Off-Line Air / Oil Cooler
Series BNK

- **Maintenance friendly design**
- **Compact dimensions**
- **Low noise emissions**
- **Broad performance range**
- **Rugged cooling matrix**
- **Comprehensive accessories**

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Why coolers?

The off-line installation of an air/oil cooler is in many cases the most efficient and affordable cooling solution, while offering low installation space and costs. The inclusion of an off line filter can further increase efficiency by removing harmful impurities from the system fluid.

The BNK series is a comprehensive range of off-line air /oil coolers with an integrated circulation pump. The gerotor type pump guarantees low noise emissions and the flow rates and matrix sizes are selected to provide optimal solutions.

Where requested we can deliver the off-line coolers equipped with high quality filters.

Why Buhler?

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

The development of the new BNK series is based on over 30 years of experience in design and sales of air/oil-coolers. Fatique life of the cooling matrix was a major consideration in the product development.

If our comprehensive standard range of products does not meet your requirements we will be pleased to find specific 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 software which makes sizing easier for you.

BNK

BNF, BKF

Description

The BNK series consist of the following components:

- cooler matrix
- fan case with mounting feet
- fan motor assembly consisting of an AC motor carrying ciculation pump and fan with finger guard motor console

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 BNK series is made from aluminium. The matrix is suitable for use with hydraulic fluids.

The cooling matrix can be equipped with by-pass valves of different configurations (see type code).

Please note the installation chapter.

General Data

Material / surface protection
Cooling matrix aluminium, varnished
Vent housing, protection grid and motor console mild steel, powder coated

Colour RAL 7001

Fluids
Mineral oil according to DIN 51524

Operating pressure
static max. 10 bar
suction pressure max. -0,4 bar

Operating temperature
Media max. 100°C (higher temperature upon request)

Max. viscosity 100 cSt average viscosity, (higher values upon request)

Electrical motors (others on demand)
Voltage 230 / 400 V 50 Hz ± 5%
276 / 480 V 60 Hz ± 5%
Insulation class F
Rise in temperature B
Protection class IP 55
Design according to IEC 34-1, IEC 72-1, DIN 57530, VDE 0530

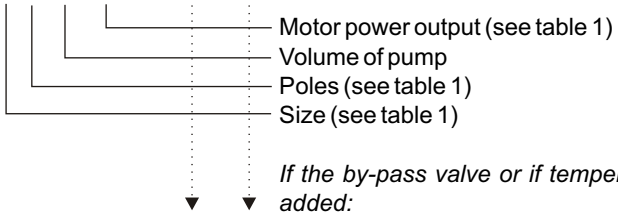
Basic Data (at 50 Hz Frequency)

