

Page



Capacitor Switching -Contactors 2

Typical Circuit Diagram 2



Contactors 3



Auxiliary Contact Blocks 3

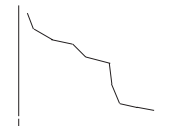


Dimensions 4

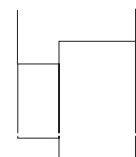


Technical Data 5,6,7

Contactor operation 8



Function 9



Construction 10

Oscillogram 11

Capacitor Switching Contactors

for use with reactive or non-reactive capacitor banks



Rated Operational Power at 50/60Hz Ambient Temperature						Aux. Contacts Built-in Add.		Type	Pack Weight		
50°C			60°C			NO	NC	pcs.	Coil Voltage 220-240V 50Hz	pcs.	kg/pc.
380V 400V kVAr	415V 440V kVAr	660V 690V kVAr	380V 400V kVAr	415V 440V kVAr	660V 690V kVAr						
0-12,5	0-13	0-20	0-12,5	0-13	0-20	1	-	1 ¹⁾	K3-18K10 230	1	0,34
0-12,5	0-13	0-20	0-12,5	0-13	0-20	-	1	1 ¹⁾	K3-18K01 230	1	0,34
10-20	10,5-22	17-33	10-20	10,5-22	17-33	-	-	3 ²⁾	K3-24K00 230	1	0,62
10-25	10,5-27	17-41	10-25	10,5-27	17-41	-	-	3 ²⁾	K3-32K00 230	1	0,62
20-33,3	23-36	36-55	20-33,3	23-36	36-55	-	-	3 ²⁾	K3-50K00 230	1	1,0
20-50	23-53	36-82	20-50	23-53	36-82	-	-	3 ²⁾	K3-62K00 230	1	1,0
20-75 ³⁾	23-75 ³⁾	36-120 ³⁾	20-60	23-64	36-100	-	-	3 ²⁾	K3-74K00 230	1	1,0
33-80	36-82	57-130	33-75	36-77	57-120	-	-	6 ⁴⁾	K3-90K00 230	1	2,3
33-100 ⁵⁾	36-103 ⁵⁾	57-170 ⁵⁾	33-90 ⁵⁾	36-93 ⁵⁾	57-148 ⁵⁾	-	-	6 ⁴⁾	K3-115K00 230	1	2,3

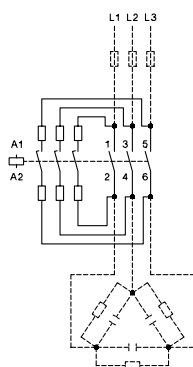
- 1) HN.. or HA.. snap-on
- 2) 2 HB.. on the left or right side and 1 HN.. or HA.. snap-on
- 3) Consider the max. thermal current of the contactor K3-74A: I_{th} 130A
- 4) 2 HB.. on the left or right side and 4 HN.. or HA.. snap-on
- 5) Consider the min. cross-section of conductor at max. load

Specification: Contactors K3..K are suitable for switching low-inductive and low loss capacitors in capacitor banks (IEC70 and 831, VDE 0560) without and with reactors.
 Capacitor switching contactors are fitted with early make contacts and damping resistors, to reduce the value of make current <math><70 \times I_e</math>.
Operating Conditions: Capacitor switching contactors are protected against contact welding for a prospective making current of $200 \times I_e$.

Technical Data acc. to IEC 947-4-1, IEC 947-5-1, EN 60947-4-1, EN 60947-5-1, VDE 0660

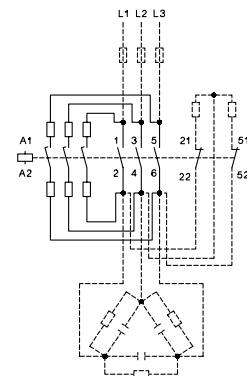
Type		K3-18K	K3-24K	K3-32K	K3-50K	K3-62K	K3-74K	K3-90K	K3-115K	
Max. frequency of operations z	1/h	120	120	120	120	120	80	80	80	
Contact life	S x 10 ³	250	150	150	150	150	120	100	100	
Rated operational current I _e	at 50°C	A	0-18	14-28	14-36	30-48	30-72	30-108	50-115	50-144
	at 60°C	A	0-18	14-28	14-36	30-48	30-72	30-87	50-115	50-144
Fuses gL (gG)	from / to	A	35 / 63	50 / 80	63 / 100	80 / 160	125 / 160	160/200	160/200	160/250

Typical Circuit Diagram



Wiring Diagram for Quick Discharge Resistors

Make sure that the current of the discharge resistors is not higher than the rated current (AC1) of the auxiliary contacts



Mounting instructions:

In the area of capacitor switching contactors, difficulty inflammable and self-extinguishing materials may be used only, because abnormal temperatures within the area of the resistance spirals cannot be excluded.

