

Oil / air cooler Series BLK-DC



- maintenance friendly design
- compact dimensions
- low noise emissions
- broad performance range
- rugged cooling matrix
- comprehensive accessoires

Why coolers?

There are basically two main concepts in the development of fluid power systems. One is to design systems without any cooler and if the operational conditions show in practice that the system needs a cooler to install it later. This however requires compromises that usually result in financial overspend.

The other concept recognizes that a system originally designed with an integrated cooler can be designed more compactly, needs less installation space and runs more reliably due to the stabilized temperature of the fluid.

Why Bühler?

Today's requirements for an oil/air cooler demand for an effective and compact design with low noise emission and very easy maintenance.

The development of the new BLK-DC series is based on over 30 years of experience in design and sales of air/oil-coolers. In particular the fatigue life of the cooling matrix was highlighted in the development as the matrix has to withstand pressure peaks in the return line.

Due to the exposure to the various ambient conditions air/oil cooler matrixes inevitably require some maintenance. Therefore the cooling matrix can be easily separated from the fan case without the need to dismantle the ventilator or motor or any other parts. If our comprehensive standard range of products does not have an answer for your application we will be pleased to find special solutions for your application.

The data contained in this leaflet is sufficient to determine the right cooler for your application. However, we can offer you a computer program which makes this sizing easier for you.



BNK



BNF, BKF

Description

The BLK-DC series consist of the following components:

- cooler matrix
- fan case with mounting feet
- fan motor assembly consisting of DC motor, fan and finger guard

The cooling matrix and fan can be separated from the fan case individually without the need to dismantle other components.

The cooling matrix of the BLK-DC series is made from aluminium. The matrix is suitable for use with hydraulic fluids (also return lines) but is not suitable for clean water or water based fluids

Please pay attention to the chapter installation.

Sizing the right cooler

The determination of a cooler follows two steps:

- determination of cooler size
- determination of expected pressure loss

Nomenclature

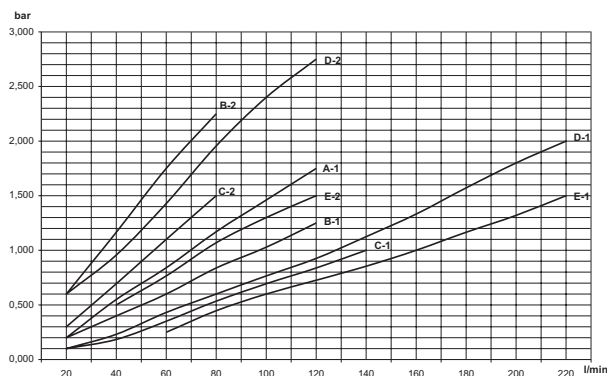
t_{0E} [°C]	inlet oil temperature
t_{LE} [°C]	inlet air temperature
ETD [K]	temperature differential: $ETD = t_{0E} - t_{LE}$
P_{spez} [kW / K]	specific cooling performance (see performance curves) $P_{spez} = P / ETD$
P [kW]	cooling performance in kW
Q [l/min]	oil flow rate
C_{oi} [kJ/kgK]	specific heat capacity of oil (approx. 2,0 kJ / kgK)
[kg/dm ³]	specific gravity of oil $\approx 0,9$ kg/dm ³

Calculation sample:

assumptions:

tank capacity	(V)	ca. 200 l
start up temperature of oil	(T ₁)	15 °C
The oil is heated up approx. 25 minutes to	(T ₂)	45 °C
required oil temperature	(t _{0E})	60 °C
inlet air temperature	(t _{LE})	30 °C
oil flow rate	(Q)	80 l/min

Pressure loss curves determined with an average viscosity of 30 cSt



Attention: If the coolers are used in open air or the oil has even higher viscosity the installation of by-pass valves may be necessary. Please check the section "function schemes".

