BÜHLER TECHNOLOGIES

Fluidcontrol

Oil/air cooler ELK

Temperature is one of the key parameters in oil-hydraulic systems. Oils change their viscosity with the temperature, resulting in different lubricating and adhesion properties.

A carefully selected temperature level can also significantly extend the life of the oils.

Die ELK series oil/air coolers stabilise the temperature reliably and efficiently, both in the return or bypass of the systems.

The ELK series is characterised by efficient cooling matrices made from high-strength aluminium as well as a simple and affordable design. They are equipped with energy-efficient fan motors.

Compact design
Low noise emission
High cooling capacities
Rugged cooling matrix
Flexible use in the return or bypass

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Planning information

Set-up

The cooler must be set up so it does not interfere with the air supply and exhaust. The distance to air obstacles behind the cooler should be at least half the cooler height (dimension B).

Ensure adequate ventilation. During set-up, avoid exiting hot air or noise emission from causing problems.

If the ambient air is dirty, excess deposit on the cooling matrix must be expected. This will reduce the cooling capacity. In this case, particularly in the case of air loaded with oil mist, the air ducts must be cleaned regularly.

For outdoor setup, adequately protect the motor from the weather.

Ensure easy access for inspection and maintenance.

Mount

The coolers are secured to the mounting rails with four screws. Be sure the support structure is adequately sized. Install in any position.

Connecting the oil circuit

The connection between the system and the cooling matrix should be stress and vibration free, which can be achieved by using conduit.

Follow the appropriate safety regulations to prevent environmental damage due to possible oil leaks (e.g. collection pans).

Technical Data

Technical Data	
Materials/surface protection	
Cooling matrix:	Aluminium, powder-coated
Fan hub:	Aluminium, bare
Fan blades:	Glass-reinforced polypropylene (PPG), bare
Ventilation box, guard and motor brackets:	Steel, galvanised, powder-coated
Screw connections:	V2A stainless steel
Hydraulic screw fittings:	Steel, zinc-nickel coated
Colour:	Steel parts: RAL 9005, jet black Motor: RAL9005 jet black or RAL7031 blue grey (special colours on request)
Surface protection:	Steel parts: ISO 12944, C3 medium Motor: ISO 12944, C2 medium (higher on request)
Operating fluids:	Mineral oils according to DIN 51524 Gear lubricant according to DIN 51517-3 Oil/water emulsions HFA and HFB according to CETOP RP 77 H Water glycol HFC according to CETOP RF 77 H Phosphoric ester HFD-R according to CETOP RP 77 H
permissible operating pressure	
static	max. 305 psi
dynamic	218 psi (at 2 M load cycle, 3 Hz)
Operating oil temperature:	max. 176 °F (higher upon request)
Ambient temperature:	-4 °F to 104 °F (different ambient temperatures on request)
max. set-up altitude:	3.3 ft (higher on request)

Electric motors (others available upon request)	
Voltage/frequency:	230/400 V 50 Hz 265/460V 60Hz (special voltages/motor approvals on request)
Thermal stability:	Class of insulation F, utilisation per class B (higher on request)
IP rating:	IP55 (higher on request)
The motors comply with standards IEC 60034, IEC 60072, IEC 60085, EU 2019/1781	

Basic data

Item no.	Cooler model	Power output Number of contacts Rated current		Weight (lb)	Volume (gal)	Sound pressure level db(A)*	
		400 V 50 Hz	460 V 60 Hz	50/60 Hz	50/60 Hz	50 Hz	60 Hz
35ELK10040	ELK100 -50/60Hz	0.12 hp/4-poles/0.31 A	0.13 hp/4-poles/0.3 A	37	0.45	66	70
35ELK20040	ELK200 -50/60Hz	0.16 hp/4-poles/0.37 A	0.19 hp/4-poles/0.37 A	46	0.45	67	71
35ELK30040	ELK300 -50/60Hz	0.34 hp/4-poles/0.66 A	0.39 hp/4-poles/0.67 A	62	0.58	70	74
35ELK40040	ELK400 -50/60Hz	0.5 hp/4-poles/0.92 A	0.58 hp/4-poles/0.91 A	71	0.85	73	77
35ELK50040	ELK500 -50/60Hz	1.01 hp/4-poles/1.75 A	1.15 hp/4-poles/1.68 A	97	0.98	77	81
35ELK60041	ELK600 -50Hz	1.48 hp/4-poles/2.5 A	-	119	1.14	80	-
35ELK60042	ELK600 -60Hz	-	1.74 hp/4-poles/2.5 A			-	83