Contactors

for use with reactive capacitor banks



Rated Operational Power at 50/60Hz Ambient Temperature						Aux. Contacts		Type	Pack	Weight	
50°C			60°C			Built-in	Add.				
380V kVAr	415V kVAr	660V kVAr	380V kVAr	415V kVAr	660V kVAr	NO	NC	Coil Voltage 220-240V 50Hz ↓	pcs.	kg/pc.	
5	5,5	8	5	5,5	8	1	-				4 ¹⁾
9	9,5	15	9	9,5	15	1	-	4 ¹⁾	K3-14A10 230	1	0,23
12,5	13	20	12,5	13	20	1	-	4 ¹⁾	K3-18A10 230	1	0,23
13	14	22	13	14	22	1	-	4 ¹⁾	K3-22A10 230	1	0,23
20	22	33	20	22	33	-	-	6 ²⁾	K3-24A00 230	1	0,48
25	27	41	25	27	41	-	-	6 ²⁾	K3-32A00 230	1	0,48
27,5	30	48	27,5	30	48	-	-	6 ²⁾	K3-40A00 230	1	0,48
33,3	36	55	33,3	36	55	-	-	6 ²⁾	K3-50A00 230	1	0,85
50	53	82	50	53	82	-	-	6 ²⁾	K3-62A00 230	1	0,85
75 ³⁾	75 ³⁾	100	60	64	100	-	-	6 ²⁾	K3-74A00 230	1	0,85
80	82	130	75	77	120	-	-	9 ⁴⁾	K3-90A00 230	1	2,2
100 ⁵⁾	103 ⁵⁾	170 ⁵⁾	90 ⁵⁾	93 ⁵⁾	148 ⁵⁾	-	-	9 ⁴⁾	K3-115A00 230	1	2,2

- 1) 4 HN.. or HA.. snap-on
- 2) 2HB11 on the left or right side and 4 HN.. or HA.. snap-on
- 3) Consider the max. thermal current: I_{th} 130A
- 4) 2 HB.. on the left or right side and 7 HN.. or HA.. snap-on
- 5) Consider the min. cross-section of conductor at max. load

Auxiliary Contact Blocks



Rated Operational Current				Contacts	Type	Pack	Weight
AC15 230V A	AC1 400V A	AC1 690V A	For Contactors				
6	4	25	K3-10.. bis K3-115..	- 1	HA01	10	0,03
3	2	10	K3-24.. to K3-115..	1 1	HB11	10	0,02
3	2	10	for side mounting	- 2	HB02	10	0,02
3	2	10	K3-10.. to K3-115..	1 -	HN10	10	0,02
3	2	10	K3-10.. to K3-115..	- 1	HN01	10	0,02

Capacitor Switching Contactors

Data according to IEC 947-4-1, EN 60947-4-1, VDE 0660

Switching of non-reactive and reactiv 3-phase capacitor banks			Type	K3-18K	K3-24K	K3-32K	K3-50K	K3-62K	K3-74K	K3-90K	K3-115K
Ambient temperature $\leq 50^{\circ}\text{C}$											
Rated operational current I_e	690V	A	0-18	14-28	14-36	30-48	30-72	30-108 ¹⁾	50-115	50-144 ²⁾	
Rated operational power	220-240V	kVAr	0-7	5-11	5-14	12-20	12-28	12-33	20-45	20-55 ²⁾	
	380-400V	kVAr	0-12,5	10-20	10-25	20-33,3	20-50	20-75 ¹⁾	33-80	33-100 ²⁾	
	415-440V	kVAr	0-13	10,5-22	10,5-27	23-36	23-53	23-75 ¹⁾	36-82	36-103 ²⁾	
	500V	kVAr	0-15	12-25	12-30	26-40	26-60	26-75	43-100	43-120 ²⁾	
	525V	kVAr	0-15	12-25	12-32	26-43	26-64	26-80	45-105	45-125 ²⁾	
	660-690V	kVAr	0-20	17-33	17-41	36-55	36-82	36-120	57-130	57-170 ²⁾	
	1000V	kVAr	-	-	-	-	-	-	85-160	85-200 ²⁾	
Ambient temperature $\leq 60^{\circ}\text{C}$											
Rated operational current I_e	690V	A	0-18	14-28	14-36	30-48	30-72	30-87	50-108	50-130 ²⁾	
Rated operational power	220-240V	kVAr	0-7	5-11	5-14	12-20	12-28	12-30	20-40	20-50 ²⁾	
	380-400V	kVAr	0-12,5	10-20	10-25	20-33,3	20-50	20-60	33-75	33-90 ²⁾	
	415-440V	kVAr	0-13	10,5-22	10,5-27	23-36	23-53	23-64	36-77	36-93 ²⁾	
	500V	kVAr	0-15	12-25	12-30	26-40	26-60	26-70	43-90	43-110 ²⁾	
	525V	kVAr	0-15	12-25	12-32	26-43	26-64	26-75	45-95	45-115 ²⁾	
	660-690V	kVAr	0-20	17-33	17-41	36-55	36-82	36-100	57-120	57-148 ²⁾	
	1000V	kVAr	-	-	-	-	-	-	85-150	85-180 ²⁾	

