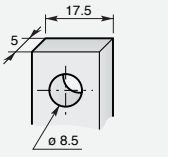
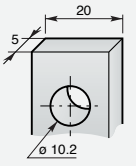
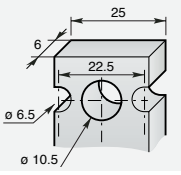
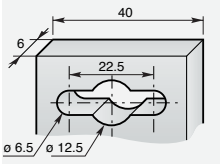
IEC Technical data
A/AF145 — AF750

Connecting Characteristics

Contactor types:	A...	145	185	210	260	300	–	–	–	–
	AF...	145	185	210	260	300	400	460	580	750
Main terminals Flat type										
Connecting capacity (min. ... max.) Main conductors (poles)										
Rigid:	1 x mm²	–	–	–	–	–	–	–	–	–
	2 x mm²	–	–	–	–	–	–	–	–	–
Rigid with connector										
single for Cu cable	mm²	6 ... 185		16 ... 240			240		300	
single for Al/Cu cable	mm²	25 ... 150		120 ... 240			240		300	
double for Al/Cu cable	mm²	–		2 x 95 ... 120			2 x 240		3 x 185	
Flexible	1 x mm²	–	–	–	–	–	–	–	–	–
	2 x mm²	–	–	–	–	–	–	–	–	–
Bars or lugs	L mm ≤	24		32			47 / 45		52 / 50	
	Ø mm >	8		10			10		12	
Auxiliary conductors (coil terminals)										
Rigid solid	1 x mm²	1 ... 4								
	2 x mm²	1 ... 4								
Flexible with cable end	1 x mm²	0.75 ... 2.5								
	2 x mm²	0.75 ... 2.5								
Lugs	L mm ≤	8								
	l mm >	3.7								
Degree of protection acc. to IEC 60947-1 / EN 60947-1 and IEC 60529 / EN 60529		Protection against direct contact acc. to VDE 0106 - part 100								
– Main terminals		IP 00								
– Coil terminals		IP 20								
– Built-in auxiliary terminals		–								
Screw terminals										
Main terminals		Screws and bolts								
		M8		M10			M10		M12	
Coil terminals (delivered in open position)		M3.5 (+,-) pozidriv 2 screws with cable clamp								
Built-in auxiliary terminals		–	–	–	–	–	–	–	–	–
		–	–	–	–	–	–	–	–	–
Tightening torque										
Main pole terminals										
– recommended	Nm / lb.in	18 / 160		28 / 240			40 / 354		45 / 443	
– max.	Nm	20		30			44		49	
Coil terminals										
– recommended	Nm / lb.in	1.00 / 9								
– max.	Nm	1.20								
Built-in auxiliary terminals										
– recommended	Nm / lb.in	–	–	–	–	–	–	–	–	–
– max.	Nm	–	–	–	–	–	–	–	–	–
Terminal marking and positioning		see pages 1.36 & 1.37								

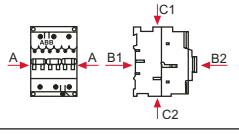
Connecting Characteristics

Contactor types: AF...	1350	1650
Main terminals Flat type		
Connecting capacity (min. ... max.) Main conductors (poles)		
Rigid: 1 x mm² / 2 x mm²		
Rigid with connector single for Cu cable mm² single for Al/Cu cable mm² double for Al/Cu cable mm²		
Flexible 1 x mm² / 2 x mm²		
Bars or lugs  L mm ≤ / Ø mm >		
Auxiliary conductors (coil terminals)		
Rigid solid 1 x mm² / 2 x mm²		
Flexible with cable end 1 x mm² / 2 x mm²		
Lugs  L mm ≤ / l mm >		Consult factory
Degree of protection acc. to IEC 60947-1 / EN 60947-1 and IEC 60529 / EN 60529 – Main terminals – Coil terminals – Built-in auxiliary terminals		
Screw terminals Main terminals		
Coil terminals (delivered in open position)		
Built-in auxiliary terminals		
Tightening torque Main pole terminals – recommended Nm / lb.in – max. Nm		
Coil terminals – recommended Nm / lb.in – max. Nm		
Built-in auxiliary terminals – recommended Nm / lb.in – max. Nm		
Terminal marking and positioning		

UL/CSA & IEC Technical data
AL9 — AL40

Contactor types:	AL	AL9	AL12	AL16	AL26	AL30	AL40
Rated insulation voltage U_i							
according to IEC 60947-4-1	V				1000		
according to UL/CSA	V				600		
Rated impulse withstand voltage $U_{imp.}$	kV				8		
Standards					Devices complying with international standards IEC 60947-1 / 60947-4-1 and European standards EN 60947-1 / 60947-4-1		
Air temperature close to contactor					see "Conditions for use" page 1.50, for control voltage limits and authorized mounting positions		
– fitted with thermal O/L relay	°C				-25 to +55		
– without thermal O/L relay	°C				-40 to +70 (55 max. for TAE... contactors)		
– for storage	°C				-60 to +80		
Climatic withstand					acc. to IEC 60068-2-30 and 60068-2-11 - UTE C 63-100 specification II		
Operating altitude	m				≤ 3000		

Shock withstand
acc. IEC 60068-2-27 and EN 60068-2-27
Mounting position 1 (see page 1.50)



1/2 sinusoidal shock for 11 ms: no change in contact position

Shock direction	Making position	Breaking position
A	20 g	20 g
B1	10 g	5 g
B2	15 g	15 g
C1	20 g	20 g
C2	20 g	20 g

IEC Technical data
AL9 — AL40

Main Pole - Utilization Characteristics

Contactor types:		AL	AL9	AL12	AL16	AL26	AL30	AL40
Rated operational voltage U_e max.		V	690					
Rated frequency limits		Hz			25-400			
Conventional free-air thermal current I_{th} acc. to IEC 60947-4-1,								
open contactors ø ≤ 40 °C		A	26	28	30	45	65	65
with conductor cross-sectional area	mm²	4	4	4	6	16	16	35
Rated operational current I_e / AC-1 for air temperature close to contactor								
U_e max. 690 V	ø ≤ 40 °C	A	25	27	30	45	55	60
	ø ≤ 55 °C	A	22	25	27	40	55	60
	ø ≤ 70 °C ③	A	18	20	23	32	39	42
with conductor cross-sectional area	mm²		2.5	4	4	6	10	16
Utilization categorie AC-3 for air temperature close to contactor ≤ 55 °C								
Rated operational current I_e AC-3 ①								
3-phase motors	220-230-240 V	A	9	12	17	26	33	40
	380-400 V	A	9	12	17	26	32	37
	415 V	A	9	12	17	26	32	37
	440 V	A	9	12	16	26	32	37
	500 V	A	9	12	14	22	28	33
	690 V	A	7	9	10	17	21	25
	1000 V	A	–	–	–	–	–	–
Rated operational power AC-3 ①								
1500 r.p.m. 50 Hz 1800 r.p.m. 60 Hz 3-phase motors	220-230-240 V	kW	2.2	3	4	6.5	9	11
	380-400 V	kW	4	5.5	7.5	11	15	18.5
	415 V	kW	4	5.5	9	11	15	18.5
	440 V	kW	4	5.5	9	15	18.5	22
	500 V	kW	5.5	7.5	9	15	18.5	22
	690 V	kW	5.5	7.5	9	15	18.5	22
	1000 V	kW	–	–	–	–	–	–
Rated making capacity AC-3 according to IEC 60947-4-1			10 x I_e AC-3					
Rated breaking capacity AC-3 according to IEC 60947-4-1			8 x I_e AC-3					
Short-circuit protection for contactors without thermal O/L relay - Motor protection exclud								
U_e ≤ 500 V a.c. - gG type fuse		A	25	32	32	50	63	
Rated short-time withstand current I_{cw} at 40 °C ambient temp., in free air,								
from a cold state	1 s	A	250	280	300	400	600	
	10 s	A	100	120	140	210	400	
	30 s	A	60	70	80	110	225	
	1 min	A	50	55	60	90	150	
	15 min	A	26	28	30	45	65	
Maximum breaking capacity cos ø = 0.45 (cos ø = 0.35 for I_e > 100 A)								
	at 440 V	A	250			420	820	
	at 690 V	A	90			170	340	
Heat dissipation per pole	I_e / AC-1	W	0.8	1	1.2	1.8	2.5	
	I_e / AC-3	W	0.1	0.2	0.35	0.6	0.9	
Max. electrical switching frequency								
– for AC-1		cycles/h	600					
– for AC-3		cycles/h	1200					
– for AC-2, AC-4		cycles/h	300					
Mechanical durability								
– millions of operating cycles			10					
– max. mechanical switching frequency		cycles/h	3600					

IEC Technical data
AL9 — AL40, TAL9 – TAL40

Magnet system characteristics for AL contactors

Contactor types: AL		AL9	AL12	16	26	30	40
Rated control circuit voltage U_c V d.c.		12 ... 240 (24V & 48V for AL...Z)					
Coil operating limits according to IEC 60947-4-1		ø ≤ 55 °C 0.85 ... 1.1 x U_c					
Drop-out voltage in % of U_c		roughly 15 ... 30 %					
Coil consumption - Average values							
– pull-in value	W	3 (2.4 for AL9Z - AL16Z)			3.5		
– holding value	W	3 (2.4 for AL9Z - AL16Z)			3.5		
Coil time constant							
– open L/R	ms	40					
– closed L/R	ms	90					
Operating time between coil energization and:							
– N.O. contact closing	ms	50 ... 75					
– N.C. contact opening	ms	45 ... 70					
between coil de-energization and							
– N.O. contact opening	ms	15 ... 30					
– N.C. contact closing	ms	17 ... 32					

Magnet System Characteristics for TAL... Contactors

Contactor types: TAL		TAL9	TAL12	TAL16	TAL26	TAL30	TAL40
Rated control circuit voltage U_c V d.c.		9 ... 264					
Coil operating limits according to IEC 60947-4-1		ø ≤ 55 °C 0.85 ... 1.1 x U_c					
Drop-out voltage in % of U_c max.		roughly 20... 35 %					
Coil consumption values for U_c max. and 20 °C							
– Uc max. DC	W	8.5			9		
– Uc min. DC	W	2.5			2.7		
– Uc DC	W	5			5.4		
Operating time between coil energization and:							
– N.O. contact closing	ms	50 ... 100			55 ... 110		
– N.C. contact opening	ms	20 ... 70			25 ... 75		
between coil de-energization and							
– N.O. contact opening	ms	10 ... 17 ①			12 ... 18 ①		
– N.C. contact closing	ms	16 ... 27 ①			18 ... 28 ①		

① The use of surge suppressors increases the opening time on a scale of 1.1 to 1.5 for a varistor suppressor and on a scale of 4 to 8 for a diode suppressor.

Built-in Auxiliary Contacts - Utilization Characteristics

Contactor types: AL		AL9	AL12	AL16	AL26	AL30	AL40
Rated operational voltage U_e max.	V			690			
Conventional free air thermal current I_{th} - ø ≤ 40 °C	A			16			
Rated frequency limits	Hz			25 ... 400			
Rated operational current I_e / AC-15 according to IEC 60947-5-1							
24-127 V 50/60 Hz	A			6			
220-240 V 50/60 Hz	A			4			
380-440 V 50/60 Hz	A			3			
500 V 50/60 Hz	A			2			
690 V 50/60 Hz	A			2			
Rated operational current I_e / DC-13 according to IEC 60947-5-1							
24 V d.c.	A / W			6 / 144			
48 V d.c.	A / W			2.8 / 134			
72 V d.c.	A / W			2 / 144			
125 V d.c.	A / W			1.1 / 138			
250 V d.c.	A / W			0.55 / 138			
Rated making capacity acc. to IEC 60947-5-1				10 x I_e / AC-15			
Rated breaking capacity acc. to IEC 60947-5-1				10 x I_e / AC-15			
Short-circuit protection gG type fuse	A			10			
Rated short-time withstand current I_{cw}							
for 1.0 s	A			100			
for 0.1 s	A			140			
Minimum switching capacity	V / mA			17 / 5			
Non-overlapping time between N.O. and N.C. contacts	ms			≥ 2			
Insulating resistance at 500 V d.c. after durability test	MOhm			5			
Heat dissipation per pole at 6 A	W			0.10			

IEC Technical data
AL9 — AL40

Mounting characteristics

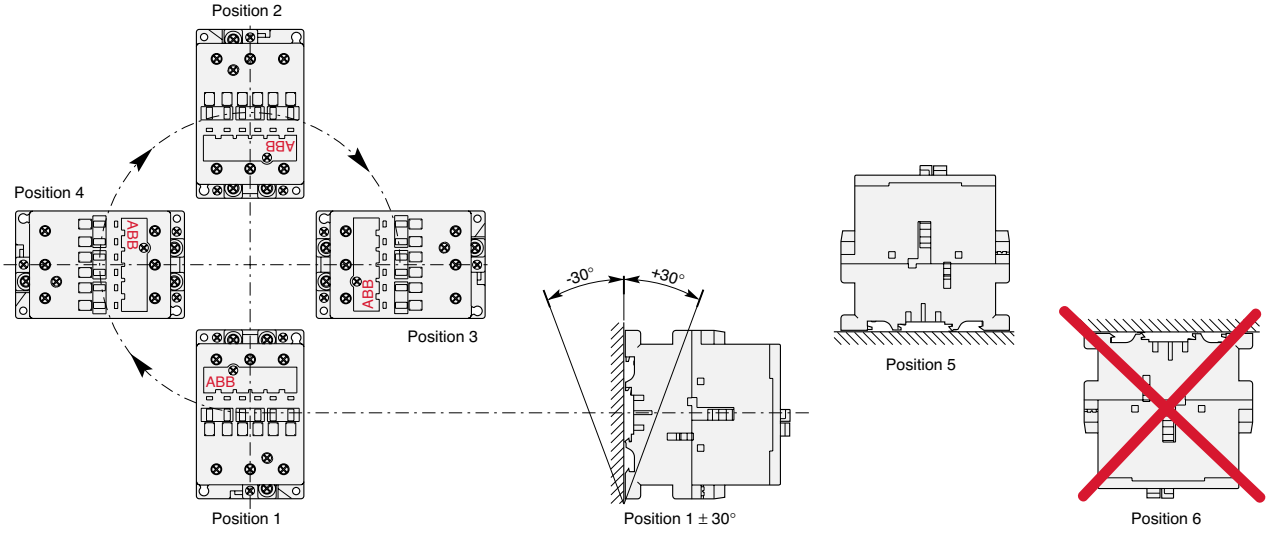
Contactor types: AL	AL9 AL12 AL16 AL26 AL30 AL40
Mounting positions	see "Conditions for use"
Mounting distances	The contactors can be assembled side by side
Mounting	
on DIN rail according to IEC 715 and EN 50022 / EN 50023	35 x 7.5 mm 35 x 15 mm
by screws (not supplied)	2 x M4

Conditions for Use

Sustainable utilization conditions for contactors involving at the same time the Mounting position, Ambient temperature and Control voltage operating limits are summarized in the table below.

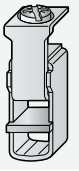
Contactors	Mounting position	Ambient temperature	Control voltage
AL9 – AL40	1, 1 ± 30°, 2, 3, 4, 5 55 ... 70 °C	≤ 55 °C U_c	0.85 ... 1.1 x U_c
	6 (Unauthorized)		

Mounting Positions (see the above table for authorized positions)



IEC Technical data
AL9 — AL40

Connecting Characteristics

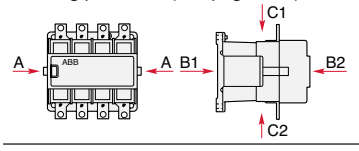
Contactor types: AL		AL9	AL12	AL16	AL26	AL30	AL40
Main terminals		 with cable clamp				 with double connector 2 x (5.6 x 6.5 mm)	
Connecting capacity (min. ... max.) Main conductors (poles)							
Rigid: solid (≤ 4 mm²)	1 x mm²	1 ... 4			1.5 ... 6	2.5 ... 16	
stranded (≥ 6 mm²)	2 x mm²	1 ... 4			1.5 ... 6	2.5 ... 16	
Rigid with connector single for Cu cable	mm²	–	–	–	–	–	–
single for Al/Cu cable	mm²	–	–	–	–	–	–
double for Al/Cu cable	mm²	–	–	–	–	–	–
Flexible with cable end	1 x mm²	0.75 ... 2.5			0.75 ... 4	2.5 ... 10	
	2 x mm²	0.75 ... 2.5			0.75 ... 4	2.5 ... 10	
Bars or lugs	L mm ≤	8			10	–	–
	l mm >	3.7			4.2	–	–
Auxiliary conductors (built-in auxiliary terminals + coil terminals)							
Rigid solid	1 x mm²	1 ... 4					
	2 x mm²	1 ... 4					
Flexible with cable end	1 x mm²	0.75 ... 2.5					
	2 x mm²	0.75 ... 2.5					
Lugs	L mm ≤	8			①	8	
	l mm >	3.7			①	3.7	
Degree of protection acc. to IEC 60947-1 / EN 60947-1 and IEC 60529 / EN 60529		Protection against direct contact acc. to VDE 0106 - Part. 100					
– Main terminals		IP 20					
– Coil terminals		IP 20					
– Built-in auxiliary terminals		IP 20					
Screw terminals		(delivered in open position, screws of unused terminals must be tightened)					
Main terminals		(+,-) pozidriv 2 screws					
		M3.5			M4	M5	
Coil terminals		M3.5 (+,-) pozidriv 2 screws with cable clamp					
Built-in auxiliary terminals		(+,-) pozidriv 2 screws with cable clamp					
		M3.5			M4	M5	
Tightening torque							
Main pole terminals							
– recommended	Nm / lb.in	1.00 / 9			1.7 / 15	2.30 / 20	
– max.	Nm	1.20			2.20	2.60	
Coil terminals							
– recommended	Nm / lb.in	1.00 / 9					
– max.	Nm	1.20					
Built-in auxiliary terminals							
– recommended	Nm / lb.in	1.00 / 9			1.7 / 15	1.00 / 9	
– max.	Nm	1.20			2.20	1.20	
Terminal marking and positioning		see pages 1.35					

① L ≤ 8 and l > 3.7 for coil terminal - L ≤ 10 and l > 4.2 for built-in auxiliary terminals.
② With LW 110 enlargement piece. See page 1.31.

IEC Technical data
EK100 — EK1000

General Technical Data

Contactor types: EK...		110	150	175	210	370	550	1000
Rated insulation voltage U_i								
according to IEC 60947-4-1	V	1000						
according to UL/CSA	V	600						
Rated impulse withstand voltage $U_{imp.}$	kV	8						
Standards		Devices complying with international standards IEC 60947-1 / 60947-4-1 and European standards EN 60947-1 / 60947-4-1						
Air temperature close to contactor		see "Conditions for use" page 1.63, for control voltage limits and authorized mounting positions						
– fitted with thermal O/L relay	°C	-25 to +55						
– without thermal O/L relay	°C	-40 to +70						
– for storage	°C	-50 to +70						
Climatic withstand		acc. to IEC 60068-2-30						
Operating altitude	m	≤ 3000						
Shock withstand								
acc. IEC 60068-2-27 and EN 60068-2-27								
Mounting position 1 (see page 1.63)		1/2 sinusoidal shock for 15 ms: no change in contact position						
		Contactor in making or breaking position						
		Shock direction: A, C1, C2: 10 g						
		B1: 10 g						
		B2: 10 g						



IEC Technical data
EK110 — EK1000

Main Pole - Utilization Characteristics

Contactor types: EK...			110	150	175	210	370	550	1000
Rated operational voltage U_e max.		V	1000						690
Rated frequency limits		Hz	25 ... 400						
Conventional free-air thermal current I_{th} acc. to IEC 60947-4-1,									
open contactors ø ≤ 40 °C		A	200	250	300	350	550	800	1000
with conductor cross-sectional area		mm²	95	150	185	240	2 x 185	2 x 240	2 x 300
Rated operational current I_e / AC-1 for air temperature close to contactor									
U_e max. 690 V	ø ≤ 40 °C	A	200	250	300	350	550	800	1000
	ø ≤ 55 °C	A	180	230	270	310	470	650	800
	ø ≤ 70 °C	A	155	200	215	250	400	575	720
with conductor cross-sectional area		mm²	95	150	185	240	2 x 185	2 x 240	2 x 300
Utilization categorie AC-3 for air temperature close to contactor ≤ 55 °C									
Rated operational current I_e AC-3									
3-phase motors	220-230-240 V	A	120	145	210		400	550	–
	380-400 V	A	120	145	210		400	550	–
	415 V	A	120	145	210		400	550	–
	440 V	A	120	145	210		370	550	–
	500 V	A	120	145	210		370	550	–
	690 V	A	120	120	210		370	550	–
	1000 V	A	64	80	113		155	175	–
Rated operational power AC-3									
1500 r.p.m. 50 Hz	220-230-240 V	kW	30	45	59		110	160	–
1800 r.p.m. 60 Hz	380-400 V	kW	55	75	110		200	280	–
3-phase motors	415 V	kW	55	75	110		220	315	–
	440 V	kW	59	75	110		220	315	–
	500 V	kW	75	90	132		250	400	–
	690 V	kW	110	110	160		355	500	–
	1000 V	kW	90	110	160		220	250	–
Rated making capacity AC-3 according to IEC 60947-4-1			10 x I_e AC-3						–
Rated breaking capacity AC-3 according to IEC 60947-4-1			8 x I_e AC-3						–
Short-circuit protection for contactors without thermal O/L relay - Motor protection excluded									
U_e ≤ 500 V a.c. - gG type fuse		A	250		355		630	800	1000
Rated short-time withstand current I_{cw} at 40 °C ambient temp., in free air, from a cold state	1 s	A	1700	1800	2300		5500		6800
	10 s	A	900	1200	1680		5300		6400
	30 s	A	600	700	1000		3700		4400
	1 min	A	450	550	800		3000		3400
	15 min	A	210	250	320		1000		1200
Maximum breaking capacity cos ø = 0.45 (cos ø = 0.35 for I_e > 100 A)									
	at 440 V	A	1400	1500	2000		5000	5400	–
	at 690 V	A	1100	1200	1700		5000	5400	–
Heat dissipation per pole	I_e / AC-1	W	10	13	18		40	60	80
	I_e / AC-3	W	3	5	9		15	25	–
Max. electrical switching frequency									
– for AC-1		cycles/h	300						300
– for AC-3		cycles/h	300						–
– for AC-2, AC-4		cycles/h	150		120				–
Electrical durability			see pages 1.75						
Mechanical durability									
– millions of operating cycles			10				5		
– max. mechanical switching frequency		cycles/h	3600				3600		

IEC Technical data
EK110 — EK1000

Magnet System Characteristics for EK... Contactors - a.c. Operated

Contactor types: EK...			110	150	175	210	370	550	1000
Rated control circuit voltage U_c									
– at 50 Hz		V	24 ... 500				48 ... 500		
– at 60 Hz		V	24 ... 600				110 ... 600		
Coil operating limits			ø ≤ 70 °C						
according to IEC 60947-4-1			0.85 ... 1.1 x U_c						
Drop-out voltage in % of U_c			roughly 45 ... 65 %						
Coil consumption									
Average pull-in value	50 Hz①	VA	800		1100		3500		
	60 Hz①	VA	900		1200		4000		
	50/60 Hz②	VA/VA	500/500		630/630		3800/3400		
Average holding value	50 Hz①	VA/W	44/15		52/18		125/50		
	60 Hz①	VA/W	52/18		65/22		140/60		
	50/60 Hz②	VA/W	2.5/2.5		2.5/2.5		140/60		
Operating time									
between coil energization and:									
– N.O. contact closing		ms	20 ... 40① / 30 ... 50②				30 ... 60		
– N.C. contact opening		ms	15 ... 35① / 25 ... 45②				25 ... 55		
between coil de-energization and:									
– N.O. contact opening		ms	7.5 ... 15① / 95 ... 120②				10 ... 20		
– N.C. contact closing		ms	10 ... 18① / 100 ... 125②				13 ... 23		

Magnet System Characteristics fo EK... Contactors - d.c. Operated

Contactor types: EK...			110	150	175	210	370	550	1000
Rated control circuit voltage U_c									
		V d.c.	12 ... 220				24 ... 220		
Coil operating limits			ø ≤ 70 °C						
according to IEC 60947-4-1			0.85 ... 1.1 x U_c						
Drop-out voltage in % of U_c			roughly 15 ... 50 %						
Coil consumption - Average values									
– pull-in value		W	500		630		1100		
– holding value		W	2.5		2.5		20		
Coil time constant									
– open	L/R	ms	8				12		
– closed	L/R	ms	50				60		
Operating time									
between coil energization and:									
– N.O. contact closing		ms	30 ... 50				60 ... 80		
– N.C. contact opening		ms	27 ... 47				55 ... 75		
between coil de-energization and:									
– N.O. contact opening		ms	10 ... 35						
– N.C. contact closing		ms	13 ... 38						

① "A" coil voltage codes see page 1.29.
② 50/60 Hz "E" coil voltage codes see page 1.29.

Mounting Characteristics

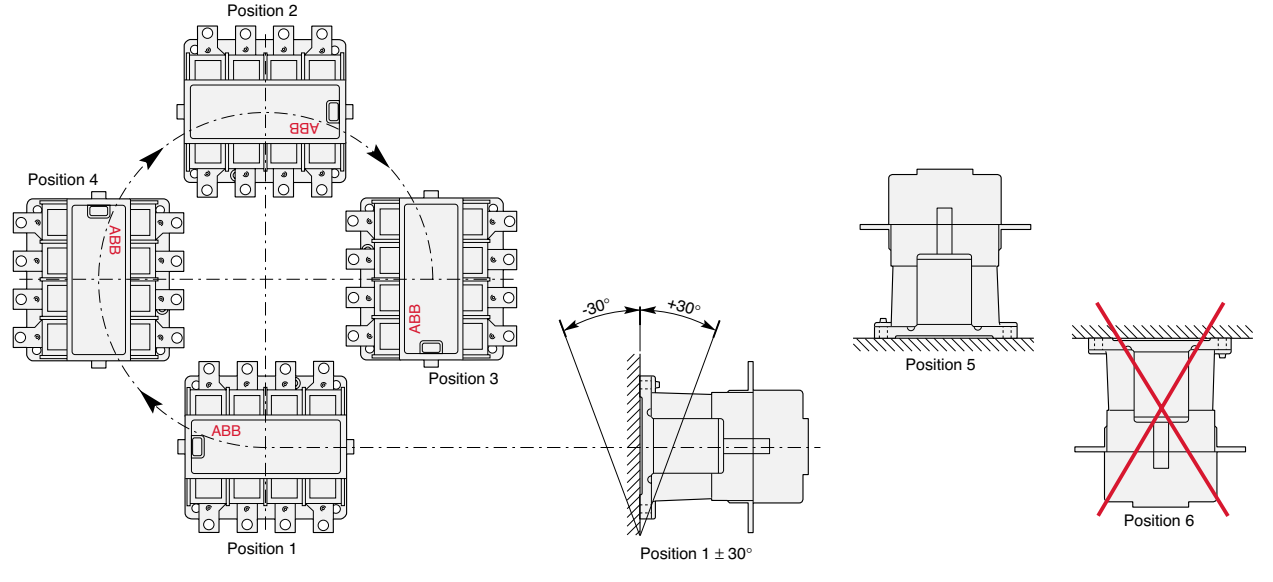
Contactor types: EK...	110	150	175	210	370	550	1000
Mounting positions	see "Conditions for use"						
Fixing by screws (supplied) 4 x M6	4 x M6 (1)						

Conditions for Use

Sustainable utilization conditions for contactors involving at the same time the Mounting position, Ambient temperature and Control voltage operating limits are summarized in the table below.

Contactors	Mounting position	Ambient temperature	Control voltage
E110 ... EK210	1, 1 ± 30°, 3, 4, 5	≤ 70 °C	0.85 ... 1.1 x U_c
	2, 6 unauthorized		
E370 ... EK1000	1, 1 ± 30°, 2, 3, 4, 5	≤ 70 °C	0.85 ... 1.1 x U_c
	6 unauthorized		

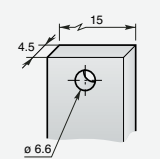
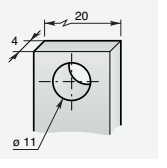
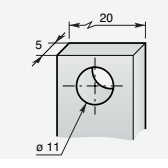
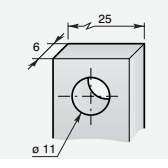
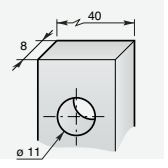
Mounting Positions (see the above table for authorized positions)



① Damping elements are supplied

IEC Technical data
EK110 — EK1000

Connecting Characteristics

Contactor types: EK...			110	150	175	210	370	550	1000
Main terminals Flat type									
Connecting capacity (min. ... max.) Main conductors (poles)									
Rigid:		1 x mm²	–	–	–	–	–	–	–
		2 x mm²	–	–	–	–	–	–	–
Rigid with connector single for Cu cable	mm²	25 ... 120	25 ... 185			70 ... 300		–	
single for Al/Cu cable		mm²	10 ... 70	35 ... 120			70 ... 300		95 ... 300
double for Al/Cu cable		mm²	–	–			2 x 35 ... 185		2 x 95 ... 300
Flexible		1 x mm²	–	–	–	–	–	–	–
		2 x mm²	–	–	–	–	–	–	–
Bars or lugs		L mm ≤	30	30	33		55		
		Ø mm >	6	10	10		10		
Auxiliary conductors (coil terminals)									
Rigid solid		1 x mm²	0.5 ... 2.5						
		2 x mm²	0.5 ... 2.5						
Flexible with cable end		1 x mm²	0.5 ... 2.5						
		2 x mm²	0.5 ... 2.5						
Lugs		L mm ≤	8						
		l mm >	3.7						
Degree of protection acc. to IEC 60947-1 / EN 60947-1 and IEC 60529 / EN 60529			Protection against direct contact acc. to VDE 0106 - Part. 100						
– Main terminals			IP 00						
– Coil terminals			IP 20						
Screw terminals Main terminals			Screws and bolts						
			M6	M10					
Coil terminals (delivered in open position)			M3.5 (+,-) pozidriv 2 screws with cable clamp						
Tightening torque Main pole terminals									
– recommended		Nm / lb.in	5 / 44	18 / 160					
– max.		Nm	6	22					
Coil terminals									
– recommended		Nm / lb.in	1.00 / 9						
– max.		Nm	1.20						

IEC Technical data
Contactor electrical durability and Utilization categories

General

Utilization categories determine the current making and breaking conditions relating to the characteristics of the loads to be controlled by the contactors. International standard IEC 60947-4-1 and European standard EN 60947-4-1 are the standards to be referred to.

If I_c is the current to be broken by the contactor and I_e the rated operational current normally drawn by the load, then:

- Categories AC-1 and AC-3: $I_c = I_e$
- Category AC-2: $I_c = 2.5 \times I_e$
- Category AC-4: $I_c = 6 \times I_e$

Generally speaking $I_c = m \times I_e$ where m is a multiple of the load operational current.
On pages 1.66 - 1.71, the curves corresponding to categories AC-1, AC-2, AC-3 and AC-4 represent the electrical durability variation of standard contactors in relation to the breaking current I_c.
Electrical durability is expressed in millions of operating cycles.
These curves have been plotted for 400 V - 50 Hz 3-phase currents but remain valid up to 690 V - 40 ... 60 Hz provided that a check is carried out to make sure that at the operational voltage U_e, the current I_e normally drawn by the load does not exceed the value of the contactor rated operational current: I_e / AC-1 for category AC-1 and I_e / AC-3 for categories AC-3 and AC-4. The values are given for each type of contactor in pages 1.44, 1.45, 1.54, and 1.61 (Technical Data).

Curve Utilization Mode

Electrical durability forecast and contactor selection for categories AC-1, AC-2, AC-3 or AC-4

- Note the characteristics of the load to be controlled:
  - Operational voltage ..... U_e
  - Current normally drawn ..... I_e (U_e / I_e / kW relation for motors, + page 0/0).
  - Utilization category ..... AC-1, AC-2, AC-3 or AC-4
  - Breaking current ..... $I_c = I_e$ for AC-1 and for AC-3 ; $I_c = 2.5 \times I_e$ for AC-2 ; $I_c = 6 \times I_e$ for AC-4
- Define the number of operating cycles N required.
- On the diagram corresponding to the operational category, select the contactor with the curve immediately above the intersection point (I_c ; N).

Electrical durability forecast and contactor selection for mixed duty motor control: AC-3 ($I_c = I_e$) type switching off while "motor running" and, occasionally, AC-4 ($I_c = 6 \times I_e$) type switching off while "motor accelerating".

- Note the characteristics of the motor to be controlled:
  - Operational voltage ..... U_e
  - Current normally drawn while "motor running" ..... I_e (U_e / I_e / kW relation for motors, + 0/0).
  - Breaking current for AC-3 ..... $I_c = I_e$
  - Breaking current for AC-4 while "motor accelerating" ..... $I_c = 6 \times I_e$
  - Percentage of AC-4 operations ..... K (on the basis of the total number of operating cycles)
- Define the total number of operating cycles N required.
- Note the smallest contactor rating compatible for AC-3 (U_e / I_e) on pages 2/62, 2/63, 2/73, and 2/79.
- For the selected contactor make a note of the following in relation to the voltage using diagram AC-3 page 2/85 and AC-4 page 2/86 or 2/87:
  - The number of operating cycles A for $I_c = I_e$ (AC-3)
  - The number of operating cycles B for $I_c = 6 \times I_e$ (AC-4)
- Calculate the estimated number of cycles N' (N' is always below A)

$$N' = \frac{A}{1 + 0.01\ K\ (A/B - 1)}$$

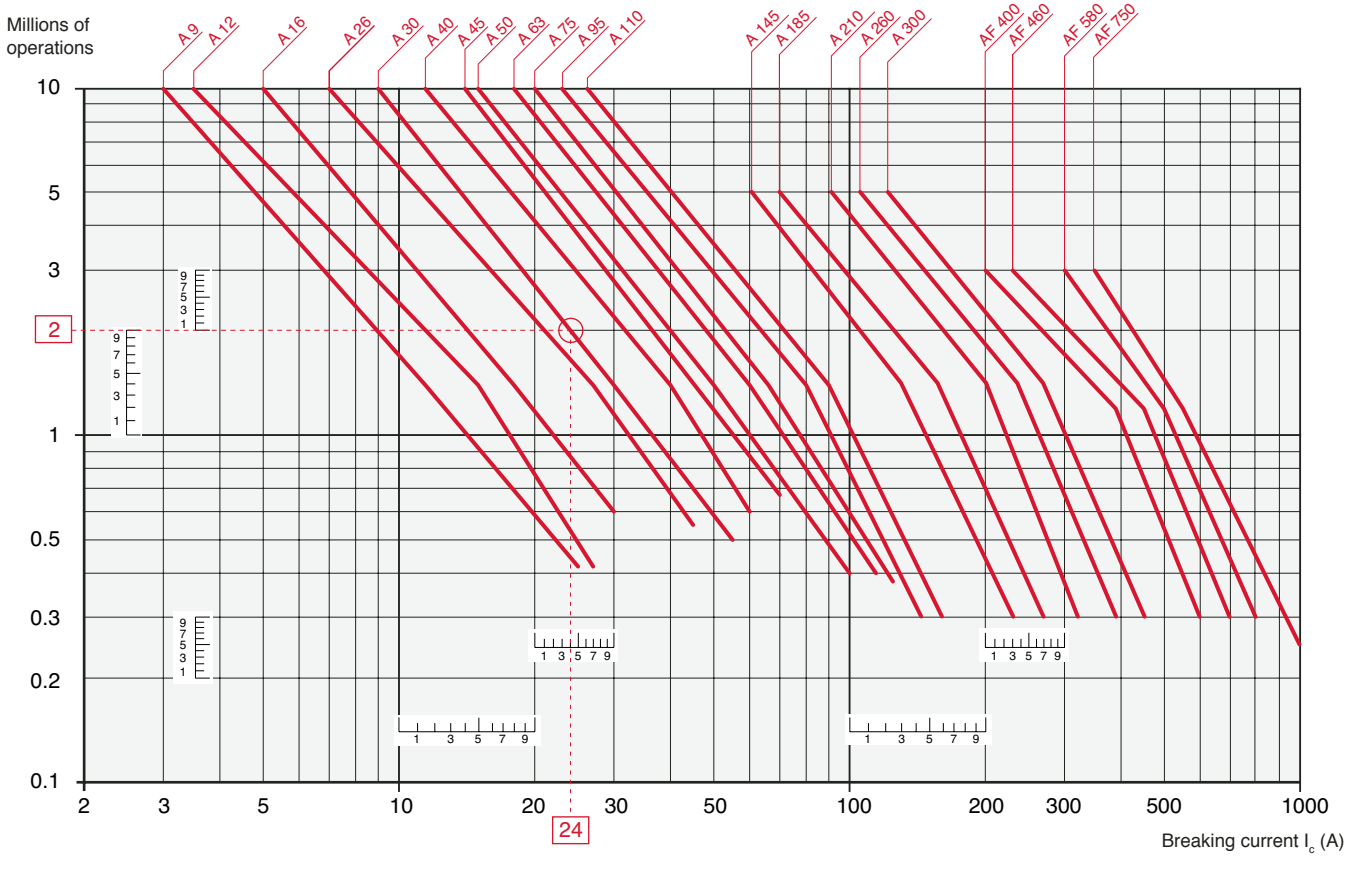
•If N' is too low in relation to the target N, calculate the estimated number of cycles for a higher contactor rating.

Case of uninterrupted duty.
Among the different utilization categories, the uninterrupted duty implies the following remark. The combinated effect of environmental conditions and the proper temperature of the product may require some disposals. As a matter of fact, for this duty, the use duration prevails over the number of operating cycles.
For long term service, some verifications of preventing maintenance are needed to check the functionality of the concerned product (consult us).
Over a duration of five years, in these conditions the contactor might present high internal resistance. We recommend to change the contactor or change the contacts.

IEC Technical data
A9 — AF750
Electrical durability

Electrical Durability for AC-1 Utilization Category. Ambient Temperature ≤ 55 °C

Switching non-inductive or slightly inductive loads. The breaking current I_c for AC-1 is equal to the rated operational current of the load.

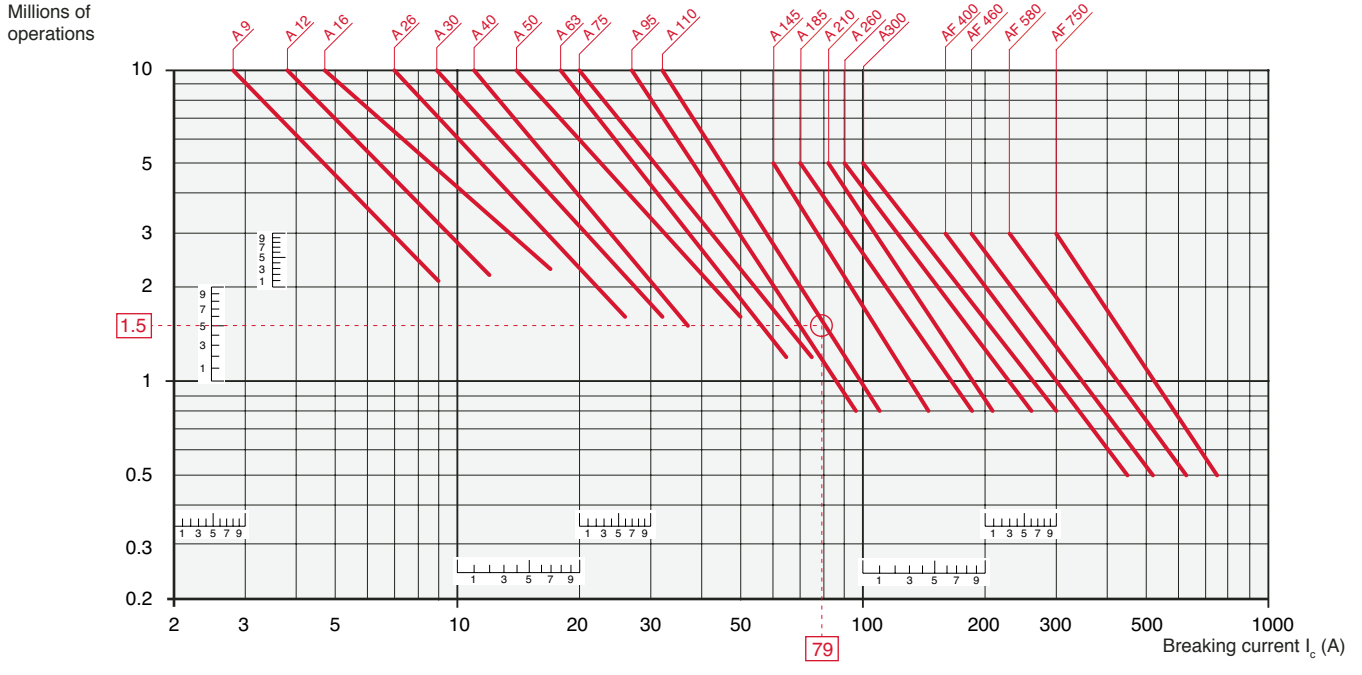


Example:
I_c / AC-1 = 24 A – Electrical durability required = 2 million operations.
Using the AC-1 curves above select the A 30 contactor at intersection "○" (24 A / 2 million operations).

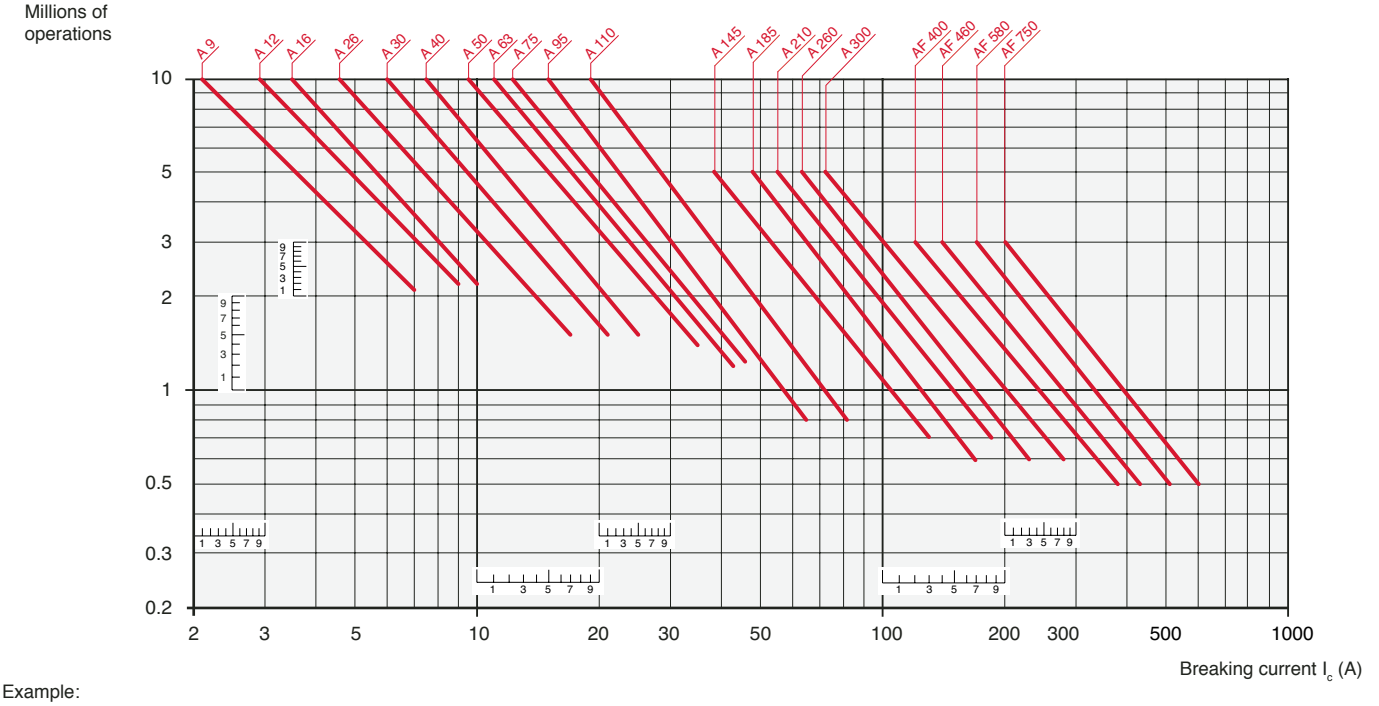
IEC Technical data
A9 — AF750
Electrical durability

Switching cage motors: starting and switching off running motors. The breaking current I_c for AC-3 is equal to the rated operational current I_e (I_e = motor full load current).

Electrical Durability for AC-3 Utilization Category - $U_e \leq 440$ V. Ambient Temperature ≤ 55 °C



Electrical Durability for AC-3 Utilization Category - 440 V < $U_e \leq$ 690 V. Ambient Temperature ≤ 55 °C



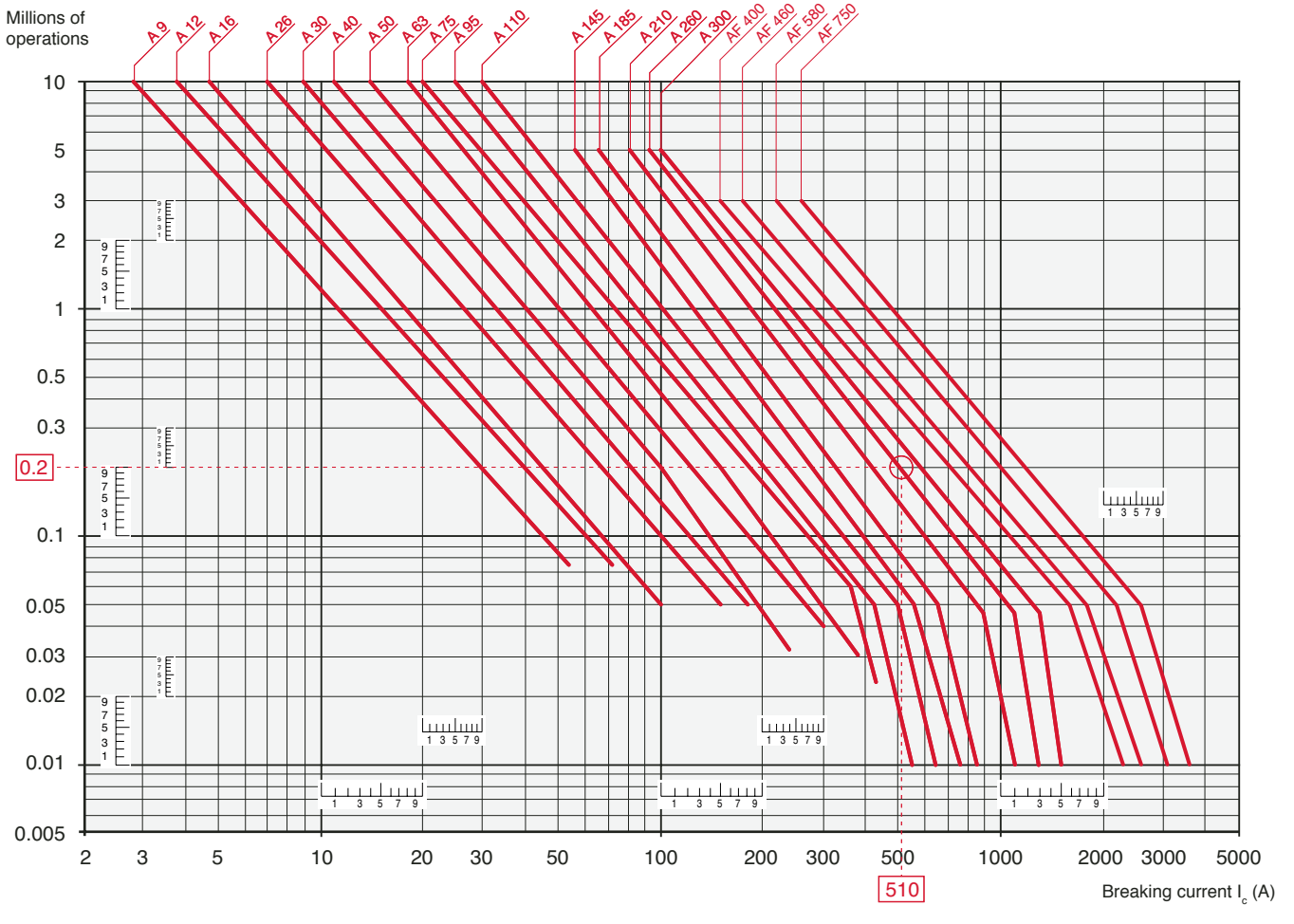
Example:
Motor power 40 kW for AC-3 - U_e = 400 V utilization – Electrical durability required = 1.5 million operations.
40 kW, 400 V corresponds to I_e = 79 A. For AC-3: $I_c = I_e$. Select the A 110 contactor at intersection "○" (79 A / 1.5 million operations) on the curves (AC-3 - $U_e \leq 440$ V).

IEC Technical data
A9 — AF750
Electrical durability

Electrical Durability for AC-2 or AC-4 Utilization Category - $U_e \leq 440$ V. Ambient Temperature ≤ 55 °C

Maximum number of AC-2 or AC-4 operations: 300 per hour for A 9 ... A 40 contactors,
150 per hour for A 50 ... A 300 contactors.

Switching cage motors: starting, reverse operation and step-by-step operation. The breaking current I_c is equal to 2.5 x I_e for AC-2 and 6 x I_e for AC-4, keeping in mind that I_e is the motor rated operational current (I_e = motor full-load current).



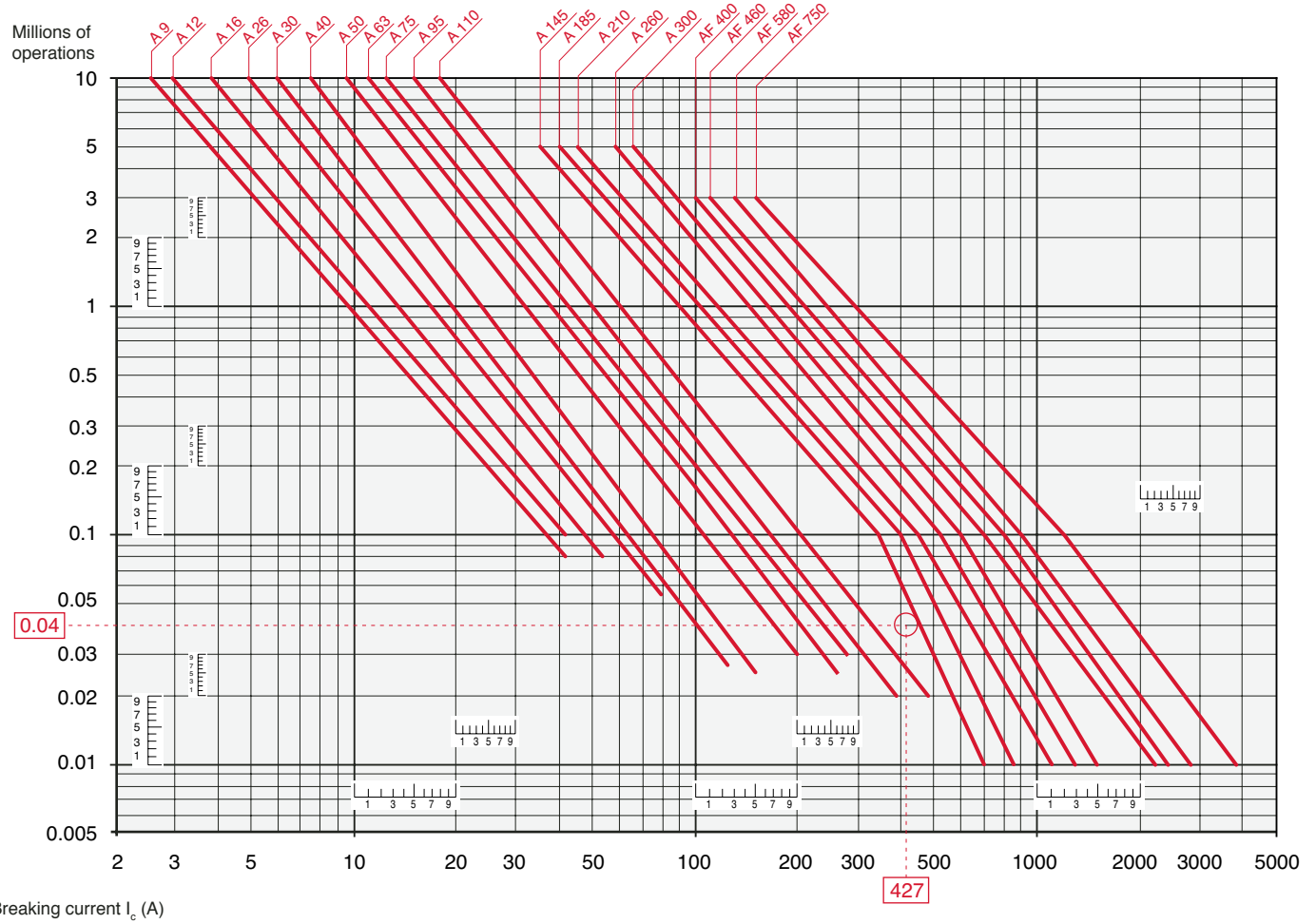
Example:
Motor power 45 kW for AC-4 - U_e = 400 V utilization – Electrical durability required = 0.2 million operations.
45 kW, 400 V corresponds to I_e = 85 A.
For AC-4: I_c = 6 x I_e = 510 A - Select the A 260 contactor at intersection "○" (510 A / 0.2 million operations) on the curves (AC-4 - $U_e \leq 440$ V).

IEC Technical data
A9 — AF750
Electrical durability

Electrical Durability for AC-2 or AC-4 Utilization Category - 440 V < U_e ≤ 690 V. Ambient Temperature ≤ 55 °C

Maximum number of AC-2 or AC-4 operations: 300 per hour for A 9 ... A 40 contactors,
150 per hour for A 50 ... A 300 contactors.

Switching cage motors: starting, reverse operation and step-by-step operation. The breaking current I_c is equal to 2.5 x I_e for AC-2 and 6 x I_e for AC-4, keeping in mind that I_e is the motor rated operational current (I_e = motor full-load current).



Example:
Motor power 59 kW for AC-4 - U_e = 600 V utilization – Electrical durability required = 0.04 million operations.
As stated on page 0/0: 59 kW, 600 V corresponds to I_e = 71.1 A.
For AC-4: I_c = 6 x I_e = 426.6 A - Select the A 145 contactor at intersection "○" (427 A / 0.04 million operations) on the curves (AC-4 - 440 V < U_e ≤ 690 V).

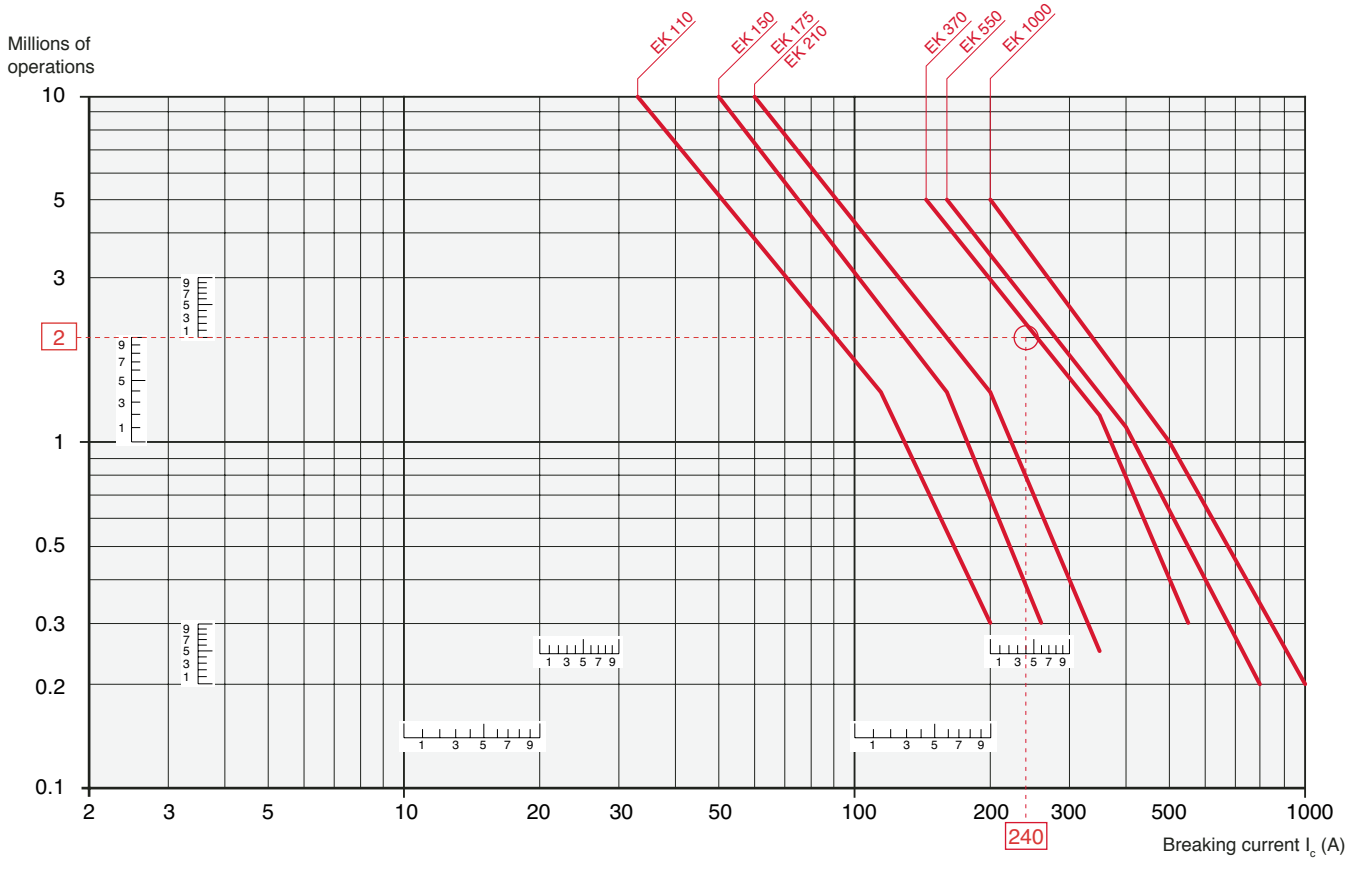
IEC Technical data
AL9 — AL40
Electrical durability

Consult factory

IEC Technical data
EK110 — EK1000
Electrical durability

Electrical Durability for AC-1 Utilization Category. Ambient Temperature ≤ 55 °C

Switching non-inductive or slightly inductive loads. The breaking current I_c for AC-1 is equal to the rated operational current of the load.



Example:
I_c / AC-1 = 240 A – Electrical durability required = 2 million operations.
Using the AC-1 curves above select the EK 370 contactor at intersection "○" (240 A / 2 million operations).

IEC Technical data
Influence of the length of conductors used in contactor control circuits

A 50-30-00

AF 460-30-11

Under certain conditions the excessive length of the control circuit conductors may prevent the contactor from carrying out closing and opening orders.

– no closing: due to excessive voltage drop (in a.c. or d.c.).
– no opening: due to excessive capacitance (in a.c.).

Contactor Closing (contactor with a.c. or d.c. fed control circuit)

The voltage drop is due to the pull-in current (pull-in power) and to the resistance of the control circuit conductors.

The table and graph below can be used to determine the single length of line feeders (distance between the control device and the contactor coil) in relation to:

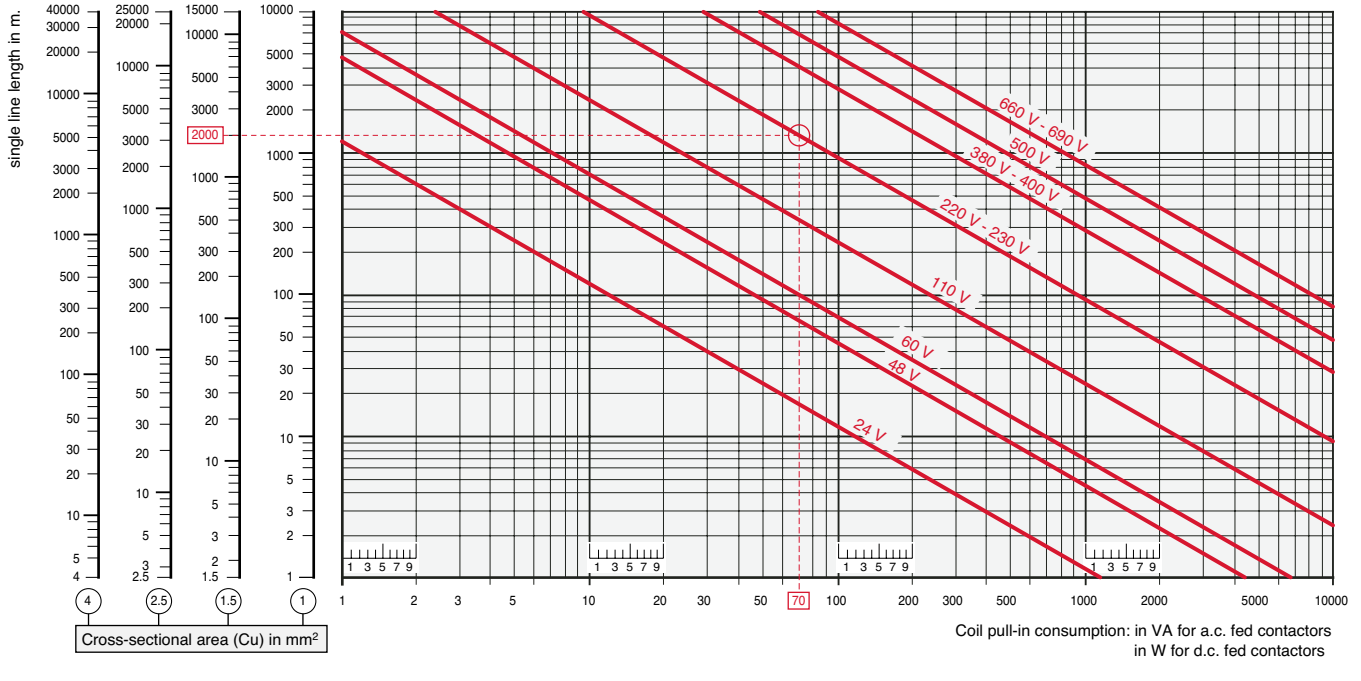
- the coil pull-in consumption.
- the supply voltage.
- the connecting wire cross-sectional area.

The graph has been drawn for a max. line voltage drop of 5 %.

Coil pull-in consumption (average value)

Contactors	a.c. control circuit 50 Hz	Contactors	d.c. control circuit
A 9, 12, 16	70 VA	AE 9, 12, 16	90 W
A 26, 30, 40	120 VA	AE 26, 30, 40	110 W
A 45, 50, 63, 75	180 VA	AE 45, 50, 63, 75	200 W
A 95, 110	450 VA	AE 95, 110	400 W
A 145, 185	700 VA	BC 9, 16, 18, 25, 30	7 W
A 210, 260, 300	1700 VA		
AF 45, 50, 63, 75	210 VA	AF 45, 50, 63, 75	190 W
AF 95, 110	350 VA	AF 95, 110	400 W
AF 145,185	430 VA	AF 145,185	500 W
AF 210, 260, 300	470 VA	AF 210, 260, 300	520 W
AF 400, 460	890 VA	AF 400, 460	990 W
AF 580, 750	850 VA	AF 580, 750	950 W

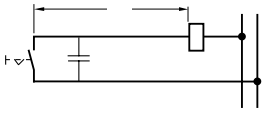
Permissible single length for the control circuit conductors on contactor closing:
Depending on the coil pull-in power consumption on the supply voltage and on the control circuit conductor cross-sectional area.



Example:
A 9 contactor
Coil voltage: 230 V 50 Hz, contactor coil pull-in power consumption: 70 VA,
control circuit conductor cross-sectional area: Cu 1.5 mm².
Max. permissible length: 2000 m.

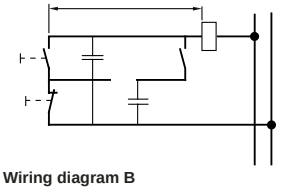
IEC Technical data
Influence of the length of conductors used in contactor control circuits

Single control line length



Wiring diagram A
Via maintained pushbutton and 2-core cable (with a capacity of 0.2 μF/km, for example).

Single control line length



Wiring diagram B
Via momentary pushbutton plus hold-in contact and 3-core cable (with a capacity of 2 x 0.2 = 0.4 μF/km, for example).

Contactor Opening (contactor with a.c. fed control circuit)

Under certain conditions, an a.c. operated contactor does not open when the control circuit is de-energized.

This is due to a critical capacity of the excessively long control circuit line and the type of contactor coil control layout (see diagrams A and B opposite).

This may be caused by the following factors:

- high control voltage.
- low coil holding consumption.
- low contactor drop-out voltage (according to IEC 60947-4-1: 0.2 to 0.75 x U_c).

If lines longer than those indicated are required, the following measures must be taken:

- select a contactor with a higher rating.
- select a lower control voltage.
- connect "R_P" impedances in parallel with the contactor coil:

sizing of parallel resistor: $R_P = \frac{10^3}{C}$ (with C in μF)

The table and graph below can be used to determine the single length of line feeders (distance between the control device and the contactor coil) in relation to:

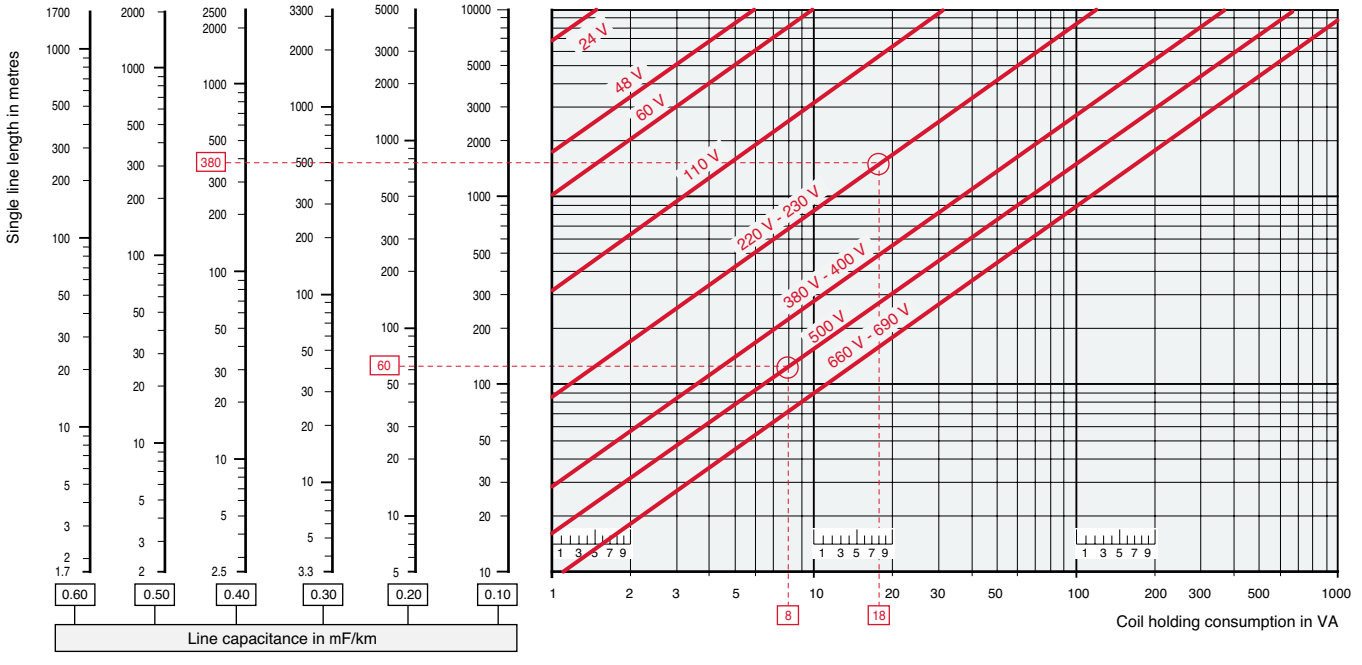
- the coil holding consumption VA.
- the supply voltage.
- the capacity in μF/km (depending on the control layout).

Wiring diagrams A and B opposite show two supply and coil control wiring examples.

Coil holding consumption (average value)

Contactors	a.c. control circuit 50 Hz	Contactors	a.c. control circuit 50 Hz
A 9, 12, 16	8 VA	AF 45, 50, 63, 75	7 VA
A 26, 30, 40	12 VA	AF 95, 110,	7 VA
A 45, 50, 63, 75	18 VA	AF 145, 185,	12 VA
A 95, 110	22 VA	AF 210, 260, 300	10 VA
A 145, 185	35 VA	AF 400, 460	12 VA
A 210, 260, 300	60 VA	AF 580, 750	12 VA

Permissible single length for the control circuit conductors on contactor opening:
Depending on the coil holding power consumption, on the supply voltage and on the control circuit conductor capacity.



Examples:

A 16 contactor
Coil voltage U_c = 500 V, 50 Hz, 8 VA contactor coil holding consumption, control type: diagram A, via maintained pushbutton, and 2-core cable with a capacity of 0.2 μF/km.
Max. permissible length: 60 m.

A 50 contactor
Coil voltage U_c = 230 V, 50 Hz, 18 VA contactor coil holding consumption, control type: diagram B via momentary pushbutton, hold-in contact and 3-core cable with a capacity of 2 x 0.2 μF/km = 0.4 μF/km.
Max. permissible length: 380 m.

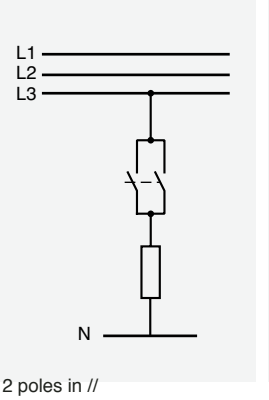
IEC Technical data
Parallel connection of main poles

Parallel Connection of Main Poles

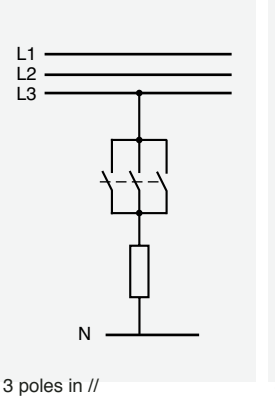
Purpose: Increasing the a.c. resistive load.
Remarks:
– Parallel connection of main poles to increase the d.c. resistive load is not acceptable.
– Parallel connection of main poles does'nt increase the breaking capacity.

Means: The poles can be connected in parallel via shorting bars. See page 1.30.
– LP and LH for parallel connection of 2 poles,
– LY and LF for parallel connection of 3 poles,

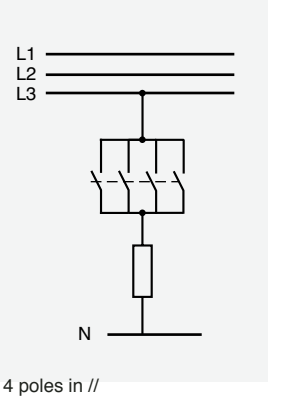
The table below shows the uprating factor for I_e / AC-1 max. in relation to the number of poles in parallel and for a max. switching frequency.



2 poles in //



3 poles in //



4 poles in //

Contactors			Factor to be applied to the rated operational current I_e / AC-1 to obtain the permissible				
a.c. Operated	d.c. Operated	Cycles / h	current I_e / AC-1 with "n" poles in parallel.				
3-pole contactors							
A 9 ... A 75	AF 50 ... AF 75						
AF 50 ... AF 75	AE..., TAE...	600	1.6	2.2	–		
	AL...	A 95 ... A 300	AF 145 ... AF 750	300	1.6	2.2	–
AF 145 ... AF 750							
4-pole contactors							
A 9 ... A 75	AF 45 ... AF 75						
AF 45 ... AF 75	AE..., TAE...	600	1.6	2.2	2.6		
	AL...	EK...	EK...	300	1.6	2.2	2.8

IEC Technical data
Temporary or intermittent duty

Utilization of Contactors for Temporary / Intermittent Duty

The table below shows the factor to be applied to the rated operational current I_e / AC-1 to obtain the permissible operational current I_e / AC-1 in relation to the switching frequency and the current flow time per cycle.

Operating cycles per hour		120	60	20	6	2	1
Current flow time per cycle in seconds.		Factor to be applied to the rated operational current I_e / AC-1 max. to obtain the permissible current I_e / AC-1 for temporary / intermittent duty.					
	5	2.8	3.4	4	4.7	5	5.2
	10	2.2	2.6	3	3.4	3.7	3.8
	20	1.6	2	2.4	2.6	2.7	2.8
	30	–	1.7	2.1	2.2	2.3	2.4
	40	–	1.5	1.9	2.0	2.1	2.2
	60	–	–	1.7	1.8	1.8	1.9

Example:

A 9 contactor (intermittent duty, resistive load)

Rated operational current I_e / AC-1 at 55 °C (see page 1.42)	22 A
Switching frequency	2 operations/h
Current flow time per cycle	20 s
Factor to be applied to the current I_e / AC-1	2.7
Permissible current: 2.7 x 22 =	59 A

Technical data
Technical terms and definitions

Altitude
Refers to the height of the site where the equipment is located, expressed in meters above the sea level.

Ambient temperature
Temperature of the air surrounding the unit.

Circuits
• Auxiliary circuit

All the conducting parts of a contactor, intended to be included in a circuit different from the main circuit and the control circuit of the contactor e.g. signalization, interlocking circuits etc …

• Control circuit

All the conducting parts of a contactor (other than the main circuit) included in a circuit used for the closing operation, or opening operation, or both, of the contactor.

• Main circuit

All the conducting parts of a contactor included in the circuit which it is designed to close or open.

Coil operating range
Expressed as a multiple of the rated control circuit voltage Uc for the lower and upper limits.

Cycle duration
Total time of the on-load + off-load period.

Endurance / durability
• Electrical endurance

Number of on-load operating cycles (i.e. with current on the main contacts) a contactor can achieve, varies depending on the utilization category.

• Mechanical endurance

Number of off-load operating cycles (i.e. without current on the main contacts) a contactor can achieve.

Inching
Energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.

Insulation class according to the VDE 0110 and NFC 20-040
Characterizes contactors suitability in accordance with environment and utilization conditions. A contactor can be classified depending on its own clearance and creepage distances in the insulation classes A, B, C, D which correspond to different insulation voltage values.

The insulation class C is applicable to most of the industrial applications. Equipment described in this catalogue correspond to insulation class C.

Intermittent duty
Duty in which the main contacts of a contactor remain closed for periods of time insufficient to allow the contactor to reach thermal equilibrium, the current-carrying periods being separated by off-load periods of sufficient duration to restore equality of temperature with the cooling medium.

Mounting positions
Stated by the manufacturer. Please note restrictions when applicable.

On-load factor
Ratio of the current flow time to the total time of the cycle x 100.

Plugging
Stopping or reversing a motor quickly by interchanging two supply leads whilst the motor is running.

Rated breaking capacity; Rated making capacity
Value of r.m.s current a contactor can break or make at a fixed voltage value, within the conditions specified by the standards, depending on the utilization category.

Rated control circuit voltage Uc
Control voltage value for which the control circuit of the unit is sized.

Rated insulation voltage U_i
Voltage value which designates the unit and to which dielectric tests, clearance and creepage distances are referred.

Rated impulse withstand voltage U_{imp}
The highest peak value of an impulse voltage of prescribed form 1.2/50, which does not cause breakdown under specified conditions of test.

Rated operating current I_e
Current value stated by the manufacturer and taking into account the rated operating voltage U_e, the rated frequency, the rated duty, the utilization category, the electrical contact life and the type of the protective enclosure.

Rated operating voltage U_e
Voltage value to which utilization characteristics of the contactor are referred, i.e. phase to phase voltage in 3 phase circuits.

Conventional thermal current I_{th}
Value of current the contactor can withstand with poles in closed position, in free air for an eight hour duty, without the temperature rise of its various parts exceeding the limits specified by the standards.

Resistance to shocks
Requirements applicable for instance to vehicles, crane operation or switchgear slide-in module systems.

At the quoted permissible «g» values, contactors must not undergo a change in switching state and O/L relays must not trip.

Resistance to vibrations
Requirements applicable to all the vehicles, vessels and other similar transport systems. At the quoted amplitude and vibration frequency values, the unit must be capable to achieve the required duty.

Short-circuit protection co-ordination
Achieved by using back-up protection devices such as circuit-breakers, H.R.C. fuses or standard fuses.

Co-ordination types a, b, c are defined in IEC 292-1 publication, VDE 0660, NFC 63-650 standards. Co-ordination types "1" and "2" are defined in IEC 947-4-1.

• Type 1 co-ordination

There has been no discharge of parts beyond the enclosure. Damage to the contactor and the overload relay is acceptable.

• Type 2 co-ordination

No damage to the overload relay or other parts has occured, except that welding of contactor or starter contacts is permitted, if they are easily separated.

Switching frequency
Number of operating cycles per hour.

Time
• Closing time

Time between energization of the coil until the moment the contacts of the first current path to be closed actually close.

• Opening time

Time from the beginning of state causing breaking until the moment when the contacts of the last current path to be opened are open.

• Minimal operation time

Shortest control duration to ensure complete closing or opening of a contactor.

• Short time current permissible

Value of current which the contactor can withstand in closed position for a short time period and within specified conditions.

• Time constant

Ratio of inductance to the resistance : L/R = mH/Ohm = ms.

IEC Technical data
Standards, utilization categories

Standards

• IEC standards 158-1: “Contactors” and series IEC 292 :

“Motor-starters” have been revised and replaced by the new IEC 947-4-1 (1990-05): “Contactors and Motor-starters” referring to IEC 947-1 (1988): “General rules”

The new standards will constitute the basis of the future European and National standards, not yet revised.

Therefore the ratings indicated in this catalog are established according to the former and the future standards.

• Main changes and additions in the new standards are:

• Revision and extension of the utilization categories (see hereafter)

• Replacement of the coordination classes types a, b, c by new types: “1” (approximately equivalent to former class “a”) and “2” (approximately equivalent to former class “c”) with additional requirements.

• Classification of the thermal overload relays in tripping classes: 10 A; 10; 20 and 30 depending on their tripping times, at 1.5 and 7.2 times their setting current, in order to cover motor applications depending on their starting times. Class 10 A is adapted for motors according to IEC 34-1.

• Introduction of tests to verify the connecting capability and the mechanical strength of terminals.

Utilization categories

A contactor duty is characterized by the utilization category plus indication of the rated operating voltage and the rated operating current (see at Rated …), or the motor characteristics.

Utilization categories for contactors according to IEC 947-4-1

Alternating current:	AC-1	Non-inductive or slightly inductive loads, resistance furnaces. Power factor 0.7 - 0.8 (slightly inductive).
	AC-2	Slip-ring motors: starting, switching-off.
	AC-3	Squirrel-cage motors: starting, switching-off motors during running. Power factor 0.4 - 0.5 (AC-3).
	AC-4	Squirrel-cage motors: starting, plugging, inching.
	AC-5a	Switching of electric discharge lamp controls.
	AC-5b	Switching of incandescent lamps.
	AC-6a	Switching of transformers.
	AC-6b	Switching of capacitor banks
	AC-8a	Hermetic refrigerant compressor motor control with manual resetting of overload releases
	AC-8b	Hermetic refrigerant compressor motor control with automatic resetting of overload releases.
Direct current:	DC-1	Non-inductive or slightly inductive loads, resistance furnaces.
	DC-3	Shunt motors: starting, plugging, inching. Dynamic breaking of d.c. motors.
	DC-5	Series motors: starting, plugging, inching. Dynamic breaking of d.c. motors.
	DC-6	Switching of incandescent lamps

Utilization categories for contactor relays according to IEC 947-5-1

Alternating current:	AC-12	Control of resistive loads and solid state loads with isolation by opto couplers.
	AC-13	Control of solid state loads with transformer isolation.
	AC-14	Control of small electromagnetic loads (≤ 72 VA).
	AC-15	Control of electromagnetic loads (> 72 VA).
Direct current:	DC-12	Control of resistive loads and solid state loads with isolation by opto couplers.
	DC-13	Control of electromagnets.
	DC-14	Control of electromagnetic loads having economy resistors in circuit.

Utilization categories AC-1, AC-2, AC-3, AC-4 and DC-1, DC-3, DC-5 are maintained with slightly more severe tests.

Other categories have been added in order to standardize specific applications. In fact some contactor applications and the specific criteria characterizing the types of load controlled can modify the recommended utilization characteristics. These major applications are, for example :

Switching of capacitor banks

This application is characterized by high current peaks when switching-on the contactor and presence of harmonic currents on uninterrupted duty. For this application, IEC 947-4-1 has defined an utilization category AC-6b. Practical ratings have to be defined according to tests or, in absence of tests, by a calculation indicated in IEC 947-4-1.

Switching of transformers

This application is characterized by high current peaks on contactor closing due to magnetization phenomena. The corresponding utilization category according to IEC 947-4-1 is AC-6a. Ratings are derived from test-values for AC-3 or AC-4 according to formula given in IEC 947-4-1.

Switching of lighting circuits

The current peaks on contactor closing and power factor vary depending on the type of lamps, the switching method used and if compensation systems are fitted or not.

IEC 947-4-1 contains two standard utilization categories

AC-5a for switching of the electric discharge lamps.
AC-5b for switching of incandescent lamp.

UL/CSA Technical data
Motor data

Ampere ratings of 3 phase, AC induction motors

Horse power	110 – 120V			200 – 208V			220 – 240V			380 – 415V①		440 – 480V			550 – 600V		
	Single phase	Two phase	Three phase	Single phase	Two phase	Three phase	Single phase	Two phase	Three phase	Single phase	Three phase	Single phase	Two phase	Three phase	Single phase	Two phase	Three phase
1/10	3.0	—	—	1.65	—	—	1.5	—	—	1.0	—	—	—	—	—	—	—
1/8	3.8	—	—	2.1	—	—	1.9	—	—	1.2	—	—	—	—	—	—	—
1/6	4.4	—	—	2.4	—	—	2.2	—	—	1.4	—	—	—	—	—	—	—
1/4	5.8	—	—	3.2	—	—	2.9	—	—	1.8	—	—	—	—	—	—	—
1/3	7.2	—	—	4.0	—	—	3.6	—	—	2.3	—	—	—	—	—	—	—
1/2	9.8	4.0	4.4	5.4	2.2	2.4	4.9	2.0	2.2	3.2	1.3	2.5	1.0	1.1	2.0	0.8	0.9
3/4	13.8	4.8	6.4	7.6	2.6	3.5	6.9	2.4	3.2	4.5	1.8	3.5	1.2	1.6	2.8	1.0	1.3
1	16.0	6.4	8.4	8.8	3.6	4.6	8.0	3.2	4.2	5.1	2.3	4.0	1.6	2.1	3.2	1.3	1.7
1 1/2	20.0	9.0	12.0	11.0	5.0	6.6	10.0	4.5	6.0	6.4	3.3	5.0	2.3	3.0	4.0	1.8	2.4
2	24.0	11.8	13.6	13.2	6.5	7.5	12.0	5.9	6.8	7.7	4.3	6.0	3.0	3.4	4.8	2.4	2.7
3	34.0	16.6	19.2	18.7	9.2	10.6	17.0	8.3	9.6	10.9	6.1	8.5	4.2	4.8	6.8	3.3	3.9
5	56.0	26.4	30.4	30.8	14.5	16.8	28.0	13.2	15.2	17.9	9.7	14.0	6.6	7.6	11.2	5.3	6.1
7 1/2	80.0	38.0	44.0	44.0	21.0	24.2	40.0	19.0	22.0	27.0	14.0	21.0	9.0	11.0	16.0	8.0	9.0
10	100.0	48.0	56.0	55.0	26.4	30.8	50.0	24.0	28.0	33.0	18.0	26.0	12.0	14.0.	20.0	10.0	11.0
15	135.0	72.0	84.0	75.0	39.6	46.2	68.0	36.0	42.0	44.0	27.0	34.0	18.0	21.0	27.0	14.0	17.0
20	—	94.0	108.0	96.8	52.0	60.0	88.0	47.0	54.0	56.0	34.0	44.0	23.0	27.0	35.0	19.0	22.0
25	—	118.0	136.0	121.0	65.0	75.0	110.0	59.0	68.0	70.0	44.0	55.0	29.0	34.0	44.0	24.0	27.0
30	—	138.0	160.0	150.0	76.0	88.0	136.0	69.0	80.0	87.0	51.0	68.0	35.0	40.0	54.0	28.0	32.0
40	—	180.0	208.0	194.0	100.0	115.0	176.0	90.0	104.0	112.0	66.0	88.0	45.0	52.0	70.0	36.0	41.0
50	—	226.0	260.0	238.0	125.0	143.0	216.0	113.0	130.0	139.0	83.0	108.0	56.0	65.0	86.0	45.0	52.0
60	—	—	—	—	147.0	160.0	—	133.0	154.0	—	103.0	—	67.0	77.0	—	53.0	62.0
75	—	—	—	—	183.0	212.0	—	166.0	192.0	—	128.0	—	83.0	96.0	—	66.0	77.0
100	—	—	—	—	240.0	273.0	—	218.0	248.0	—	165.0	—	109.0	124.0	—	87.0	99.0
125	—	—	—	—	—	344.0	—	—	312.0	—	208.0	—	135.0	156.0	—	108.0	125.0
150	—	—	—	—	—	396.0	—	—	360.0	—	240.0	—	156.0	180.0	—	125.0	144.0
200	—	—	—	—	—	528.0	—	—	480.0	—	320.0	—	208.0	240.0	—	167.0	192.0
250	—	—	—	—	—	663.0	—	—	602.0	—	403.0	—	—	302.0	—	—	242.0
300	—	—	—	—	—	—	—	—	—	—	482.0	—	—	361.0	—	—	289.0
350	—	—	—	—	—	—	—	—	—	—	560.0	—	—	414.0	—	—	336.0
400	—	—	—	—	—	—	—	—	—	—	636.0	—	—	477.0	—	—	382.0
500	—	—	—	—	—	—	—	—	—	—	786.0	—	—	590.0	—	—	472.0

① To obtain full load currents for 265V and 277V motors, decrease corresponding 220 – 240V ratings by 13 percent and 17 percent.