Calculation example and nomenclature

Determination

An oil/air cooler is determined in two steps:

1. Determining or selecting the cooler size
2. Determining the actual pressure loss

$t_{ÖE}$ [°F]	Inlet oil temperature
t_{LE} [°F]	Inlet air temperature
ETD [°F]	Temperature differential: ETD = $t_{ÖE}$ - t_{LE}
P_{spec} [hp / °F]	specific cooling performance (see performance curves): P_{spec} = P / ETD
P [hp]	Cooling performance in hp
Q [gpm]	Oil flow rate
C_{Oil} [BTU/lb·°F]	Specific heat capacity of the oil (approx. 0,48 BTU/lb·°F)
ς [lb/gal]	Gravity of oil ≈ 7,51 lb/gal

Calculation example

Assumptions:

Tank capacity	(V)	approx. 52.8 gal
Start up temperature of oil	(T_1)	59 °F (≈ 288 K)
Oil heats up in approx. t = 25 min. (1500 s) to	(T_2)	113 °F (≈ 318 K)
Required oil temperature	($t_{ÖE}$)	140 °F
Inlet air temperature	(t_{LE})	86 °F

Calculation

1. Calculating P from the tank warming

$$P = \frac{V \cdot ς \cdot c_{Oil} \, (T_2 - T_1)}{t} = \frac{52.8 \text{ gal} \cdot 0.9 \, \frac{\text{kg}}{\text{l}} \cdot 2 \, \frac{\text{kJ}}{\text{kg} \cdot \text{K}} \cdot (318 \text{ K} - 288 \text{ K})}{1500 \text{ s}} = 7.2 \text{ kW}$$

2. ETD = $t_{ÖE}$ - t_{LE} = 140 °F – 86 °F = 54 °F
3. Determining the cooler size: P_{spec} = P / ETD = 9,7 hp / 54 °F ≈ 0.18 hp/°F
4. In the graph, select a cooler at 80 L/min (21.1 gpm) with P_{spec} 0.18 hp/°F → ELK300