Switching of reactiv 3-phase capacitor banks			Type	K3-18A	K3-24A	K3-32A	K3-50A	K3-62A	K3-74A	K3-90A	K3-115A
Ambient temperature $\leq 50^{\circ}\text{C}$											
Rated operational current I_e	690V	A	18	28	36	48	72	108 ¹⁾	115	144 ²⁾	
Rated operational power	220-240V	kVAr	7	11	14	20	28	33	45	55 ²⁾	
	380-400V	kVAr	12,5	20	25	33,3	50	75 ¹⁾	80	100 ²⁾	
	415-440V	kVAr	13	22	27	36	53	75 ¹⁾	82	103 ²⁾	
	500V	kVAr	15	25	30	40	60	75	100	120 ²⁾	
	525V	kVAr	15	25	32	43	64	80	105	125 ²⁾	
	660-690V	kVAr	20	33	41	55	82	120	130	170 ²⁾	
	1000V	kVAr	-	-	-	-	-	-	160	200 ²⁾	
Ambient temperature $\leq 60^{\circ}\text{C}$											
Rated operational current I_e	690V	A	18	28	36	48	72	87	108	130 ²⁾	
Rated operational power	220-240V	kVAr	7	11	14	20	28	30	40	50 ²⁾	
	380-400V	kVAr	12,5	20	25	33,3	50	60	75	90 ²⁾	
	415-440V	kVAr	13	22	27	36	53	64	77	93 ²⁾	
	500V	kVAr	15	25	30	40	60	70	90	110 ²⁾	
	525V	kVAr	15	25	32	43	64	75	95	115 ²⁾	
	660-690V	kVAr	20	33	41	55	82	100	120	148 ²⁾	
	1000V	kVAr	-	-	-	-	-	-	150	180 ²⁾	

1) Consider the max. thermal current: I_{th} 130A

2) Consider the min. cross-section of conductor at max. load

Capacitor Switching Contactors for North America

Data according to UL508

Main Contacts	Type	K3-18K	K3-24K	K3-32K	K3-50K	K3-62K	K3-74K	K3-90K	K3-115K	
Rated operational power of 3-phase capacitor banks at 60Hz (3ph)	110-120V	kVAr	0-3,5	3-5,5	3-7	6,5-10	6,5-15	6,5-18 ¹⁾	-	-
	200V	kVAr	0,5-6	4,5-10	4,5-12,5	10-16,7	10-25	10-32 ¹⁾	-	-
	220-240V	kVAr	0-7	5,5-11	5,5-15	12,5-20	12,5-30	12,5-36 ¹⁾	-	-
	440-480V	kVAr	0-15	11,5-25	11,5-30	25-40	25-60	25-72 ¹⁾	-	-
	550-600V	kVAr	0-18	14,5-30	14,5-35	31-50	31-75	31-90 ¹⁾	-	-
Fuses	A	50	90	125	175	225	250	-	-	
Suitable for use on a capability of delivering not more than	rms	A	5000	5000	5000	5000	5000	5000	-	-
	V	600	600	600	600	600	600	600	-	-
Auxiliary Contacts (cULus)		A600	-	-	-	-	-	-	-	-

