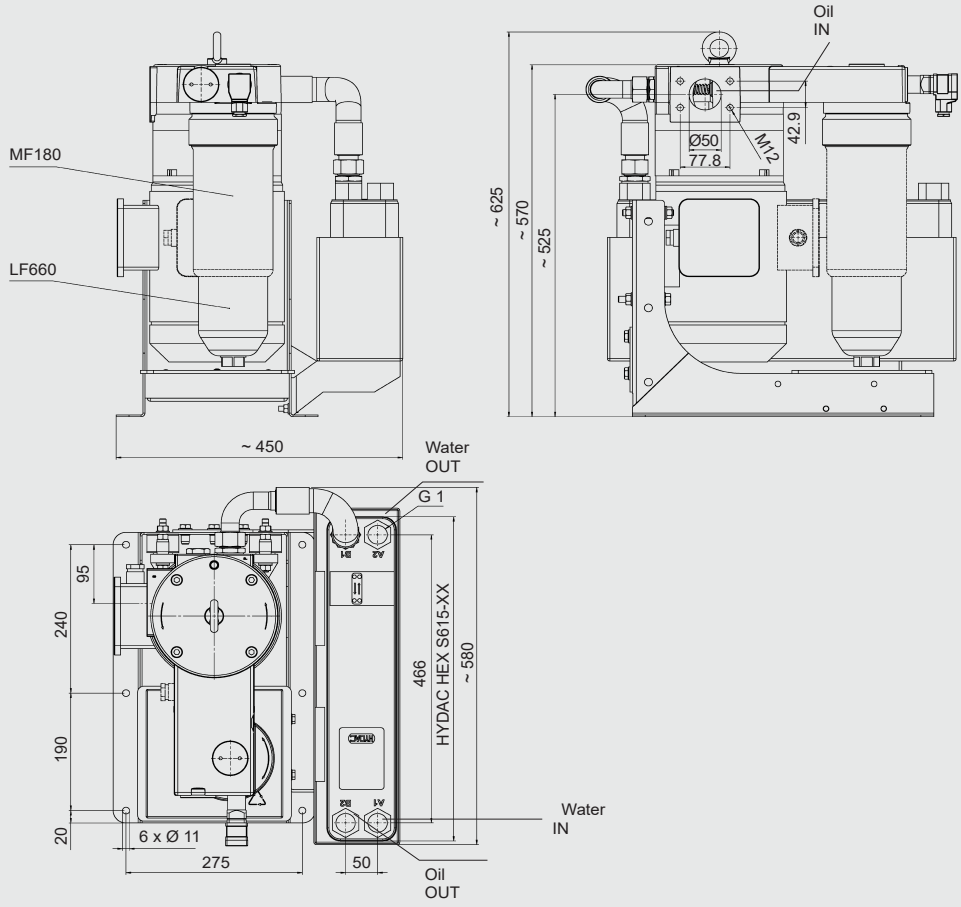
Motor-pump unit	Heat exchanger	Filter
0.75 kW: 16 kg	610-20: 11 kg	MF180: 2 kg
1.5 kW: 20 kg	610-40: 14 kg	LF330: 5 kg
	615-20: 14 kg	LF500: 7 kg
	615-40: 18 kg	

UKF-3

UF-3



UKF-3



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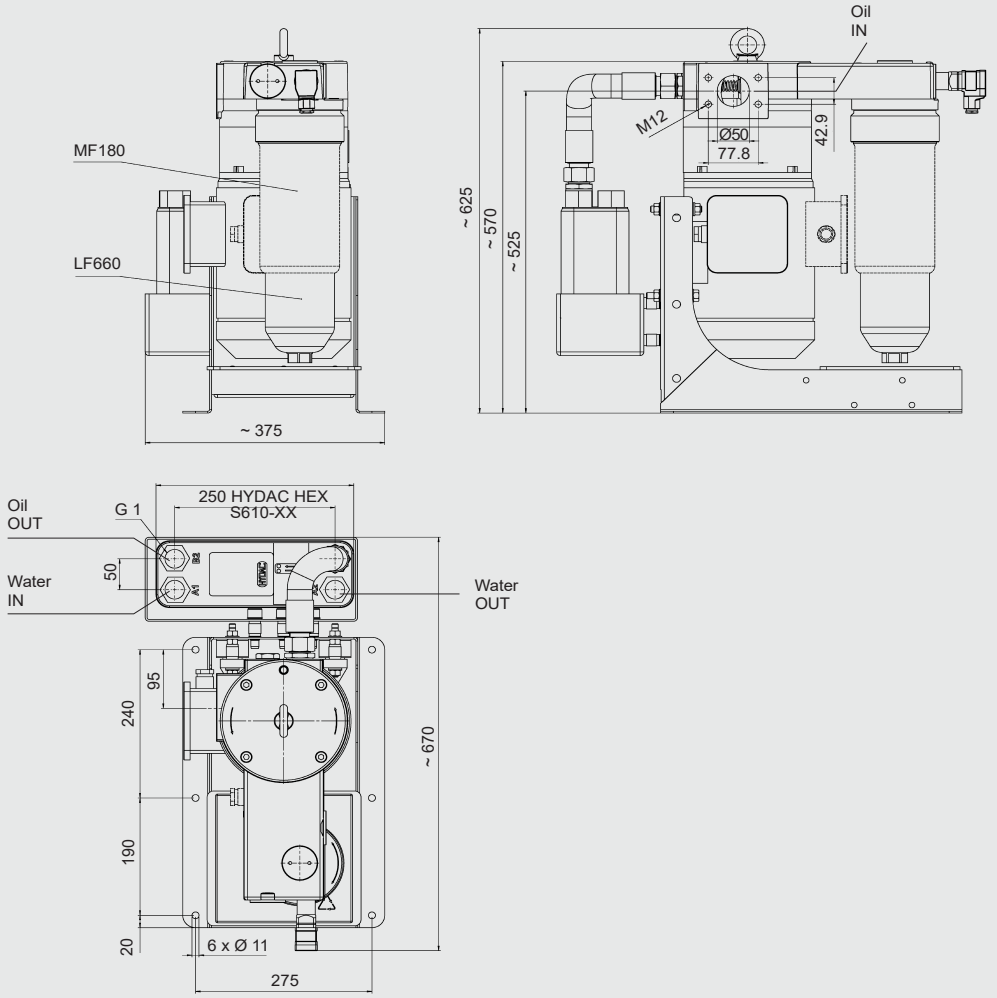
UKF-3