Calculation

1. calculation of P

$$P = \frac{200 \times 0,9 \times 2,0 \times (45-15)}{25 \times 60} = 7,2 \text{ kW}$$

2. $ETD = t_{0E} - t_{LE} = 60^\circ\text{C} - 30^\circ\text{C} = 30 \text{ K}$

3. required specific performance:

$$P_{spez} = P / ETD = 7,2 \text{ kW} / 30 \text{ K} = 0,24 \text{ kW/K}$$

4. choose in curve at 80 l/min a cooler with:

$$P_{spez} 0,24 \text{ kW/K:}$$

select BLK-DC-B-1

Temperature/viscosity table

Type of oil	at 50°C	at 60°C	at 70°C	
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

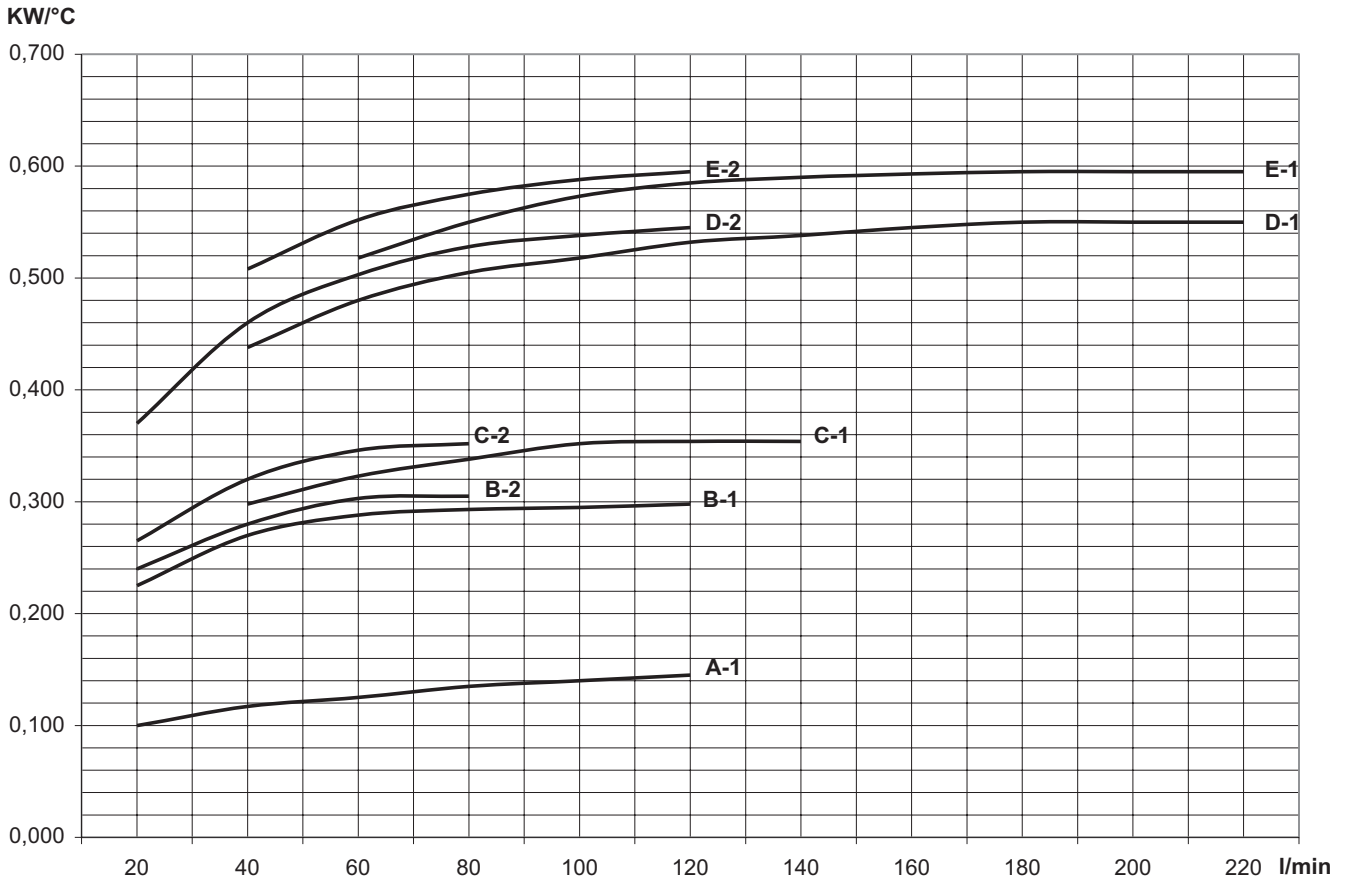
Correction factor k(visc)

viscosity (cSt)	k(visc)	viscosity (cSt)	k(visc)
10	0,6	60	1,6
20	0,8	80	2,1
30	1,0	100	2,7
40	1,2	150	4,2
50	1,4		