1) Consider the max. thermal current of the contactor K3-74A: I_{th} 130A

Contactors

Data according to IEC 947-4-1, EN 60947-4-1, VDE 0660

Main Contacts	Type	K3-10	K3-14	K3-18	K3-22	K3-24	K3-32	K3-40	K3-50	K3-62	K3-74	K3-90	K3-115
Rated insulation voltage U_i¹⁾	V AC	690	690	690	690	690	690	690	690	690	690	1000	1000
Rated operational current I_e ($=I_{th}$) at 40°C, open 690V	A	25	25	32	32	50	65	80	110	120	130	160	200
Maximum ambient temperature													
Operation	open °C	-40 to +60 (+90) ¹⁾											
	enclosed °C	-40 to +40											
Storage	°C	-50 to +90											
Short circuit protection													
Coordination-type "1" acc. to IEC 947-4-1													
Contact welding without hazard of persons													
fuse size	from gL (gG) A	35	35	35	35	50	63	63	80	125	160	160	160
	to gL (gG) A	63	63	63	63	80	100	100	160	160	200	200	250
Cable cross-sections													
main connector	solid or stranded mm ²	0,75 - 6				1,5 - 25			4 - 50			120+95	
	flexible mm ²	1 - 4				2,5 - 16			10 - 35			95+70	
	flexible with multicore cable end mm ²	0,75 - 4				1,5 - 16			6 - 35				
Cables per clamp		2				1			1			1 + 1	
	solid or stranded mm ²	6+(1-6) / 4+(0,75-4)				16+(2,5-6) / 10+(4-10)			50+4 / 35+6 / 25+(6-16)				
	flexible mm ²	2,5+(0,75-2,5) / 1,5+(0,75-1,5)				6+(4-6) / 4+(2,5-4)			16+(6-16) / 10+(6-16)				
	flexible mm ²	6+(1,5-6) / 4+(1-4)				16+(2,5-6) / 10+(4-10)			50+(4-10) / 35+(4-16)				
	flexible mm ²	2,5+(0,75-2,5) / 1,5+(0,75-1,5)				6+(4-6) / 4+(2,5-4)			25+(4-25) / 16+(4-16)				
Cables per clamp		2				2			2				
		2				2			2				
für Hauptleiter	solid AWG	18 - 10				16 - 10			12 - 10				
	flexible AWG	18 - 10				14 - 4			10 - 0				
Cables per clamp		2				1			1				
	solid AWG	10+(16-10) / 12+(18-12)				10+(16-10) / 12+(18-12)			10+(12-10) / 12+12				
	flexible AWG	14+(18-14) / 16+(18-16)				14+(18-14) / 16+(18-16)			4+(18-12) / 6+(18-8)			1+(12-10) / 2+(8-12)	
	flexible AWG	10+(14-10) / 12+(18-12)				4+(18-12) / 6+(18-8)			1+(12-10) / 2+(8-12)				
	flexible AWG	14+(18-14) / 16+(18-16)				8+(18-8) / 10+(18-12)			3+(12-8) / 4+(10-6)				
Cables per clamp		2				2			2				
		2				2			2				
Mechanical life													
AC operated	S x 10 ⁶	10	10	10	10	10	10	10	10	10	10	5	5
DC operated	S x 10 ⁶	10	10	10	10	10	10	10	10	10	10	5	5
Short time current	10s-current A	96	120	144	176	184	240	296	360	504	592	680	880
Power loss													
per pole	at I_e /AC3 400V W	0,21	0,35	0,5	0,75	0,7	1,3	2	2,2	3,9	5,5	4,3	6,0

1) With reduced control voltage range 0,9 up to 1,0 x U_s and with reduced rated current I_e /AC1 according to I_e /AC3

2) Maximum cable cross-section with prepared conductor

Data according to IEC 947-4-1, EN 60947-4-1, VDE 0660

Auxiliary Contacts		Type	K3-10	K3-14	K3-18	K3-22	K3-24	K3-32	K3-40	K3-50	K3-62	K3-74	K3-90	K3-115
Rated insulation voltage U_i ¹⁾		V~	690	690	690	690	-	-	-	-	-	-	-	-
Thermal rated current I_{th} to 690V														
Ambient temperature 40°C		A	16	16	16	16	-	-	-	-	-	-	-	-
60°C		A	12	12	12	12	-	-	-	-	-	-	-	-
Utilization category AC15														
Rated operational current I_e 220-240V		A	12	12	12	12	-	-	-	-	-	-	-	-
380-415V		A	4	4	4	4	-	-	-	-	-	-	-	-
440V		A	4	4	4	4	-	-	-	-	-	-	-	-
500V		A	3	3	3	3	-	-	-	-	-	-	-	-
660-690V		A	1	1	1	1	-	-	-	-	-	-	-	-
Utilization category DC13														
Rated operational current I_e 60V		A	8	8	8	8	-	-	-	-	-	-	-	-
110V		A	1	1	1	1	-	-	-	-	-	-	-	-
220V		A	0,1	0,1	0,1	0,1	-	-	-	-	-	-	-	-
Short circuit protection														
short-circuit current 1kA, contact welding not accepted max. fuse size		gL (gG) A	25	25	25	25	-	-	-	-	-	-	-	-
Control Circuit														
Power consumption of coils														
AC operated														
inrush		VA		33-45				90-115			140-165			190-280
sealed		VA		7-10				9-13			13-18			2,5-4
W				2,6-3				2,7-4			5,4-7			2,5-4
DC operated														
inrush		W		75				140			200			190-280
sealed		W		2				2			6			2,5-4
Operation range of coils														
in multiples of control voltage U_s														
AC operated				0,85-1,1				0,85-1,1			0,85-1,1			0,85-1,1
DC operated				0,8-1,1				0,8-1,1			0,8-1,1			0,8-1,1
Switching time														
at control voltage $U_s \pm 10\%$ ^{2) 3)}														
AC operated														
make time		ms		8-16				10-25			12-28			
release time		ms		5-13				8-15			8-15			
arc duration		ms		10-15				10-15			10-15			10-15
DC operated														
make time		ms		8-12				10-20			12-23			
release time		ms		8-13				10-15			10-18			
arc duration		ms		10-15				10-15			10-15			
Cable cross-section														
Auxiliary connector														
solid		mm ²		0,75-6				-			-			-
flexible		mm ²		1-4				-			-			-
flexible with multicore cable end		mm ²		0,75-4				-			-			-
Magnet coil														
solid		mm ²		0,75-2,5				0,75-2,5			0,75-2,5			0,75-2,5
flexible		mm ²		0,5-2,5				0,5-2,5			0,5-2,5			0,5-2,5
flexible with multicore cable end		mm ²		0,5-1,5				0,5-1,5			0,5-1,5			0,5-1,5
Clamps per pole				2				2			2			2
Auxiliary connector														
solid		AWG		18 - 10-				-			-			-
flexible		AWG		18 - 10				-			-			-
Magnet coil														
solid		AWG		14 - 12				14 - 12			14 - 12			14 - 12
flexible		AWG		18 - 12				18 - 12			18 - 12			18 - 12
Clamps per pole				2				2			2			2