Weight (unfilled)
Motor-pump unit + heat exchanger + filter

Motor-pump unit	Heat exchanger	Filter
1.5 kW: 44 kg	610-20: 11 kg	MF180: 2 kg
2.2 kW: 48 kg	610-40: 14 kg	LF330: 5 kg
4 kW: 52 kg	610-70: 17 kg	LF500: 7 kg
	610-100: 22 kg	LF660: 8 kg
	610-120: 25 kg	
	615-20: 14 kg	
	615-40: 18 kg	
	615-60: 24 kg	
	615-80: 30 kg	

Model Code

UKF-2 - 1.0 - P - 40 - 1.5 - 610-40 - MF180 - 10 - D

Type
UKF = Pump + heat exchanger + filter
UF = Pump + filter
UK = Pump + heat exchanger

Version
1.0 = Heat exchanger series 610
2.0 = Heat exchanger series 615
1.2 / 2.2 = With filter bypass

Seals
P+V = Static seal Perbunan + Dynamic seal Viton
P = Static and dynamic seal Perbunan

Pump flow rate: cm³/revolution

	cm³/revolution	1,000 1/min	1,500 1/min
UKF-1	3.5	5 l/min	
	5	7.5 l/min	
	7	10 l/min	
	10	15 l/min	
UKF-2	15	15 l/min	20 l/min
UKF-2 / UKF -3	20	20 l/min	30 l/min
	30	30 l/min	45 l/min
	40	40 l/min	60 l/min
UKF-3	50	50 l/min	75 l/min
	60	60 l/min	90 l/min
	70	70 l/min	105 l/min
	100	100 l/min	150 l/min
	130	130 l/min	180 l/min

Motor

UKF-1	0.37 kW	@ 1,500 1/min
	0.55 kW	@ 1,500 1/min
UKF-2	0.75 kW	@ 1,500 1/min
UKF-2 / UKF -3	1.1 kW	@ 1,000 1/min (6-pole motor)
	1.5 kW	@ 1,500 1/min
UKF-3	2.2 kW	@ 1,500 1/min
	2.2-6p kW	@ 1,000 1/min (6-pole motor)
	4 kW	@ 1,500 1/min
	4-6p kW	@ 1,000 1/min (6-pole motor)

Plate heat exchanger – No. of plates

610	-10	-20	-30	-40	-50	-60	-70	-100	-120
UKF-1	•	•							
UKF-2		•	•	•					
UKF-3		•			•	•	•	•	•

615	-10	-20	-30	-40	-60	-80
UKF-1	•	•				
UKF-2		•	•	•		
UKF-3		•		•	•	•

Other plate heat exchangers on request.

Filter

	N5AM/DM	MF160	MF180	LF330	LF500	LF660
UKF-1	•	•	•			
UKF-2			•	•		
UKF-3			•	•	•	•

Filtration rating
-03 = 3 µm
-05 = 5 µm
-10 = 10 µm
-20 = 20 µm
For further details on filter elements, see relevant brochure in Fluid Filters catalogue.

Differential pressure of clogging indicator
D = visual-electrical
Additional clogging indicators on request, see relevant brochure in Fluid Filters catalogue.

