



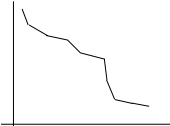
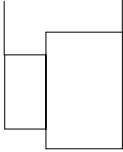


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Contactors

for use with reactive capacitor banks

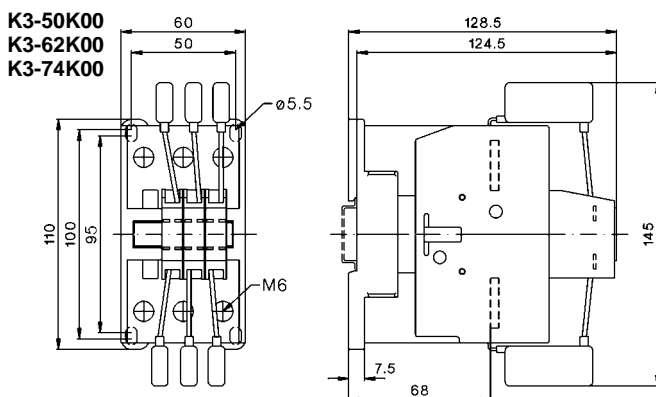
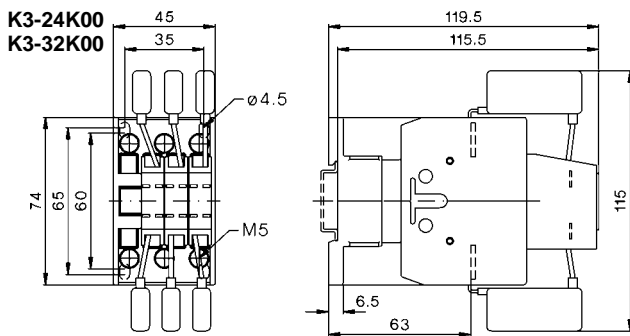
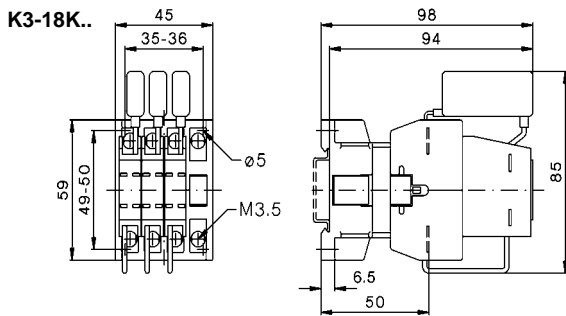


Rated Operational Power at 50/60Hz Ambient Temperature						Aux. Contacts Built-in Add.			Type	Pack	Weight
50°C			60°C			NO	NC	pcs.	Coil Voltage 220-240V 50Hz	pcs.	kg/pc.
380V 400V kVAr	415V 440V kVAr	660V 690V kVAr	380V 400V kVAr	415V 440V kVAr	660V 690V kVAr						
5	5,5	8	5	5,5	8	1	-	4 ¹⁾	K3-10A10 230	1	0,23
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

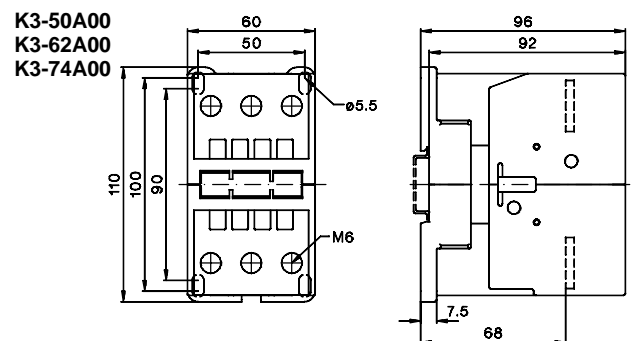
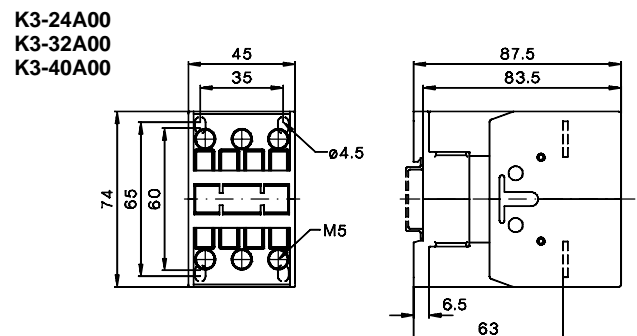
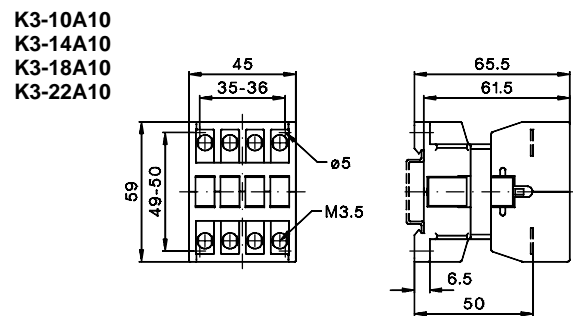
- 1) 4 HN.. or HA.. snap-on
- 2) 2HB11 on the left or right side and 4 HN.. or HA.. snap-on
- 3) Consider the max. thermal current: I_{th} 130A

Dimensions

Capacitor switching contactors, AC operated



Contactors AC-operated



Capacitor Switching Contactors

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

Main Contacts			Type	K3-18K	K3-24K	K3-32K	K3-50K	K3-62K	K3-74K
Switching of 3-phase capacitor banks									
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⁾
Rated operational power	220-240V	kVAr		0-7	5-11	5-14	12-20	12-28	12-33
	380-400V	kVAr		0-12,5	10-20	10-25	20-33,3	20-50	20-75 ¹⁾
	415-440V	kVAr		0-13	10,5-22	10,5-27	23-36	23-53	23-75 ¹⁾
	500V	kVAr		0-15	12-25	12-30	26-40	26-60	26-75
	525V	kVAr		0-15	12-25	12-32	26-43	26-64	26-80
	660-690V	kVAr		0-20	17-33	17-41	36-55	36-82	36-120
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
Rated operational power	220-240V	kVAr		0-7	5-11	5-14	12-20	12-28	12-30
	380-400V	kVAr		0-12,5	10-20	10-25	20-33,3	20-50	20-60
	415-440V	kVAr		0-13	10,5-22	10,5-27	23-36	23-53	23-64
	500V	kVAr		0-15	12-25	12-30	26-40	26-60	26-70
	525V	kVAr		0-15	12-25	12-32	26-43	26-64	26-75
	660-690V	kVAr		0-20	17-33	17-41	36-55	36-82	36-100

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

Capacitor Switching Contactors for North America

Data according to UL508

Main Contacts (cULus)			Type	K3-18K	K3-24K	K3-32K	K3-50K	K3-62K	K3-74K
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
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	
Maximum ambient temperature												
Operation	open						-40 to +60 (+90) ¹⁾					
	enclosed						-40 to +40					
Storage							-50 to +90					
Short circuit protection for contactors without thermal overload relay												
Coordination-type "1" according to IEC 947-4-1 Contact welding without hazard of persons												
max. fuse size	gL (gG)	A	63	63	63	63	80	80	80	160	160	160
Coordination-type "2" according to IEC 947-4-1 Light contact welding accepted												
max. fuse size	gL (gG)	A	25	35	35	35	50	50	50	100	125	125
Cable cross-sections for contactors without thermal overload relay												
main connector												
	solid or stranded	mm ²	0,75 - 6			1,5 - 25			4 - 50			
	flexible	mm ²	1 - 4			2,5 - 16			10 - 35			
	flexible with multicore cable end	mm ²	0,75 - 4			1,5 - 16			6 - 35			
Cables per clamp			2			1			1			
Cables per clamp												
	solid or stranded	mm ²	6+(1-6) / 4+(0,75-4) 2,5+(0,75-2,5) / 1,5+(0,75-1,5)			16+(2,5-6) / 10+(4-10) 6+(4-6) / 4+(2,5-4)			50+4 / 35+6 / 25+(6-16) 16+(6-16) / 10+(6-16)			
	flexible	mm ²	6+(1,5-6) / 4+(1-4) 2,5+(0,75-2,5) / 1,5+(0,75-1,5)			16+(2,5-6) / 10+(4-10) 6+(4-6) / 4+(2,5-4)			50+(4-10) / 35+(4-16) 25+(4-25) / 16+(4-16)			
Cables per clamp			2			2			2			
main connector												
	solid	AWG	18 - 10			16 - 10			12 - 10			
	flexible	AWG	18 - 10			14 - 4			10 - 0			
Cables per clamp			2			1			1			
Cables per clamp												
	solid	AWG	10+(16-10) / 12+(18-12) 14+(18-14) / 16+(18-16)			10+(16-10) / 12+(18-12) 14+(18-14) / 16+(18-16)			10+(12-10) / 12+12			
	flexible	AWG	10+(14-10) / 12+(18-12) 14+(18-14) / 16+(18-16)			4+(18-12) / 6+(18-8) 8+(18-8) / 10+(18-12)			1+(12-10) / 2+(8-12) 3+(12-8) / 4+(10-6)			
Cables per clamp			2			2			2			
Mechanical life												
AC operated	S x 10 ⁶		10	10	10	10	10	10	10	10	10	
DC operated	S x 10 ⁶		10	10	10	10	10	10	10	10	10	
Short time current												
	10s-current	A	96	120	144	176	184	240	296	360	504	592
Power loss per pole												
	at I _g /AC3 400V	W	0,21	0,35	0,5	0,75	0,7	1,3	2	2,2	3,9	5,5

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

2) Maximum cable cross-section with prepared conductor

Contactors

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
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	-	-	-	-	-	-
For contactors with thermal overload relay the device with the smaller admissible control fuse (contactor or thermal overload relay) determines the fuse.													
Control Circuit													
Power consumption of coils													
AC operated			inrush VA	33-45			90-115			140-165			
			sealed VA	7-10			9-13			13-18			
			W	2,6-3			2,7-4			5,4-7			
DC operated			inrush W	75			140			200			
			sealed W	2			2			6			
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			
			DC operated	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			
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			
			flexible mm ²	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			
Clamps per pole				2			2			2			
Auxiliary connector			solid AWG	18 - 10-			-			-			
			flexible AWG	18 - 10			-			-			
Magnet coil			solid AWG	14 - 12			14 - 12			14 - 12			
			flexible AWG	18 - 12			18 - 12			18 - 12			
Clamps per pole				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)

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:

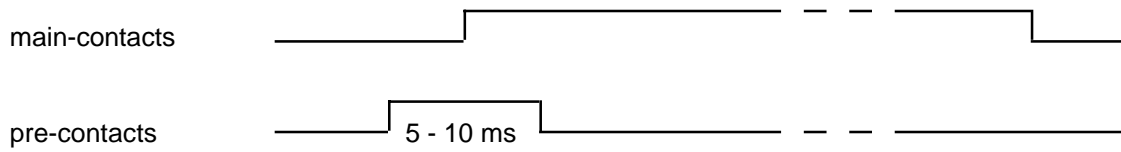
During operation the resistor wires are not getting warmer, because they are not in the circuit.

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

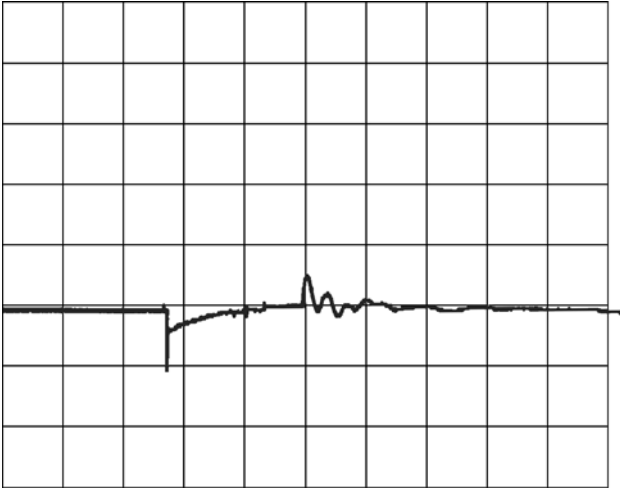


Practical function - oscillogram

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

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

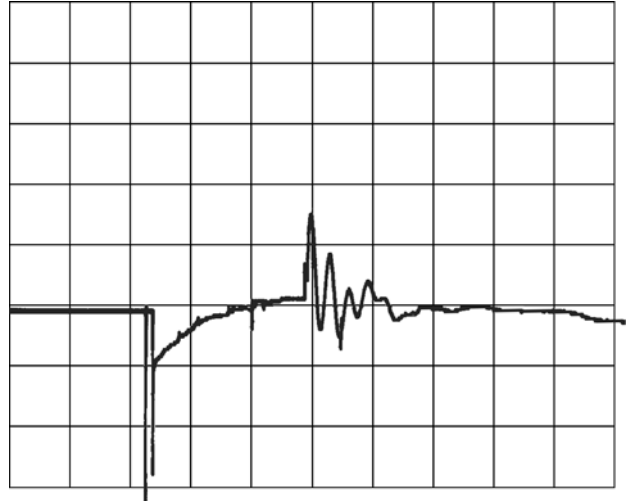
vertical: **250A** / div horizontal: 1ms / div



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.

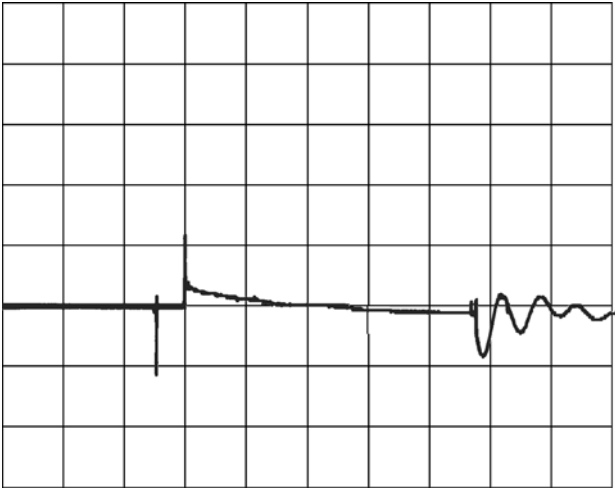
Second current peak due to building-up the main-circuit with notable lower amplitude as the first and not so steep, that means lower frequency.