Determine of real pressure loss:

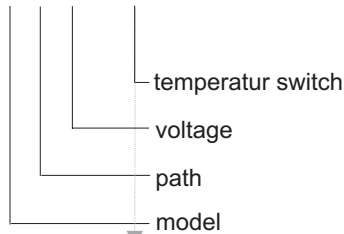
1. select in graph the Δp at Q of a chosen cooler type
2. determine real viscosity from temperature/viscosity table
3. take correction factor k(visc) according to real viscosity and multiply with Δp in bar

Performance curves



Type code

BLK-DC-A-1-12V-T60



temperatur switch TSE-BLK-DC-T*
technical data see below

standard type	1 path / 12V part - no.	1path / 24V part - no.	2 path / 12V part - no.	2 path / 24V part - no.
BLK-DC-A	35DCA112	35DCA124	-	-
BLK-DC-B	35DCB112	35DCB124	35DCB212	35DCB224
BLK-DC-C	35DCC112	35DCC124	35DCC212	35DCC224
BLK-DC-D	35DCD112	35DCD124	35DCD212	35DCD224
BLK-DC-E	35DCE112	35DCE124	35DCE212	35DCE224

General data

material / surface protection

cooler matrix aluminium, gray RAL 9006
house: steel, black RAL 9005
fan: PPG

Fluids

mineral oil to DIN 51524
water glykol HFC according to CETOP RF 77 H

Operating pressure

static max. 26 bar
dynamic: max. 20 bar

temperature

operating max. 120°C
ambient max. 50°C

max. viscosity

100 cSt average viscosity,
higher viscosity upon request

electrical motors

protection class

12 oder 24 V DC
IP 64

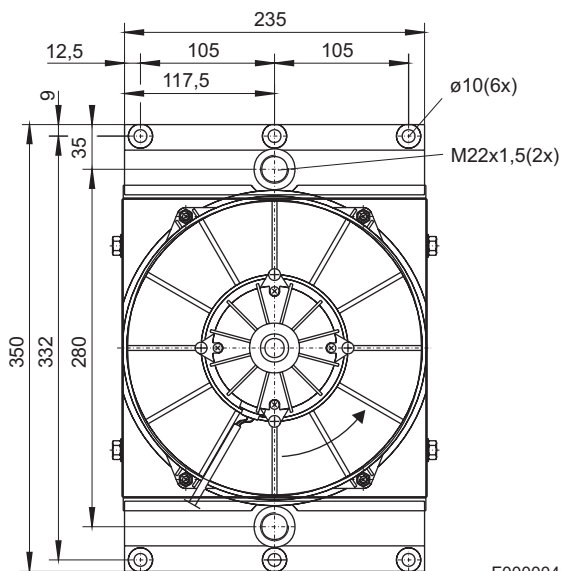
temperatur switch

* Switch point

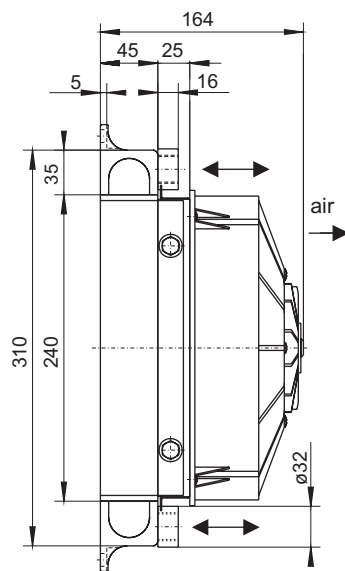
voltage max.
current load max.
function
hysteresis
protection class

TSE-BLK-DC-
T60 = 60 °C (140 °F)
T70 = 70 °C (158 °F)
230 VAC/DC
2A
n.c. (opener)
approx 15°C (27 °F)
IP 65