Part No.	Type	Spec. cooling performance kW/K	Cooling performance ETD = 40K (kW)	Max. flow rate (l/min)	Power output Poles Full load at 400V	Weight (kg)	Volume (l)	Noise emission db(A) *
3601406IE2	BNK 1.4-7,5-0,75kW	0,04	1,6	7,5	0,75 kW /4/ 1,94 A	25	0,7	64
3601401IE2	BNK 1.4-15-0,75kW	0,07	2,8	15	0,75 kW /4/ 1,94 A	25	0,7	64
3602401IE2	BNK 2.4-15-0,75kW	0,09	3,6	15	0,75 kW /4/ 1,94 A	30	1,3	66
3602402IE2	BNK 2.4-30-0,75kW	0,13	5,0	28	0,75 kW /4/ 1,94A	33	1,3	66
3602407IE2	BNK 2.4-40-1,1kW	0,16	6,4	42	1,1 kW /4/ 2,74 A	35	1,3	66
3603401IE2	BNK 3.4-15-0,75kW	0,15	6,0	15	0,75 kW /4/ 1,94 A	35	1,8	71
3603402IE2	BNK 3.4-30-0,75kW	0,24	9,6	28	0,75 kW /4/ 1,94 A	38	1,8	71
3603407IE2	BNK 3.4-40-1,1kW	0,28	11,2	42	1,1 kW /4/ 2,74 A	40	1,8	71
3604402IE2	BNK 4.4-30-0,75kW	0,32	12,8	28	0,75 kW /4/ 1,94 A	43	2,3	73
3604407IE2	BNK 4.4-40-1,1kW	0,34	13,6	42	1,1 kW /4/ 2,74 A	45	2,3	73
3604403IE2	BNK 4.4-60-1,5kW	0,36	14,4	57	1,5 kW /4/ 3,4 A	51	2,3	73
3604404IE2	BNK 4.4-90-2,2kW	0,38	15,2	86	2,2 kW /4/ 4,59 A	61	2,3	73
3604605IE2	BNK 4.6-40-1,1kW	0,24	9,6	38	1,1 kW /6/ 2,54 A	51	2,3	63
3604603IE2	BNK 4.6-60-1,1kW	0,26	10,4	57	1,1 kW /6/ 2,54 A	61	2,3	63
3605403IE2	BNK 5.4-60-2,2kW	0,51	20,4	57	2,2 kW /4/ 4,59 A	71	3,1	79
3605404IE2	BNK 5.4-90-2,2kW	0,56	22,4	86	2,2 kW /4/ 4,59 A	73	3,1	79
3605605IE2	BNK 5.6-40-1,5kW	0,33	13,2	36	1,5 kW /6/ 3,31 A	70	3,1	68
3605603IE2	BNK 5.6-60-1,5kW	0,38	15,2	55	1,5 kW /6/ 3,31 A	72	3,1	68
3606413IE2	BNK 6.4-60-3,0kW	0,90	36,0	57	3,0 kW /4/ 6,33 A	87	4,1	86
3606414IE2	BNK 6.4-90-3,0kW	1,01	40,4	86	3,0 kW /4/ 6,33 A	88	4,1	86
3606613IE2	BNK 6.6-60-2,2kW	0,65	26,0	58	2,2 kW /6/ 4,85 A	86	4,1	74
3607413IE2	BNK 7.4-60-3,0kW	0,93	37,2	58	3,0 kW /4/ 6,33 A	99	5,4	89
3607414IE2	BNK 7.4-90-3,0kW	1,05	42,0	86	3,0 kW /4/ 6,33 A	100	5,4	89
3607613IE2	BNK 7.6-60-2,2kW	0,71	28,4	58	2,2 kW /6/ 4,85 A	98	5,4	75
3608613IE2	BNK 8.6-60-3,0kW	1,13	45,2	58	3,0 kW /6/ 6,6 A	118	6,3	79

*DIN EN ISO 3744, Class 3

Type code

BNK 4 .4-30-0,75kW- IBx - T50



If the by-pass valve or if temperature switch are needed the following codes have to be added:

BLK 4 . 4-30-0,75kW- IBx - T50

By-pass version	**AB**	external by-pass
	IB	integrated by-pass
	ITB	integrated temperature operated by-pass 2 bar / 45°C
	ATB	external temperature operated by-pass 2 bar / 45°C
	x	by-pass pressure **2 bar**
Temperature switch	**T50,T60**	figures stand for °C, details see data sheet
	T70,T80	

Definitions and Example

$t_{ÖE}$ [°C]	inlet oil temperature
t_{LE} [°C]	inlet air temperature
ETD [K]	temperature differential: **ETD = $t_{ÖE}$ - 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
$C_{öl}$ [kJ/kgK]	specific heat capacity of oil (approx. 1,8 kJ / kgK)
ς [kg/dm³]	specific gravity of oil = 0,89 kg/dm³

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	($t_{ÖE}$)	60 °C
inlet air temperature	(t_{LE})	30 °C