1) Suitable for: earthed-neutral systems, overvoltage category I to IV, pollution degree 3 (standard-industry): $U_{imp} = 8kV$. Data for other conditions on request

2) Total breaking time = release time + arc duration

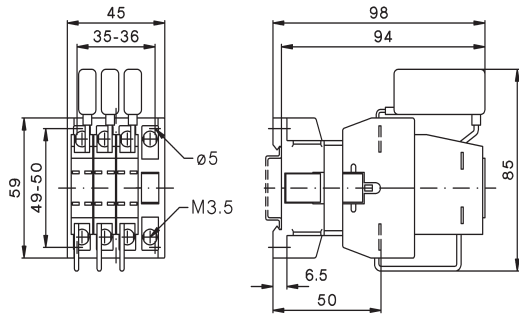
3) Values for delay of the release time of the make contact and the make time of the break contact will be increased, if magnet coils are protected against voltage peaks (varistor, RC-unit, diode-unit)

Contactors

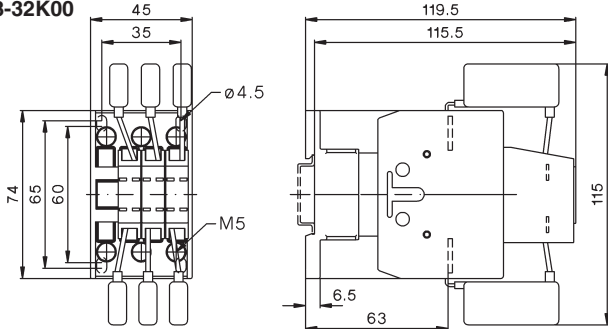
Dimensions

Capacitor switching contactors, AC operated

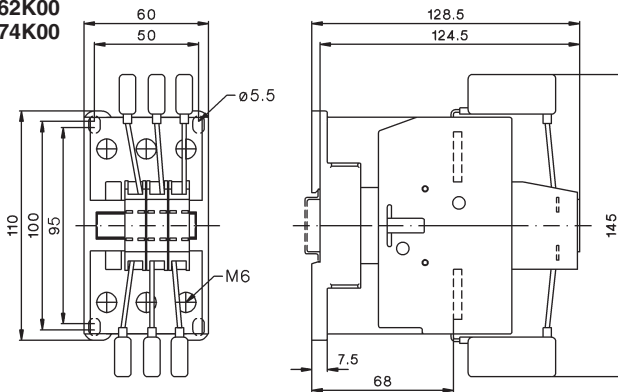
K3-18K..