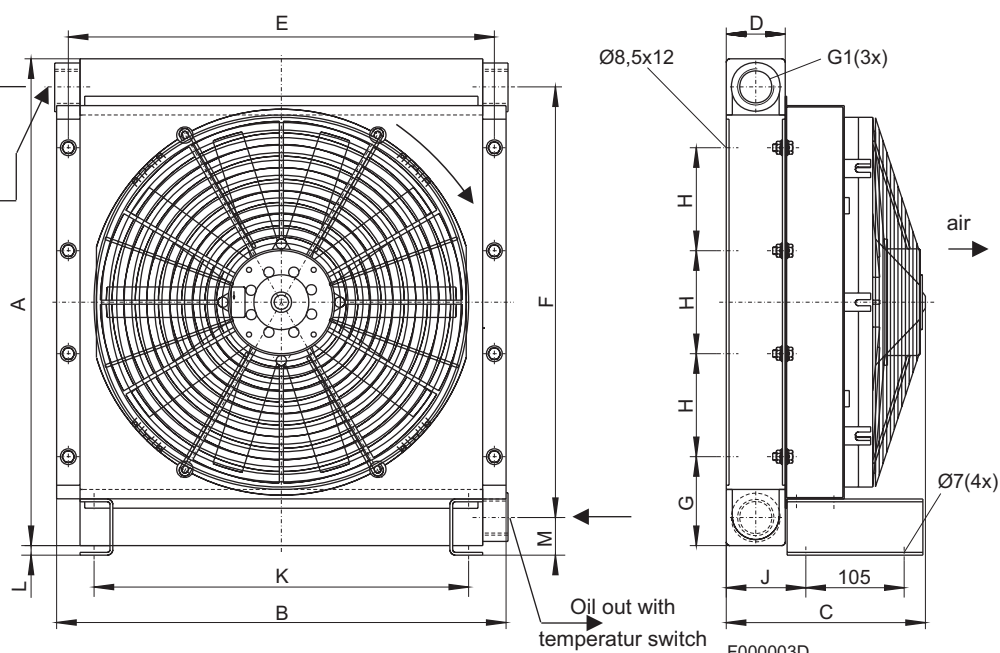
BLK-DC-A



F000004D



BLK-DC-B - E

Oil in with
temperatur switch

F000003D

dimension	A	B	C	D	E	F	G	H	J	K	L	M
BLK-DC-B	420	342	220	63	317	360	110	100	83	302	17	47
BLK-DC-C	420	342	251	94	317	360	110	100	114	302	17	47
BLK-DC-D	520	480	213	63	455	460	95	110	83	390	12	42
BLK-DC-E	520	480	241	94	455	460	95	110	114	390	12	42

	full load current [A]		air flow m ³ /s	noise emission 1 m [db(A)]	noise emission 7 m [db(A)]	weight [kg]
	12 V	24 V				
BLK-DC-A	10,5	5,2	0,24	73	63	6
BLK-DC-B	18,5	10	0,49	79	64	10
BLK-DC-C	18,5	10	0,45	79	64	13
BLK-DC-D	21,8	10,7	0,84	84	67	17
BLK-DC-E	21,8	10,7	0,74	84	67	24

Installation

Location

The cooler must be located in such a way that the air flowing through the matrix has free flow on entry and exit. The distance between air intake or air outlet to the nearest surrounding obstacle should be a minimum of half the height of the matrix (dimension A). Free air flow must be provided. If the cooler is to be used near to working personnel the effect of hot draught and noise emissions must be taken into account.

If the ambient air is carrying impurities or other particulates the cooling matrix could become clogged quite quickly thus reducing the cooling efficiency. If this situation is unavoidable we recommend cleaning the matrix on a regular basis (see operation manual).

Always provide good accessibility for inspection or maintenance.

Mounting

The BLK's are mounted with four bolts through their mounting feet to an adequate support structure. The cooler can be mounted over head or to walls with no restriction.

Connection of oil circuit

The connections from the cooler to the system should be stress and vibration free. The use of flexible hoses is highly recommended. Please comply with local safety requirements and avoid any risk to the environment from oil spills etc.

The series BLK is a product designed by BÜHLER company

The company

BÜHLER MESS- UND REGELTECHNIK GmbH, Ratingen was founded in 1969.

BÜHLER's corporate philosophy is to offer products and solutions representative of the state of the art.

BÜHLER also specialises in producing level and temperature measuring equipment, particularly for the fluid power industry.



The products

Our commitment to customers has given rise to a production program which comprises specialized products for fluid technology.

Although these products were initially developed entirely as specials many of them have now become industry standards.

Bühler quality

Bühler has achieved accreditation from Lloyd's register to be in compliance with ISO 9001 and therefore consider it our obligation to offer our customers not only excellent products, but also the best service possible.