Pump-Transfer Cooler Filtration Unit Selection

Determining the cooling capacity

Estimating the cooling capacity requirements for mineral oil based on increase in tank temperature

$$p = \frac{\Delta T \times V}{t} \times \frac{1}{35}$$

p = heat dissipation [kW]
ΔT = temperature increase in the reservoir [K]
V = tank capacity [l]
T = operating time [min]

Example:
In an system, the tank temperature rises from + 20 °C to + 70 °C (= 50 K) in 30 minutes.
The tank volume is 100 l.

$$p = \frac{50 \times 100}{30} \times \frac{1}{35}$$

p = 4.8 [kW]

Estimating the cooling capacity requirement based on installed electrical power

p ≈ ¼ x installed electrical power

Calculating the oil and water outlet temperature

Drop in oil temperature:

$$\Delta T \approx \frac{p}{Q_{Oil}} \times 36$$

Increase in water temperature:

$$\Delta T \approx \frac{p}{\times 14.4\ Q_{Water}}$$

p = Cooling capacity [kW]
Q_{Oil} = Oil flow rate [l/min]
Q_{Water} = Water flow rate [l/min]

Selection of the plate heat exchanger:

A sizing program is available to calculate accurately the required cooling capacity and a suitable plate heat exchanger. For this, five of the following seven variables are required:

- Oil inlet and outlet temperature
- Oil flow rate
- Water inlet and outlet temperature
- Water flow rate
- Cooling capacity

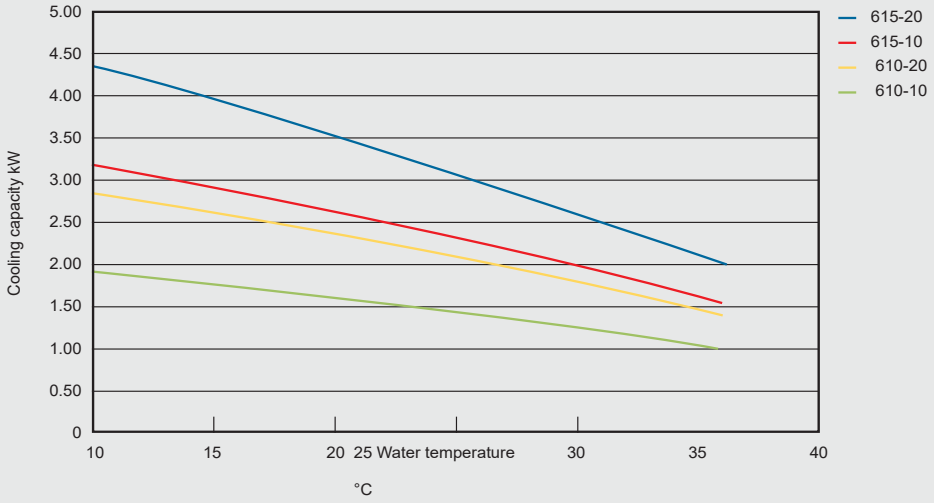
Additionally, the viscosity of the oil is required.

The following graphs show the selection of plate heat exchangers based on cooling capacity.

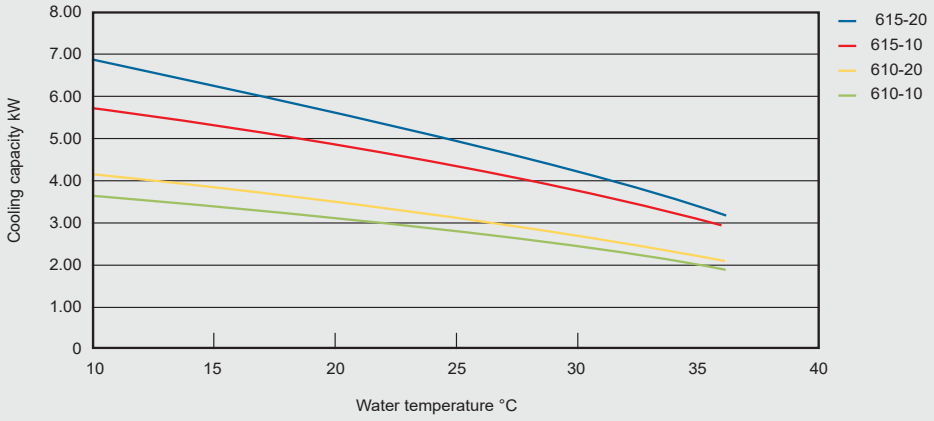
UKF-1

$\frac{Q_{Oil}}{Q_{Water}}$ Operating condition: T_{Oil} = + 55 °C; oil ISO VG 46; = 1