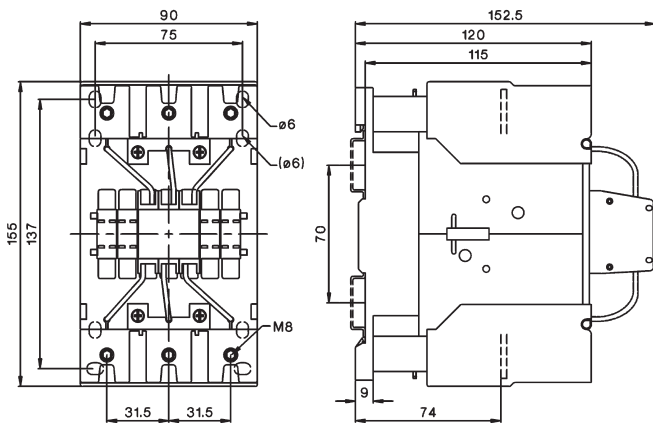
**K3-24K00
K3-32K00**



**K3-50K00
K3-62K00
K3-74K00**

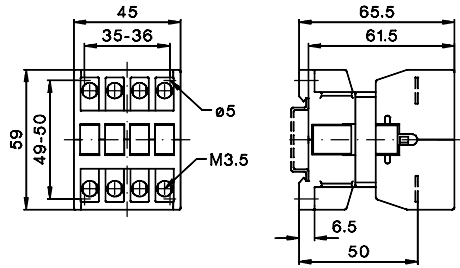


**K3-90K00
K3-115K00**

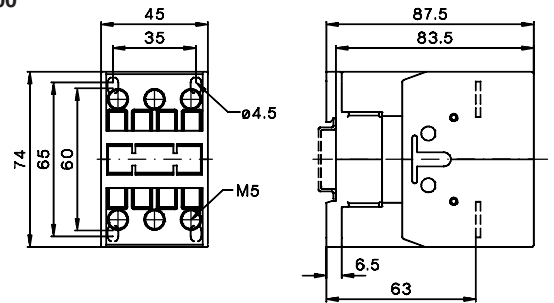


Contactors AC-operated

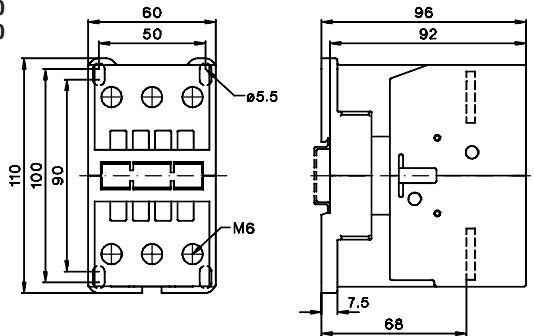
**K3-10A10
K3-14A10
K3-18A10
K3-22A10**



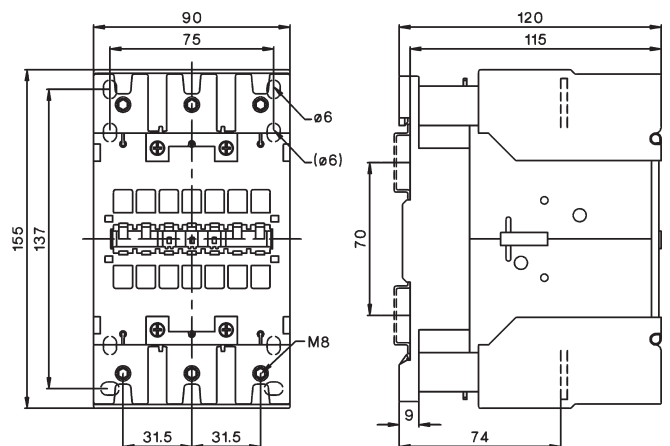
**K3-24A00
K3-32A00
K3-40A00**



**K3-50A00
K3-62A00
K3-74A00**



**K3-90A00
K3-115A00**



Contactor operation at direct switching of capacitors

Theoretic view of function

Make

In case of the pre-contacts during make, the current peaks are attenuate by resistor wires. These current peaks would weld the main-contacts of contactor and they are also not good for the capacitors.

The total resistance of the resistor wires is mostly ohmic, the inductive one can be ignored. The looking like a coil is only a case of construction.

The single controlled pre-contacts are increasing the safety of operating, in opposite of contamination during operation.

Operation:

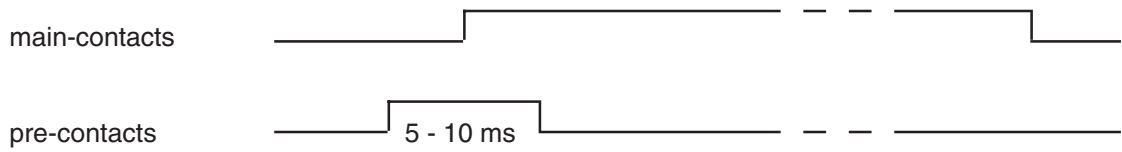
During operation the resistor wires are not getting warmer, because they are not in the circuit.

Break:

Important: these contactors can be used for both installations, because the pre-contacts have no function during break, thus means that the peaks of the break-over voltage (power) of the chokes can't make any damage.

