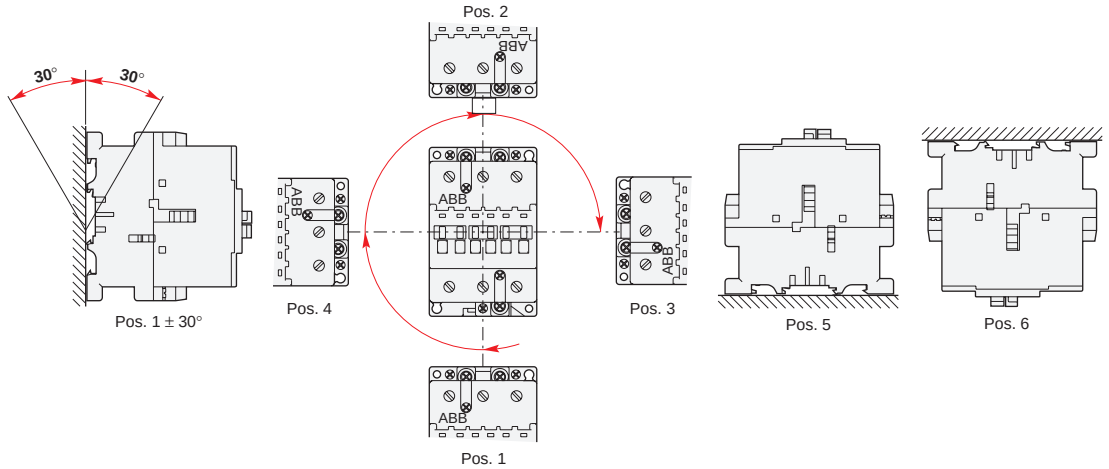
UL & CSA Technical data
A/AE9 – A/AE/AF110
AC & DC operated

ABB contactor frame size		A/AE 9	A/AE 12	A/AE 16	A/AE 26	A/AE 30	A/AE 40	A/AE/AF 45	A/AE/AF 50	A/AE/AF 63	A/AE/AF 75	A/AE/AF 95	A/AE/AF 110
NEMA size		00	—	0	1	1P	—	—	2	—	3	—	—
Number of poles		3 OR 4	3	3 OR 4	3 OR 4	3	3	4	3 OR 4	3	3 OR 4	3	3
AC rating information													
NEMA cont. amp rating	thermal current	9	—	18	27	36	—	—	45	—	90	—	—
NEMA maximum H.P. ratings	1 phase												
115	VAC	1/3	—	1	2	3	—	—	3	—	—	—	—
230	VAC	1	—	2	3	5	—	—	7.5	—	—	—	—
NEMA maximum H.P. ratings	3 phase												
200	VAC	1.5	—	3	7.5	—	—	—	10	—	25	—	—
230	VAC	1.5	—	3	7.5	—	—	—	15	—	30	—	—
460/575	VAC	2	—	5	10	—	—	—	25	—	50	—	—
U.L. general purpose current	40°C	21	25	30	40	50	60	65	80	90	105	125	140
Max. 3 Ph Switching motor loads	A	9	11	17	28	34	42	54	65	80	95	110	
U.L. maximum H.P. ratings	1 phase												
115	VAC	1/2	3/4	1	2	3	3	—	3	5	7.5	7.5	10
230	VAC	2	2	3	5	7.5	7.5	—	7.5	10	15	20	25
U.L. maximum H.P. ratings	3 phase												
200-208	VAC	2	3	5	7.5	10	10	—	15	20	25	30	30
220-240	VAC	2	3	5	10	10	15	—	20	25	30	30	40
440-480	VAC	5	7.5	10	20	25	30	—	40	50	60	60	75
550-600	VAC	7.5	10	15	25	30	40	—	50	60	75	75	100
U.L. maximum H.P. ratings													
120	VDC	1	1.5	2	3	3	5	—	7.5	10	10	—	—
240	VDC	2	3	3	5	7.5	10	—	15	20	25	—	—
Lighting — ballast and incandescent	600VAC	15	15	20	35	50	60	65	65	85	105	—	—
Resistive heating applications	600VAC	15	15	20	35	50	60	65	65	85	105	—	—
CSA Elevator ratings													
220 – 240VAC	3 phase	—	—	5	—	—	10	—	15	—	20	—	—
440 – 480VAC	3 phase	—	—	10	—	—	20	—	30	—	30	—	—
550 – 600VAC	3 phase	—	—	10	—	—	20	—	30	—	40	—	—
230VAC	1 phase	—	—	2	—	—	5	—	7.5	—	10	—	—
Auxiliary contacts													
NEMA rating	AC	A600	A600	A600	A600	A600	A600	—	A600	A600	A600	A600	A600
AC rated voltage	VAC	600	600	600	600	600	600	—	600	600	600	600	600
AC thermal rated current	A	10	10	10	10	10	10	—	10	10	10	10	10
AC maximum volt-ampere making	VA	7200	7200	7200	7200	7200	7200	—	7200	7200	7200	7200	7200
AC maximum volt-ampere breaking	VA	720	720	720	720	720	720	—	720	720	720	720	720
NEMA rating	DC	P600	P600	P600	P600	P600	P600	—	P600	P600	P600	P600	P600
DC rated voltage	VDC	600	600	600	600	600	600	—	600	600	600	600	600
DC thermal rated current	A	5	5	5	5	5	5	—	5	5	5	5	5
DC Maximum make-break	A	0.2	0.2	0.2	0.2	0.2	0.2	—	0.2	0.2	0.2	0.2	0.2
Approximate weight													
Contactor	lbs.	0.7	0.7	0.7	1.01	1.2	2.25	2.25	2.25	2.25	2.25	3.5	5
Starter	lbs.	1.04	1.04	1.04	1.35	1.54	3	—	3	3	3	6	7
Terminal wire range	AWG	18-10	18-10	18-10	12-8	8-4	8-4	8-1	8-1	8-1	8-1	6-2/0	6-2/0
Number of wires per phase		2	2	2	2	2	2	1	1	1	1	1	1
Maximum short circuit ratings													
MCCB,MCP,Amps/kA	480VAC	50/35	50/35	50/35	100/35	150/65	150/65	—	150/85	250/85	250/85	250/85	250/85
MCCB,MCP,Amps/kA	600VAC	10/35	10/35	—	100/35	150/25	150/25	—	—	—	—	250/35	250/35
Fuse,Amps — type/kA	600VAC	30J/200	30J/200	30J/200	60J/200	60J/200	100J/200	—	100J/200	200J/200	200J/200	200J/200	200J/200

Mounting positions



UL & CSA Technical data
A/AF145 – AF750
AC & DC operated

ABB contactor frame size		A/AF 145	A/AF 185	A/AF 210	A/AF 260	A/AF 300	AF 400	AF 460	AF 580	AF 750
NEMA size		4	—	—	5	—	—	6	—	7
Number of poles		3	3	3	3	3	3	3	3	3
AC rating information										
NEMA maximum H.P. ratings	3 phase									
200	VAC	40	—	—	75	—	—	150	—	—
230	VAC	50	—	—	100	—	—	200	—	300
460/575	V	100	—	—	200	—	—	400	—	600
U.L. general purpose current	40°C	230	250	300	350	400	550	650	750	900
Max. 3 Ph switching motor loads	Amps	130	156	192	248	302	414	480	590	720
U.L. maximum H.P. ratings	1 phase									
115	VAC	10	15	—	—	—	—	—	—	—
230	VAC	25	30	40	50	—	—	—	—	—
U.L. maximum H.P. ratings	3 phase									
200—208	VAC	40	50	60	75	100	125	150	200	250
220—240	VAC	50	60	75	100	100	150	200	250	300
440—480	VAC	100	125	150	200	250	350	400	500	600
550—600	VAC	125	150	200	250	300	400	500	600	700
Auxiliary contacts										
NEMA rating	AC	A600	A600	A600	A600	A600	A600	A600	A600	A600
AC rated voltage	VAC	600	600	600	600	600	600	600	600	600
AC thermal rated current	A	10	10	10	10	10	10	10	10	10
AC maximum volt—ampere making	VA	7200	7200	7200	7200	7200	7200	7200	7200	7200
AC maximum volt—ampere breaking	VA	720	720	720	720	720	720	720	720	720
NEMA rating	DC	P600	P600	P600	P600	P600	P600	P600	P600	P600
DC rated voltage	VDC	600	600	600	600	600	600	600	600	600
DC thermal rated current	A	5	5	5	5	5	5	5	5	5
DC Maximum make—break	A	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Approximate weight										
Contactor	lbs.	7.1	7.1	13	13	13	26	26	33	33
Starter	lbs.	9.11	9.11	17.67	17.67	17.67	35	35	45	45
Terminal wire range	AWG	6—250MCM	6—250MCM	4—400MCM	4—400MCM	4—500MCM	250—500MCM	250—500MCM	2/0—500MCM	2/0—500MCM
Number of wires per phase		1	1	1	1	2	2	2	2	3
Maximum short circuit ratings										
MCCB,MCP,amps/kA	480VAC	400/85	400/85	800/85	800/85	800/85	800/80	800/80	1200/42	1200/42
MCCB,MCP,amps/kA	600VAC	400/35	400/35	800/35	800/35	800/35	800/42	800/42	—	—
Fuse, amps—Type/kA	600VAC	400J/200	400J/200	600J/200	600J/200	600J/200	1000L/80	1000L/80	1200L/80	1200L/80