Description

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

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

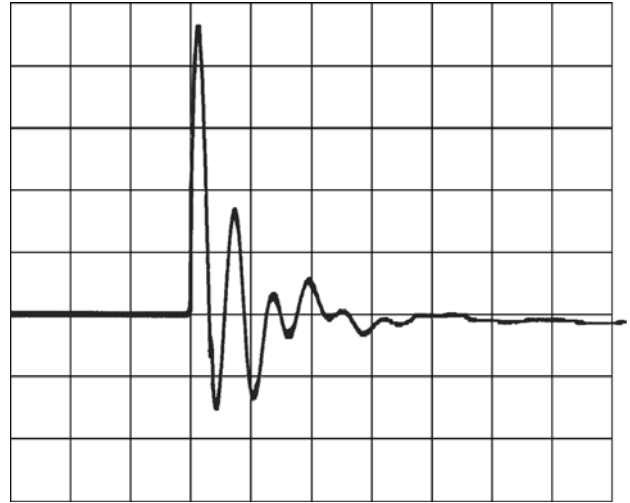
vertical: 250A / div horizontal: 0.5ms / div



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).

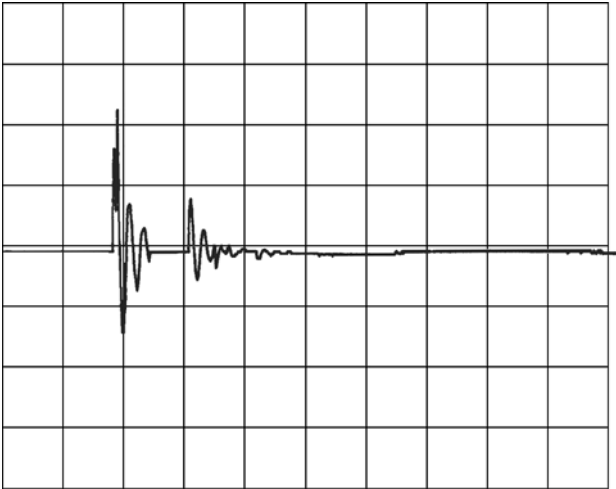
Of course, the contactors endure a few switches without pre-contacts.

Switching of capacitor banks at different conditions

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

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

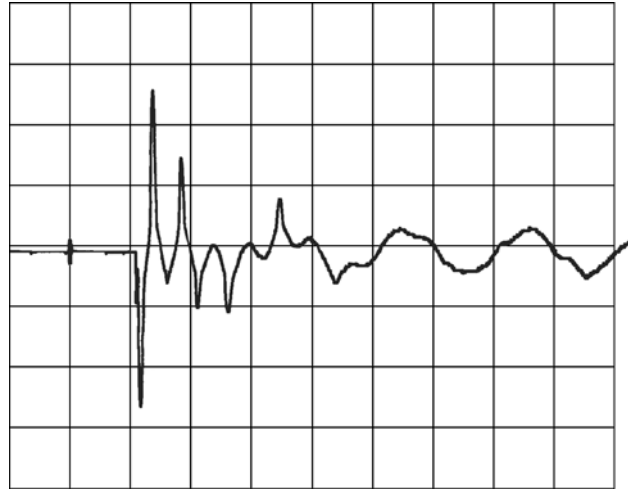
vertical: **2000A** / div horizontal: 0.625ms / div



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

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

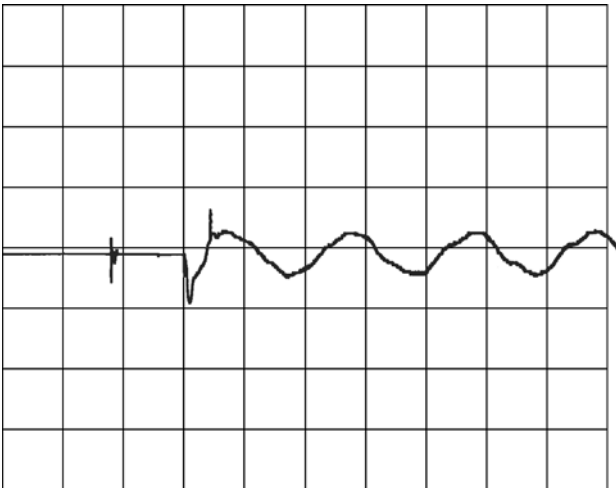
vertical: **200A** / div horizontal: 10ms / div



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:

Notice: