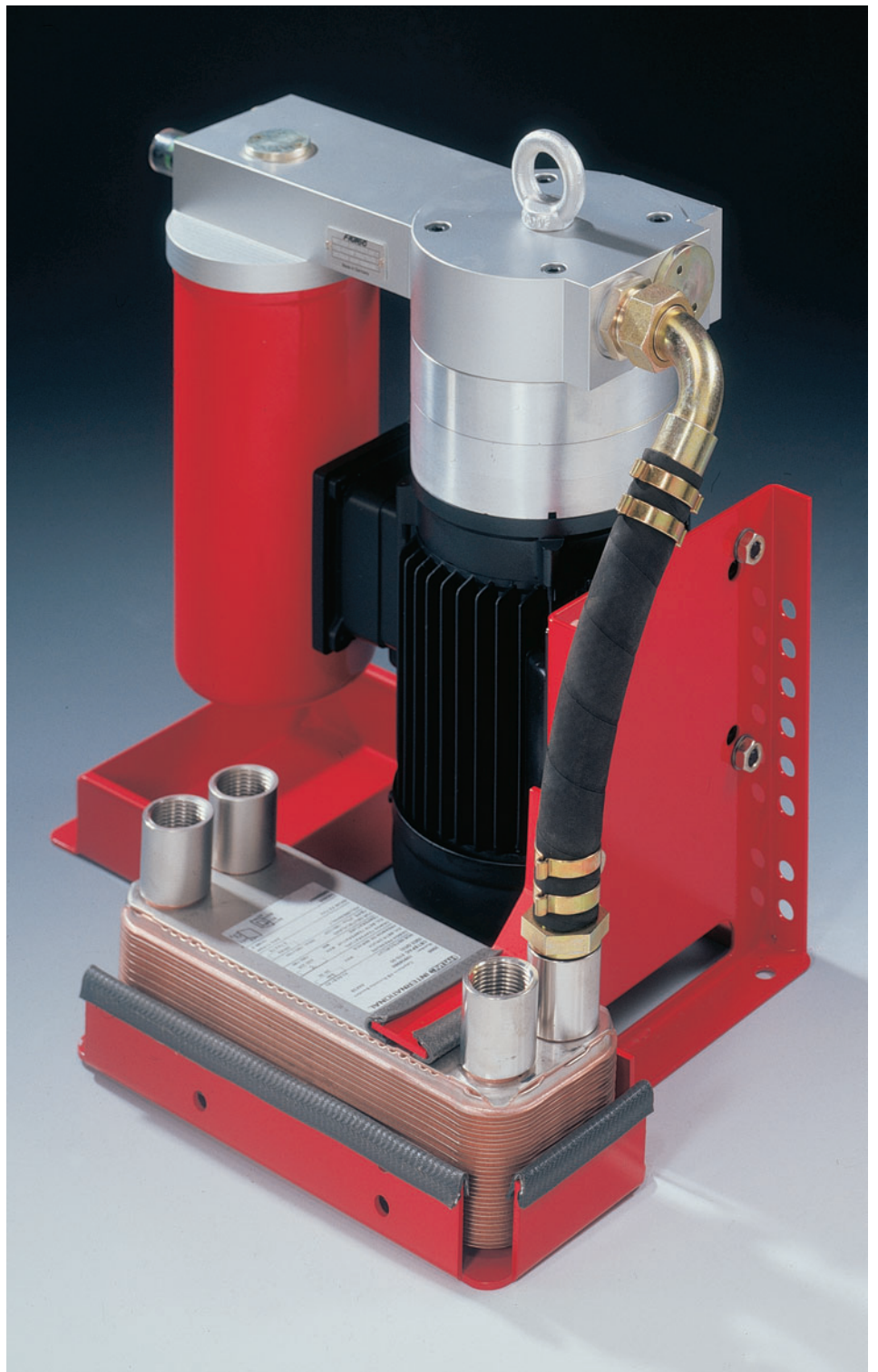


HYDAC

INTERNATIONAL

Pump-Transfer Cooler Filtration Unit UKF-2



Pump-transfer cooler filtration unit UKF

1. DESCRIPTION

1.1 GENERAL

The UKF unit is a compact, easy-to-install unit for off-line filtration cooling circuits. Installation is simply a matter of hydraulic inline mounting to and from the tank and connecting the voltage supply.