IEC Technical data
A/AE9 – A/AE/AF110
AC & DC operated

Type			A/AE 9	A/AE 12	A/AE 16	A/AE 26	A/AE 30	A/AE 40	A/AE/AF 45	A/AE/AF 50	A/AE/AF 63	A/AE/AF 75	A/AE/AF 95	A/AE/AF 110
Number of poles			3 or 4	3	3 or 4	3 or 4	3	3	4	3 or 4	3	3 or 4	3	3
Insulation characteristics														
Rated insulation voltage U_i														
according to IEC947-4-1 and VDE0110 (Gr. C)		V	1000											
according to UL/CSA		V	600											
Rated impulse withstand voltage $U_{imp.}$			8 kV											
Main pole utilization characteristics														
Rated operational voltage U_e		V	690			690			1000				1000	
Conventional free-air thermal current I_{th}														
acc. to IEC947-4-1, open contactors	θ ≤ 40°C	A	26	28	30	45	65	65	100	100	125	125	145	160
with conductor cross-sectional area		mm²	4	4	4	6	16	16	35	35	50	50	50	70
Rated operational current I_e/AC-1 for air temperature close to contactor														
	θ ≤ 40°C	A	25	27	30	45	55	60	70	100	115	125	145	160
	θ ≤ 55°C	A	22	25	27	40	55	60	60	85	95	105	135	145
	θ ≤ 70°C	A	18	20	21	32	39	42	50	70	80	85	115	130
with conductor cross sectional area		mm²	2.5	4	4	6	10	16	25	35	50	50	50	70
Utilization category 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	40	53	65	75	96	110
	380-400 V	A	9	12	17	26	32	37	37	50	65	75	96	110
	415 V	A	9	12	17	26	32	37	37	50	65	72	96	110
	440 V	A	9	12	16	26	32	37	37	45	65	70	93	100
	500 V	A	9	12	14	22	28	33	33	45	55	65	80	100
	690 V	A	7	9	10	17	21	25	25	35	43	46	65	82
	1000 V	A	—	—	—	—	—	—	—	23	25	28	30	30
Rated operational power AC-3 (1)														
1500 r.p.m. - 50 Hz	220-230-240 V	kW	2.2	3	4	6.5	9	11	11	15	18.5	22	25	30
1800 r.p.m. - 60 Hz	380-400 V	kW	4	5.5	7.5	11	15	18.5	18.5	22	30	37	45	55
3-phase motors	415 V	kW	4	5.5	9	11	15	18.5	18.5	25	37	40	55	59
	440 V	kW	4	5.5	9	15	18.5	22	22	25	37	40	55	59
	500 V	kW	5.5	7.5	9	15	18.5	22	22	30	37	45	55	59
	690 V	kW	5.5	7.5	9	15	18.5	22	22	30	37	40	55	75
	1000 V	kW	—	—	—	—	—	—	—	30	33	37	40	40
DC operated AE contactors														
Coil operating limits acc. to IEC 947-4-1: 0.85 to 1.1 x U_e			0 ≤ 55°C										0 ≤ 70°C	
Drop-out voltage % of U_e			10 – 30%			10 – 30%			approx. 15 – 40%				approx. 15 – 40%	
Coil consumption (average value)														
• pull-in, from cold state		W	90			110			200				400	
• holding, from warm state		W	2			2.5			4				2.4	
Rated control circuit voltage U_e														
• open		L/R ms	40			40			15				6	
• closed		L/R ms	90			90			25				30 – 40	
		V	12 – 240			12 – 240			12 – 250				12 – 250	
Operating time														
Between coil energization and:														
• N.O. contact closing		ms	10 – 16			13 – 21			13 – 30				15 – 25	
• N.C. contact opening		ms	8 – 12			11 – 16			10 – 27				12 – 22	
Between coil de-energization and:														
• N.O. contact closing		ms	5 – 14			6 – 12			5 – 15				15 – 20	
• N.C. contact opening		ms	11 – 17			8 – 16			8 – 18				18 – 23	

* 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.

AC operated A contactors														
Coil operating limits acc. to IEC 947-4-1: 0.85 to 1.1 x U_e			0 ≤ 55°C										0 ≤70°C	
Drop-out voltage % of U_e			roughly 40 – 65%											
Coil consumption (average value)														
• pull-in, from cold state														
50 Hz		VA	70			120			180				350	
60 Hz		VA	80			140			210				450	
50/60 Hz (voltage codes 80 to 88, see page 1.26)		VA	74/70			125/120			190/180				410/365	
• holding, from warm state														
50 Hz		VA/W	8/2			12/3			18/5.5				22/6.5	
60 Hz		VA/W	8/2			12/3			18/5.5				26/8	
50/60 Hz		VA/W	8/2			12/3			18/5.5				27/7.5	
Rated control circuit voltage U_e														
• 50 Hz		V	20 – 690											
• 60 Hz		V	24 – 600											
Operating time														
Between coil energization and:														
• N.O. contact closing		ms	10 – 26			8 – 21			8 – 27				10 – 25	
• N.C. contact opening		ms	7 – 21			6 – 18			7 – 22				7 – 22	
Between coil de-energization and:														
• N.O. contact closing		ms	4 – 11			4 – 11			4 – 11				7 – 15	
• N.C. contact opening		ms	9 – 16			7 – 14			7 – 14				10 – 18	

IEC Technical data
A/AE9 – A/AE/AF110
AC & DC operated

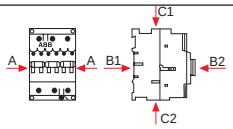
Type			A/AE 9	A/AE 12	A/AE 16	A/AE 26	A/AE 30	A/AE 40	A/AE/AF 45	A/AE/AF 50	A/AE/AF 63	A/AE/AF 75	A/AE/AF 95	A/AE/AF 110
Rated frequency limits		Hz	25 – 400											
Mechanical durability in millions of operating cycles														
A contactors			10										10	
AE contactors			5										5	
Max. mechanical switching frequency		cycles/h	3600										3600	
Max. electrical switching frequency														
A contactors	for AC-1	cycles/h	600	600	600	600	600	600	600	600	600	600	300	300
	for AC-3	cycles/h	1200	1200	1200	1200	1200	1200	600	600	600	600	300	300
	for AC-2, AC-4	cycles/h	300	300	300	300	300	300	150	150	150	150	150	150
AE contactors	for AC-1	cycles/h	600	600	600	600	600	600	300	300	300	300	300	300
	for AC-3	cycles/h	600	600	600	600	600	600	300	300	300	300	300	300
	for AC-2, AC-4	cycles/h	300	300	300	300	300	300	150	150	150	150	150	150
Electrical durability			see pages 1.50 - 1.53											
Rated making capacity AC-3 according to IEC947-4-1			10 x I_e AC-3										10 x I_e AC-3	
Rated breaking capacity AC-3 according to IEC947-4-1			8 x I_e AC-3										8 x I_e AC-3	
Max. breaking capacity cos φ = 0.45	at 440 V	A	250	250	250	420	820	820	900	900	900	900	1160	1160
(cos φ = 0.35 for I_e > 100 A)	at 690 V	A	100	100	100	170	340	340	490	490	490	490	800	800
Short-circuit protection for contactors														
without thermal O/L relays - Motor protection excluded①														
U_e ≤ 500 V a.c. – gG (gl) type fuses		A	25	32	32	50	63	63	80	100	125	160	160	200
Rated short-time withstand current I_{cw}	1 s	A	250	280	300	400	600	600	1000	1000	1000	1000	1320	1320
at 40°C ambient temp., in free air,	10 s	A	100	120	140	210	400	400	650	650	650	650	800	800
from a cold state	30 s	A	60	70	80	110	225	225	370	370	370	370	500	500
	1 min	A	50	55	60	90	150	150	250	250	250	250	350	350
	15 min	A	26	28	30	45	65	65	100	100	100	100	160	175
Heat dissipation per pole	I_e/AC-1		0.8	1	1.2	1.8	2.5	3	2.5	5	6.5	7	6.5	7.5
	I_e/AC-3	W	0.1	0.2	0.35	0.6	0.9	1.3	0.65	1.3	1.5	2	2.7	3.6

① Please consult us for the protection of motor starters against short circuits.

IEC Technical data
A/AE9 – A/AE/AF110
AC & DC operated

Type	A/AE 9	A/AE 12	A/AE 16	A/AE 26	A/AE 30	A/AE 40	A/AE/AF 45	A/AE/AF 50	A/AE/AF 63	A/AE/AF 75	A/AE/AF 95	A/AE/AF 110
Number of poles	3 or 4	3	3 or 4	3 or 4	3	3	4	3 or 4	3	3 or 4	3	3

General technical data

Standards	Devices complying with international standards IEC947-1 / 947-4-1 and European standards EN60 947-1 / 60 947-4-1 Electromagnetic compatibility (EMC) according to amendment A11 to IEC947-1; EN60 947-1 and amendment 2 to IEC947-4-1											
Air temperature close to contactor												
— fitted with thermal O/L relay °C	— 25 to + 55 (0.85 – 1.1 U_c)										– 25 to +55 (0.85–1.1U_c)	
— without thermal O/L relay °C	— 40 to + 55 (0.85 – 1.1 U_c) / – 40 to + 70 (U_c)										– 25 to +70 (0.85 –1.1U_c)	
— for storage °C	— 60 to + 80										– 40 to +70	
Climatic withstand	acc. to IEC 68-2-30 and 68-2-11 – UTE C 63-100 specification II										acc. to IEC 68-2-30	
Mounting positions: (see diagram, page 1.36)	Positions 1 to 5 — Ambient temperature ≤ 55°C and control voltage 0.85 – 1.1 U_c — Ambient temperature 55 – 70°C and control voltage equal to U_c Position 6 — Ambient temperature ≤ 55°C and control voltage 0.95 – 1.1 U_c — Ambient temperature > 55°C unauthorized											
Operating altitude m	≤ 3000											
Shock withstand acc. to IEC68-2-27 and EN60068-2-27 Mounting position 1 (See page 1.36)	 1/2 sinusoidal shock for 11ms: no change in contact position Shock direction: A, C1, C2 : 20 g B1 : 5 g B2 : 15 g Note: only on plate for A95 and A110											
Mounting • on mounting rail	acc. to IEC715 and EN50 022 35 x 7.5 mm 35 x 15 mm						acc. to IEC715 35 x 15 EN50 022 75 x 25 EN50 023				acc. to IEC715 and EN50 023 75 x 25	
• by screws (not supplied)	2 x M4						2 x M6					
Connecting terminals (delivered in open position) — Main poles	(+,–) pozidriv 2screw											
	M 3.5 with cable clamp			M 4 with clamp	M 5 with 2x(5.6x6.5mm) double connect.		M 8 slotted screw head with single connector 13 x 10 mm				HC, M 8 hexagon socket screw with single connector 14 x 14 mm	
— Coil terminals	M 3.5 (+,-) pozidriv 2 screws with cable clamp											
— Built in aux. terminals	(+,-) pozidriv 2 screw and cable clamp											
	M 3.5			M 4	M 3.5							
Connecting capacity												
Main conductors (poles)	min. – max.			min.– max.	min. – max.		min. – max.				min. – max.	
Rigid solid (≤4 mm²) / rigid stranded (≥6 mm²) 1 x mm²	1 – 4			1.5 – 6	2.5 – 16		6 – 50				6 – 95	
2 x mm²	1 – 4			1.5 – 6	2.5 – 16		6 – 25				6 – 35	
Flexible without cable end 1 x mm²	0.75 – 2.5			1 – 4	2.5 – 10		6 – 35				6 – 70	
2 x mm²	0.75 – 2.5			1 – 4	2.5 – 10		6 – 16				6 – 35	
Bars or lugs: max. width mm ≤	8			10	—		—				30	
hole Ø mm >	3.7			4.2	—		—				6	
Auxiliary conductors (built in aux. terminals + coil terminals)	min. - max.											
Rigid solid 1 or 2 x mm²	1 - 4										0.75 – 2.5	
Flexible without cable end 1 x mm²	0.75 – 2.5			①	0.75 – 2.5		1 – 2.5				0.75 – 2.5	
2 x mm²	0.75 – 2.5			①	0.75 – 2.5		0.75 – 2.5				0.75 – 2.5	
Degree of protection acc. to IEC529, IEC947-1 and EN60529	Protection against direct contact acc. to VDE0106 — Part. 100											
— Main terminals	IP20						IP10					
— Coil terminals	IP20											
— Auxiliary terminals	IP20											

① 1 or 2 times 0.75 – 2.5 mm² but with 0.75 and 1 mm² cable end.