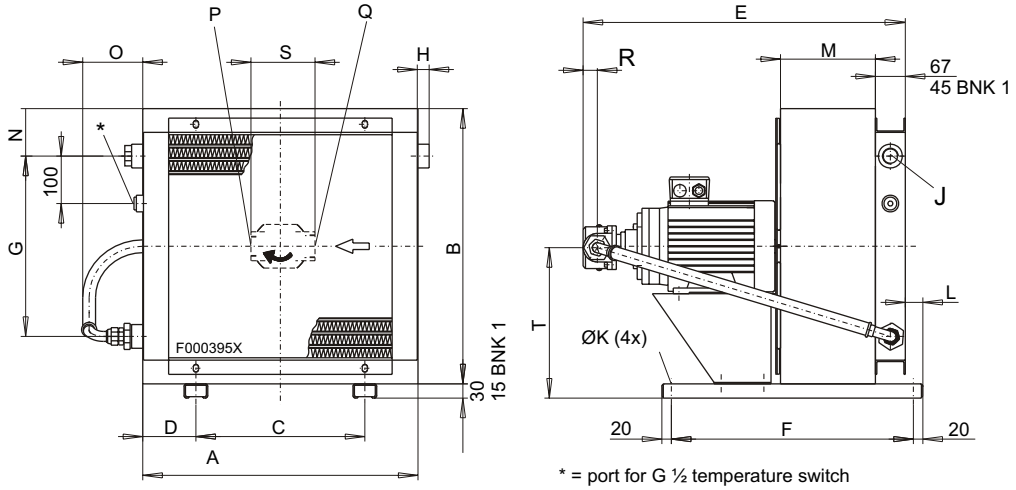
Calculation

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 = $t_{ÖE}$ - t_{LE} = 60°C - 30 °C = 30 K
3. required specific performance:
   P_{spez} = P / ETD = 7,2 kW / 30 K = 0,24 kW/K
4. From the table, select a cooler with:
   P_{spez} 0,24 kW/K:
   There is only one possibility:
   BLK 3.4 with 30 l pump