Description

Function diagram

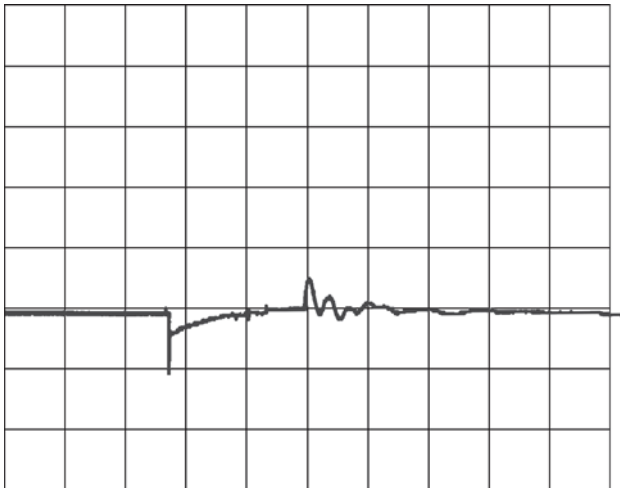


Practical function - oscillogram

make with pre-contacts (B&J\Oszi11)

K3-18K 12.5kVAr (18A / 400V)

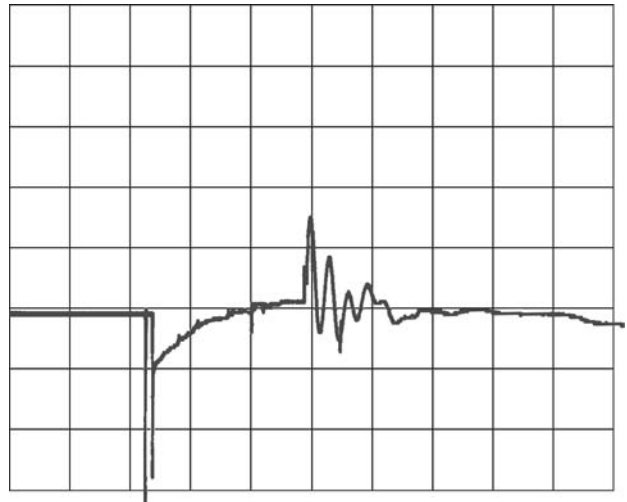
vertical: **250A** / div horizontal: 1ms / div



make with pre-contacts (B&J\Oszi10)

K3-18K 12.5kVAr (18A / 400V)

vertical: **100A** / div horizontal: 1ms / div



Description:

The difference of the diagrams is the current scale only.

First current peak due to make of pre-contacts.

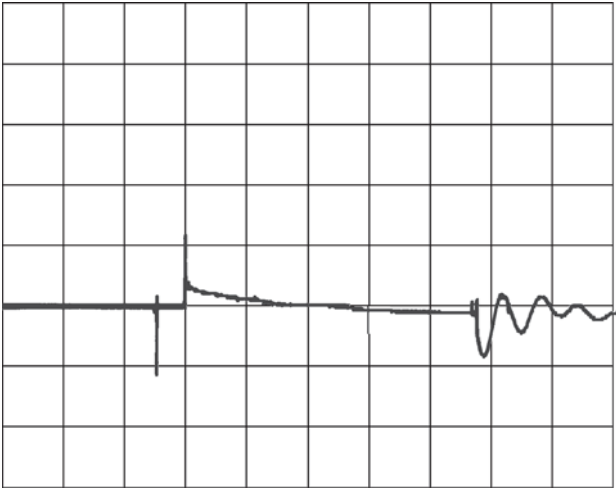
Second current peak due to building-up the main-circuit with notable lower amplitude as the first and not so steep, that means lower frequency.

Description

make **with** pre-contacts (B&J\Oszi13)

K3-18K 12.5kVAr (18A / 400V)

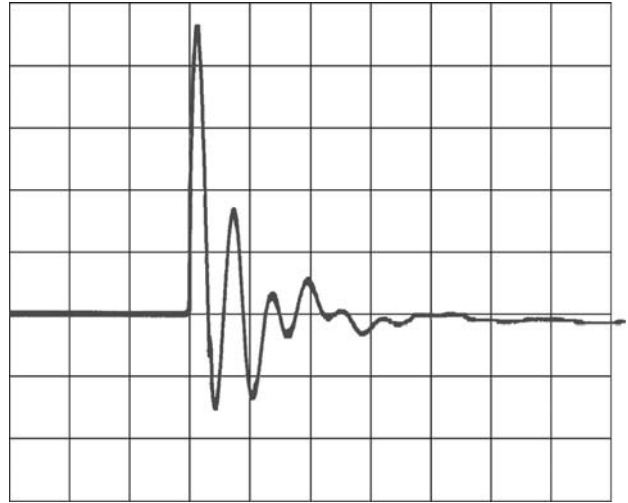
vertical: 250A / div horizontal: 0.5ms / div



make **without** pre-contacts (B&J\Oszi12)

K3-18A 12.5kVAr (18A / 400V)

vertical: 250A / div horizontal: 0.5ms / div



The difference of the left picture to the others before is the time scale.
The peak before the first current peak can be seen as a measuring failure.