IEC Technical data
A9 – A40
AC operated

Characteristics of A9 – A40 contactor built in auxiliary contacts
(for additional auxiliary contact blocks: see page 1.19)

Rated operational voltage U_e			V	690
Conventional free air thermal current I_{th} - θ ≤ 40°C A				16
Rated operational current	24 – 127 V	50/60 Hz	A	6
I_e /AC-15 acc. to IEC947-5-1	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
I_e /DC-13 acc. to IEC947-5-1	24 V	DC	A/W	6 / 144
	48 V	DC	A/W	2.8 / 134
	72 V	DC	A/W	2 / 144
	125 V	DC	A/W	1.1 / 138
	250 V	DC	A/W	0.55 / 138
Operational current frequency			Hz	25 – 400
Rated making capacity	acc. to IEC 947-5-1			10 x I_e/AC-15
Rated breaking capacity	acc. to IEC 947-5-1			10 x I_e/AC-15
Short circuit protection – gG (gl) type fuses			A	10
Rated short time withstand current I_{cw}			for 1.0 s	100A
			for 0.1 s	140A
Insulating resistance at 500 V d.c.				after durability test: 5MΩ
Min. switching capacity				17V/ 5 mA
Non overlapping time between N.O. and N.C. contacts			ms	≥ 2
Heat dissipation per pole at 6 A			W	0.10

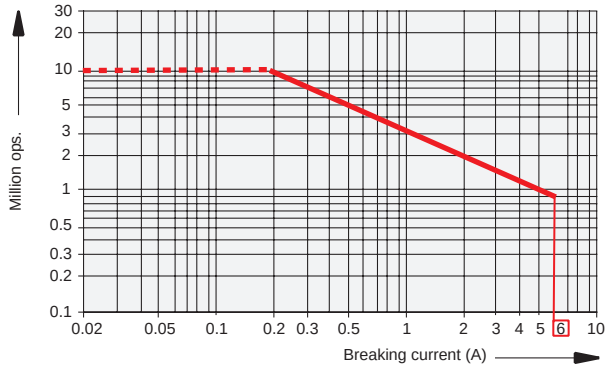
Electrical durability

Max. switching frequency 1200 cycles/h

AC-15 according to IEC947-5-1
making current: 10 x I_e with cos φ = 0.7 and U_e
breaking current: I_e with cos φ = 0.4 and U_e

The curve opposite shows the electrical durability of the built in auxiliary contacts with respect to the breaking current.

This curve has been drawn for resistive and inductive loads up to 690 V, 40 – 60 Hz.



IEC Technical data
A/AF145 – AF750
AC & DC operated

Type			A/AF 145	A/AF 185	A/AF 210	A/AF 260	A/AF 300	AF 400	AF 460	AF 580	AF 750
Number of Poles			3	3	3	3	3	3	3	3	3
Insulation characteristics											
Rated Insulation voltage U_1											
according to IEC947-4-1 and VDE0110 (Gr.C)		V	1000	1000	1000	1000	1000	1000	1000	1000	1000
according to UL/CSA		V	600	600	600	600	600	600	600	600	600
Rated impulse withstand voltage $U_{imp.}$		KV	8	8	8	8	8	8	8	8	8
Main pole utilization characteristics											
Rated operational voltage U_e		V	1000	1000	1000	1000	1000	1000	1000	1000	1000
Conventional free-air thermal current I_{th}											
acc. To IEC947-4-1 open contactors	0 ≤ 40°C	A	250	275	350	400	450	550	650	800	1000
with conductor cross sectional area		mm^2	120	150	185	240	300	2 x 185	2 x 240	2 x 240	2 x 80 x 5
Rated operational current I/AC-for	0 ≤ 40°C	A	250	275	350	400	500	600	700	800	1050
air temperature close to contactor	0 ≤ 55°C	A	230	250	300	350	400	500	600	700	800
	0 ≤ 70°C	A	180	180	240	290	325	400	480	580	720
with conductor cross sectional area		mm^2	120	150	185	240	300	2 x 185	2 x 240	2 x 240	2 x 80 x 5
Utilization category AC-3 for air temperature close to contactor ≤55°C											
Rated operational current, Ie/AC-3(1)											
	220 – 240V	A	145	185	210	260	305	400	460	580	750
	380 – 400V	A	145	185	210	260	305	400	460	580	750
	415V	A	145	185	210	260	300	400	460	580	750
3-Phase Motors	440V	A	145	185	210	240	280	370	460	580	750
	500V	A	145	170	210	240	280	370	460	580	750
	690V	A	120	170	210	220	280	370	400	500	650
Rated operational power											
AC-3(1)	220 – 240V	kW	45	55	59	80	90	110	132	160	220
1500 r.p.m. — 50Hz	380 – 400V	kW	75	90	110	140	160	200	250	315	400
1800 r.p.m. — 60Hz	415V	kW	75	90	110	140	160	220	250	355	425
3-Phase Motors	440V	kW	75	90	110	140	160	220	250	355	450
	500V	kW	90	110	132	1800	200	250	315	400	520
	690V	kW	110	132	160	200	250	315	355	500	600
Magnet system characteristics											
Coil operating limits acc.to IEC947-4-1:0.85 – 1.1xU_e			-30°C – +70°C								
Drop out voltage in % of U_e			approx. 45% – 65%								
Coil consumption											
A145-A300 contactors											
Average pull in value (A contactors)											
50Hz		VA	550	550	1350	1350	1350	—	—	—	—
60Hz		VA	600	600	1550	1550	1550	—	—	—	—
50/60Hz		VA/VA	700/650	700/650	1700/1550	1700/1550	1700/1550	—	—	—	—
Average holding value											
50Hz		VA/W	35/11	35/11	60/16	60/16	60/16	—	—	—	—
60Hz		VA/W	40/12	40/12	65/19	65/19	65/19	—	—	—	—
50/60Hz		VA/W	44/13	44/13	80/21	80/21	80/21	—	—	—	—
AF145-AF750											
Pull in AC		VA/W	250/250	250/250	400/400	400/400	400/400	800/800	800/800	600/600	600/600
Pull in DC		W	350	350	450	450	450	900	900	700	700
Holding AC		VA/W	2.5/2.5	2.5/2.5	2.5/2.5	2.5/2.5	2.5/2.5	4/4	4/4	3.3/3.3	3.3/3.3
Holding DC		W	3	3	1	1	1	4.5	4.5	4	4
Rated control circuit voltage Ue											
at 50Hz		V	20 - 690								
at 60Hz		V	24 - 600								
A Contactors											
Operating time	Between coil energization and:										
	N.O. contact closing	ms	13-27	13-27	17-35	17-35	17-35	—	—	—	—
	N.C. contact opening	ms	80-22	80-22	12-30	12-30	12-30	—	—	—	—
	Between coil deenergization and:										
	N.O. contact closing	ms	5-10	5-10	7-13	7-13	7-13	—	—	—	—
	N.C. contact opening	ms	9-13	9-13	10-16	10-16	10-16	—	—	—	—
AF Contactors											
Operating time	Between coil energization and:										
	N.O. contact closing	ms	50-90	50-90	50-90	50-90	50-90	50-120	50-120	50-120	50-120
	N.C. contact opening	ms	45-85	45-85	45-85	45-85	45-85	45-115	45-115	45-115	45-115
	Between coil deenergization and:										
	N.O. contact opening	ms	40-50	40-50	40-50	40-50	40-50	45-55	45-55	45-70	45-70
	N.C. contact closing	ms	43-53	43-53	43-53	43-53	43-53	48-58	48-58	53-73	53-73
Rated frequency limits		Hz	25-400								

① Values given in watts. These coils are both AC & DC.

IEC Technical data
A/AF145 – AF750
AC & DC operated

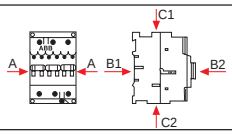
Type			A/AF 145	A/AF 185	A/AF 210	A/AF 260	A/AF 300	AF 400	AF 460	AF 580	AF 750
Mechanical durability in millions of operating cycles			5	5	5	5	5	3	3	3	3
Max. mechanical switching frequency	cycles/h		3600	3600	3600	3600	3600	300	300	300	300
Max. electrical switching frequency	cycles/h	AC1	300	300	300	300	300	300	300	300	300
	cycles/h	AC3	300	300	300	300	300	300	300	300	300
	cycles/h	AC4	150	150	150	150	150	60	60	60	60
Electrical durability			See pages 1.50 – 1.53								
Rated making capacity AC-3 according to IEC947-4-1			10 x I_e								
Rated breaking capacity AC-3 according to IEC947-4-1			8 x I_e								
Short-circuit protection for contactors without thermal O/L relays — Motor protection excluded U_e ≤500V a.c. — gG(gl) type fuses			315	355	400	500	500	630	800	1000	1000
Rated short-time withstand current Icw	1s	A	1800	2000	2500	3500	3500	4600	4600	7000	7000
"at 40°C ambient temp., in free air,"	10s	A	1200	1500	1700	2400	2400	4400	4400	6400	6400
from a cold state	30s	A	800	1000	1200	1500	1500	3100	3100	4500	4500
1 min	1m	A	600	800	1000	1100	1100	2500	2500	3500	3500
15 min	15m	A	280	320	400	500	500	840	840	1300	1300
Heat dissipation per pole	I_e/AC-1	W	13	16	18	25	32	30.25	42.25	32	50
	I_e/AC-3	W	5	8	9	14	18	16	21.2	16.8	28.2

IEC Technical data
BC9 – BC30
DC operated

Type			BC9	BC16	BC25	BC30
Number of poles			3 or 4	3 or 4	3 or 4	3
Insulation characteristics						
Rated insulation voltage U_i						
according to IEC947-4-1 and VDE0110 (Gr. C)		V	690	1000		
according to UL/CSA		V	600	600		
Rated impulse withstand voltage $U_{imp.}$		kV	6			
Main pole utilization characteristics						
Rated operational voltage U_e		V	690			
Conventional free air thermal current I_{th}						
acc. to IEC947-4-1, open contactors	θ ≤ 40°C	A	26	28	45	65
with conductor cross sectional area		mm^2	4	4	6	10
Rated operational current Ie/AC–1 for air temperature close to contactor	θ ≤ 40°C	A	22	28	45	55
	θ ≤ 55°C	A	20	25	40	45
	θ ≤ 70°C	A	17	23	32	36
with conductor cross sectional area		mm^2	2.5	4	6	6
Utilization category 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	16	25	33①
	380 – 400 V	A	9	16	25	30
	415 V	A	9	16	25	30
	440 V	A	9	16	20	27
	500 V	A	7	13	17	23
	690 V	A	6	8	13	18
	1000 V	A	—	—	—	—
Rated operational power AC-3 (1)						
1500 r.p.m. – 50 Hz or 1800 r.p.m. – 60 Hz 3 phase motors	220 – 230 – 240 V	kW	2.2	4	6.5②	9
	380 – 400 V	kW	4	7.5	11	15
	415 V	kW	4	7.5	11	15
	440 V	kW	4	7.5	11	15
	500 V	kW	4	7.5	11	15
	690 V	kW	4	5.5	11	15
	1000 V	kW	—	—	—	—
Rated frequency limits		Hz	25 – 400			
Mechanical durability in millions of operating cycles			—	10		
Max. mechanical switching frequency		cycles/h	—	6000	3000	
Max. electrical switching frequency	for AC-1	cycles/h	—	600	600	
	for AC-3	cycles/h	—	1200	600	
	for AC-2, AC-4	cycles/h	—	300	150	
Electrical durability			see page 1.50 – 1.53			
Rated making capacity AC-3 according to IEC947-4-1			10 x I_e / AC-3			
Rated breaking capacity AC-3 according to IEC947-4-1			8 x I_e / AC-3			
Max. breaking capacity with cos j = 0.45	at 440V	A	200		315	380
(cos j = 0.35 for I_e > 100 A)	at 690V	A	120		210	290
Short-circuit protection for contactors without thermal O/L relay – Motor protection excluded③						
U_e ≤ 500 V a.c. – gG (gl) type fuses		A	25	32/35	50	63
Rated short-time withstand current I_{cw}	1 s	A	200	280	350	400
	10 s	A	90	130	200	250
at 40°C ambient temperature, in free air,	30 s	A	50	70	110	150
from cold state	1 min	A	40	50	90	120
	15 min	A	22	28	45	55
Heat dissipation per pole	I_e/AC-1	W	0.55	1.5	2.4	2.2
	I_e/AC-3	W	0.10	0.4	0.6	0.6

① 32 A at 240V
② 7.5 kW at 240V
③ For the protection of motor starters against short circuits, please consult us.

IEC Technical data
BC9 – BC30
DC operated

Type			BC9	BC16	BC25	BC30
Number of poles			3 or 4	3 or 4	3 or 4	3
General technical data						
Standards			Devices complying with international standards IEC947-1 / 947-4-1 and European standards EN60 947-1 / 60 947-4-1 Electromagnetic compatibility (EMC) according to amendment A11 to IEC947-1; EN60 947-1 and amendment 2 to IEC947-4-1			
Air temperature close to contactor						
– with a thermal O/L relay mounted		°C	-25 to +50 (0.85 to 1.1 U_c)			
– without thermal O/L relay mounted		°C	-40 to +55 (0.85 to 1.1 U_c) / +55 to +70 (U_c)			
– for storage		°C	-60 to +80			
Climatic withstand			according to IEC 68-2-30 and 68-2-11 – UTE C 63-100 specification II			
Mounting positions: (see drawing page 1.36)			Positions 1,3 ,4 -θ ≤ 55 °C: 0.85 to 1.1 U_c; -θ = 55 to 70 °C: — U_c — Positions 1 to 5 - θ ≤ 55 °C: 0.85 to 1.1 U_c; - θ = 55 to 70 °C: — U_c — Positions 2,6 -θ ≤ 55 °C: 0.95 to 1.1 U_c; -θ > 55 °C: not acceptable — Position 6 - θ ≤ 55 °C: 0.95 to 1.1 U_c; - θ > 55 °C: not acceptable — Position 5: see tables p. 1.36			
Operating altitude		m	≤ 3000			
Shock withstand acc. to IEC68-2-27 and EN60068-2-27 Mounting position 1 (See page 1.36)			1/2 sinusoidal shock for 11ms: no change in contact position — Shock direction: A, C1, C2: 20 g; B1 : 5 g; B2 : 15 g — Note: only on plate for A95 and A110			
Mounting	• on mounting rail		according to IEC715 and EN50 022 35 x 7.5 mm 35 x 15 mm			
	• by screws (not supplied)		2 x M 4			
Connecting terminals (delivered in open position)	– Main poles		(+,-) pozidriv 2 screw with cable clamp			
			M 3.5		M 4	M 5
	– Coil terminals		M 3.5 (+,-) pozidrive 2 screw with cable clamp			
	– Built in aux. terminals		(+,-) pozidriv 2 screw with cable clamp			
			M 3.5		M 4	—
Connecting capacity						
Main conductors (poles)			min. – max.		min. – max.	min. – max.
Rigid solid (≤ 4 mm²) / rigid stranded (≥ 6 mm²)		**1 x** mm²	1 – 4		1.5 – 6	2.5 – 10
		2 x mm²	1 – 4		1.5 – 6	2.5 – 10
Flexible without cable end		**1 x** mm²	1 – 2.5		1.5 – 4	2.5 – 6
		2 x mm²	0.75 – 2.5		1.5 – 4	2.5 – 6
Bars or lugs: max. width		mm ≤	8		10	13
hole Ø		mm >	3.7		4	5
Auxiliary conductors (built in auxiliary terminals + coil terminals)			min. – max.			
Rigid solid		**1 or 2 x** mm²	1 – 4			
Flexible without cable end①		**1 x** mm²	1 – 2.5			
		2 x mm²	0.75 – 2.5			
Degree of protection acc. to IEC529, IEC947-1 and EN60529			Protection against direct contact according to VDE 0106 – Part. 100			
– Main terminals			IP10			
– Coil terminals			IP20			
– Auxiliary terminals			IP10			

① Except auxiliary built into AC25: 0.75 – 4 mm²

IEC Technical data
BC9 – BC30
DC operated

Magnet system characteristics

Type			BC9	BC16	BC25	BC30
Number of poles			3 or 4	3 or 4	3 or 4	3
Coil operating limits acc. to IEC947-4-1: 0.85 to 1.1 x $\mathbf{U_c}$			≤ 55°C			
Drop out voltage % of U_c			roughly 15 – 40 %			
Coil consumption (average value)						
	— pull in, from cold state	W	7			
	— holding, from warm state	W	7			
Rated control circuit voltage U_c		V	6 – 250			
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*			
	*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.					

Characteristics of BC9 – BC25 contactor built in auxiliary contacts

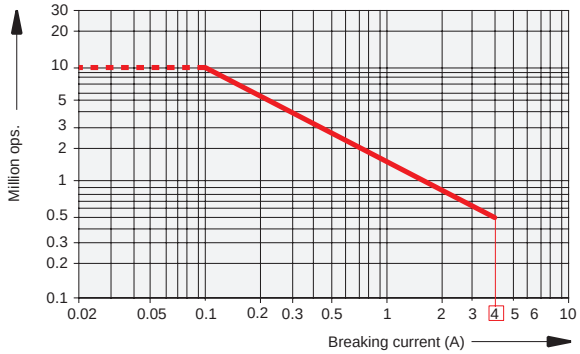
Rated operational voltage U_e			V	690
Conventional free air thermal current I_{th}			A	10
Rated operational current	24 – 127 V	50/60 Hz	A	6
I_e /AC-15 acc. to IEC947-5-1	220 – 240 V	50/60 Hz	A	4
	380 – 440 V	50/60 Hz	A	3
	500 V	50/60 Hz	A	2
	690 V	50/60 Hz	A	2
I_e /DC-13 acc. to IEC947-5-1	24 V	DC	A/W	6 / 144
	48 V	DC	A/W	2.8 / 134
	72 V	DC	A/W	2 / 144
	125 V	DC	A/W	1.1 / 138
	250 V	DC.	A/W	0.55 / 138
Operational current frequency			Hz	25 – 400
Rated making capacity		acc. to IEC947-5-1		10 x I_e/AC – 15
Rated breaking capacity		acc. to IEC947-5-1		10 x I_e/AC –15
Short circuit protection – gG (gl) type fuses			A	10
Rated short time withstand current I_{cw}			for 1.0 s	50 A
			for 0.1 s	100 A
Insulation resistance at 500 V d.c.				after durability test: 5 MΩ
Min. switching capacity				24V / 5 mA
Non overlapping time between N.O. and N.C. contacts		ms	≥ 2	
Heat dissipation per pole at 6 A			W	0.15

Electrical durability
Max. switching frequency 1200 cycles/h

AC-15 according to IEC947-5-1
making current: 10 x $\mathbf{I_e}$ with cos φ = 0.7 and $\mathbf{U_e}$
breaking current: $\mathbf{I_e}$ with cos φ = 0.4 and $\mathbf{U_e}$

The curve opposite shows the electrical durability of the built in auxiliary contacts with respect to the breaking current.

This curve has been drawn for resistive and inductive loads up to 690 V, 40 – 60 Hz.



IEC Technical data
A/AE, GA/GAE, DC circuit switching
AC & DC operated

General

The arc switching on d.c. is more difficult than on a.c.
- For selecting a contactor it is essential to determine the current, the voltage and the L/R time constant of the controlled load.
- For information, typical time constant values are quoted hereafter: non inductive loads such as resistance furnaces (L/R ≃ 1 ms), inductive loads such as shunt motors (L/R ≃ 2 ms) or series motors (L/R ≃ 7.5 ms).
- The addition of a resistor in parallel with an inductive winding helps in the elimination of the arcs.
- All the poles required for breaking must be connected in series between the load and the source polarity not linked to earth (or chassis).

Technical data

- The tables indicate for the standard contactors the I_e max. operating currents depending on: the utilization category (i.e. L/R) DC-1, DC-3, DC-5 as defined in the IEC 947-4-1 publication, the operating voltage U_e and the pole coupling details.

Ampere values quoted in the tables below are valid for a –25 … +70 °C temperature close to the contactors, as long as the AC-1 Ampere values for the corresponding ambient temperature are not exceeded.
- Max. switching frequency: 300 ops/h.
- For switching higher d.c. ratings, we recommend the use of bar mounted contactors, R series (63… 2000 A).

Type		A/AE 9	A/AE 12	A/AE 16	A/AE 26	A/AE 30	A/AE 40	A/AE/AF 45	A/AE/AF 50	A/AE/AF 63	A/AE/AF 75	GA/GAE 75
Utilization category DC-1, L/R ≤ 1 ms												
≤ 72 V	A	25	27	30	45	55	60	100	100	110	120	120
110 V	A	10	15	20	–	–	–	–	–	–	–	120
220 V	A	–	–	–	–	–	–	–	–	–	–	120
440 V	A	–	–	–	–	–	–	–	–	–	–	100
600 V	A	–	–	–	–	–	–	–	–	–	–	75
≤ 72 V	A	25	27	30	45	55	60	100	100	110	120	–
110 V	A	25	27	30	45	55	60	100	100	110	120	–
220 V	A	10	15	20	–	–	–	–	–	–	–	–
≤ 72 V	A	25	27	30	45	55	60	100	100	110	120	–
110 V	A	25	27	30	45	55	60	100	100	110	120	–
220 V	A	25	27	30	45	55	60	100	100	110	120	–
≤ 72 V	A	25	27	30	45	–	–	70	100	–	120	–
110 V	A	25	27	30	45	–	–	70	100	–	120	–
220 V	A	25	27	30	45	–	–	70	100	–	120	–
440 V	A	10	15	20	–	–	–	–	–	–	–	–
Utilization category DC-3, L/R ≤ 2 ms												
≤ 72 V	A	25	27	30	45	55	60	100	100	110	120	120
110 V	A	6	7	8	–	–	–	–	–	–	–	120
220 V	A	–	–	–	–	–	–	–	–	–	–	100
440 V	A	–	–	–	–	–	–	–	–	–	–	85
≤ 72 V	A	25	27	30	45	55	60	100	100	110	120	–
110 V	A	25	27	30	45	55	60	100	100	110	120	–
220 V	A	6	7	8	–	–	–	–	–	–	–	–
≤ 72 V	A	25	27	30	45	55	60	100	100	110	120	–
110 V	A	25	27	30	45	55	60	100	100	110	120	–
220 V	A	25	27	30	45	55	60	100	100	110	120	–
≤ 72 V	A	25	27	30	45	–	–	70	100	–	120	–
110 V	A	25	27	30	45	–	–	70	100	–	120	–
220 V	A	25	27	30	45	–	–	70	100	–	120	–
440 V	A	6	7	8	–	–	–	–	–	–	–	–
Utilization category DC-5, L/R ≤ 7.5 ms												
≤ 72 V	A	9	12	16	25	30	40	50	50	63	75	85
110 V	A	4	4	4	–	–	–	–	–	–	–	85
220 V	A	–	–	–	–	–	–	–	–	–	–	85
440 V	A	–	–	–	–	–	–	–	–	–	–	35
≤ 72 V	A	25	27	30	45	55	60	100	100	110	120	–
110 V	A	10	15	20	30	45	50	80	80	90	100	–
220 V	A	4	4	4	–	–	–	–	–	–	–	–
≤ 72 V	A	25	27	30	45	55	60	100	100	110	120	–
110 V	A	25	27	30	45	55	60	100	100	110	120	–
220 V	A	9	12	16	25	30	40	50	50	63	75	–
≤ 72 V	A	25	27	30	45	–	–	70	100	–	120	–
110 V	A	25	27	30	45	–	–	70	100	–	120	–
220 V	A	10	15	20	30	–	–	70	70	–	100	–
440 V	A	4	4	4	–	–	–	–	–	–	–	–

IEC Technical data
A/AE/AF, DC switching ratings
AC & DC operated

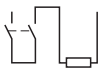
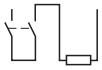
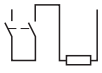
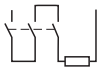
General

The arc switching on d.c. is more difficult than on a.c.
- For selecting a contactor it is essential to determine the current, the voltage and the L/R time constant of the controlled load.
- For information, typical time constant values are quoted hereafter: non inductive loads such as resistance furnaces (L/R ≃ 1 ms), inductive loads such as shunt motors (L/R ≃ 2 ms) or series motors (L/R ≃ 7.5 ms).
- The addition of a resistor in parallel with an inductive winding helps in the elimination of the arcs.
- All the poles required for breaking must be connected in series between the load and the source polarity not linked to earth (or chassis).

Technical data

- The tables indicate for the standard contactors the I_e max. operating currents depending on: the utilization category (i.e. L/R) DC-1, DC-3, DC-5 as defined in the IEC 947-4-1 publication, the operating voltage U_e and the pole coupling details.

Ampere values quoted in the tables below are valid for a –25 … +70 °C temperature close to the contactors, as long as the AC-1 Ampere values for the corresponding ambient temperature are not exceeded.
- Max. switching frequency: 300 ops/h.
- For switching higher d.c. ratings, we recommend the use of bar mounted contactors, R series (63… 2000 A).

	Type	A/AE/AF 95	A/AE/AF 110	A/AF 145	A/AF 185	A/AF 210	A/AF 260	A/AF 300	AF 400	AF 460	AF 580	AF 750
Utilization category DC-1, L/R ≤ 1 ms												
 110 V	A	–	–	–	–	–	–	–	600	700	800	1050
 110 V	A	145	160	250	275	350	400	450	600	700	800	1050
220 V	A	–	–	–	–	–	–	–	–	–	–	–
 110 V	A	145	160	250	275	350	400	450	600	700	800	1050
220 V	A	145	160	250	275	350	400	450	600	700	800	1050
440 V	A	–	–	–	–	–	–	–	600	700	800	1050
600 V	A	–	–	–	–	–	–	–	600	700	800	1050
Utilization category DC-3, L/R ≤ 2 ms												
 ≤ 110 V	A	–	–	–	–	–	–	–	600	700	800	1050
 110 V	A	145	160	250	275	350	400	450	600	700	800	1050
220 V	A	–	–	–	–	–	–	–	600	700	800	1050
 110 V	A	145	160	250	275	350	400	450	600	700	800	1050
220 V	A	145	160	250	275	350	400	450	600	700	800	1050
440 V	A	–	–	–	–	–	–	–	600	700	800	1050
600 V	A	–	–	–	–	–	–	–	600	700	800	1050
Utilization category DC-5, L/R ≤ 7.5 ms												
 110 V	A	–	–	–	–	–	–	–	600	700	800	1050
 110 V	A	145	160	250	275	350	400	450	600	700	800	1050
220 V	A	–	–	–	–	–	–	–	600	700	800	1050
 110 V	A	145	160	250	275	350	400	450	600	700	800	1050
220 V	A	145	160	250	275	350	400	450	600	700	800	1050
440 V	A	–	–	–	–	–	–	–	600	700	800	1050
600 V	A	–	–	–	–	–	–	–	600	700	800	1050

IEC Technical data
EK, DC circuit switching
AC & DC operated

General

The arc switching on d.c. is more difficult than on a.c.

- For selecting a contactor it is essential to determine the current, the voltage and the L/R time constant of the controlled load.
- For information, typical time constant values are quoted hereafter: non inductive loads such as resistance furnaces (L/R ≃ 1 ms), inductive loads such as shunt motors (L/R ≃ 2 ms) or series motors (L/R ≃ 7.5 ms).
- The addition of a resistor in parallel with an inductive winding helps in the elimination of the arcs.
- All the poles required for breaking must be connected in series between the load and the source polarity not linked to earth (or chassis).

Type		EK 110	EK 150	EK 175	EK 210	EK 370
Utilization category DC-1, L/R ≤ 1 ms						
≤ 72 V	A	120	145	210	210	370
110 V	A	120	145	210	210	370
≤ 72 V	A	200	200	300	300	550
110 V	A	200	200	300	300	550
220 V	A	200	200	300	300	550
≤ 72 V	A	200	200	300	300	550
110 V	A	200	200	300	300	550
220 V	A	200	200	300	300	550
440 V	A	–	–	210	210	450
600 V	A	–	–	–	–	450
≤ 72 V	A	200	200	260	300	–
110 V	A	200	200	260	300	–
220 V	A	200	200	260	300	–
440 V	A	200	200	260	300	–
600 V	A	–	–	260	300	–
Utilization category DC-3, L/R ≤ 2 ms						
≤ 72 V	A	120	145	210	210	370
≤ 72 V	A	135	135	210	210	450
110 V	A	135	135	210	210	450
220 V	A	135	135	210	210	450
≤ 72 V	A	135	135	210	210	450
110 V	A	135	135	210	210	450
220 V	A	135	135	210	210	450
440 V	A	–	–	210	210	450
600 V	A	–	–	–	–	450
≤ 72 V	A	135	135	170	210	–
110 V	A	135	135	170	210	–
220 V	A	135	135	170	210	–
440 V	A	135	135	170	210	–
600 V	A	–	–	170	210	–
Utilization category DC-5, L/R ≤ 7.5 ms						
≤ 72 V	A	135	135	210	210	450
110 V	A	135	135	210	210	450
220 V	A	135	135	210	210	450
≤ 72 V	A	135	135	210	210	450
110 V	A	135	135	210	210	450
220 V	A	135	135	210	210	450
440 V	A	–	–	210	210	450
600 V	A	–	–	–	–	450
≤ 72 V	A	135	135	210	210	450
110 V	A	135	135	210	210	450
220 V	A	135	135	210	210	450
440 V	A	–	–	210	210	450
600 V	A	–	–	–	–	450
≤ 72 V	A	135	135	170	210	–
110 V	A	135	135	170	210	–
220 V	A	135	135	170	210	–
440 V	A	135	135	170	210	–
600 V	A	–	–	170	210	–

Technical data

- The tables indicate for the standard contactors the I_e max. operating currents depending on: the utilization category (i.e. L/R) DC-1, DC-3, DC-5 as defined in the IEC 947-4-1 publication, the operating voltage U_e and the pole coupling details.
- Ampere values quoted in the tables below are valid for a –25 … +70 °C temperature close to the contactors, as long as the AC-1 Ampere values for the corresponding ambient temperature are not exceeded.
- Max. switching frequency: 300 ops/h.
- For switching higher d.c. ratings, we recommend the use of bar mounted contactors, R series (63… 2000 A).

IEC Technical data
DC Circuit Switching
BC9 – BC 30

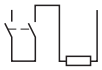
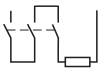
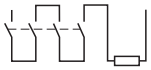
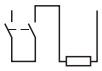
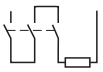
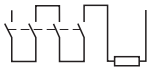
General

The arc switching on DC is more difficult than on AC.

- For selecting a contactor it is essential to determine the current, the voltage and the L/R time constant of the controlled load.
- For information, typical time constant values are quoted hereafter: non inductive loads such as resistance furnaces (L/R ≃ 1 ms), inductive loads such as shunt motors (L/R ≃ 2 ms) or series motors (L/R ≃ 7.5 ms).
  The addition of a resistor in parallel with an inductive winding helps in the elimination of the arcs.
- All the poles required for breaking must be connected in series between the load and the source polarity not linked to earth (or chassis).

Technical data

- The tables indicate for the standard contactors the I_e max. operating currents depending on: the utilization category (i.e. L/R) DC-1, DC-3, DC-5 as defined in the IEC 947-4-1 publication, the operating voltage U_e and the pole coupling details.
  Ampere values quoted in the tables below are valid for a –25 … +70 °C temperature close to the contactors, as long as the **AC-1 Ampere values** (see page 1.44) for the corresponding ambient temperature are not exceeded.
- Max. switching frequency: 300 ops/h.
- For switching higher DC ratings, we recommend the use of bar mounted contactors, R series (63… 2000 A).

– d.c. operated contactors	Type		BC 9	BC 16	BC 25	BC 30
Utilization category DC-1, L/R ≤ 1 ms						
	≤ 72 V	A	22	28	45	55
	110 V	A	5	10	–	–
	≤ 72 V	A	22	28	45	55
	110 V	A	22	28	45	55
	220 V	A	5	10	–	–
	≤ 72 V	A	22	28	45	55
	110 V	A	22	28	45	55
	220 V	A	22	28	45	55
	≤ 72 V	A	22	28	45	–
	110 V	A	22	28	45	–
	220 V	A	22	28	45	–
	440 V	A	5	10	–	–
Utilization category DC-3, L/R ≤ 2 ms **Utilization category DC-5,** L/R ≤ 7.5 ms						
	≤ 72 V	A	5	9	15	25
	110 V	A	2	2	–	–
	≤ 72 V	A	9	18	25	30
	110 V	A	8	16	20	30
	220 V	A	2	2	–	–
	≤ 72 V	A	10	16	25	30
	110 V	A	10	16	25	30
	220 V	A	10	10	15	25
	≤ 72 V	A	10	16	25	–
	110 V	A	10	16	25	–
	220 V	A	10	16	20	–
	440 V	A	2	2	–	–

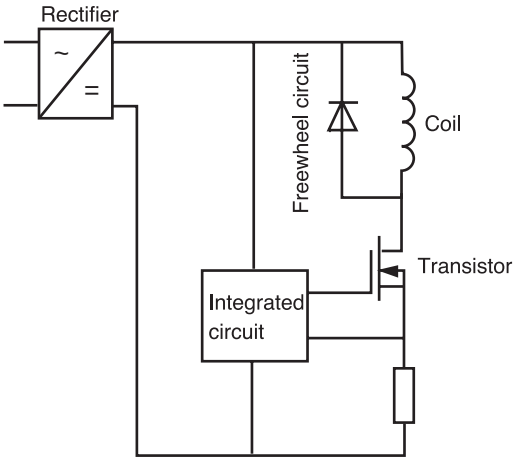
IEC Technical data
EK contactors, AC & DC operated

Type			EK 110	EK 150	EK 175	EK 210	EK 370	EK 550	EK1000
Number of poles			4	4	4	4	4	4	4
Insulation Characteristics									
Rated insulated voltage U_i									
according to IEC 947-4-1 and VDE 0110 (Gr.C)		V	1000	1000	1000	1000	1000	1000	1000
according to UL/CSA		V	600	600	600	600	600	600	-
Rated impulse voltage $U_{imp.}$		kV	8	8	8	8	8	8	8
Main Pole Characteristics									
Conventional free air thermal current I_{th}									
acc to IEC 947-4-1, open contactors $\theta \leq 40°C$		A	200	250	300	350	550	800	1000
with conductor cross-sectional area		mm^2	95	150	185	240	2 x 185	2 x 240	2 x 300
Rated operational current I_e/AC-1									
for air remperature									
	$\theta \leq 40°C$	A	200	250	300	350	550	800	1000
measured close to the contactor	$\theta \leq 55°C$	A	180	230	270	310	470	650	800
	$\theta \leq 70°C$	A	155	200	215	250	400	575	720
with conductor cross-sectional area		mm^2	95	150	185	240	2 x 185	2 x 240	2 x 300
Utilization category AC-3									
for air temperature – $\theta \leq 55°C$ close to the contactor									
Rated operational current									
I_e/AC-3 (1)									
	220-230-240 V	A	120	145	210	210	400	550	-
	380-400	V	A	120	145	210	210	400	550
-									
	415 V	A	120	145	210	210	400	550	
-									
	440 V	A	120	145	210	210	370	550	
-									
	500 V	A	120	145	210	210	370	550	
-									
	690 V	A	120	120	210	210	370	550	
-									
	1000 V	A	64	80	113	113	155	175	
-									
Rated short-time withstand current I_{cw}									
at 40°C ambient temperature	1 s	A	1700	1800	2300	2300	5500	5500	6800
in free air from cold state	10 s	A	900	1200	1680	1680	5300	5300	6400
	30 s	A	600	700	1000	1000	3700	3700	4400
	1 min	A	450	550	800	800	3000	3000	3400
	15 min	A	210	250	320	320	1000	1000	1200
Heat dissipation per pole									
	I_e/AC-1	W	10	13	18	18	40	60	80
	I_eAC-3	W	3	5	9	9	15	25	—
UL/CSA data									
Continous amp - rating		A	170	200	250	300	420	540	—

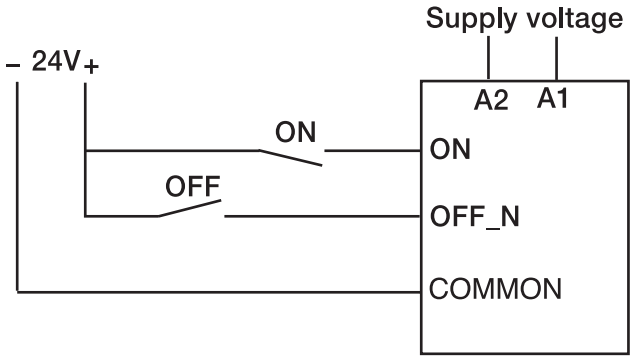
IEC Technical data
EK contactors, AC & DC operated

Type			EK 110	EK 150	EK 175	EK 210	EK 370	EK 550	EK1000
Number of poles			4	4	4	4	4	4	4
Magnet System Characteristics									
Coil operating limits acc. to IEC 947-4-1			0.85 - 1.1 x U_c at an ambient temp. of max 70°C						
Drop-out voltage in % of U_c									
		a.c. d.c.	45-65% 15-50%	45-65% 15-50%	45-65% 15-50%	45-65% 15-50%	45-65% 15-50%	45-65% 15-50%	45-65% 15-50%
Coil consumption									
Coil code A:									
Average pull-in value	50 Hz	VA	800	800	1100	1100	3500	3500	3500
	60 Hz	VA	900	900	1200	1200	4000	4000	4000
Average holding value	50 Hz	VA/W	44/15	44/15	52/18	52/18	125/50	125/50	125/50
	60 Hz	VA/W	52/18	52/18	65/22	65/22	140/60	140/60	140/60
Coil code E:									
Average pull-in value	50/60 Hz	VA/VA	500	500	630	630	3800/3400	3800/3400	3800/3400
Average holding value		VA/W	2.5	2.5	2.5	2.5	140/60	140/60	140/60
DC coil code D:									
Average pull-in value		W	500	500	630	630	1100	1100	1100
Average holding value		W	2.5	2.5	2.5	2.5	20	20	20
Operating times									
AC coil, code A:									
From coil energization to									
closing of the NO contact	ms		20-40	20-40	20-40	20-40	30-60	30-60	30-60	30-60
opening of the NC contact	ms		15-35	15-35	15-35	15-35	25-55	25-55	25-55	25-55
From coil de-energization to									
opening of the NO contact	ms		7-15	7-15	7-15	7-15	10-20	10-20	10-20	10-20
closing of the NC contact	ms		10-18	10-18	10-18	10-18	13-23	13-23	13-23	13-23
AC coil code E:									
From coil energization to									
closing of the NO contact	ms		30-50	30-50	30-50	30-50	30-60	30-60	30-60	30-60
opening of the NC contact	ms		25-45	25-45	25-45	25-45	25-55	25-55	25-55	25-55
From coil de-energization to									
opening of the NO contact	ms		95-120	95-120	95-120	95-120	10-20	10-20	10-20	10-20
closing of the NC contact	ms		100-125	100-125	100-125	100-125	13-23	13-23	13-23	13-23
DC coil code D :									
From coil energization to									
opening of the NO contact	ms		30-50	30-50	30-50	30-50	60-80	60-80	60-80	60-80
opening of the NC contact	ms		27-47	27-47	27-47	27-47	55-75	55-75	55-75	55-75
From coil de-energization to									
opening of the NO contact	ms		10-35	10-35	10-35	10-35	10-35	10-35	10-35	10-35
closing of the NC contact	ms		13-38	13-38	13-38	13-38	13-38	13-38	13-38	13-38

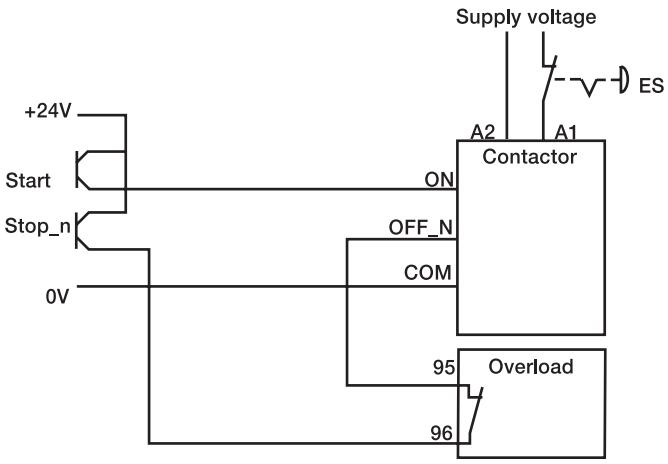
Circuit diagram



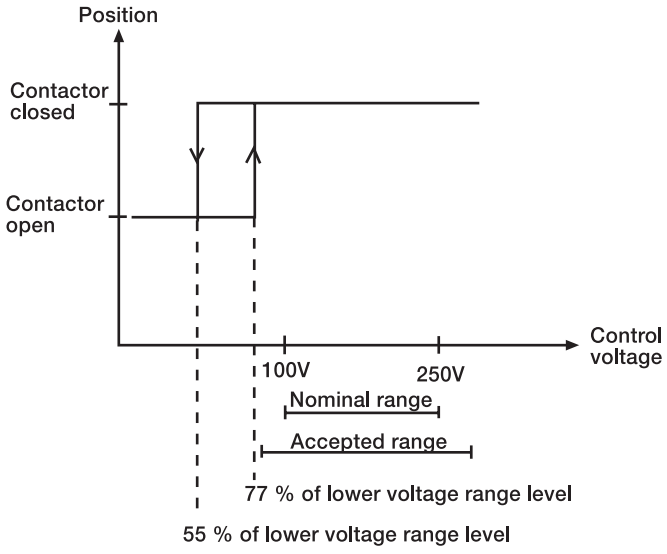
Control inputs AF 400...750



Control circuit diagram



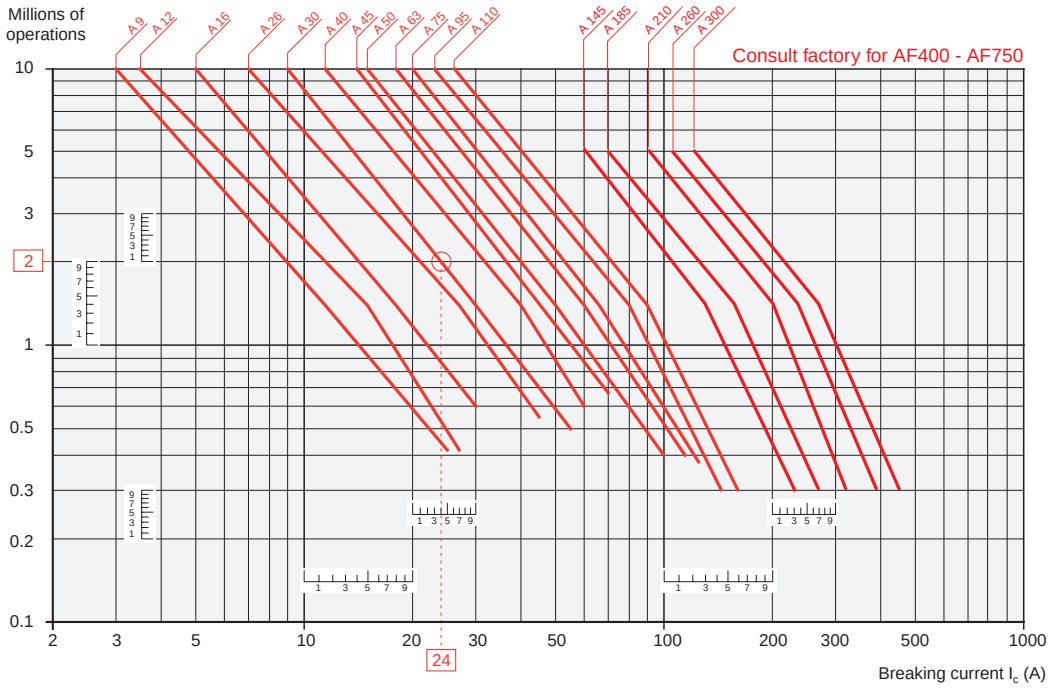
Operating diagram



Technical data
Contactor utilization categories & electrical durability
AC-1

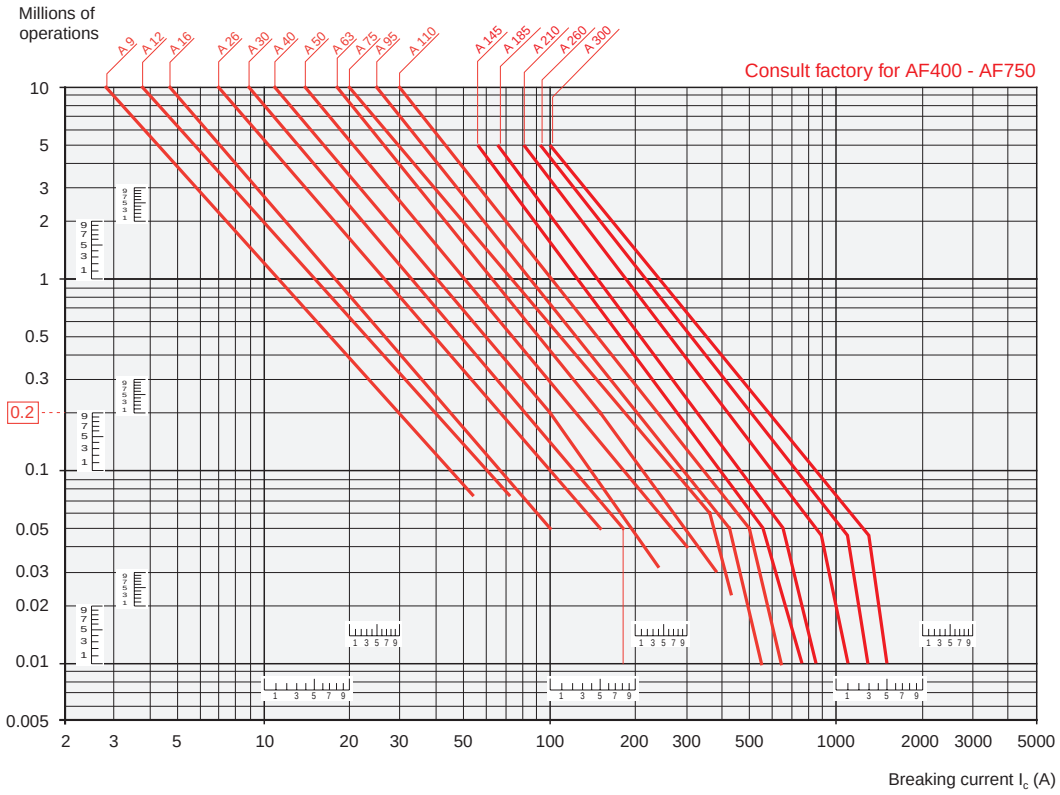
Electrical durability for AC-1 utilization category, ambient temperature ≤ 55°C

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



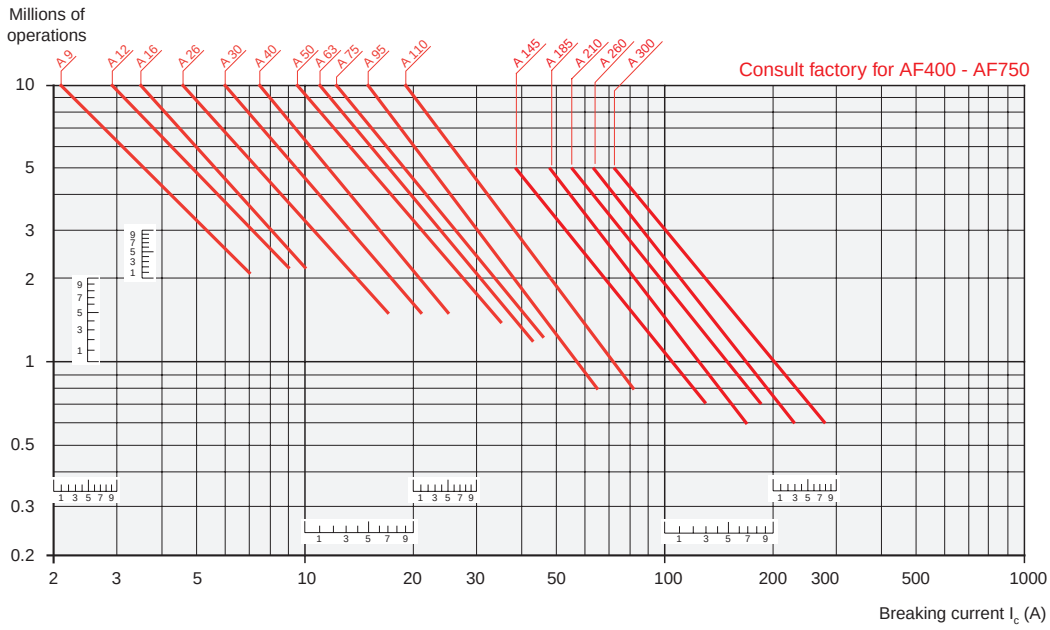
Electrical durability for utilization category AC-3 - $U_e \leq 440V$

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



Electrical durability for utilization category AC-3 - $440V < U_e \leq 690V$

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

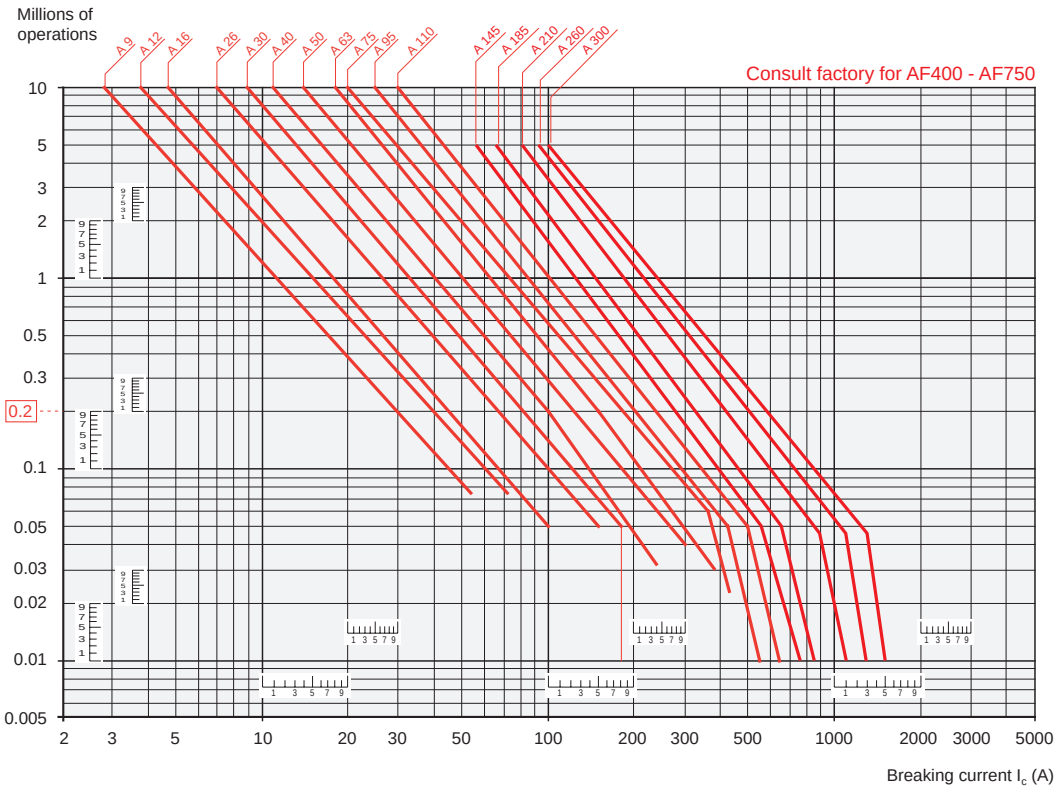


Technical data
Contactor utilization categories & electrical durability
AC-4

Electrical durability for utilization category AC-4 - $U_e \leq 440V$

Maximum number of AC-4 operations: 300 per hour for A9 - A110 contactors

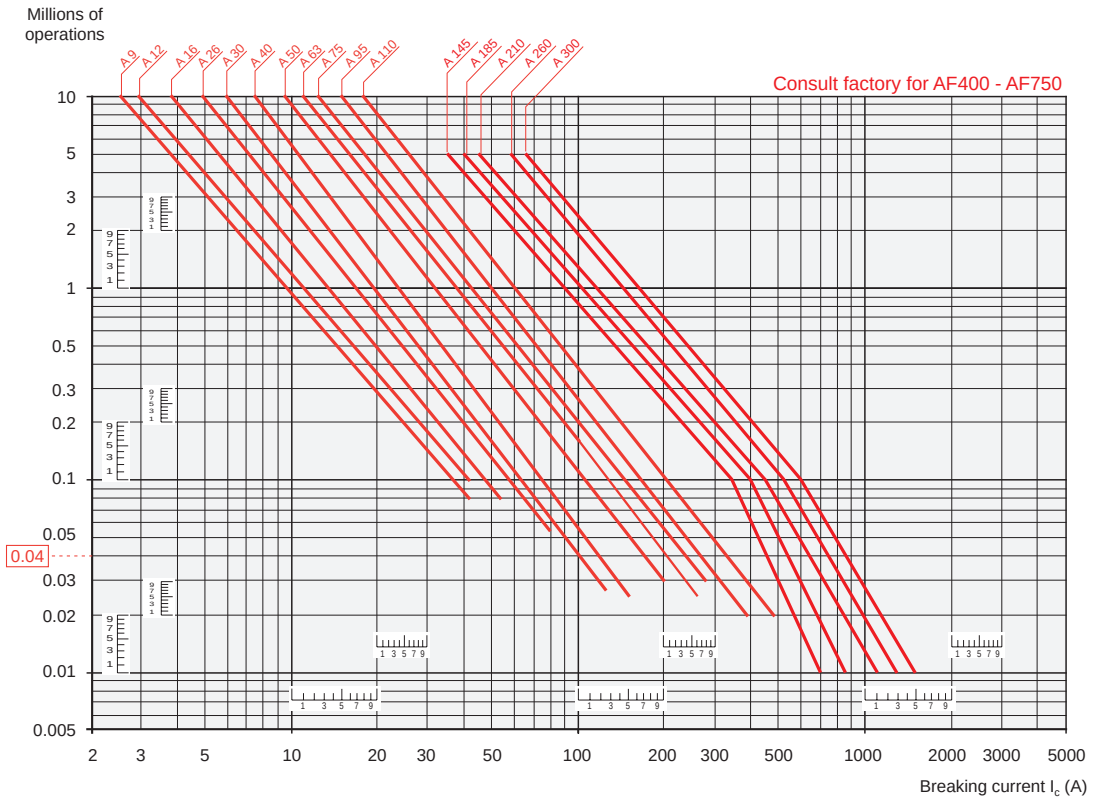
Switching cage motors; starting, reverse operation and step-by-step operation. The breaking current I_c is equal to 6 x I_e, where I_e is the motor rated operational current (I_e = motor full load current)



Electrical durability for utilization category AC-4 - 440V < U_e ≤ 690V

Maximum number of AC-4 operations: 300 per hour for A9 - A110 contactors

Switching cage motors; starting, reverse operation and step-by-step operation. The breaking current I_e is equal to 6 x I_e, where I_e is the motor rated operational current (I_e = motor full load current)



Technical data
Motor data

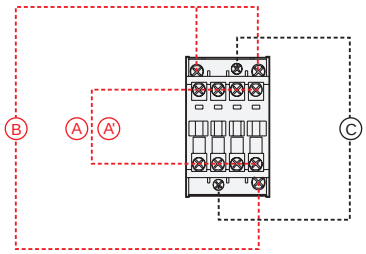
Ampere ratings of 3 phase, AC induction motors

	110 – 120V			200 – 208V			220 – 240V			380 – 415V①		440 – 480V			550 – 600V		
Horse power	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

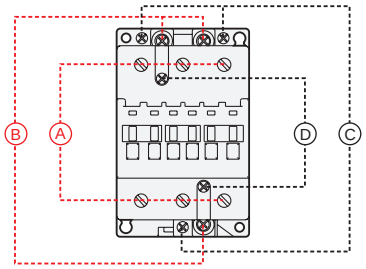
① To obtain full load currents for 265V and 277V motors, decrease corresponding 220 – 240V ratings by 13 percent and 17 percent.

Technical Data
Tightening torques for A/AE/BC contactors, N/KC control relays and accessories

Contactors:
B 9 - BC30
A9 - A40
Control relays:
N and KC



A/AE45 - A/AE110 Contactors



Type of contactors	Main poles Ⓐ		Built-in aux. poles Ⓐ'		Coil terminals Ⓑ		Housing assembly Ⓒ			Cover fixing Ⓓ		Contact screws	
	M3.5 ± poz. 2		**M3.5 ± poz.2**		**M3.5 ± poz.2**		**Ø 3.5**						
	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: **Screws**	recommended **Ncm/lb.in**	max. Ncm				
KC, BC9, BC16	**100/9**	120	**100/9**	120	**100/9**	120	± Poz.2	**160/14.4**	175				
N, A 9, A12, A16							± Poz.2	**120/10.5**	135				
	M4 ± poz. 2		**M4 ± poz.2**		**M3.5 ± poz.2**		**Ø 3.5**						
	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: **Screws**	recommended **Ncm/lb.in**	max. Ncm				
BC18, BC25	**170/15**	220	**170/15**	220	**100/9**	120	± Poz.2	**160/14.4**	175				
A26							± Poz.1	**120/10.5**	135				
	M5 ± poz. 2				**M3.5 ± poz.2**		**Ø 3.5 ± poz.2**			**M2.5 slotted screws**			
	Tightening torque: recommended **Ncm/lb.in**	max. Ncm			Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**		max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm		
BC30	**280/25**	320			100/9	120	**160/14.4**		175	**80/7.2**	90		
	M5 ± poz. 2		**M3.5 ± poz. 2**		**M3.5 ± poz.2**		**Ø 3.5 ± poz.1**						
	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**		max. Ncm				
A30, A40	**230/20**	260	**100/9**	120	**100/9**	120	**120/10.5**		135				
	M8 slotted screws for Ø 6.5				**M3.5 ± poz.2**		**Ø 3.5 ± poz.2**			**Ø 3.5 ± poz.2**		**Ø 3 ± poz.1**	
	Tightening torque: recommended **Ncm/lb.in**	max. Ncm			Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**		max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm
A/AE45 - A/AE75	**400/35**	450			**100/9**	120	**120/10.5**		135	**100/9**	110	**60/5.4**	70
	HC, M8				**M3.5 ± poz.2**		**M 3.5 ± poz.2**			**Ø 3.5 ± poz.2**		**CBLX - M5 / T25**	
	Tightening torque: recommended **Ncm/lb.in**	max. Ncm			Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**		max. Ncm	Tightening torque: recommended **Ncm/lb.in**	max. Ncm	Tightening torque: recommended **Ncm/lb.in**	
A/AE 95 - A/AE110	**600/53**	650			**100/9**	120	**135/12**		150	**100/9**	120	**500/45**	

Accessories	Pole terminals	
CA5, CAL5, CC5 **CAL16, CCL16**	**M3.5 ± poz. 2**	
TP **LK75-A, LK75-A1** **VE5-1, VE5-2**	Tightening torque: recommended **Ncm**	max. Ncm
WB75 (± poz.1 screw)	**100**	120

Technical Data
Tightening torques for A/AF contactors
Lugs

Type of contactors	Main poles Ⓐ	Built-in aux. poles Ⓐ'	Coil terminals Ⓑ	
	M8		**M3.5 ± poz.2**	
	Tightening torque: recommended **Ncm/lb.in**		Tightening torque: recommended **Ncm/lb.in**	max. Ncm
A/AF 145-185	**900/80**		**100/9**	120
	M10		**M3.5 ± poz.2**	
	Tightening torque: recommended **Ncm/lb.in**		Tightening torque: recommended **Ncm/lb.in**	max. Ncm
A/AF 210-300	**1800/160**		**100/9**	120
	M10		**M3.5 ± poz.2**	
	Tightening torque: recommended **Ncm/lb.in**		Tightening torque: recommended **Ncm/lb.in**	max. Ncm
A/AF 400-460	**400/354**		**100/9**	120
	M12		**M3.5 ± poz.2**	
	Tightening torque: recommended **Ncm/lb.in**		Tightening torque: recommended **Ncm/lb.in**	max. Ncm
A/AF 580-750	**450/443**		**100/9**	120

Lugs

Lugs	Mounting torque (lb. in.)	Wire clamp (lb. in.)
ATK185	80	300
ATK300	160	375
ATK300/2	160	375
ATK580/2	88	275
ATK750/3	80	375

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.

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.
	AC-2	Slip-ring motors: starting, switching-off.
	AC-3	Squirrel-cage motors: starting, switching-off motors during running.
	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.

Switching of slip-ring motors

Contactors used for short-circuiting the rotor resistances can be used at operating voltages greater than their own rated insulation voltage.
This application is characterized by easy making and breaking conditions, the on-load factor is generally low.
Utilization is also a function of the switching diagram.

Switching of DC power circuits

On d.c. the arc breaking is more difficult than on a.c. particularly when the time constant is of a high value. This makes it necessary to connect several poles in series to improve the breaking conditions.

Switching of higher currents in AC circuits

Contactor performances can be increased by connecting the poles in parallel.

Switching of circuits in temporary or intermittent duties

For these applications, greater operating currents are permissible. Up-rating factors are quoted in this catalog.

Influence of long control leads in coil control circuits

Depending on operation voltages, conductor cross-sections, coil consumption, control wiring details, nuisance caused by wire resistance and capacitance may occur on contactor closing or opening.

Conditions for making and breaking corresponding to utilization categories

Utilization category	Standard duty						Occasional duty					
	Making conditions			Breaking conditions			Making conditions			Breaking conditions		
	I/I_e	U/U_e	Cos. j or L/R (ms)	I/I_e	U/U_e	Cos. j or L/R (ms)	I_c/I_e	U_r/U_e	Cos. j or L/R (ms)	I_c/I_e	U_r/U_e	Cos. j or L/R (ms)
Contactors for AC circuit switching												
AC-1	1	1	0.95	1	1	0.95	1.5	1.05	0.8	1.5	1.05	0.8
AC-2	2.5	1	0.65	2.5	1	0.65	4	1.05	0.65	4	1.05	0.65
AC-3 $I_e \leq$ 17 A	6	1	0.65	1	0.17	0.65	10	1.05	0.45	8	1.05	0.45
17 < $I_e \leq$ 100 A	6	1	0.35	1	0.17	0.35	10	1.05	0.45	8	1.05	0.45
I_e > 100 A	6	1	0.35	1	0.17	0.35	10	1.05	0.35	8	1.05	0.35
AC-4 $I_e \leq$ 17 A	6	1	0.65	6	1	0.65	12	1.05	0.45	10	1.05	0.45
17 < $I_e \leq$ 100 A	6	1	0.35	6	1	0.35	12	1.05	0.45	10	1.05	0.45
I_e > 100 A	6	1	0.35	6	1	0.35	12	1.05	0.35	10	1.05	0.35
Contactors for DC circuit switching												
DC-1	1	1	1	1	1	1	1.5	1.05	1	1.5	1.05	1
DC-3	2.5	1	2	2.5	1	2	4	1.05	2.5	4	1.05	2.5
DC-5	2.5	1	7.5	2.5	1	7.5	4	1.05	15	4	1.05	15
Contactor relays for AC circuit switching												
AC-14 (≤ 72 VA)	6	1	0.3	1	1	0.3	6	1.1	0.7	6	1.1	0.7
AC-15 (> 72 VA)	10	1	0.3	1	1	0.3	10	1.1	0.3	10	1.1	0.3

Contactor relays for DC circuit switching

	Standard duty						Occasional duty					
	Making conditions			Breaking conditions			Making conditions			Breaking conditions		
	I/I_e	U/U_e	Cos. j or L/R (ms)	I/I_e	U/U_e	Cos. j or L/R (ms)	I_c/I_e	U_r/U_e	Cos. j or L/R (ms)	I_c/I_e	U_r/U_e	Cos. j or L/R (ms)
DC-13	1	1	6 P ①	1	1	6 P ①	1.1	1.1	6 P ①	1.1	1.6	6 P ①
DC-14	10	1	15 ms	1	1	15 ms	10	1.1	15 ms	10	1.1	15 ms

Legend :
U (I) = applied voltage (current)
U_r = recovery voltage
L/R = time constant of test circuit
U_e (I_e) = rated operational voltage (current)
I_c = current made or broken d.c. or a.c. r.m.s.
$T_{0.95}$ = time to reach 95 % of the steady state current in milliseconds

① The value "6 P" results from an empirical relationship which is found to represent most d.c. magnetic loads to an upper limit of P = 50 W.
Loads having power consumption greater than 50 W are assumed to consist of smaller loads in parallel.
Therefore, the value 6 x P = 300 ms is to be an upper limit, irrespective of the power consumption value.