1.2 FEATURES

Off-line 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

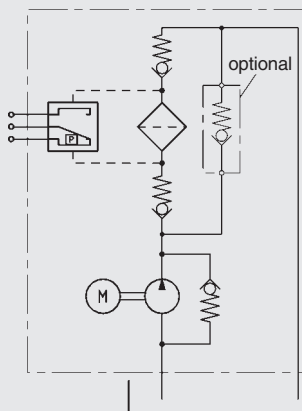
1.3 APPLICATIONS

- plastic injection moulding machines
- presses
- machining centres
- transmission systems

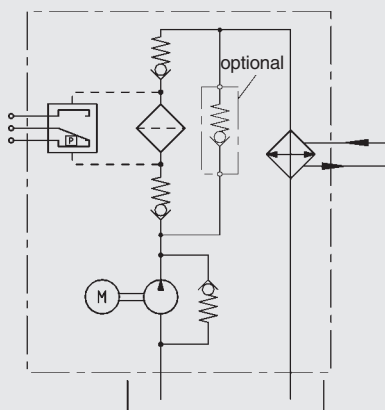
1.4 SYMBOLS

(shown with electrical differential pressure indicator)

UF (without heat exchanger)



UKF



2. TECHNICAL SPECIFICATIONS

2.1 OPERATING PRESSURE

Oil side : max. 6 bar
Water side : max. 27 bar (static)

2.2 SUCTION PRESSURE ACROSS THE SUCTION CONNECTION

max. : - 0.4 bar to 0.5 bar

2.3 OPERATING FLUID

Oil side:
Mineral oil to DIN 51524 part 1 and part 2
Permissible contamination ≤ NAS 12

2.4 TEMPERATURE OF OPERATING FLUID

Oil side : + 10 °C to + 80 °C
Water side : + 5 °C to + 60 °C

2.5 MAX. VISCOSITY

See graph on page 5

2.6 AMBIENT TEMPERATURE

+ 10 °C to + 40 °C

2.7 MOUNTING POSITION

Vertical

2.8. PRESSURE DIFFERENTIALS AT $v = 46 \text{ mm}^2/\text{s}$

- Housing: 0.5 bar
- Shut-off valves: 0.4 bar
- Filter: Page 7
- Heat exchanger: Page 8

2.9 REVOLUTIONS

min 900 rpm to
max 2000 rpm

2.10 DIRECTION OF ROTATION

Clockwise -
see direction of arrow

2.11 WEIGHT (DRY UNIT)

(UF + heat exchanger + filter)

UF:
0.75 KW 16 kg
1.5 KW 20 kg

Heat exchanger:
410 - 20 11 kg
410 - 40 14 kg
415 - 20 14 kg
415 - 40 18 kg

Filter:
MF180 2 kg
LF 330 4 kg
LF 500 6 kg

2.12 DRIVE

Three-phase electric motor
Insulation class: F
Safety type: IP 55

2.13 VOLUMETRIC EFFICIENCY

> 90 % at $v = 40 \text{ mm}^2/\text{s}$

2.14 NOISE LEVELS

(at 1500 rpm)

Pump [ccm/U]	1 bar	6 bar
15	61	61
20	61	61
30	61	62
40	62	63

Test medium: ISO-VG 46 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.

2.15 OPERATING DATA FOR HEAT EXCHANGER

● Medium (water side):

- Water glycol (coolant)
- HFC operating fluid
- Water
- Oils

● Contamination:

The quantity of particles in suspension should be less than 10 mg/l, particle size < 0.6 mm (spherical).

Thread-like particles cause a rapid rise in the pressure drops.

● Corrosion:

The following critical values refer to a pH value of 7

- Free chlorine: $\text{Cl}_2 < 0.5 \text{ ppm}$
- Chloride ions: $\text{Cl} < 700 \text{ ppm at } 20 \text{ }^\circ\text{C}$
 $< 200 \text{ ppm at } 50 \text{ }^\circ\text{C}$
- Other critical values:
 - pH 7 - 10
 - Sulphate $\text{SO}_4^{2-} < 100 \text{ ppm}$
 - $[\text{HCO}_3^-] / [\text{SO}_4^{2-}] > 1$
 - Ammonia, $\text{NH}_3 < 10 \text{ ppm}$
 - Free CO < 10 ppm

The following ions are not corrosive under normal conditions:

Phosphate, nitrate, nitrite, iron, manganese, sodium and potassium.

● Heat exchanger connections

Female thread
(max. torque rating: 385 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.

3. MODEL CODE

(also order example)

UKF-2 / 1.0 / P / 40 / 1.5 / 410-40 / MF180 / 10 / D
UF -2 / 1.0 / P / 40 / 1.5 / --- / MF180 / 10 / D

Typ

UKF pump + heat exchanger + filter
 UF pump + filter

Model

1.0 : UF
 UKF with CP 410 - xx
 2.0 : UKF with CP 415 - xxx

Seals

P : Perbunan

Pump flow rate: cm³/rev

cm³/rev 1500 1/min
 15 20 l/min
 20 30 l/min
 30 45 l/min
 40 60 l/min

Motor

0.75 KW - 1500 rpm
 1.5 KW - 1500 rpm

Wide voltage range motor

All voltages and frequencies between
 380/420V - 50Hz and
 440/480V - 60Hz possible
 For calculation, see page 5

Heat exchanger UKF:

Type	1.0	2.0
	410 - 20	415 - 20
	410 - 40	415 - 40

For calculation, see page 4

UF without heat exchanger: ---

Filter

MF 180
 LF 330
 LF 500

Filtration rating

		Contamination retention at Δp: 5 bar		
		MF180	LF330	LF500
3	: 3 μm Absolute	89 g	36.9 g	60.7 g
5	: 5 μm Absolute	90 g	39.4 g	64.8 g
10	: 10 μm Absolute	94 g	44.3 g	72.9 g
20	: 20 μm Absolute	111 g	49.2 g	81 g

For further details on filter elements, see brochure:

Mobile Spin-On Filters, brochure no.: 7.301../..

Filter elements, brochure no.: 7.200../..

For determination of pressure differential, see page 7

Differential pressure clogging indicator 2 bar

BM : VM 2 BM.1 (visual; manual reset)
 C : VD2 C.0 (electrical)
 D : VM 2D.0/-L24 (electrical/visual)

For further details, see brochure:

Clogging Indicators for Filters

brochure no.: 7.050../..

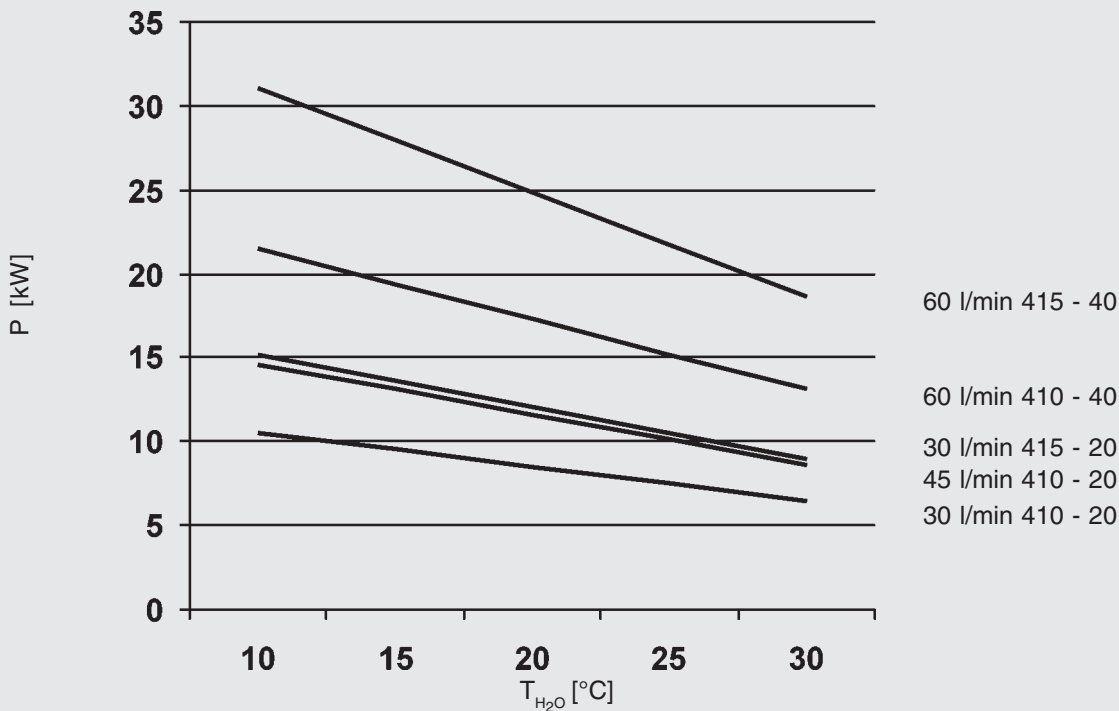
4. DETERMINING THE COOLING CAPACITY OF UKF

(see also point 11 and 12)

Parameters:

$$T_{oil} = 55^{\circ}\text{C} \quad \frac{Q_{oil}}{Q_{H_2O}} = 4$$

Oil ISO VG 46



* see point 5 for pressure differential graph

Table for exact determination of cooling capacity

P: Cooling capacity at $T_{oil\ in} = 55^{\circ}\text{C}$ and $T_{H_2O\ in} = 20^{\circ}\text{C}$

L/min	410-20				410-40				415-20				415-40			
	F _{oil}	F _{H₂O}	K	P	F _{oil}	F _{H₂O}	K	P	F _{oil}	F _{H₂O}	K	P	F _{oil}	F _{H₂O}	K	P
20	0.20	0.137	2.5	5.8	0.20	0.154	1.8	6.1	0.28	0.205	3	8.3	0.25	0.235	0.45	8.6
30	0.30	0.205	3.9	8.5	0.32	0.212	4.4	9	0.40	0.310	3.7	12.1	0.43	0.320	4.55	12.7
45	0.36	0.298	2.2	11.6	0.48	0.309	7	13.2	0.56	0.45	4.7	17.4	0.64	0.465	7.1	18.8
60	0.40	0.360	1	13.8	0.62	0.420	8.4	17.3	0.62	0.575	1.3	21.3	0.86	0.618	10.1	24.8

$$P_{cool} = F_{oil} \times T_{oil\ in} - F_{H_2O} \times T_{H_2O\ in} - K$$

For T_{oil} from 45 to 55°C

T_{H_2O} from 10 to 35 °C

Oil ISO VG 46

$$\frac{Q_{oil}}{Q_{H_2O}} = 4$$

Figures in bold: preferred values

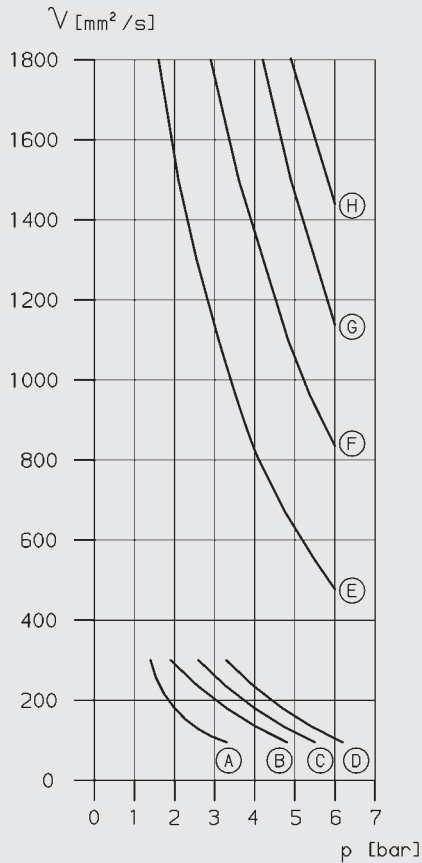
A calculation program is available for making an accurate calculation.

The following details are required:

- Type of oil
- Tank temperature required with UKF
- Required cooling capacity
- Water inlet temperature and max. water quantity.

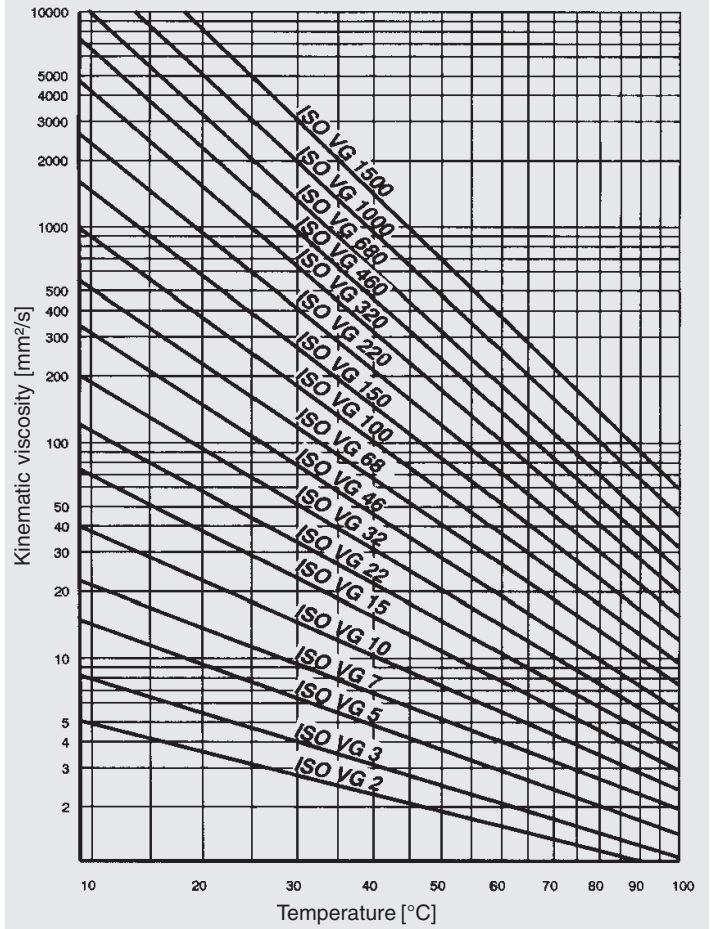
The cooling capacity is also dependent on the viscosity. At a lower viscosity the cooling capacity increases, at a higher viscosity it decreases.

5. GRAPHS FOR THE SELECTION OF MOTOR PUMPS



- | | |
|-------------------------------|------------------------------|
| Ⓐ 40cm ³ /U-0.75kW | Ⓔ 40cm ³ /U-1.5kW |
| Ⓑ 30cm ³ /U-0.75kW | Ⓕ 30cm ³ /U-1.5kW |
| Ⓒ 20cm ³ /U-0.75kW | Ⓖ 20cm ³ /U-1.5kW |
| Ⓓ 15cm ³ /U-0.75kW | Ⓗ 15cm ³ /U-1.5kW |

Viscosity Temperature Graph
to DIN 51519 viscosity index 50



Calculation of the oil and water outlet temperature

Temperature loss: oil

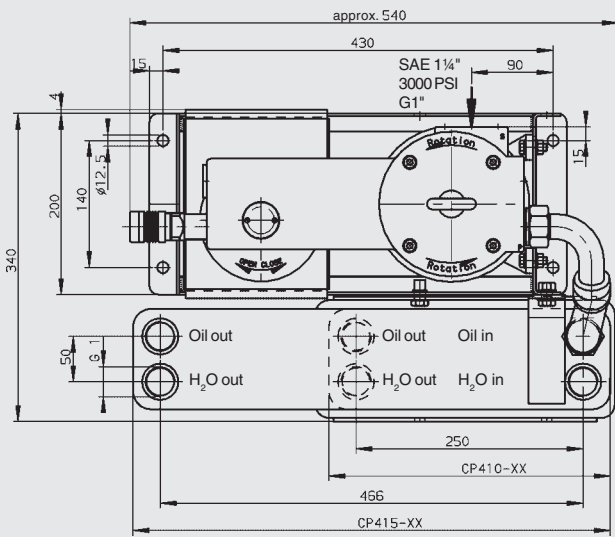
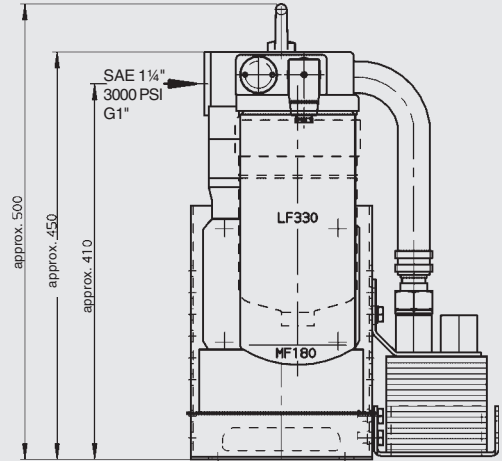
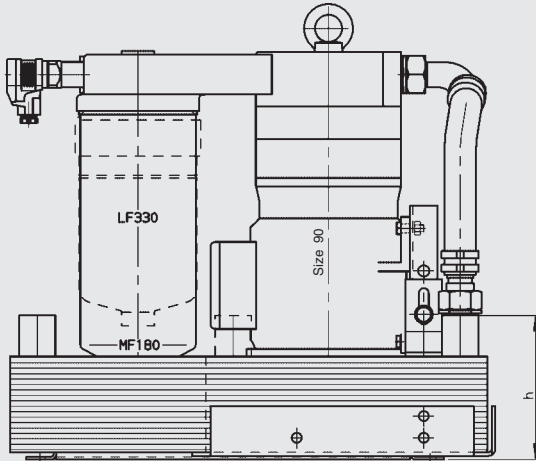
$$\Delta T \approx 36 \times \frac{P}{Q_{oil}} \quad \begin{array}{l} P = \text{cooling capacity [kW]} \\ Q_{oil} = \text{flow rate [l/min]} \end{array}$$

Temperature increase: water

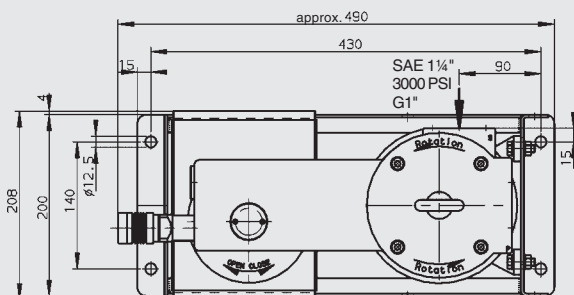
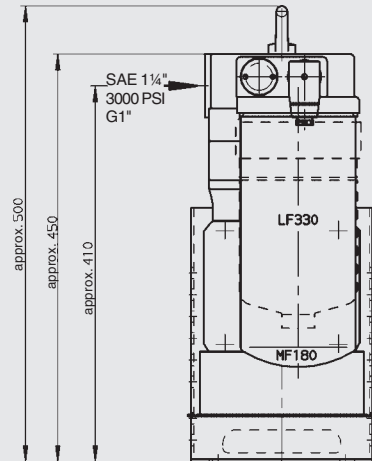
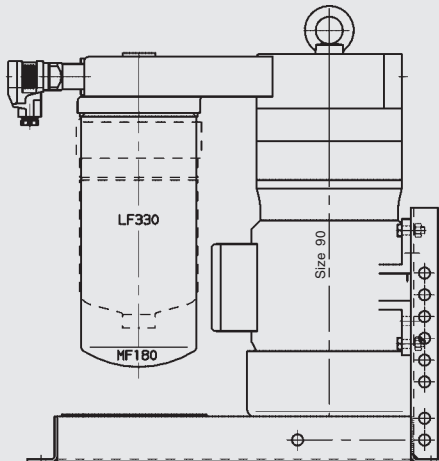
$$\Delta T \approx 14.4 \times \frac{P}{Q_{water}} \quad \begin{array}{l} P = \text{cooling capacity [kW]} \\ Q_{water} = \text{flow rate [l/min]} \end{array}$$

6. DIMENSIONS:

UKF-2/1.0
UKF-2/2.0



UF-2/1.0



7. FILTER SIZE - FILTER MATERIAL - FILTRATION RATING

7.1 SELECTING THE FILTRATION RATING ACCORDING TO MANUFACTURERS' AND OPERATORS' EXPERIENCE

Permissible contamination class to		Suggested filtration rating x in μm ($\beta_x = 100$)	Type of hydraulic system
NAS 1638	ISO 4406		
3	14/12/9	3 μm	To prevent fine contamination in highly sensitive systems with a high reliability requirement, primarily aerospace and laboratory conditions.
4	15/13/10		
5	16/14/11		
5	16/14/11	3 - 5 μm	Sensitive high performance systems & control systems in high pressure applications, frequently in aerospace technology, industrial robots and machine tools where proportional and servo valves are used.
6	17/15/12		
7	18/16/13	5 - 10 μm	High performance industrial hydraulic systems with high level of operating safety, using precision hydraulic components such as, for example, control pumps.
8	19/17/14		
8	19/17/14	10 - 20 μm	General hydraulic and mobile hydraulic systems with conventional directional valve controls
9	20/18/15		
10	21/19/16		
9	20/18/15	15 - 25 μm	Systems in heavy machinery hydraulics, primarily in the low pressure sector
10	21/19/16		
11	22/20/17		
11	22/20/17	20 - 40 μm	Low pressure systems with large tolerances and low demands for contamination protection
12	23/21/18		

7.2 PRESSURE DIFFERENTIAL FILTER ELEMENT

Filter graphs

Gradient coefficient $[K_{\Delta\text{element}}]$ at 30 mm^2/s

	filtration rating			
	3 μm	5 μm	10 μm	20 μm
MF180	0.0025	0.0020	0.0018	0.0009
LF330	0.00606	0.00485	0.00333	0.00194
LF500	0.00420	0.00300	0.00180	0.00140

$$\Delta p_{\text{element}} = [K_{\Delta\text{element}}] \times Q [l(\text{min})] \times \frac{\text{Operating viscosity} [\text{mm}^2/\text{s}]}{30 \text{ mm}^2/\text{s}}$$

8. NOTES ON INLINE MOUNTING

The pressure differential in a hydraulic line is dependent on:

- 1) Flow rate
- 2) Kinematic viscosity
- 3) Pipe dimensions

and can be estimated for hydraulic oils as follows:

$$\Delta p \approx 5.84 \times \frac{l}{d^4} \times Q \times v [\text{bar}]$$

l = pipe length [m]
d = pipe internal diameter [mm]
Q = flow rate [l/min]
v = kinematic viscosity [mm²/s]

This applies to straight pipe runs and hydraulic oils.

- Additional threaded connections and pipe bends increase the pressure differential

Note:

- As few threaded connections as possible
- Few pipe bends; if required, use large radius
- Difference in height between pump and oil level as small as possible
- Hoses must be suitable for a vacuum of min. 5000 mmW (e.g. hoses to be steel-reinforced (wire-braided))
- Do not reduce pipe cross-section predetermined by the unit

9. TABLE OF PRESSURE DROPS VIA HEAT EXCHANGER

(For $T_{oil} = 45^{\circ}\text{C}$ ISO VG 46)

L/min	410-20 Δp [bar]	410-40 Δp [bar]	415-20 Δp [bar]	415-40 Δp [bar]
20	0.36	0.18	0.65	0.3
30	0.59	0.27	1.07	0.45
45	0.95	0.4	1.76	0.72
60	1.37	0.56	2.5	1.02

10. CALCULATING PRESSURE DIFFERENTIAL AT OPERATING PRESSURE

- Pressure drops at operating temperature

10.1. FILTER ELEMENT

Calculation of the clean element as given at point 7.2 to approx. 1 bar

10.2. HEAT EXCHANGER AND PIPE ON PRESSURE SIDE

max. 2 bar combined (see point 8 and 9)

10.3. PIPE ON THE SUCTION SIDE

max. 0.4 bar (see point 8)

11. NOTES ON CALCULATING THE UKF

11.1. ESTIMATING THE COOLING CAPACITY REQUIREMENT FOR MINERAL OIL

11.1.1 From the increase in tank temperature:

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

P = heat dissipation [kW]
 ΔT = temperature increase in tank [$^{\circ}\text{C}$]
 V = tank volume [l]
 t = operating time [min]

Example:

In a system the tank temperature increases from 20°C to 70°C (= 50 K) in 30 minutes.

The tank volume is 400 l

$$P = \frac{50 \times 400}{30} \times \frac{1}{35}$$

$$P = 19 \text{ [kW]}$$

11.1.2 From the installed electrical power

Cooling capacity \approx 25% of the installed electrical power

12. SIZING A UKF USING THE 25% RULE

Cooling capacity \approx 25% of the installed electrical power

Circulation volume \approx 25% of the tank volume

Water quantity \approx 25% of the oil quantity

13. NOTES:

All calculations for the heat exchanger are based on oil data provided by the Aral company.

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

Subject to technical modifications.