Dimensions

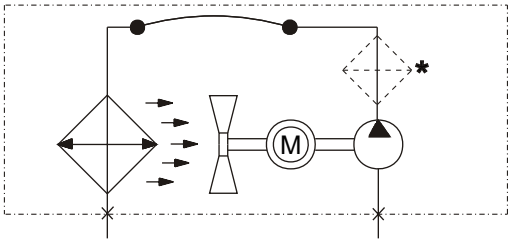


* = port for G ½ temperature switch

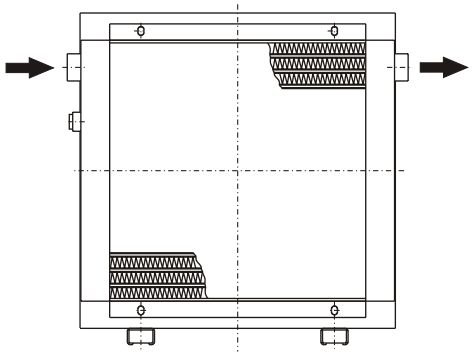
Model	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T
BNK 1.4-7,5-0,75kW	315	243	190	62.5	417	340	-	-	2x G ½	9	40	52	-	-	G1	G ¾	30	144	130
BNK 1.4-15-0,75kW	315	243	190	62.5	417	340	-	-	2x G ½	9	40	52	-	-	G1	G1 ¼	30	130	130
BNK 2.4-15-0,75kW	370	370	203	83.5	476	510	-	25	2x G1	9	33	125	106	119	G1	G1 ¼	30	130	212
BNK 2.4-30-0,75kW	370	370	203	83.5	474	510	-	25	2x G1	9	33	125	106	119	G1	G1 ¼	30	130	212
BNK 2.4-40-1,1kW	370	370	203	83,5	524	510	-	25	2x G1	9	33	125	106	119	G1	G1 ¼	30	130	212
BNK 3.4-15-0,75kW	440	440	203	118.5	501	510	230	25	3x G1	9	33	150	105	119	G1	G1 ¼	30	130	247
BNK 3.4-30-0,75kW	440	440	203	118.5	499	510	230	25	3x G1	9	33	150	105	119	G1	G1 ¼	30	130	247
BNK 3.4-40-1,1kW	440	440	203	118,5	548	510	230	25	3x G1	9	33	150	105	119	G1	G1 ¼	30	130	247
BNK 4.4-30-0,75kW	500	500	203	148.5	524	510	230	25	3x G1	9	33	175	104	119	G1	G1 ¼	30	130	277
BNK 4.4-40-1,1kW	500	500	203	148.5	574	510	230	25	3x G1	9	33	175	104	119	G1	G1 ¼	30	130	277
BNK 4.4-60-1,5kW	500	500	203	148.5	617	510	230	25	3x G1	9	33	175	104	135	G1 ¼	G1 ½	30	135	277
BNK 4.4-90-2,2kW	500	500	203	148.5	688	510	230	25	3x G1	9	33	175	104	135	G1 ¼	G1 ½	53	135	277
BNK 4.6-40-1,1kW	500	500	203	148.5	617	510	230	25	3x G1	9	33	175	104	135	G1 ¼	G1 ½	30	135	277
BNK 4.6-60-1,1kW	500	500	203	148.5	652	510	230	25	3x G1	9	33	175	104	135	G1 ¼	G1 ½	53	135	277
BNK 5.4-60-2,2kW	580	580	356	112	678	510	305	23.5	3x G1	9	33	200	100	134	G1 ¼	G1 ½	30	135	317
BNK 5.4-90-2,2kW	580	580	356	112	713	510	305	23.5	3x G1	9	33	200	100	134	G1 ¼	G1 ½	53	135	319
BNK 5.6-40-1,5kW	580	580	356	112	678	510	305	23.5	3x G1	9	33	200	100	134	G1 ¼	G1 ½	30	135	317
BNK 5.6-60-1,5kW	580	580	356	112	713	510	305	23.5	3x G1	9	33	200	100	134	G1 ¼	G1 ½	53	135	317
BNK 6.4-60-3,0kW	700	700	356	172	719	510	410	9,5	3x G1 ¼	9	33	225	110	132	G1 ¼	G1 ½	30	135	377
BNK 6.4-90-3,0kW	700	700	356	172	754	510	410	9,5	3x G1 ¼	9	33	225	110	132	G1 ¼	G1 ½	53	135	377
BNK 6.6-60-2,2kW	700	700	356	172	751	510	410	9,5	3x G1 ¼	9	33	225	110	132	G1 ¼	G1 ½	53	135	377
BNK 7.4-60-3,0kW	700	840	356	172	744	510	590	9,5	3x G1 ¼	9	33	250	91	132	G1 ¼	G1 ½	30	135	447
BNK 7.4-90-3,0kW	700	840	356	172	779	510	590	9,5	3x G1 ¼	9	33	250	91	132	G1 ¼	G1 ½	53	135	447
BNK 7.6-60-2,2kW	700	840	356	172	776	510	590	9,5	3x G1 ¼	9	33	250	91	132	G1 ¼	G1 ½	53	135	447
BNK 8.6-60-3,0kW	870	870	508	181	795	510	585	11	3xG1 ¼	9	33	275	101.5	134	G1 ¼	G1 ½	53	135	462

Function schemes

Standard BNK 2

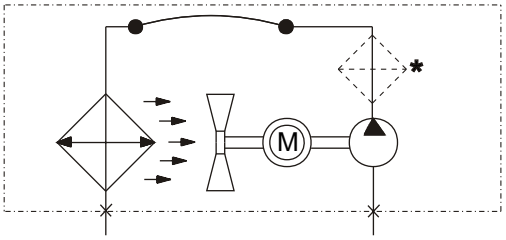


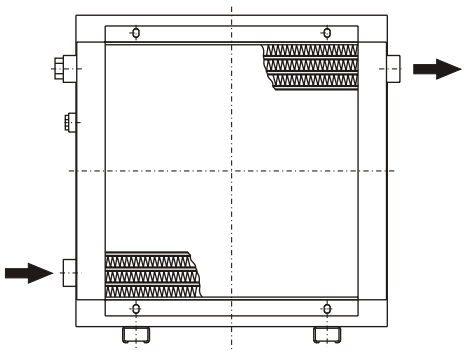
* recommended position of an additional oil filter



Flow direction from left to right. Other ports must be plugged.

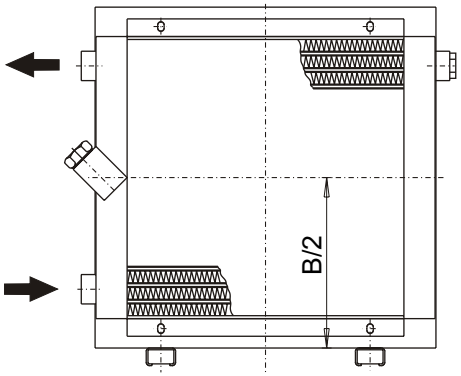
Standard BNK 1/3 to BNK 7





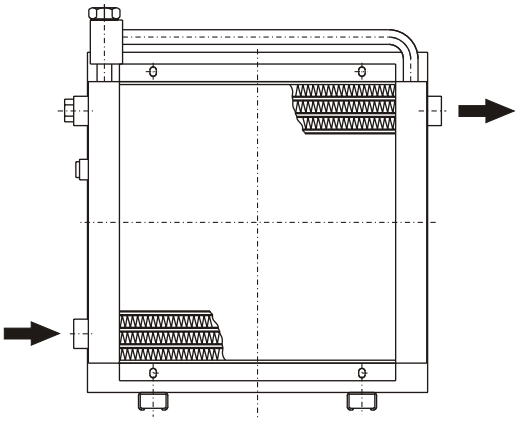
Flow direction from lower left to upper right. Other ports must be plugged.

Internal by-pass IB/ITB (BNK 3-7)



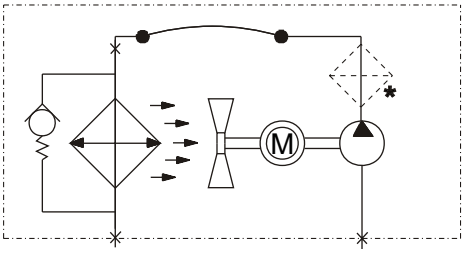
Oil inlet and outlet are at the same side. Ports on opposite side must be plugged.

External by-pass AB/ATB (BNK 2-7)

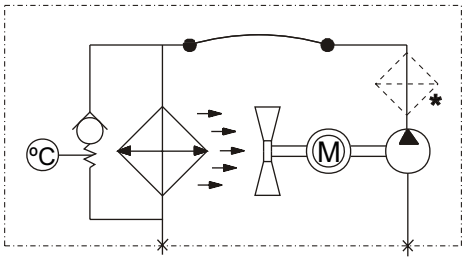


Oil inlet always from lower left port, outlet on opposite side. Other ports must be plugged.

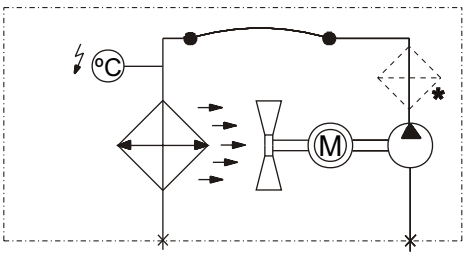
With by-pass valve



With temperature operated by-pass valve



With temperature switch



* optional mounted filter available

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 B). Free air flow must be provided. If the cooler is to be sited 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 thus reducing the cooling efficiency. If this situation is unavoidable, we recommend cleaning the matrix on a regular basis (see operation manual).

If the cooler is located in open air the motors must be weather shielded.

Always provide good accessibility for inspection or maintenance.

Mounting

The BNK's are mounted with four bolts through their mounting feet to an adequate support structure.

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 BNK is a product designed by BÜHLER company

The company

BÜHLER TECHNOLOGIES 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.