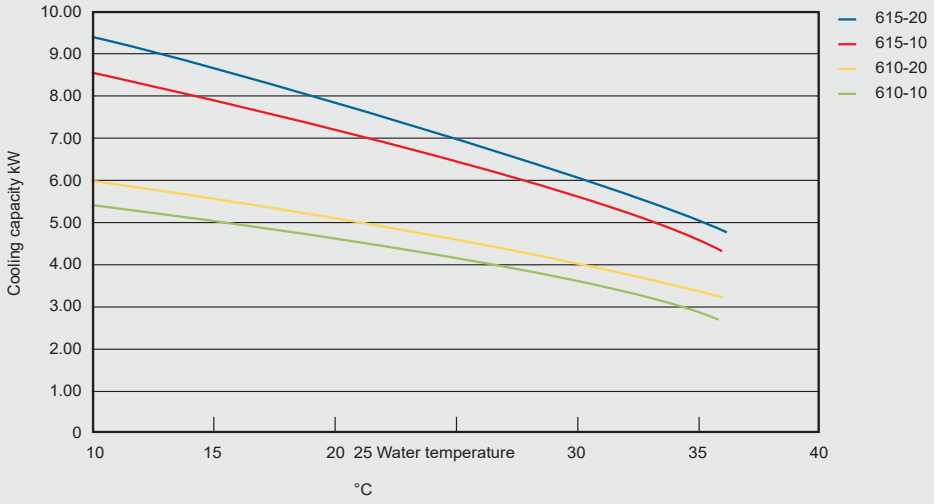
Cooling capacity at 5 l/min



Cooling capacity at 10 l/min



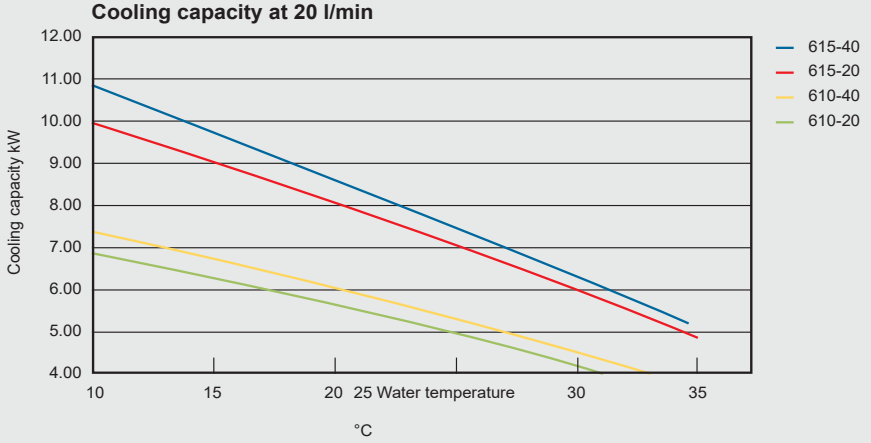
Cooling capacity at 15 l/min



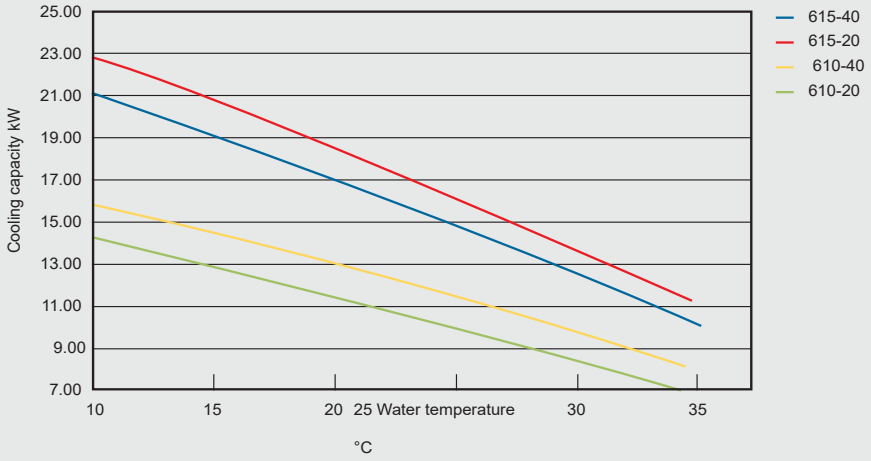
UKF-2

Q_{Oil} Operating condition: T_{Oil} = + 55 °C; oil ISO VG 46; = 4
Q_{Water}

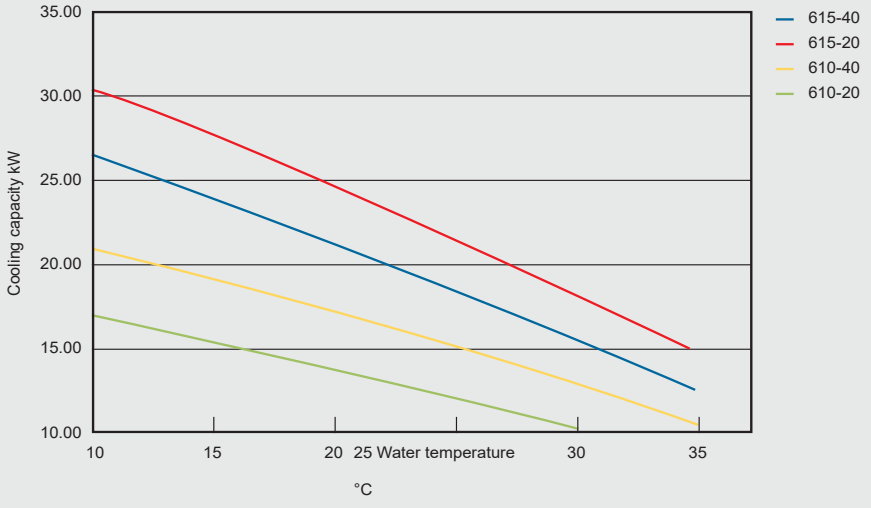
Cooling capacity at 20 l/min



Cooling capacity at 45 l/min



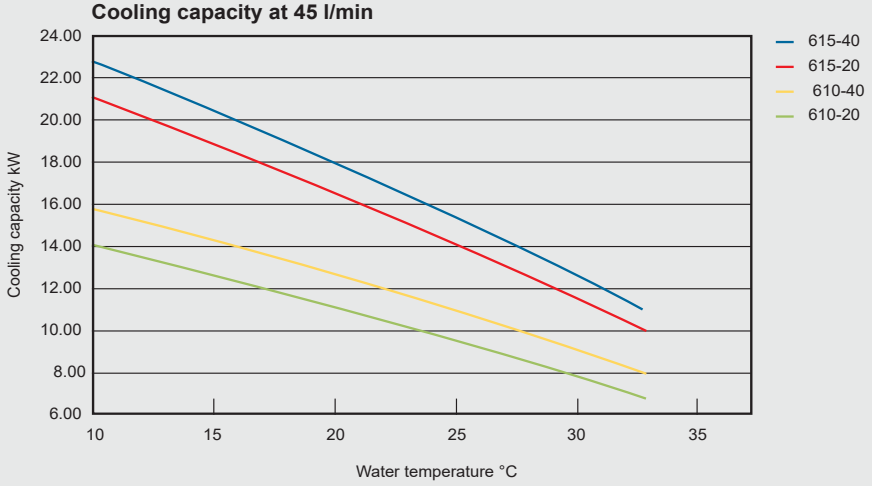
Cooling capacity at 60 l/min



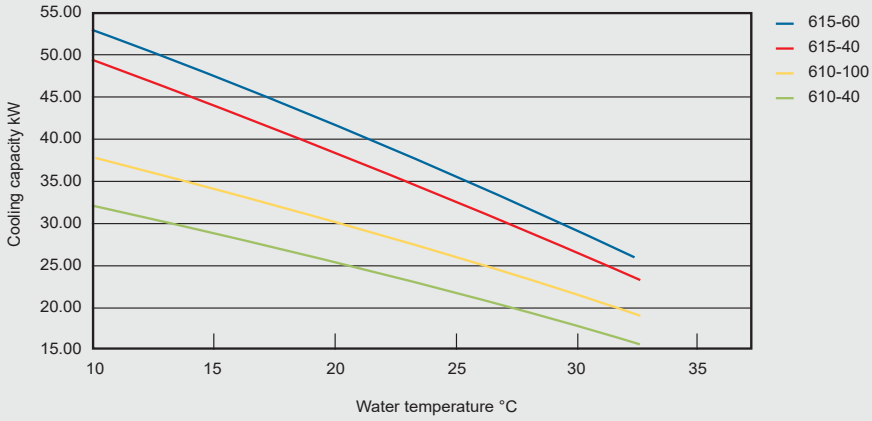
UKF-3

Q_{Oil} Operating condition: T_{Oil} = + 55 °C; oil ISO VG 46; = 4
Q_{Water}

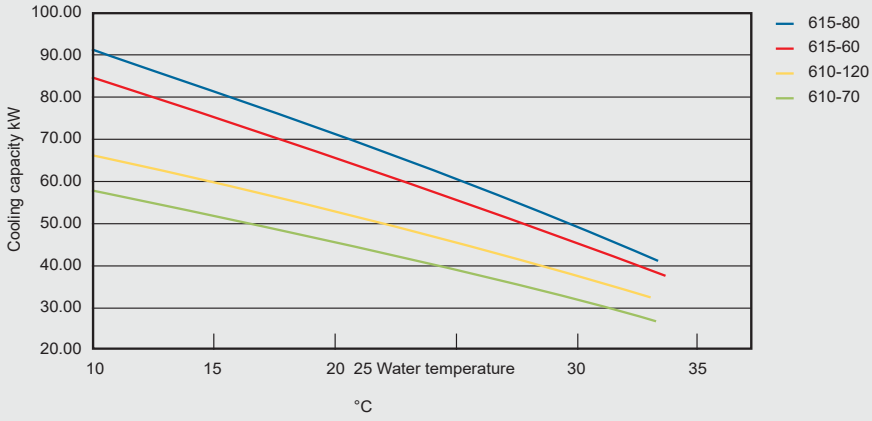
Cooling capacity at 45 l/min



Cooling capacity at 105 l/min



Cooling capacity at 185 l/min



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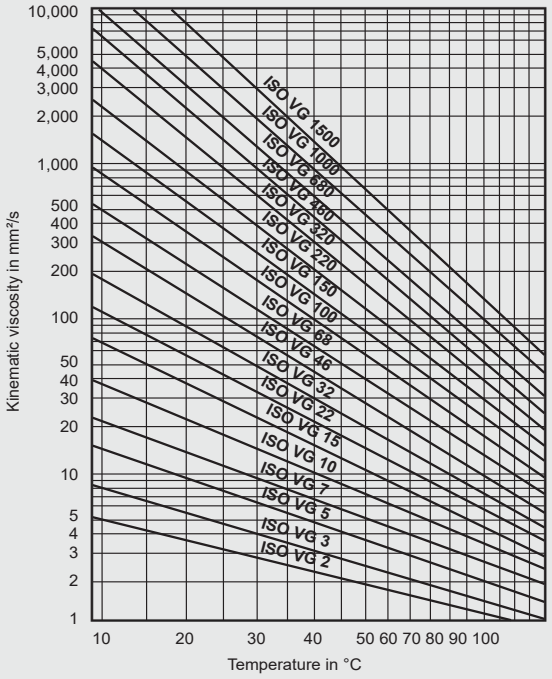
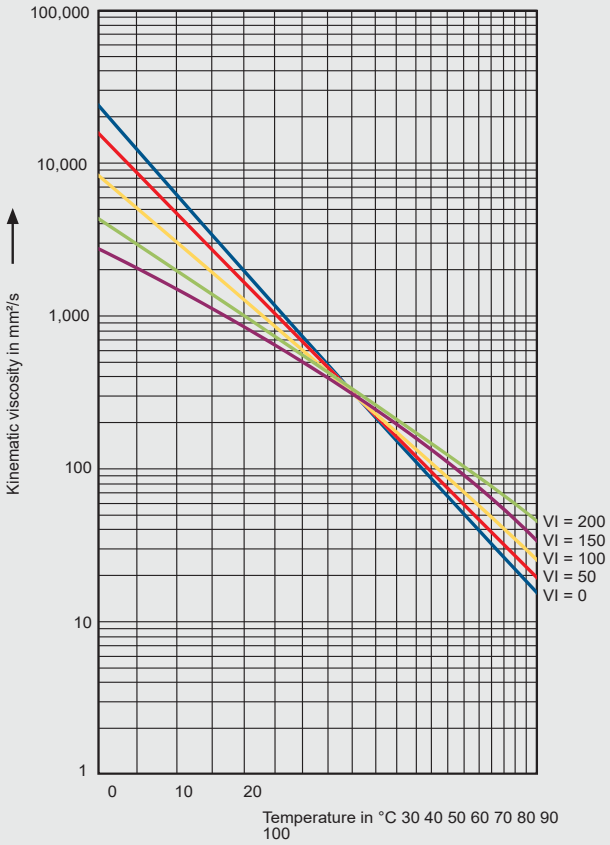
Viscosity

Viscosity / temperature graph to DIN 51519 Viscosity index 50



Viscosity / temperature graph Viscosity index 0 to 200 oil ISO VG 320



To DIN 51519, viscosity index 50,
Temperature of medium (oil) +10 °C to + 80 °C; short-term operation at higher viscosities (cold start) is permitted.

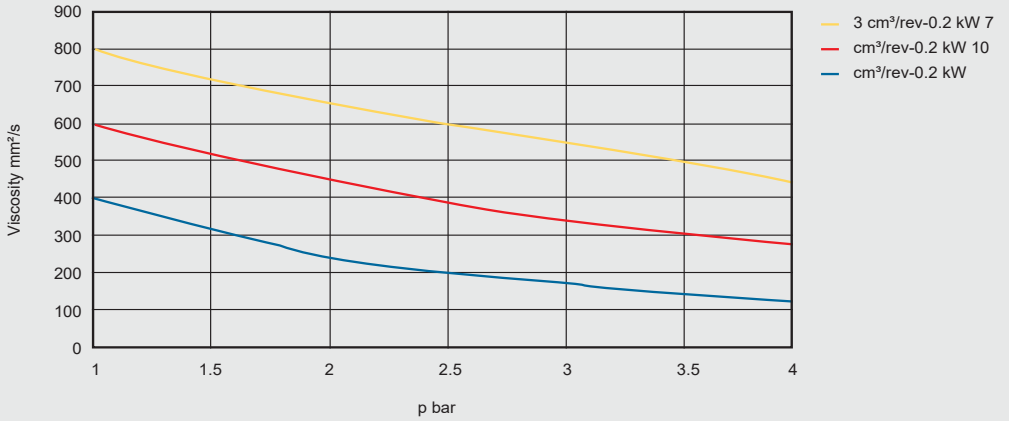
The viscosity index indicates how much the viscosity of the oil changes with temperature.

It is a measure of the temperature properties of different oils. The higher the viscosity index of an oil, the smaller the change in viscosity in relation to the temperature.

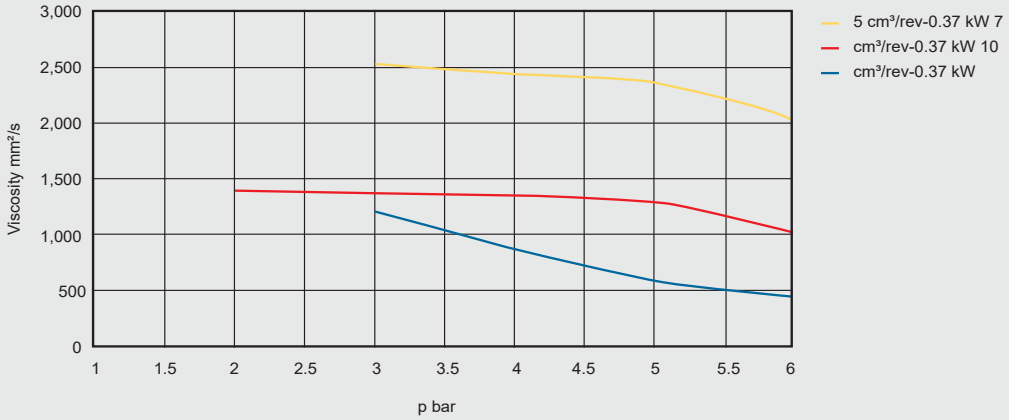
Graphs for motor-pump selection

UKF-1

Motor: 0.2 kW DC

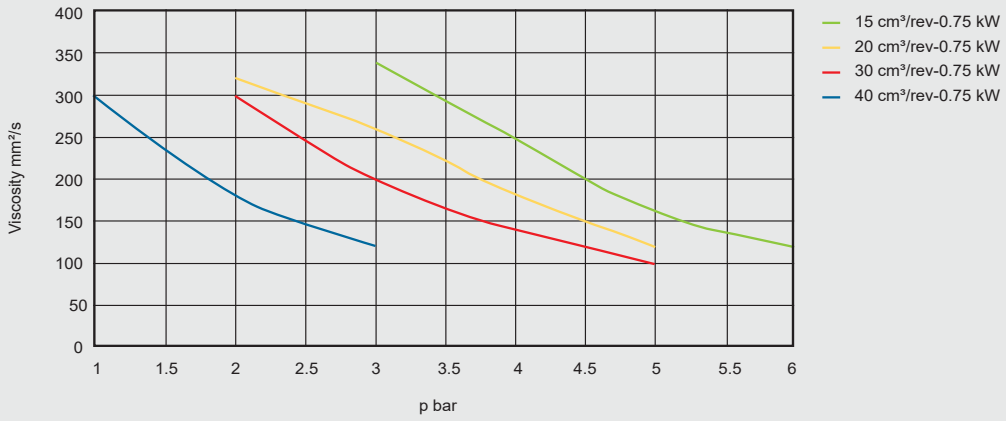


Motor: 0.37 kW

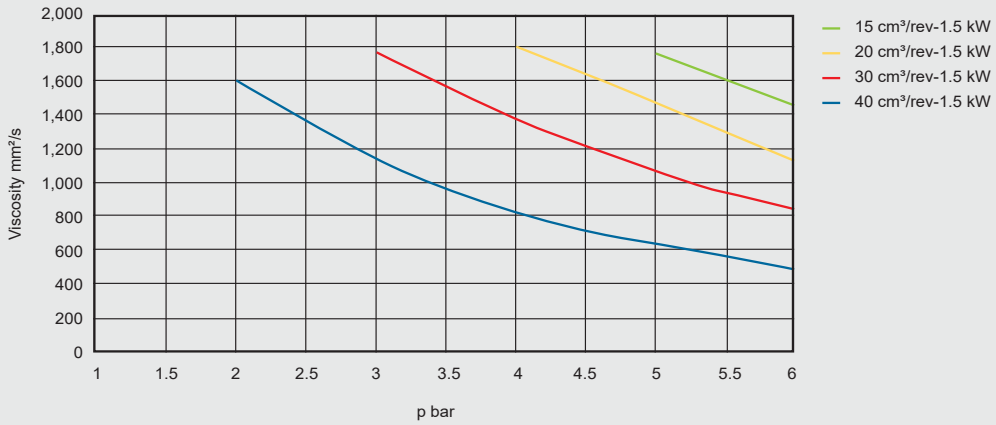


UKF-2

Motor: 0.75 kW

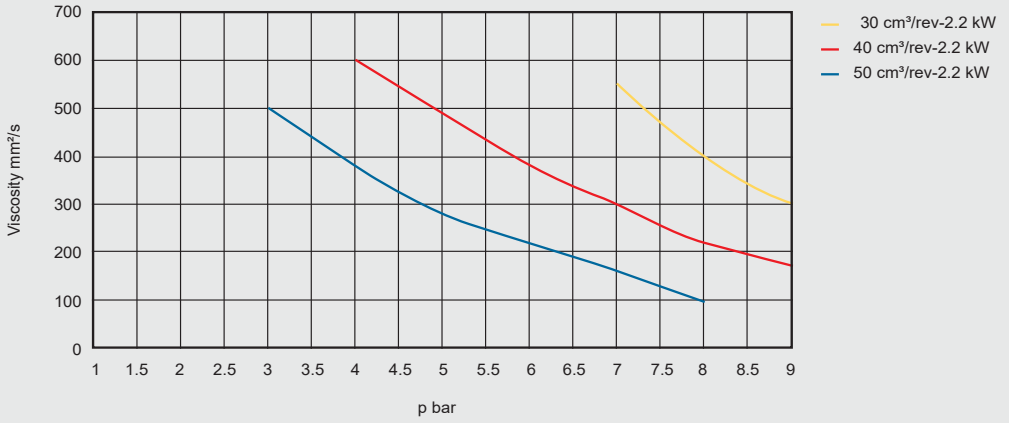


Motor: 1.5 kW

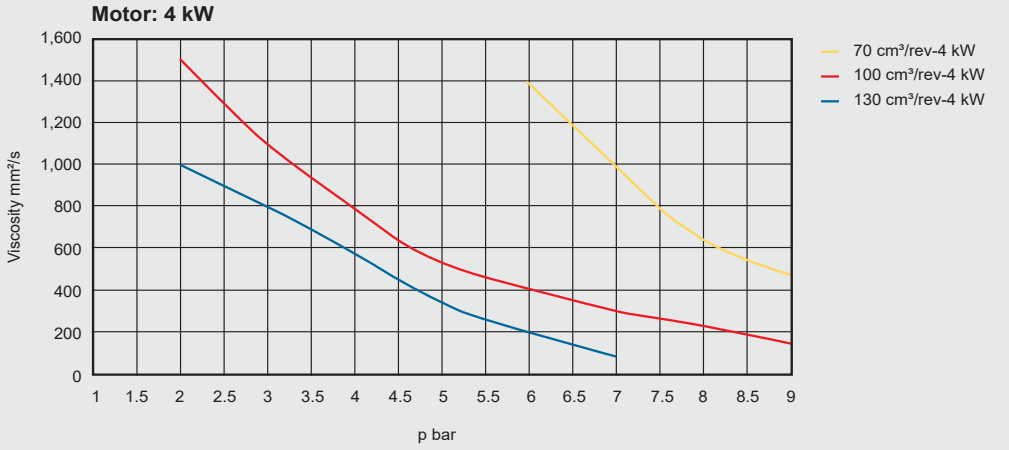


UKF-3

Motor: 2.2 kW



Motor: 4 kW

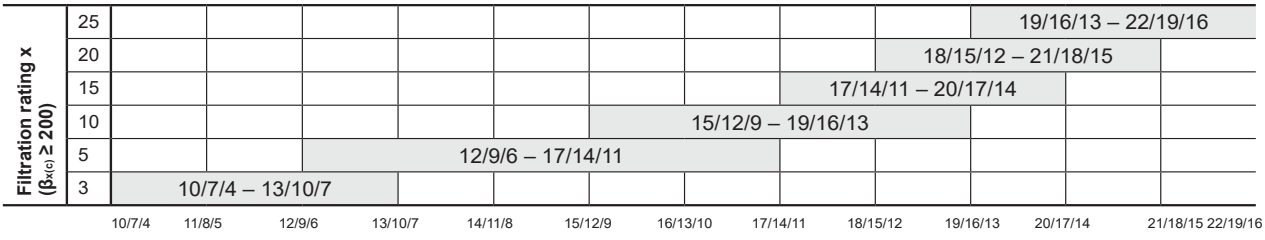


Filter selection

Cleanliness requirements for lubricating and hydraulic components.
The cleanliness level required in lubricating and hydraulic systems is determined by the most sensitive component.

Type of system/Area of application/ Components	Recommended cleanliness class
Systems with servo hydraulics sensitive to fine contamination	15/13/10
Industrial hydraulics ▯Proportional technology ▯High pressure systems	17/15/12
Industrial and mobile hydraulics ▯Electromagnetic control valve technology ▯Medium pressure and low pressure systems	 18/15/12 19/16/14
Industrial and mobile hydraulics with low demands on wear protection	20/18/15
Forced-feed circulatory lubrication on gears	18/16/13
New oil	21/19/16
Pumps /Motors ▯Axial piston pump ▯Radial piston pump ▯Gear pump ▯Vane pump	 18/16/13 19/17/13 20/18/15 19/17/14
Valves ▯Directional valves ▯Pressure control valves ▯Flow valves ▯Check valves ▯Proportional valves ▯Servo valves	 20/18/15 19/17/14 19/17/14 20/18/15 18/16/13 16/14/11
Cylinders	20/18/15

Depending on the conditions of the system and the environment, filters with the same filtration rating perform differently.
Typical fluid cleanliness classes achieved with HYDAC elements are shown below:



Oil cleanliness to ISO 4406

Notes

On piping

The pressure differential in a hydraulic line is dependent on:

- Flow rate
- Kinematic viscosity
- Pipe dimensions and can be estimated for hydraulic oils as follows:

$$\Delta p[bar] = 5.84 \times \frac{l\ [m]}{d_4\ [mm]} \times Q \times v\ [bar]$$

l = Pipe length [m]
d = Internal diameter of pipe [mm]
Q = Flow rate [l/min]
n = Kinematic viscosity [mm²/s]

This applies to straight pipe runs and hydraulic oils, and to laminar flow.

Additional threaded connections and pipe bends increase the pressure differential.

Notice

- As few threaded connections as possible
- Few pipe bends; if unavoidable, use large radius
- Difference in height between pump and oil level as small as possible
- Hoses must be suitable for a vacuum of min. 5,000 mmW
- Do not reduce pipe cross-section predetermined by the unit

Note

The information in this brochure relates to the operating conditions and applications described. For applications and operating conditions not described, please contact the relevant technical department.
Subject to technical modifications.

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