Performance curves

Tolerance: ± 5 %

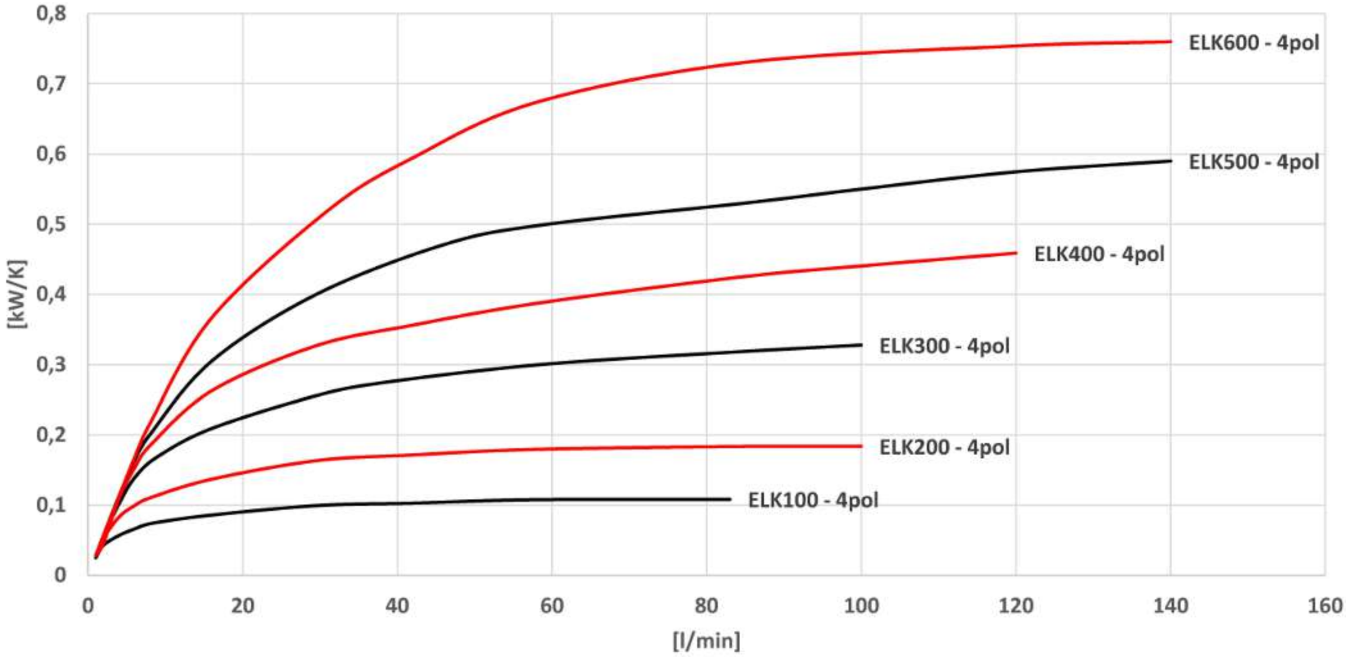


Fig. 1: Specific cooling capacity

Pressure loss curves at medium viscosity of 30 cSt

Tolerance: ± 5 %

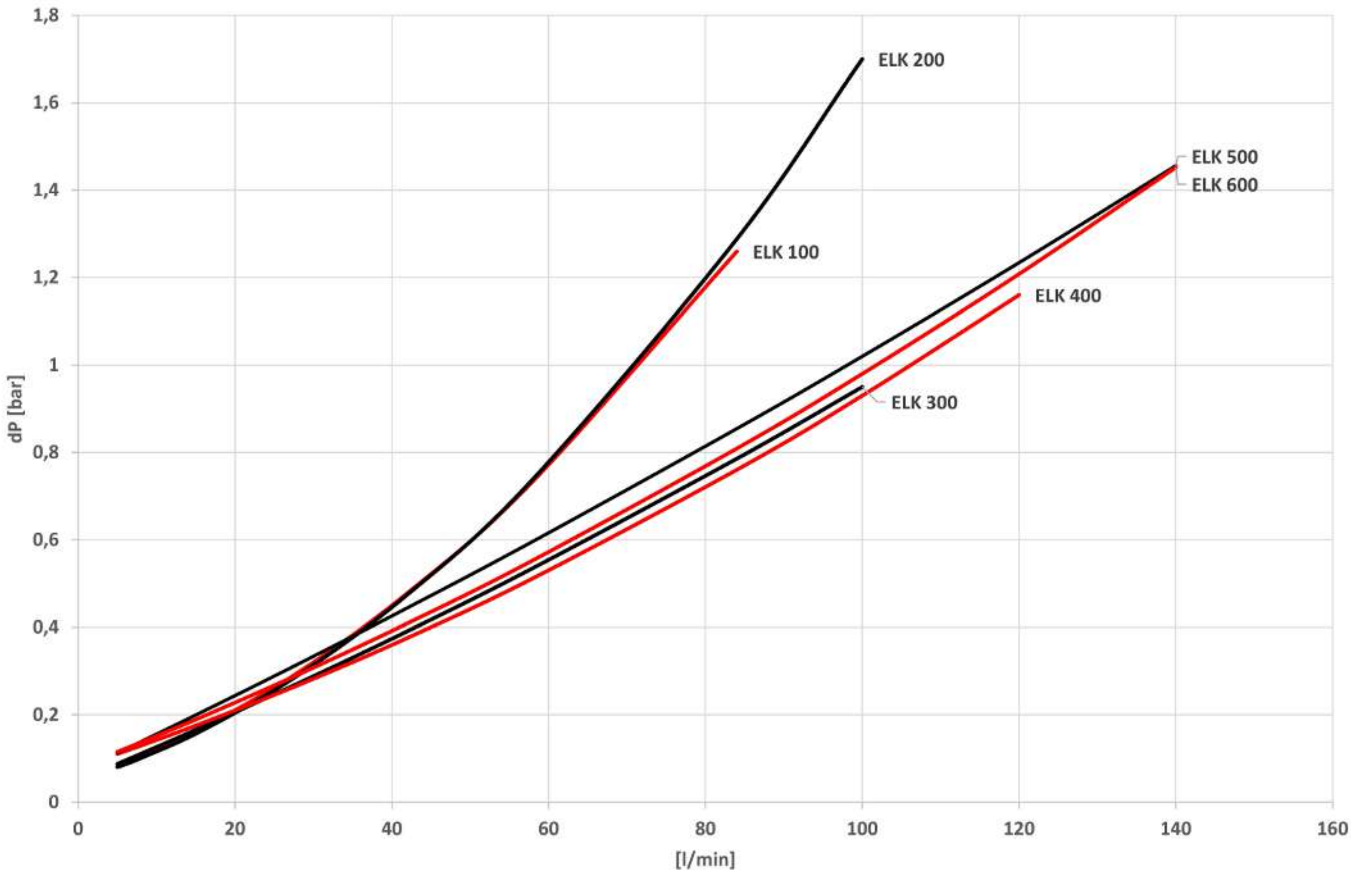


Fig. 2: Pressure loss

Note: When installed outdoors or using higher viscosities, an additional bypass valve may be required. These are not available for the ELK series. In this case, use our BLK series or an external bypass valve.

Temperature/viscosity table

Type of oil	at 122 °F	at 140 °F	at 158 °F
VG 16	9.4	5.6	3.3 cSt
VG 22	15	11	8 cSt
VG 32	21	15	11 cSt
VG 46	29	20	14 cSt
VG 68	43	29	20 cSt
VG 120	68	44	31 cSt
VG 220	126	77	51 cSt
VG 320	180	108	69 cSt

Correction k(visc)

Viscosity (cSt)	K(visc)
10	0.8
30	1
50	1.1
80	1.3
100	1.4
150	1.8

Determining the actual pressure loss

1. Determine Δp from the pressure loss graph (Fig. 2) for oil flow rate L/min and the selected cooler size.
2. Determine the viscosity from the type of oil and temperature.
3. Determine the correction factor k(visc) and multiply by Δp from calculation step 1.

Model key

ELK 300-4-50/60Hz-xxx

Motor frequency
(on the ELK 600, the 50 and 60 Hz versions are different, see table "Basic data")

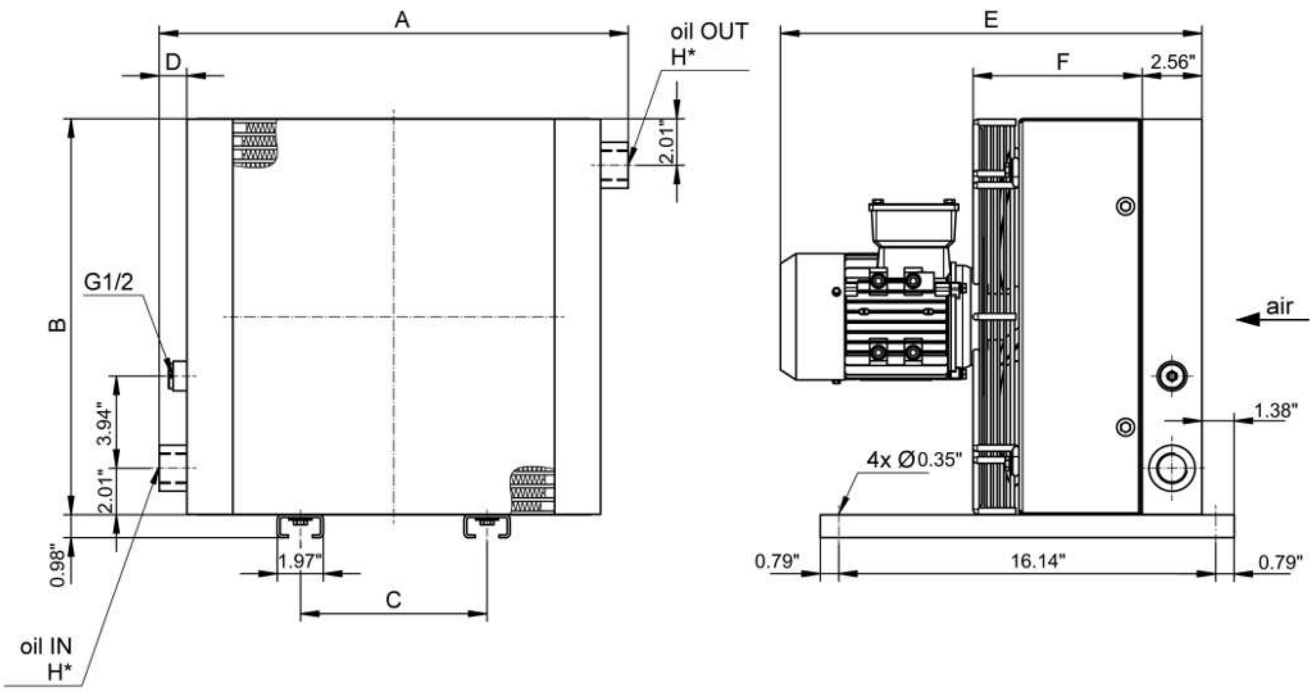
Number of motor contacts

Frame size

ELK 300-4-50/60Hz-T50 *To also have a thermal contact, the specification will be added to the type designation:*

Temperature switch	T50, T60 T70, T80	Temperature in °F, specification see separate data sheet

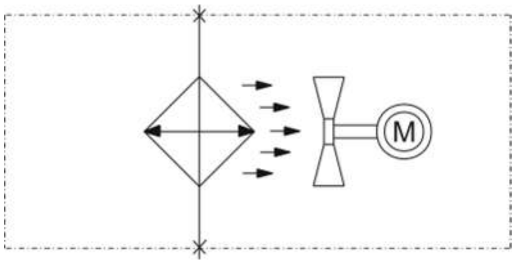
Dimensions

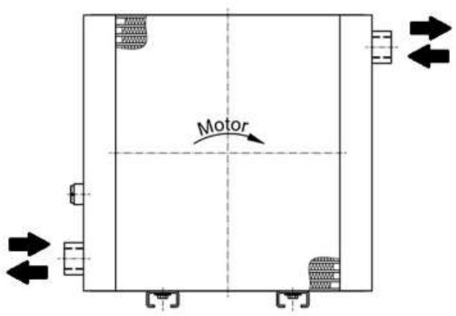


Type	A	B	C	D	E	F	G	H
ELK100	14.17"	11.42"	7.99"	0.98"	15.35"	5.94"	6.69"	2x G3/4"
ELK200	16.73"	13.98"	7.99"	0.98"	15.83"	5.67"	7.95"	2x G3/4"
ELK300	20.08"	16.93"	7.99"	1.18"	18.03"	7.24"	9.45"	2x G1"
ELK400	22.44"	19.33"	7.99"	1.18"	18.74"	7.95v	10.63"	2x G1"
ELK500	24.08"	21.69"	14.02"	1.18"	20.71"	8.39"	11.81"	2x G1"
ELK600	27.17"	24.06"	14.02"	1.18"	23.86"	9.65"	12.99"	2x G1"

Functional diagram

Standard ELK version





Direction of flow left to right or vice versa.

With temperature switch attached