The right picture shows a make current peak without pre-contacts with about 1200A with high power in opposite to 280A with low power (power = integrated area).

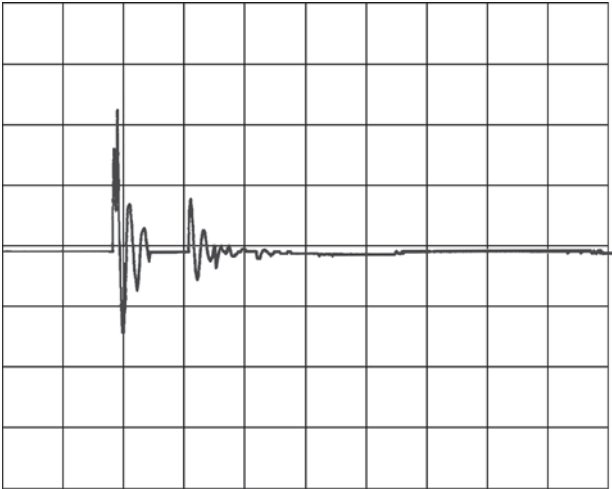
Of course, the contactors endure a few switches without pre-contacts.

Switching of capacitor banks at different conditions

make **without** pre-contacts (B&J\Oszi16)
without chokes

K3-62A 50kVAr (72A / 690V)

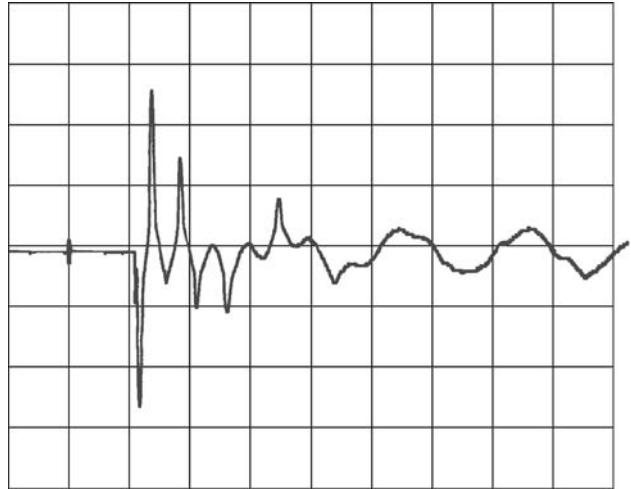
vertical: **2000A** / div horizontal: 0.625ms / div



make **without** pre-contacts (B&J\Oszi15)
with chokes

K3-62A 50kVAr (72A / 690V)

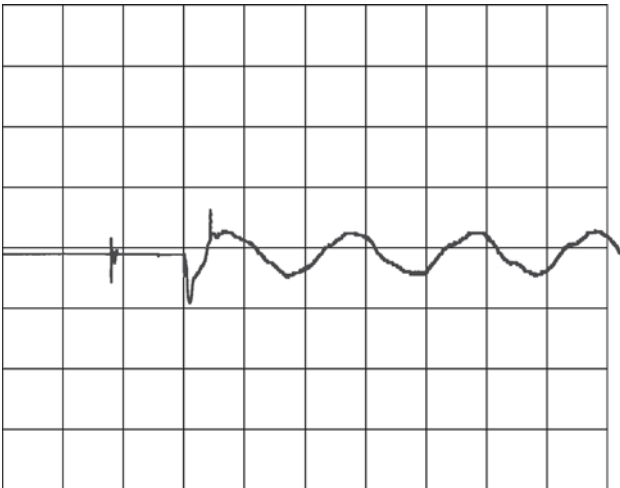
vertical: **200A** / div horizontal: 10ms / div



make **with** pre-contacts (B&J\Oszi14)
with chokes

K3-62K 50kVAr (72A / 690V)

vertical: **200A** / div horizontal: 10ms / div



The make current peak without pre-contacts and without chokes is higher than 4000A.

This peak can be reduced by the influence of chokes to approx. 500A.

In the last case we see the influence of chokes and pre-contacts of the "capacitor contactor". The peak is reduced to approx. 200A.

Also the sinus-weave is very clear by the influence of chokes because you have reduced harmonic frequencies.

Notice: