

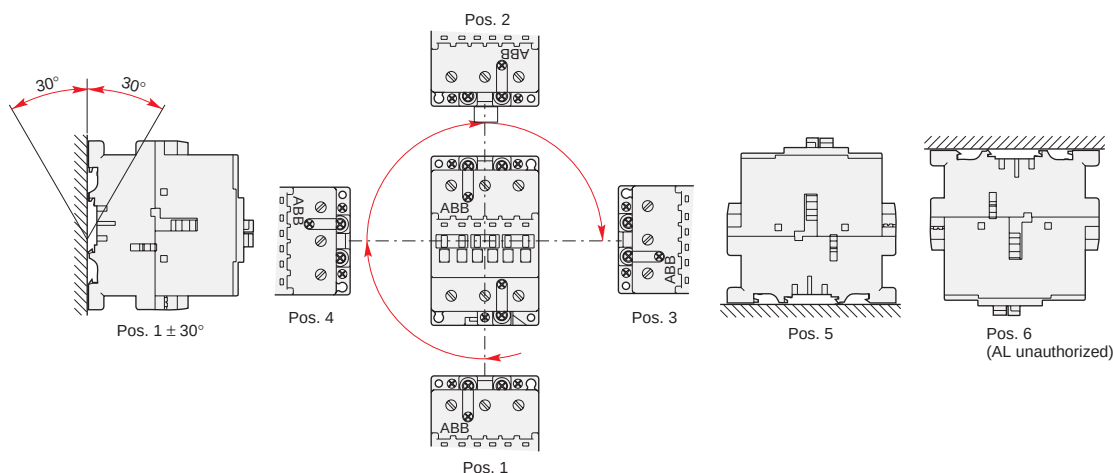
UL & CSA Technical data

A/AE9 – A/AE/AF110, AL9 – AL40

AC & DC operated

ABB contactor frame size		A/AE/AL 9	A/AE/AL 12	A/AE/AL 16	A/AE/AL 26	A/AE/AL 30	A/AE/AL 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	1.5	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 ①	35	50	60	65	65	85	105	120	—
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	20	—
440 – 480VAC	3 phase	—	—	10	—	—	20	—	30	—	30	40	—
550 – 600VAC	3 phase	—	—	10	—	—	20	—	30	—	40	50	—
230VAC	1 phase	—	—	2	—	—	5	—	7.5	—	10	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													
Number of wires per phase	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
		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	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



① 30A Ballast

UL & CSA Technical data

A/AF145 – AF750

AC & DC operated

Across the line
contactors

1

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
Lighting – ballast and incandescent	600VAC	200	—	300	—	400	—	—	—	—
CSA Elevator ratings										
220 – 240VAC	3 phase			40	50	60	—	—	—	—
240 – 480VAC	3 phase	Consult	Consult	75	100	125	—	—	—	—
550 - 600VAC	3 phase	factory	factory	100	125	150	—	—	—	—
230VAC	1 phase			—	—	—	—	—	—	—
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										
Number of wires per phase	AWG	6-250MCM	6-250MCM	4-400MCM	4-400MCM	4-500MCM	250-500MCM	250-500MCM	2/0-500MCM	2/0-500MCM
		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

UL & CSA Technical data

AF1350 – AF1650

AC & DC operated

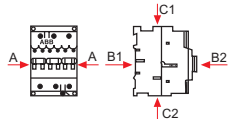
ABB contactor frame size		AF 1350	AF 1650
NEMA size		—	8
Number of poles		3	3
AC rating information			
NEMA maximum H.P. ratings	3 phase		
200	VAC	—	—
230	VAC	—	450
460/575	V	—	900
U.L. general purpose current			
	40°C	1350	1650
Max. 3 Ph switching motor loads	Amps	960	1080
U.L. maximum H.P. ratings	1 phase		
115	VAC	—	—
230	VAC	—	—
U.L. maximum H.P. ratings	3 phase		
200—208	VAC	—	—
220—240	VAC	400	450
440—480	VAC	800	900
550—600	VAC	900	1000
Auxiliary contacts			
NEMA rating	AC	A600	A600
AC rated voltage	VAC	600	600
AC thermal rated current	A	10	10
AC maximum volt—ampere making	VA	7200	7200
AC maximum volt—ampere breaking	VA	720	720
NEMA rating	DC	P600	P600
DC rated voltage	VDC	600	600
DC thermal rated current	A	5	5
DC Maximum make—break	A	0.2	0.2
Approximate weight			
Contactor	lbs.	75	75
Starter	lbs.	—	—
Terminal wire range			
	AWG	1/0-750 MCM	1/0-750 MCM
Number of wires per phase		4	6
Maximum short circuit ratings			
MCCB,MCP,amps/kA	480VAC	2000/42	2000/42
MCCB,MCP,amps/kA	600VAC	—	—
Fuse, amps—Type/kA	600VAC	1600L/82	2000L/82

UL/CSA & IEC Technical data

A/AE9 – A/AE/AF/TAE110

Across the line
contactors

1

Contactor types:	A..., AE...	9	12	16	26	30	40	45	50	63	75	95	110
	AF..., TAE...	–	–	–	–	–	–	45	50	63	75	95	110
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 30		acc. to IEC 60068-2-30 and 60068-2-11 - UTE C 63-100 specification II											acc. to IEC 68-2-
Operating altitude	m	≤ 3000											
Shock withstand acc. IEC 60068-2-27 and EN 60068-2-27		1/2 sinusoidal shock for 11 ms: no change in contact position											
Mounting position 1 (see page 1.50)		Shock direction Making position Breaking position											
		A 20 g 20 g											
		B1 10 g 5 g ①											
		B2 15 g ② 15 g ②											
		C1 20 g 20 g											
		C2 20 g 20 g											
													
		Not valid for DIN-rail mounting											

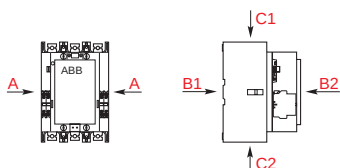
① 3 g for AF 45-22, AE 45-22, AF 75-22 and AE 75-22.
② 10 g for AF 45-22, AE 45-22, AF 75-22 and AE 75-22.

UL/CSA & IEC Technical data

A/AF145 – AF1650

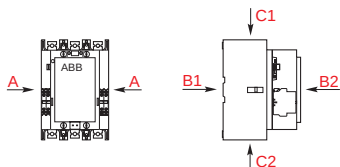
A/AF145 – AF750

Contactor types:	A...	145	185	210	260	300	-	-	-	-
	AF...	145	185	210	260	300	400	460	580	750
Rated insulation voltage U_i according to IEC 60947-4-1 according to UL/CSA	V	1000 V600								
Rated impulse withstand voltage U_{imp} . Standards	kV	8 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 – fitted with thermal O/L relay	°C	see "Conditions for use" page 1.51 , for control voltage limits and authorized mounting positions -25 to +55 -40 to +70 -40 to +70								
– without thermal O/L relay	°C									
– for storage	°C									
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 1.51)		1/2 sinusoidal shock for 30 ms: no change in contact position 5 g in all directions (A, B1, B2, C1, C2)								



AF1350 – AF1650

Contactor types:	AF...	1350	1650
Rated insulation voltage U_i according to IEC 60947-4-1 according to UL/CSA	V	1000 600	
Rated impulse withstand voltage U_{imp} . Standards	kV	8 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 – fitted with thermal O/L relay		see "Conditions for use" page 1.51 , for control voltage limits and authorized mounting positions °C-25 to +55 °C-40 to +70 °C-40 to +70	
– without thermal O/L relay			
– for storage			
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 1.51)		1/2 sinusoidal shock for 30 ms: no change in contact position 5 g in all directions (A, B1, B2, C1, C2)	



IEC Technical data

DC circuit switching

A/AE9 – GAE75

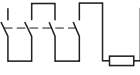
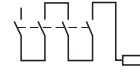
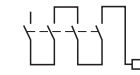
Across the line
contactors

1

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 ($L/R \approx 1$ ms), inductive loads such as shunt motors ($L/R \approx 2$ ms) or series motors ($L/R \approx 7.5$ 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).

a.c. operated contactors a.c. / d.c. operated (electronic coil interface) d.c. operated contactors			A9 – AE9	A12 – AE12	A16 – AE16	A26 – AE26	A30 – AE30	A40 – AE40	A45 AF45 AE45	A50 AF50 AE50	A63 AF63 AE63	A75 AF75 AE75	GA75 – GAE75
Utilization category DC-1, $L/R \leq 1$ ms													
	≤ 72 V	A	25	27	30	45	55	60	70	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	70	100	110	120	–
	110 V	A	25	27	30	45	55	60	70	100	110	120	–
	220 V	A	10	15	20	–	–	–	–	–	–	–	–
	≤ 72 V	A	25	27	30	45	55	60	70	100	110	120	–
	110 V	A	25	27	30	45	55	60	70	100	110	120	–
	220 V	A	25	27	30	45	55	60	70	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, $L/R \leq 2$ ms													
	≤ 72 V	A	25	27	30	45	55	60	70	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	70	100	110	120	–
	110 V	A	25	27	30	45	55	60	70	100	110	120	–
	220 V	A	6	7	8	–	–	–	–	–	–	–	–
	≤ 72 V	A	25	27	30	45	55	60	70	100	110	120	–
	110 V	A	25	27	30	45	55	60	70	100	110	120	–
	220 V	A	25	27	30	45	55	60	70	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, $L/R \leq 7.5$ 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	70	100	110	120	–
	110 V	A	10	15	20	30	45	50	70	80	90	100	–
	220 V	A	4	4	4	–	–	–	–	–	–	–	–
	≤ 72 V	A	25	27	30	45	55	60	70	100	110	120	–
	110 V	A	25	27	30	45	55	60	70	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

DC circuit switching

A/AF/AE95 – AF750

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 60947-4-1 publication, the operating voltage U_e and the pole coupling details. See page 1.81.
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 pages 1.45 - 146) 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).

The selection table for AE 50 ... AE 110 contactors can be used for the TAE 50 ... TAE 110 types.

a.c. operated contactors a.c. / d.c. operated (electronic coil interface) d.c. operated contactors			A95 AF95 AE95	A110 AF110 AE110	A145 AF145 -	A185 AF185 -	A210 AF210 -	A260 AF260 -	A300 AF300 -	- AF400 -	- AF460 -	- AF580 -	- AF750 -
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	-	-	-	-	-	-	-	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-3, L/R ≤ 2.5 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
Utilization category DC-5, L/R ≤ 15 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

DC circuit switching

AL9 — AL40

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 ($L/R \approx 1$ ms), inductive loads such as shunt motors ($L/R \approx 2$ ms) or series motors ($L/R \approx 7.5$ 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).

A.C. operated contactors			AL9	AL12	AL16	AL26	AL30	AL40
Utilization category DC-1, $L/R \leq 1$ ms								
	≤ 72 V	A	25	27	30	45	55	60
	110 V	A	10	15	20	—	—	—
	220 V	A	—	—	—	—	—	—
	440 V	A	—	—	—	—	—	—
	600 V	A	—	—	—	—	—	—
	≤ 72 V	A	25	27	30	45	55	60
	110 V	A	25	27	30	45	55	60
	220 V	A	10	15	20	—	—	—
	≤ 72 V	A	25	27	30	45	55	60
	110 V	A	25	27	30	45	55	60
	220 V	A	25	27	30	45	55	60
	≤ 72 V	A	25	27	30	45	—	—
	110 V	A	25	27	30	45	—	—
	220 V	A	25	27	30	45	—	—
	440 V	A	10	15	20	—	—	—
Utilization category DC-3, $L/R \leq 2$ ms								
	≤ 72 V	A	25	27	30	45	55	60
	110 V	A	6	7	8	—	—	—
	220 V	A	—	—	—	—	—	—
	440 V	A	—	—	—	—	—	—
	≤ 72 V	A	25	27	30	45	55	60
	110 V	A	25	27	30	45	55	60
	220 V	A	6	7	8	—	—	—
	≤ 72 V	A	25	27	30	45	55	60
	110 V	A	25	27	30	45	55	60
	220 V	A	25	27	30	45	55	60
	≤ 72 V	A	25	27	30	45	—	—
	110 V	A	25	27	30	45	—	—
	220 V	A	25	27	30	45	—	—
	440 V	A	6	7	8	—	—	—
Utilization category DC-5, $L/R \leq 7.5$ ms								
	≤ 72 V	A	9	12	16	25	30	40
	110 V	A	4	4	4	—	—	—
	220 V	A	—	—	—	—	—	—
	440 V	A	—	—	—	—	—	—
	≤ 72 V	A	25	27	30	45	55	60
	110 V	A	10	15	20	30	45	50
	220 V	A	4	4	4	—	—	—
	≤ 72 V	A	25	27	30	45	55	60
	110 V	A	25	27	30	45	55	60
	220 V	A	9	12	16	25	30	40
	≤ 72 V	A	25	27	30	45	—	—
	110 V	A	25	27	30	45	—	—
	220 V	A	10	15	20	30	—	—
	440 V	A	4	4	4	—	—	—

IEC Technical data

DC circuit switching

EK110 — EK1000

General

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

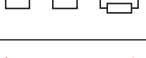
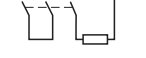
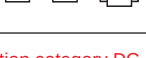
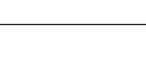
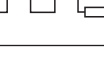
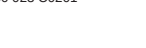
- For selecting a contactor it is essential to determine the current, the voltage and the L/R time constant of the controlled load.
- For information, typical time constant values are quoted hereafter: non inductive loads such as resistance furnaces ($L/R \approx 1$ ms), inductive loads such as shunt motors ($L/R \approx 2$ ms) or series motors ($L/R \approx 7.5$ 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 60947-4-1 publication (see page 1.75 for more details), the operating voltage U_e and the pole coupling details. Ampere values quoted in the tables below are valid for a $-25 \dots +70$ °C temperature close to the contactors, as long as the AC-1 Ampere values (see page 1.61) 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).

Selection Table

a.c. / d.c. operated contactors

			EK110	EK150	EK175	EK210	EK370	EK550	EK1000
Utilization category DC-1, $L/R \leq 1$ ms									
	≤ 72 V	A	120	145	210	210	370	550	—
	110 V	A	120	145	210	210	370	550	—
	≤ 72 V	A	200	200	300	300	550	800	—
	110 V	A	200	200	300	300	550	800	—
	220 V	A	200	200	300	300	550	800	—
	≤ 72 V	A	200	200	300	300	550	800	—
	110 V	A	200	200	300	300	550	800	—
	220 V	A	200	200	300	300	550	800	—
	440 V	A	—	—	210	210	450	650	—
	600 V	A	—	—	—	—	450	650	—
	≤ 72 V	A	200	200	300	300	550	800	—
	110 V	A	200	200	300	300	550	800	—
	220 V	A	200	200	300	300	550	800	—
	440 V	A	200	200	260	300	450	650	—
	600 V	A	—	—	260	300	450	650	—
	600 V	A	—	—	260	300	450	650	—
Utilization category DC-3, $L/R \leq 2$ ms									
	≤ 72 V	A	120	145	210	210	370	550	—
	≤ 72 V	A	135	145	210	210	450	650	—
	110 V	A	135	135	210	210	450	650	—
	220 V	A	135	135	210	210	450	650	—
	≤ 72 V	A	135	145	210	210	450	650	—
	110 V	A	135	135	210	210	450	650	—
	220 V	A	135	135	210	210	450	650	—
	440 V	A	—	—	210	210	450	650	—
	600 V	A	—	—	—	—	450	650	—
	≤ 72 V	A	135	145	210	210	450	650	—
	110 V	A	135	135	210	210	450	650	—
	220 V	A	135	135	210	210	450	650	—
	440 V	A	135	135	210	210	450	650	—
	600 V	A	—	—	170	210	450	650	—
	≤ 72 V	A	135	145	210	210	450	650	—
	110 V	A	135	135	210	210	450	650	—
	220 V	A	135	135	210	210	450	650	—
	440 V	A	135	135	210	210	450	650	—
	600 V	A	—	—	170	210	450	650	—
	600 V	A	—	—	170	210	450	650	—
Utilization category DC-5, $L/R \leq 7.5$ ms									
	≤ 72 V	A	135	145	210	210	450	650	—
	110 V	A	135	135	210	210	450	650	—
	220 V	A	135	135	210	210	450	650	—
	≤ 72 V	A	135	145	210	210	450	650	—
	110 V	A	135	135	210	210	450	650	—
	220 V	A	135	135	210	210	450	650	—
	440 V	A	—	—	210	210	450	650	—
	600 V	A	—	—	—	—	450	650	—
	≤ 72 V	A	135	145	210	210	450	650	—
	110 V	A	135	135	210	210	450	650	—
	220 V	A	135	135	210	210	450	650	—
	440 V	A	135	135	210	210	450	650	—
	600 V	A	—	—	170	210	450	650	—
	600 V	A	—	—	170	210	450	650	—

IEC Technical data

A/AE9 — A/AE/AF/TAE110

Across the line
contactors

1

Main Pole - Utilization Characteristics

Contactor types:		A..., AE..., AF..., TAE...	9	12	16	26	30	40	45	50	63	75	95	110	
			—	—	—	—	—	—	45	50	63	75	95	110	
Rated operational voltage U _e max.	V		690						1000 (690 for AF... contactors)						
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	100	100	125	125	145	160
with conductor cross-sectional area	mm ²	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															
U _e max. 690 V	$\left\{ \begin{array}{l} \varnothing \leq 40\text{ °C} \\ \varnothing \leq 55\text{ °C} \\ \varnothing \leq 70\text{ °C} \text{ ③} \end{array} \right.$	A	25	27	30	45	55	60	70	100	115	125	145	160	
		A	22	25	27	40	55	60	60	85	95	105	135	145	
		A	18	20	23	32	39	42	50	70	80	85	115	130	
with conductor cross-sectional area	mm ²		2.5	4	4	6	10	16	25	35	50	50	50	70	
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	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 ②	25 ②	28 ②	30 ②	30 ②	
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	11	15	18.5	22	25	30	
	380-400 V	kW	4	5.5	7.5	11	15	18.5	18.5	22	30	37	45	55	
	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 ②	33 ②	37 ②	40 ②	40 ②	
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		25	32	32	50	63	80	100	125	160	160	200		
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	1000					1320	1320	
10 s	A		100	120	140	210	400	650					800	800	
30 s	A		60	70	80	110	225	370					500	500	
1 min	A		50	55	60	90	150	250					350	350	
15 min	A		26	28	30	45	65	110	110	135	135		160	175	
Maximum breaking capacity cos ø = 0.45 (cos ø = 0.35 for I _e > 100 A)															
at 440 V	A		250			420	820	900	1300				1160		
at 690 V	A		90			170	340	490	630				800		
Heat dissipation per pole	I _e / AC-1 W		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	
Max. electrical switching frequency															
– for AC-1	cycles/h		600						600 (300 for AF..., AE... TAE...)				300		
– for AC-3	cycles/h		1200 (600 for AE...)						600 (300 for AF..., AE... TAE...)				300		
– for AC-2, AC-4	cycles/h		300						150				150		
Electrical durability			see pages 1.70 - 1.73												
Mechanical durability															
– millions of operating cycles			10 (5 for AE... and TAE... contactors)												
– max. mechanical switching frequency	cycles/h		3600 (300 for AF... contactors)												

① For the corresponding hp/A values of 1500 r.p.m., 50Hz, 3-phase motors, see page 1.76.

② AF... contactors excluded

③ Unauthorized for TAE... contactors.

IEC Technical data

A/AF145 – AF750

Main Pole - Utilization Characteristics

Main poles Utilization Characteristics		A...	145	185	210	260	300	–	–	–	–		
Contactor types:		AF...	145	185	210	260	300	400	460	580	750		
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 $\varnothing \leq 40\text{ °C}$													
		A	250	275	350	400	500	600	700	800	1050		
with conductor cross-sectional area ①		mm ²	120	150	185	240	300 ③	2 x 185	2 x 240	2 x 240	2 x 80 x 5 ②		
Rated operational current I _e / AC-1 for air temperature close to contactor													
U _e max. 690 V		$\varnothing \leq 40\text{ °C}$ $\varnothing \leq 55\text{ °C}$ $\varnothing \leq 70\text{ °C}$	A	250	275	350	400	500	600	700	800	1050	
			A	230	250	300	350	400	500	600	700	800	
			A	180	180	240	290	325	400	480	580	720	
with conductor cross-sectional area		mm ²	120	150	185	240	300 ③	2 x 185	2 x 240	2 x 240	2 x 80 x 5 ②		
Utilization categorie AC-3 for air temperature close to contactor $\leq 55\text{ °C}$													
Rated operational current I _e AC-3													
 3-phase motors		220-230-240 V	A	145	185	210	260	305	400	460	580	750	
		380-400 V	A	145	185	210	260	305	400	460	580	750	
		415 V	A	145	185	210	260	300	400	460	580	750	
		440 V	A	145	185	210	240	280	400	460	580	750	
		500 V	A	145	170	210	240	280	400	460	580	750	
		690 V	A	120	170	210	220	280	350	400	500	650	
		1000 V	A	–	–	–	–	–	–	–	–	–	
Rated operational power AC-3													
 1500 r.p.m. 50 Hz 1800 r.p.m. 60 Hz 3-phase motors		220-230-240 V	kW	45	55	59	80	90	110	132	160	220	
		380-400 V	kW	75	90	110	140	160	200	250	315	400	
		415 V	kW	75	90	110	140	160	220	250	355	425	
		440 V	kW	75	90	110	140	160	220	250	355	450	
		500 V	kW	90	110	132	180	200	250	315	400	520	
		690 V	kW	110	132	160	200	250	315	355	500	600	
		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 excluded U _e $\leq$ 500 V a.c. - gG type fuse													
		A	315	355	400	500	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	1800	2000	2500	3500	4600	7000				
		10 s	A	1200	1500	1700	2400	4400	6400				
		30 s	A	800	1000	1200	1500	3100	4500				
		1 min	A	600	800	1000	1100	2500	3500				
		15 min	A	280	320	400	500	840	1300				
Maximum breaking capacity cos $\varnothing$ = 0.45 (cos $\varnothing$ = 0.35 for I _e > 100 A)													
		at 440 V	A	1500	2000	2300	2600	3000	4000	5000	6000	7500	
		at 690 V	A	1200	1600	2000	2400	2500	3500	4500	5000	7000	
Heat dissipation per pole													
		I _e / AC-1	W	13	16	18	25	32	30	42	32	50	
		I _e / AC-3	W	5	8	9	14	18	16	21	17	28	
Max. electrical switching frequency													
– for AC-1		cycles/h	300		300			300		300			
– for AC-3		cycles/h	300		300			300		300			
– for AC-2, AC-4		cycles/h	150		150			60		60			
Electrical durability			see pages 1.65 ... 1.69					–	–	–	–		
Mechanical durability													
– millions of operating cycles			5					3					
– max. mechanical switching frequency			cycles/h	3600 (300 for AF... contactors)					300				

① Conductors with preparation.

② Dimensions of the bars (in mm).

③ For currents above 450A, use terminal extension / enlargement pieces LX 300 / LW 300 see page 1.31).

IEC Technical data

AF1350 – AF1650

Across the line
contactors

1

Main Pole - Utilization Characteristics

Main FxS Utilization Characteristics		1350	1650	
Contactor types: AF...				
Rated operational voltage U_e max.	V	1000	1000	
Rated frequency limits	Hz	25-400	25-400	
Conventional free-air thermal current I_{th} acc. to IEC 60947-4-1, open contactors $\vartheta \leq 40\text{ }^{\circ}\text{C}$ with conductor cross-sectional area ^①	A mm ²	1350 2/100x5	1650 3/100x5	
Rated operational current I_e / AC-1 for air temperature close to contactor				
U_e max. 690 V	$\vartheta \leq 40\text{ }^{\circ}\text{C}$	A	1350	1650
	$\vartheta \leq 55\text{ }^{\circ}\text{C}$	A	1150	1450
	$\vartheta \leq 70\text{ }^{\circ}\text{C}$	A	1000	1270
		mm ²	2 x 80 x 5 ^①	2 x 80 x 5 ^①
Utilization categorie AC-3 for air temperature close to contactor $\leq 55\text{ }^{\circ}\text{C}$				
Rated operational current I_e AC-3				
3-phase motors	220-230-240 V	A	860	1050
	380-400 V	A	860	1050
	415 V	A	860	1050
	440 V	A	860	1050
	500 V	A	—	—
	690 V	A	—	—
	1000 V	A	—	—
				
Rated operational power AC-3				
1500 r.p.m. 50 Hz 1800 r.p.m. 60 Hz 3-phase motors	220-230-240 V	kW	257	315
	380-400 V	kW	475	560
	415 V	kW	500	600
	440 V	kW	560	670
	500 V	kW	—	—
	690 V	kW	—	—
	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 excluded $U_e \leq 500\text{ V a.c.}$ - gG type fuse		Product coordination with ABB circuit breaker Consult factory		
Rated short-time withstand current I_{cw} at $40\text{ }^{\circ}\text{C}$ ambient temp., in free air, from a cold state				
	1 s	A	10,000	12,000
	10 s	A	8000	10,000
	30 s	A	6000	7500
	1 min	A	4500	5500
	15 min	A	1600	2200
Maximum breaking capacity $\cos \vartheta = 0.45$ ($\cos \vartheta = 0.35$ for $I_e > 100\text{ A}$)				
	at 440 V	A	10,000	12,000
	at 690 V	A	—	—
Max. electrical switching frequency				
– for AC-1	cycles/h	60	60	
– for AC-3	cycles/h			
– for AC-2, AC-4	cycles/h			
Electrical durability		50,000	50,000	
Mechanical durability				
– millions of operating cycles		500,000	500,000	
– max. mechanical switching frequency	cycles/h	60	60	

① Dimensions of the bars (in mm).

IEC Technical data

A/AF9 — AF110

Magnet System Characteristics for A... Contactors

Contactor types: A...			9	12	16	26	30	40	45	50	63	75	95	110		
Rated control circuit voltage U _c																
– at 50 Hz		V	20 ... 690													
– at 60 Hz		V	24 ... 600													
Coil operating limits according to IEC 60947-4-1			θ ≤ 55 °C 0.85 ... 1.1 x U _c										θ ≤ 70 °C 0.85 ... 1.1 x U _c			
Drop-out voltage in % of U _c			roughly 40 ... 65 %													
Coil consumption																
Average pull-in value	50 Hz	VA	70			120			180				350			
	60 Hz	VA	80			140			210				450			
	50/60 Hz ①	VA/VA	74/70			125/120			190/180				410/365			
Average holding value	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 ①	VA/W	8/2			12/3			18/5.5				27/7.5			
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 opening		ms	4 ... 11			4 ... 11			4 ... 11				7 ... 15			
– N.C. contact closing		ms	9 ... 16			7 ... 14			7 ... 14				10 ... 18			

Magnet System Characteristics for AF... Contactors

Contactor types: AF..			-	-	-	-	-	-	45	50	63	75	95	110
Rated control circuit voltage U _c														
- at 50 Hz		V							48 ... 250			48 ... 250		
- at 60 Hz		V							48 ... 250			48 ... 250		
- d.c.		V							20 ... 250			20 ... 250		
Coil operating limits according to IEC 60947-4-1									θ ≤ 70 °C					
									0.85 ... 1.1 x U _c					
Drop-out voltage in % of U _c									55 %					
Coil consumption														
Average pull-in value		50 Hz	VA						210			350		
		60 Hz	VA						210			350		
		d.c.	W						190			400		
Average holding value		50 Hz	VA/W						7/2.8			7/3.5		
		60 Hz	VA/W						7/2.8			7/3.5		
		d.c.	W						2.8			2		
Operating time														
between coil energization and:														
- N.O. contact closing		ms						30 ... 100			30 ... 80			
- N.C. contact opening		ms						27 ... 95			27 ... 77			
between coil de-energization and:														
- N.O. contact opening		ms						30 ... 110			55 ... 125			
- N.C. contact closing		ms						35 ... 115			60 ... 130			

① 50/60 Hz coils: voltage codes 8 0 to 8 8. see page 1.28.

IEC Technical data

A145 — AF750

Across the line
contactors

1

Magnet System Characteristics for A... Contactors

Contactor types:			A...	145	185	210	260	300	-	-	-	-
Rated control circuit voltage U _c												
– at 50 Hz		V		24 ... 690								
– at 60 Hz		V		24 ... 690								
Coil operating limits according to IEC 60947-4-1					ø ≤ 70 °C							
					0.85 ... 1.1 x U _c							
Drop-out voltage in % of U _c					roughly 25 ... 65 %							
Coil consumption												
Average pull-in value		50 Hz	VA		550		1350					
		60 Hz	VA		600		1550					
		50/60 Hz ①	VA/VA		700/650		1700/1550					
Average holding value		50 Hz	VA/W		35/11		60/16					
		60 Hz	VA/W		40/12		65/19					
		50/60 Hz ①	VA/W		44/13		80/21					
Operating time												
between coil energization and:												
– N.O. contact closing			ms		13 ... 27		17 ... 35					
– N.C. contact opening			ms		8 ... 22		12 ... 30					
between coil de-energization and												
– N.O. contact opening			ms		5 ... 10		7 ... 13					
– N.C. contact closing			ms		9 ... 13		10 ... 16					

Magnet System Characteristics for AF... Contactors

Contactor types: AF...			145	185	210	260	300	400	460	580	750	
Rated control circuit voltage U _c												
– at 50 Hz	V		48 ... 250									
– at 60 Hz	V		48 ... 250									
– d.c.	V		24 ... 250									
Coil operating limits according to IEC 60947-4-1			ø ≤ 70 °C 0.85 ... 1.1 x U _c									
Drop-out voltage in % of U _c			55 %									
Coil consumption												
Average pull-in value	50 Hz	VA	430			470			890			850
	60 Hz	VA	430			470			890			850
	d.c.	W	500			520			990			950
Average holding value	50 Hz	VA/W	12/3.5			10/2.5			12/4			12/4.5
	60 Hz	VA/W	12/3.5			10/2.5			12/4			12/4.5
	d.c.	W	2			2			4			4.5
Operating time												
between coil energization and:												
– N.O. contact closing	ms		30 ... 115						50 ... 120			
– N.C. contact opening	ms		30 ... 115						50 ... 120			
between coil de-energization and												
– N.O. contact opening	ms		25 ... 80						40 ... 70			
– N.C. contact closing	ms		25 ... 80						40 ... 70			

① 50/60 Hz coils: voltage codes 8 0 to 8 8. see page 1.28.

IEC Technical data

AF1350 — AF1650

Magnet System Characteristics for AF... Contactors

Contactor types: AF...			1350	1650
Rated control circuit voltage U _c				
– at 50 Hz	V		100 - 250	
– at 60 Hz	V		100 - 250	
– d.c.	V		100 - 250	
Coil operating limits according to IEC 60947-4-1			θ ≤ 70 °C 0.85 ... 1.1 x U _c	
Drop-out voltage in % of U _c			55 %	
Coil consumption				
Average pull-in value	50 Hz	VA	1900	
	60 Hz	VA	1900	
	d.c.	W	1700	
Average holding value	50 Hz	VA/W	48/17	
	60 Hz	VA/W	48/17	
	d.c.	W	16	
Operating time				
between coil energization and:				
– N.O. contact closing	ms		50 - 80	
– N.C. contact opening			ms	50 - 80
between coil de-energization and				
– N.O. contact opening	ms		ms	35 - 55
– N.C. contact closing			35 - 55	
With PLC				
between coil energization and				
– N.O. contact opening	ms		ms	40 - 65
– N.C. contact closing			40 - 65	
between coil de-energization and				
– N.O. contact opening	ms		ms	10 - 30
– N.C. contact closing			10 - 30	

① 50/60 Hz coils: voltage codes 8 0 to 8 8. see page 1.28.

IEC Technical data

AE9 — AE110

TAE45 — TAE110

Across the line
1

Magnet System Characteristics for AE... Contactors

Contactor types:	AE...		9	12	16	26	30	40	45	50	63	75	95	110
Rated control circuit voltage U _c	V d.c.		12 ... 250											
Coil operating limits according to IEC 60947-4-1			Ø ≤ 55 °C 0.85 ... 1.1 x U _c										Ø ≤ 70 °C	
Drop-out voltage in % of U _c			roughly 10 ... 30 %						roughly 15 ... 40 %					
Coil consumption - Average values														
– pull-in value	W		90			110			200				400	
– holding value	W		2			2.5			4				2.4	
Coil time constant														
– open	L/R	ms	2			3			3				6	
– closed	L/R	ms	9			16			15				30 ... 40	
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 opening		ms	5 ... 14 ①			6 ... 12 ①			5 ... 15 ①			15 ... 20 ①		
– N.C. contact closing		ms	11 ... 17 ①			8 ... 16 ①			8 ... 18 ①			18 ... 23 ①		

Magnet System Characteristics for TAE... Contactors

Contactor types:	TAE...	–	–	–	–	–	–	45	50	–	75	95	110
Rated control circuit voltage U_c	V d.c.	17 ... 264											
Coil operating limits according to IEC 60947-4-1		$\varnothing \leq 55^\circ\text{C}$ U_c min. ... U_c max.											
Drop-out voltage in % of U_c max.		roughly 20 ... 35 %											
Coil consumption values for U_c min. ... U_c max.													
– pull-in value	W							120 ... 250				300 ... 1000	
– holding value	W							1.7 ... 6.5				2 ... 7	
Coil time constant													
– open	L/R	ms						3				6	
– closed	L/R	ms						15				40	
Operating time between coil energization and:													
– N.O. contact closing	ms							13 ... 30				15 ... 25	
– N.C. contact opening	ms							10 ... 27				12 ... 22	
Operating time between coil de-energization and:													
– N.O. contact opening	ms							5 ... 15 ②				15 ... 20 ②	
– N.C. contact closing	ms							8 ... 18 ②				18 ... 23 ②	

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. AE 9 ... AE 40 contactors and $U_c \geq 110$ V: table values for contactors with RV 5 surge suppressor (factory mounted).

② 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.

IEC Technical data

A9 — A110

Built-in Auxiliary Contacts - Utilization Characteristics

Contactor types: A...		9	12	16	26	30	40	45	50	63	75	95	110
Rated operational voltage U_e max.	V	690						—	—	—	—	—	—
Conventional free air thermal current I_{th} - $\theta \leq 40^\circ\text{C}$	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

A/AE9 — AF/TAE110

Across the line
1
contactors

Mounting characteristics

Contactor types:	A..., AE...	9	12	16	26	30	40	45	50	63	75	95	110
	AF..., TAE...	-	-	-	-	-	-	45	50	63	75	95	110
Mounting positions		see "Conditions for use"											
Mounting distances		The contactors can be assembled side by side											
Mounting													
on DIN rail		35 x 7.5 mm											
according to IEC 715 and EN 50022 / EN 50023		35 x 15 mm											
by screws (not supplied)		2 x M4											
		2 x M6											

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
A 9 ... A 110, AE 9 ... AE 110	1, 1 ± 30°, 2, 3, 4, 5	≤ 55 °C	0.85 ... 1.1 x U _c
		55 ... 70 °C	U _c
	6	≤ 55 °C	0.95 ... 1.1 x U _c
AF 45 ... AF 110	1, 1 ± 30°, 2, 3, 4, 5	≤ 70 °C	0.85 U _c min. ... 1.1 x U _c max.
	6 unauthorized	—	—
		> 55 °C unauthorized	—
TAE 45 ... TAE 110	1, 1 ± 30°, 2, 3, 4, 5	≤ 55 °C	U _c min. ... U _c max.
	6 unauthorized	—	—
		> 55 °C unauthorized	—

Notes for 4-pole contactors

Whatever the coil voltage: Pos. 5 unauthorized for A 45-22-00, AE 45-22-00, A 75-22-00, AE 75-22-00 contactors.

For 60 Hz coil voltage: (only for devices fitted with CA 5-.. and CAL 5-11 auxiliary contacts or TP timer)

– A 45-40-00, A 50-40-00 and A 75-40-00 contactors

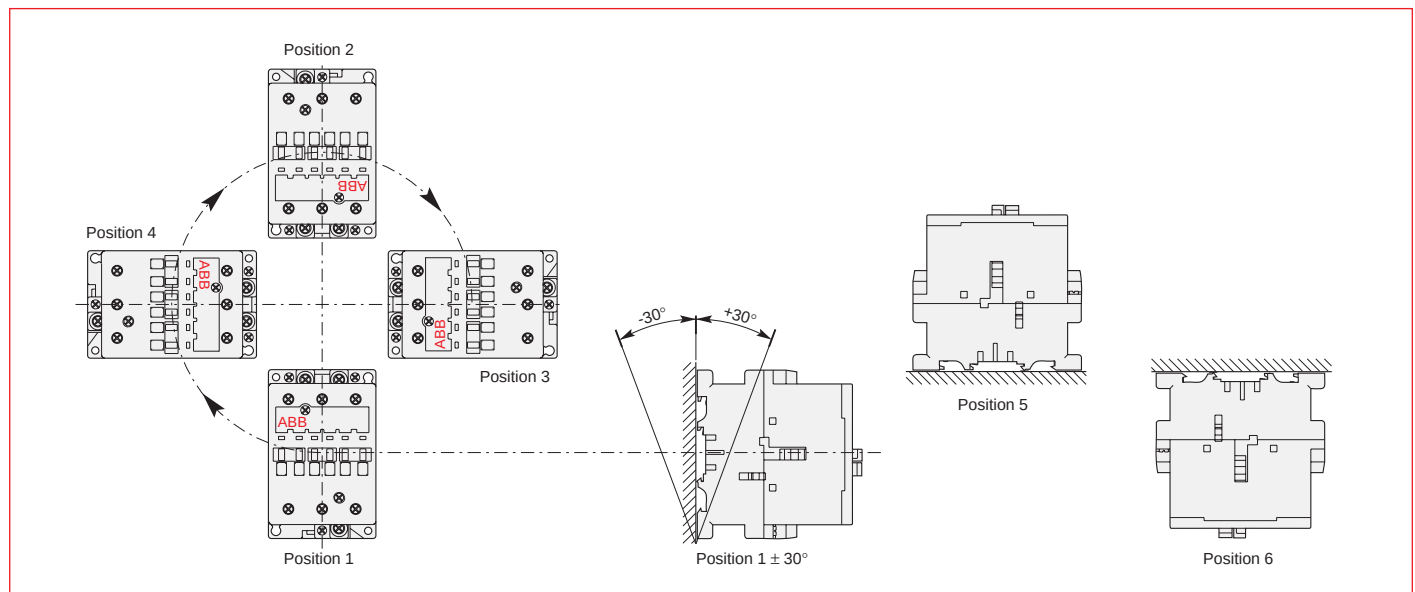
Mounting positions 1 to 5 and ambient temperature ≤ 55 °C: tolerance reduced to 0.9 ... 1.1 U_c (instead of 0.85 ... 1.1 U_c) for coil voltage codes 7 □ and 8 □.

– A 45-22-00 and A 75-22-00 contactors

Mounting positions 1 to 4 (pos. 5 unauthorized) and ambient temperature ≤ 55 °C: tolerance reduced to 0.9 ... 1.1 U_c (instead of 0.85 ... 1.1 U_c) for coil voltage codes 7 □ and 8 □.

For mounting position 6 or ambient temperature of 55 to 70 °C the information given on this page remains applicable.

Mounting Positions (see the above table for authorized positions)



IEC Technical data

A/AF145 — AF1650

Mounting Characteristics — A/AF145 — AF750

Contactor types:	A...	145	185	210	260	300	—	—	—	—
	AF...	145	185	210	260	300	400	460	580	750
Mounting positions	see "Condition for use"									
Mounting distances	The contactors can be assembled side by side									
Fixing										
on DIN rail according to IEC 715 and EN 50022 / EN 50023	—	—	—	—	—	—	—	—	—	—
by screws (not supplied)	4 x M5					4 x M6				

Mounting Characteristics — AF1350 — AF1650

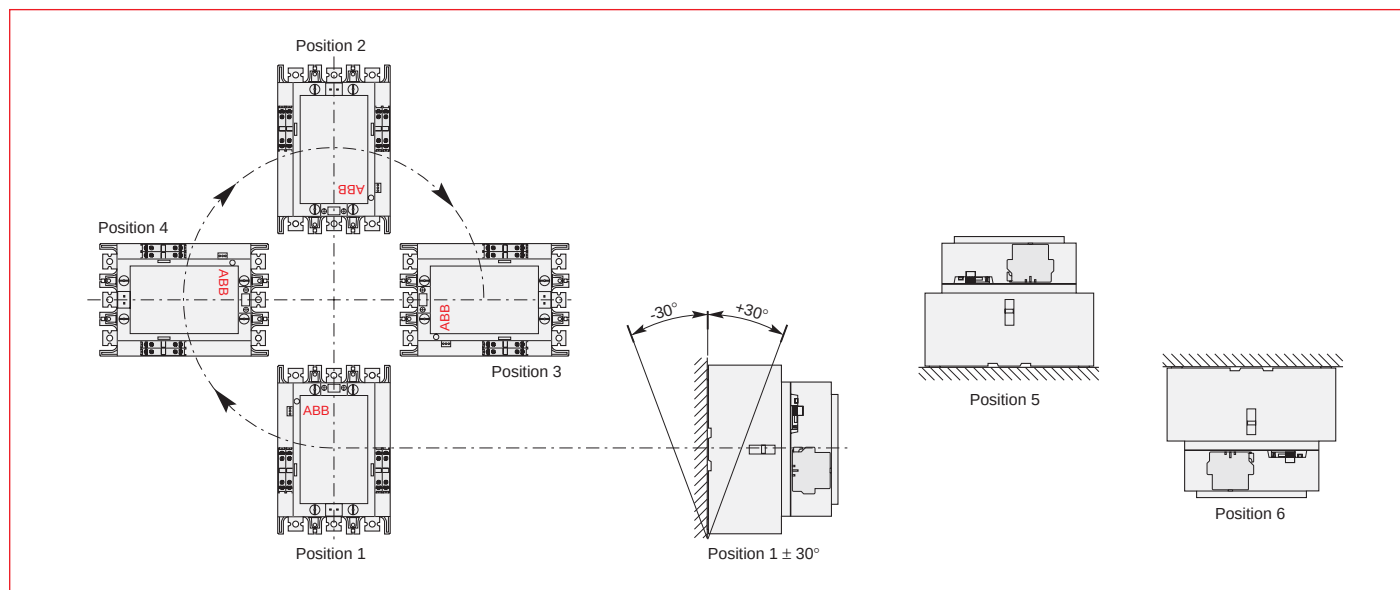
Contactor types:	AF	1350	1650
Mounting positions	see "Condition for use"		
Mounting distances	The contactors can be assembled side by side		
Fixing			
on DIN rail according to IEC 715 and EN 50022 / EN 50023	—	—	—
by screws (not supplied)	4 x M8		

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
A 145 ... A 300	1, $1 \pm 30^\circ$, 2, 3, 4, 5	$\leq 70^\circ\text{C}$	$0.85 \dots 1.1 \times U_c$
	6 unauthorized	—	—
AF 145 ... AF 750	1, $1 \pm 30^\circ$, 2, 3, 4, 5	$\leq 70^\circ\text{C}$	$0.85 \times U_c \text{ min. } \dots 1.1 \times U_c \text{ max.}$
	6 unauthorized	—	—

Mounting Positions (see the above table for authorized positions)

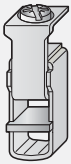
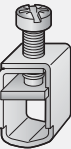
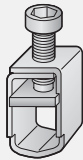


IEC Technical data

A/AE9 — AF/TAE110

Across the line
1

Connecting Characteristics

Contactor types:	A..., AE...	9	12	16	26	30	40	45	50	63	75	95	110		
	AF..., TAE...	-	-	-	-	-	-	45	50	63	75	95	110		
Main terminals															
		with cable clamp				with double connector 2 x (5.6 x 6.5 mm)		with single connector (13 x 10 mm)				with single connector (14 x 14 mm)			
Connecting capacity (min. ... max.)															
Main conductors (poles)															
Rigid: solid (≤ 4 mm²)			1 x mm²	1 ... 4		1.5 ... 6		2.5 ... 16		6 ... 50		10 ... 95			
stranded (≥ 6 mm²)			2 x mm²	1 ... 4		1.5 ... 6		2.5 ... 16		6 ... 16		6 ... 35			
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		6 ... 35		10 ... 70			
			2 x mm²	0.75 ... 2.5		0.75 ... 4		2.5 ... 10		6 ... 25		6 ... 35			
Bars or lugs			L mm ≤ l mm >	8 3.7		10 4.2		- -		- -		30 ② 6			
Auxiliary conductors															
(built-in auxiliary terminals + coil terminals)															
Rigid solid															
			1 x mm²	1 ... 4								0.75 ... 2.5			
			2 x mm²	1 ... 4								0.75 ... 2.5			
Flexible with cable end															
			1 x mm²	0.75 ... 2.5						1 ... 2.5		0.75 ... 2.5			
			2 x mm²	0.75 ... 2.5											
Lugs			L mm ≤ l mm >	8 3.7		① 8 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						IP 10							
– 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										hexagon socket			
		M3.5		M4		M5		M6		M8 (s = 4 mm)					
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		4.00 / 35		6.00 / 53				
– max.		Nm	1.20		2.20		2.60		4.50		6.50				
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 1.34													

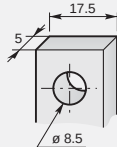
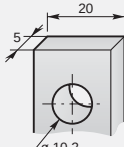
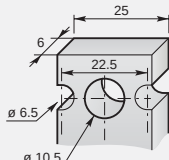
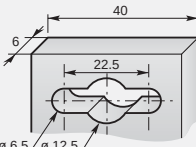
① L $\leq$ 8 and l $>$ 3.7 for coil terminal - L $\leq$ 10 and l $>$ 4.2 for built-in auxiliary terminals.

② With LW 110 enlargement piece. See page 1.31.

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 mm ²	—	—	—	—	—	—	—	—	—
		2 x mm ²	—	—	—	—	—	—	—	—	—
Rigid with connector											
single for Cu cable		mm ²	6 ... 185	16 ... 240			240			300	
single for Al/Cu cable		mm ²	25 ... 150	120 ... 240			240			300	
double for Al/Cu cable		mm ²	—	2 x 95 ... 120			2 x 240			3 x 185	
Flexible		1 x mm ²	—	—	—	—	—	—	—	—	
		2 x mm ²	—	—	—	—	—	—	—	—	
Bars or lugs		L mm ≤ Ø mm >	24 8	32 10			47 / 45 10			52 / 50 12	
Auxiliary conductors (coil terminals)											
Rigid solid		1 x mm ²	1 ... 4								
		2 x mm ²	1 ... 4								
Flexible with cable end		1 x mm ²	0.75 ... 2.5								
		2 x mm ²	0.75 ... 2.5								
Lugs		L mm ≤ l mm >	8 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								

IEC Technical data

AF1350 — AF1650

Across the line
contactors

1

Connecting Characteristics

Contactor types: AF...		1350	1650
Main terminals			
Flat type			
Connecting capacity (min. ... max.)			
Main conductors (poles)			
Rigid:	 1 x mm ²	—	—
	 2 x mm ²	—	—
Rigid with connector			
single for Cu cable	 mm ²	—	—
single for Al/Cu cable	 mm ²	—	—
double for Al/Cu cable	 mm ²	—	—
Flexible	 1 x mm ²	—	—
	 2 x mm ²	—	—
Bars or lugs	 L mm ≤ Ø mm >	100 12	100 12
Auxiliary conductors (coil terminals)			
Rigid solid	 1 x mm ²	1...4	1...4
	 2 x mm ²	1...4	1...4
Flexible with cable end	 1 x mm ²	0.75...2.5	0.75...2.5
	 2 x mm ²	0.75...2.5	0.75...2.5
Lugs	 L mm ≤ l mm >	8 3.7	8 3.7
Degree of protection acc. to IEC 60947-1 / EN 60947-1 and IEC 60529 / EN 60529			
– Main terminals		IP 00	IP 00
– Coil terminals		IP 20	IP 20
– Built-in auxiliary terminals			
Screw terminals		Screw and bolts	
Main terminals		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	45/443	45/443
– max.	Nm	49	49
Coil terminals			
– recommended	Nm / lb.in	1.00 / 9	1.00 / 9
– max.	Nm	1.20	1.20
Built-in auxiliary terminals			
– recommended	Nm / lb.in	—	—
– max.	Nm	—	—

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		1/2 sinusoidal shock for 11 ms: no change in contact position																							
Mounting position 1 (see page 1.50)		<table><tr><td>Shock direction</td><td>Making position</td><td>Breaking position</td></tr><tr><td>A</td><td>20 g</td><td>20 g</td></tr><tr><td>B1</td><td>10 g</td><td>5 g</td></tr><tr><td>B2</td><td>15 g</td><td>15 g</td></tr><tr><td>C1</td><td>20 g</td><td>20 g</td></tr><tr><td>C2</td><td>20 g</td><td>20 g</td></tr></table>						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
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

Across the line
contactors

1

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 $\vartheta \leq 40^\circ\text{C}$ with conductor cross-sectional area mm^2	A 4	26 4	28 4	30 6	45 16	65 16	65 35
Rated operational current I_e / AC-1 for air temperature close to contactor							
U_e max. 690 V							
$\vartheta \leq 40^\circ\text{C}$	A	25	27	30	45	55	60
$\vartheta \leq 55^\circ\text{C}$	A	22	25	27	40	55	60
$\vartheta \leq 70^\circ\text{C}$ ③	A	18	20	23	32	39	42
with conductor cross-sectional area mm^2		2.5	4	4	6	10	16
Utilization categorie AC-3							
for air temperature close to contactor $\leq 55^\circ\text{C}$							
Rated operational current I_e AC-3 ①							
220-230-240 V	A	9	12	17	26	33	40
3-phase motors 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							
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 excluded							
$U_e \leq 500$ 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 $\cos \varphi = 0.45$ ($\cos \varphi = 0.35$ 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		$\theta \leq 55^\circ\text{C}$ 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		$\theta \leq 55^\circ\text{C}$ 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							
– U_c max. DC	W	8.5			9		
– U_c min. DC	W	2.5			2.7		
– U_c 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.

IEC Technical data

AL9 — AL40

Across the line
contactors

1

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} - $\theta \leq 40$ °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	35 x 7.5 mm						
according to IEC 715 and EN 50022 / EN 50023	35 x 15 mm						
by screws (not supplied)	2 x M4						

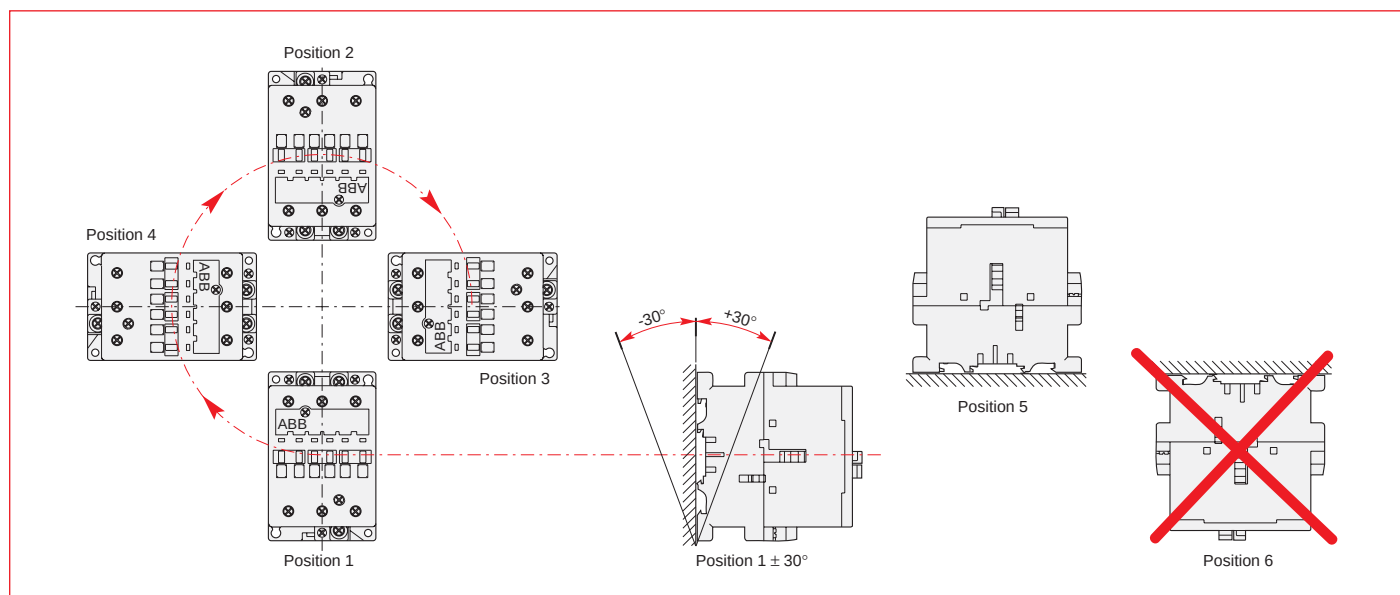
Conditions for Use

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.

Mounting position	Ambient temperature	Control voltage
1, 1 ± 30°, 2, 3, 4, 5	≤ 55 °C	0.85 ... 1.1 x U _c
6 (Unauthorized)	55 ... 70 °C	U _c

AL9 – AL40

Mounting Positions (see the above table for authorized positions)



IEC Technical data

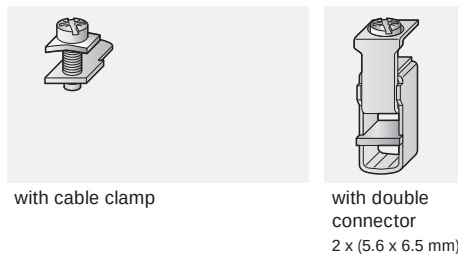
AL9 — AL40

Across the line
1

Connecting Characteristics

Contactor types: AL AL9 AL12 AL16 AL26 AL30 AL40

Main terminals



Connecting capacity (min. ... max.)

Main conductors (poles)

Rigid: solid ($\leq 4 \text{ mm}^2$) stranded ($\geq 6 \text{ mm}^2$)		1 x mm^2	1 ... 4			1.5 ... 6	2.5 ... 16
		2 x mm^2	1 ... 4			1.5 ... 6	2.5 ... 16
Rigid with connector		mm^2	—	—	—	—	—
single for Cu cable		mm^2	—	—	—	—	—
single for Al/Cu cable		mm^2	—	—	—	—	—
double for Al/Cu cable		mm^2	—	—	—	—	—
Flexible with cable end		1 x mm^2	0.75 ... 2.5			0.75 ... 4	2.5 ... 10
		2 x mm^2	0.75 ... 2.5			0.75 ... 4	2.5 ... 10
Bars or lugs		L mm $\leq$	8			10	—
		l mm $>$	3.7			4.2	—

Auxiliary conductors

(built-in auxiliary terminals + coil terminals)

Rigid solid		1 x mm^2	1 ... 4				
		2 x mm^2	1 ... 4				
Flexible with cable end		1 x mm^2	0.75 ... 2.5				
		2 x mm^2	0.75 ... 2.5				
Lugs		L mm $\leq$	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

– Main terminals
– Coil terminals
– Built-in auxiliary terminals

Protection against direct contact acc. to VDE 0106 - Part. 100
IP 20
IP 20
IP 20

Screw terminals

Main terminals	(delivered in open position, screws of unused terminals must be tightened) (+, -) 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

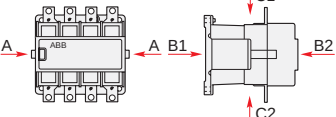
Terminal marking and positioning see pages 1.35

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

IEC Technical data

EK110 — 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

Across the line
contactors

1

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 $\varnothing \leq 40\text{ }^{\circ}\text{C}$ with conductor cross-sectional area	A mm ²	200 95	250 150	300 185	350 240	550 2 x 185	800 2 x 240	1000 2 x 300	
Rated operational current I _e / AC-1 for air temperature close to contactor									
U _e max. 690 V	$\varnothing \leq 40\text{ }^{\circ}\text{C}$	A	200	250	300	350	550	800	1000
	$\varnothing \leq 55\text{ }^{\circ}\text{C}$	A	180	230	270	310	470	650	800
	$\varnothing \leq 70\text{ }^{\circ}\text{C}$	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 categorie AC-3 for air temperature close to contactor $\leq 55\text{ }^{\circ}\text{C}$									
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 1800 r.p.m. 60 Hz 3-phase motors 	220-230-240 V	kW	30	45	59	110	160	–	
	380-400 V	kW	55	75	110	200	280	–	
	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 $\leq$ 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 $\varnothing$ = 0.45 (cos $\varnothing$ = 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 according to IEC 60947-4-1			θ ≤ 70 °C						
			0.85 ... 1.1 x U _c						
Drop-out voltage in % of U _c			roughly 45 ... 65 %						
Coil consumption									
Average pull-in value	50 Hz ^①	VA	800		1100		3500		
	60 Hz ^①	VA	900		1200		4000		
	50/60 Hz ^②	VA/VA	500/500		630/630		3800/3400		
Average holding value	50 Hz ^①	VA/W	44/15		52/18		125/50		
	60 Hz ^①	VA/W	52/18		65/22		140/60		
	50/60 Hz ^②	VA/W	2.5/2.5		2.5/2.5		140/60		
Operating time									
between coil energization and:									
– N.O. contact closing		ms	20 ... 40 ^① / 30 ... 50 ^②				30 ... 60		
– N.C. contact opening		ms	15 ... 35 ^① / 25 ... 45 ^②				25 ... 55		
between coil de-energization and:									
– N.O. contact opening		ms	7.5 ... 15 ^① / 95 ... 120 ^②				10 ... 20		
– N.C. contact closing		ms	10 ... 18 ^① / 100 ... 125 ^②				13 ... 23		

Magnet System Characteristics for 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 according to IEC 60947-4-1		θ ≤ 70 °C						
		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.

IEC Technical data

EK110 — EK1000

Across the line
contactors

1

Mounting Characteristics

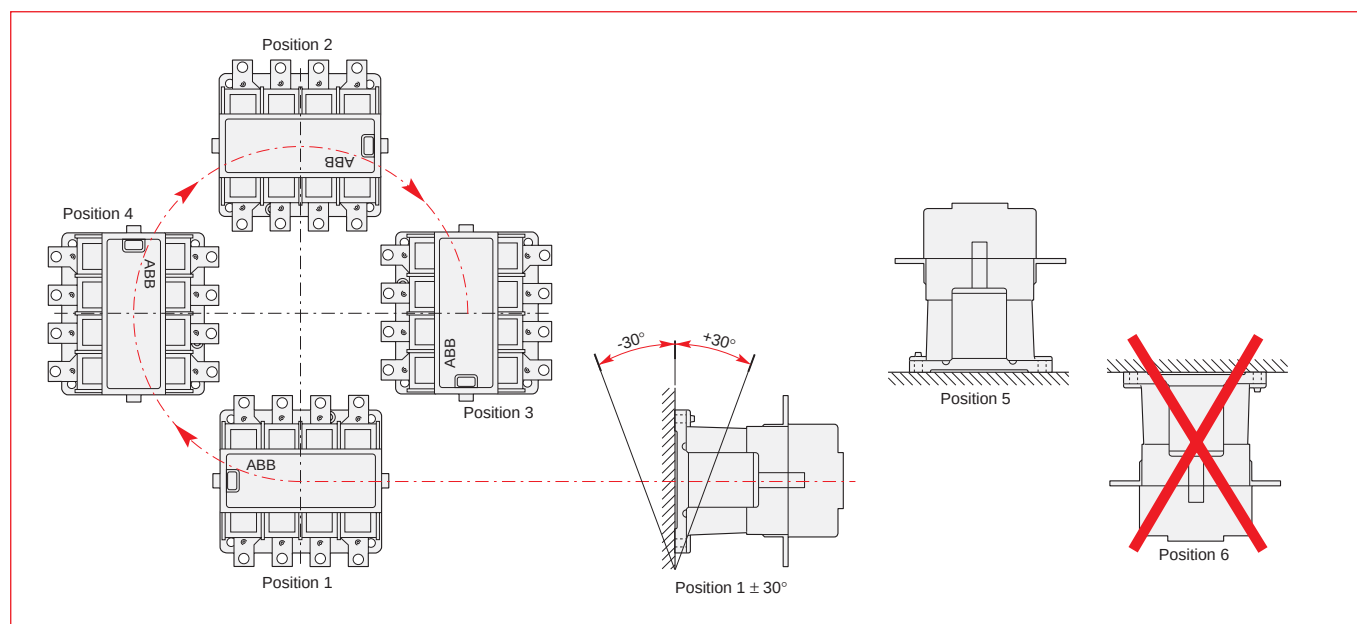
Contactor types:	EK...	110	150	175	210	370	550	1000
Mounting positions	see "Conditions for use"							
Fixing by screws (supplied)	4 x M6				4 x M6 (1)			

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, $1 \pm 30^\circ$, 3, 4, 5 2, 6 unauthorized	$\leq 70^\circ\text{C}$	$0.85 \dots 1.1 \times U_c$
E370 ... EK1000	1, $1 \pm 30^\circ$, 2, 3, 4, 5 6 unauthorized	$\leq 70^\circ\text{C}$	$0.85 \dots 1.1 \times U_c$

Mounting Positions (see the above table for authorized positions)



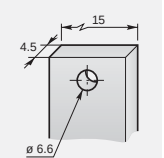
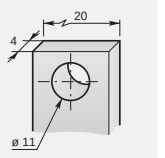
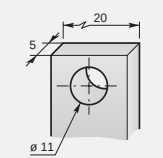
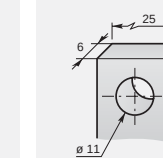
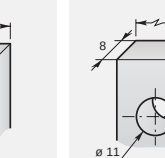
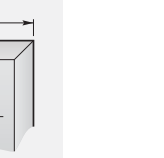
① Damping elements are supplied

IEC Technical data
EK110 — EK1000

Connecting Characteristics

Contactor types: EK...

Main terminals
Flat type

		110	150	175	210	370	550	1000
								
Connecting capacity (min. ... max.)								
Main conductors (poles)								
Rigid:		1 x mm ²	—	—	—	—	—	—
		2 x mm ²	—	—	—	—	—	—
Rigid with connector								
single for Cu cable mm ²		25 ... 120	—	—	70 ... 300	—	—	—
single for Al/Cu cable		mm ²	—	—	—	70 ... 300	—	95 ... 300
double for Al/Cu cable		mm ²	—	—	—	2 x 35 ... 185	—	2 x 95 ... 300
Flexible								
1 x mm ²		—	—	—	—	—	—	—
2 x mm ²		—	—	—	—	—	—	—
Bars or lugs		L mm ≤ Ø mm >	30 6	30 10	33 10	55 10	— —	— —
Auxiliary conductors (coil terminals)								
Rigid solid		1 x mm ²	0.5 ... 2.5	—	—	—	—	—
		2 x mm ²	0.5 ... 2.5	—	—	—	—	—
Flexible with cable end		1 x mm ²	0.5 ... 2.5	—	—	—	—	—
		2 x mm ²	0.5 ... 2.5	—	—	—	—	—
Lugs		L mm ≤ l mm >	8 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

Contactors electrical durability and Utilization categories

Across the line
contactors

1

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 combined 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.

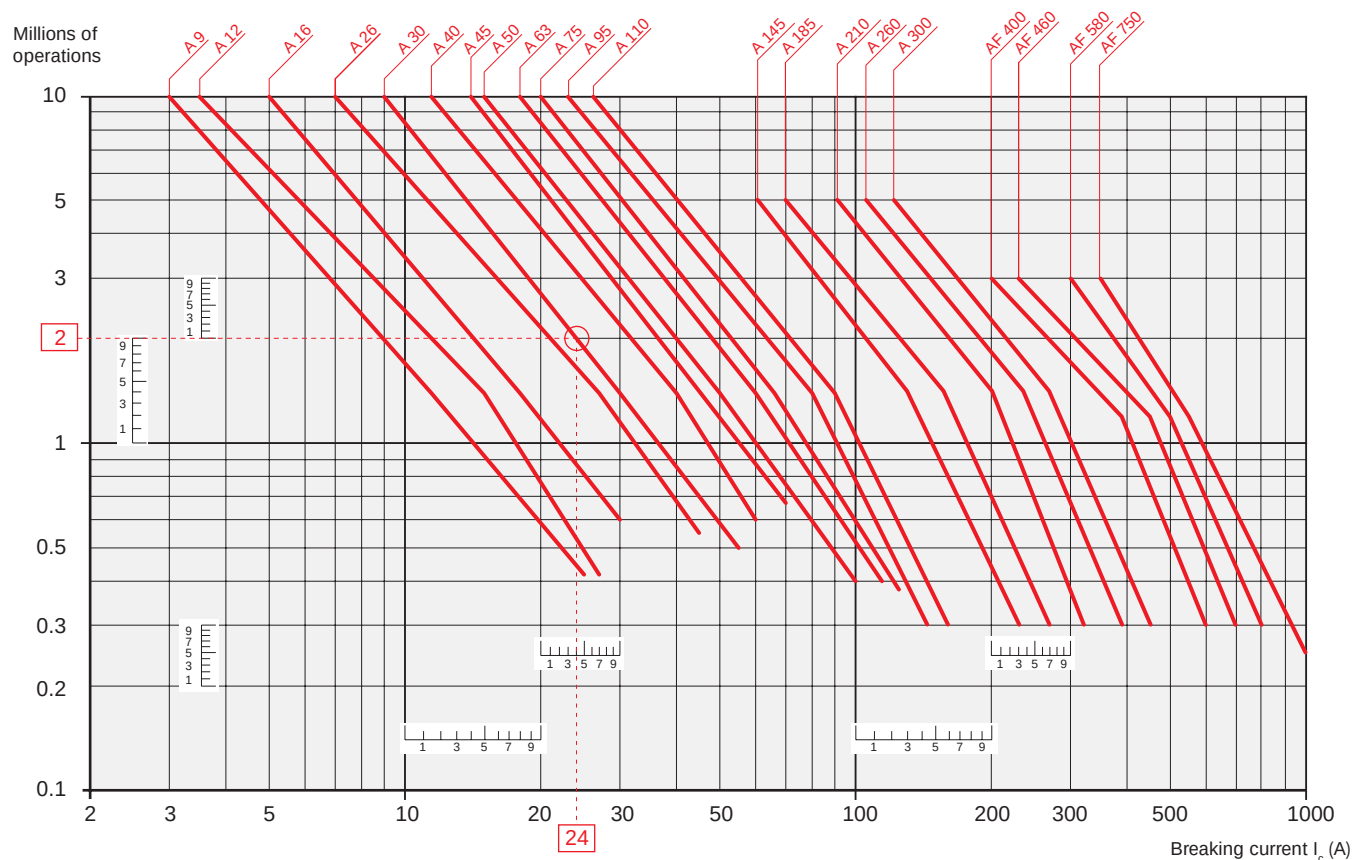
IEC Technical data

A9 — AF750

Electrical durability

Electrical Durability for AC-1 Utilization Category. Ambient Temperature $\leq 55\text{ }^{\circ}\text{C}$

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:

$I_c / \text{AC-1} = 24\text{ A}$ – Electrical durability required = 2 million operations.

Using the AC-1 curves above select the A 30 contactor at intersection "O" (24 A / 2 million operations).

IEC Technical data

A9 — AF750

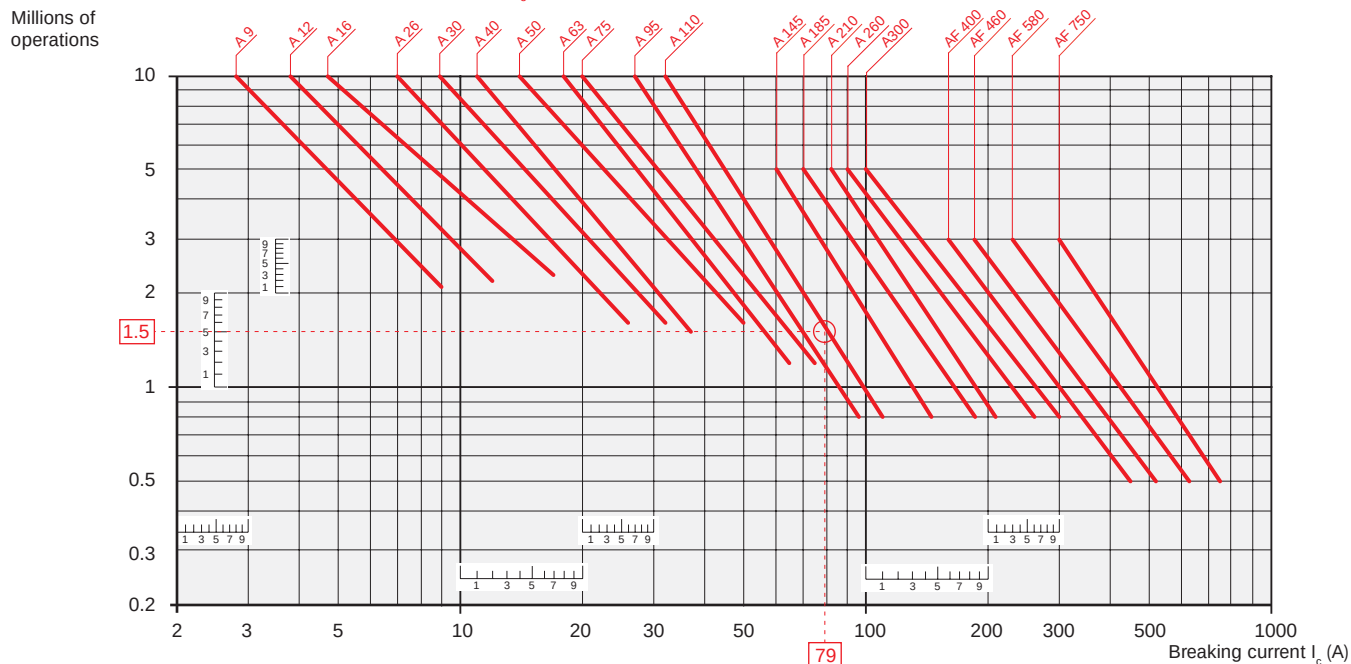
Electrical durability

Across the line
contactors

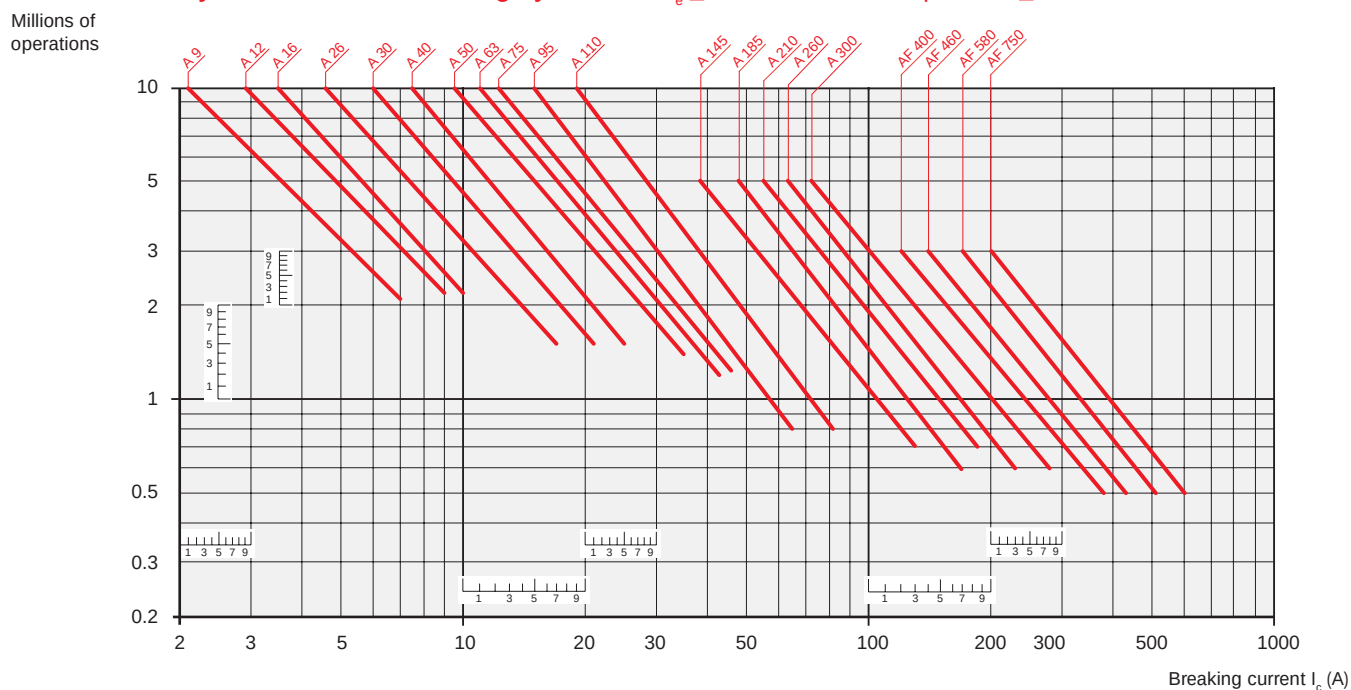
1

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 "O" (79 A / 1.5 million operations) on the curves (AC-3 - $U_e \leq 440$ V).

IEC Technical data

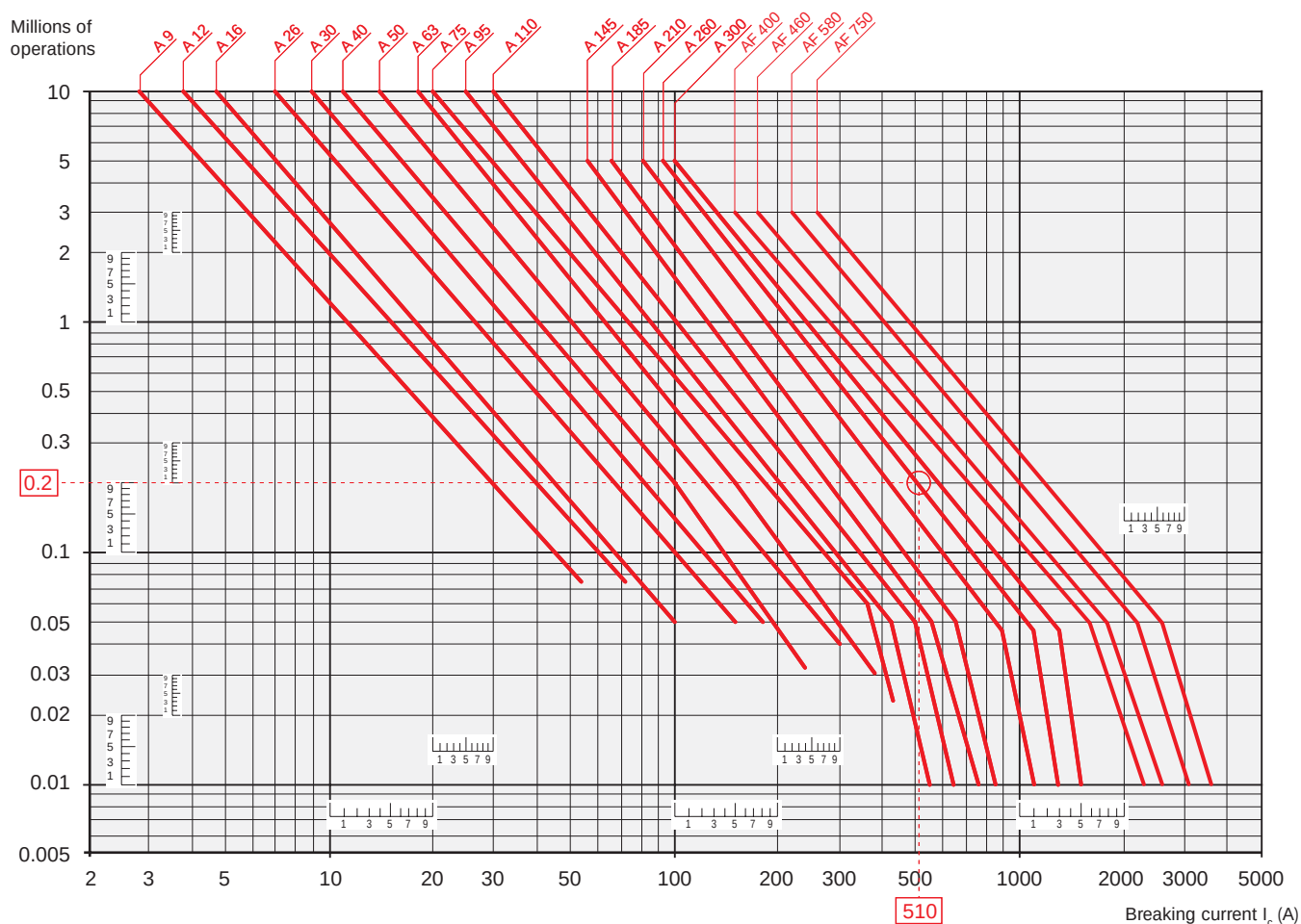
A9 — AF750

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 $2.5 \times I_e$ for AC-2 and $6 \times I_e$ 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: $I_c = 6 \times I_e = 510$ A - Select the A 260 contactor at intersection "O" (510 A / 0.2 million operations) on the curves (AC-4 - $U_e \leq 440$ V).

IEC Technical data

A9 — AF750

Electrical durability

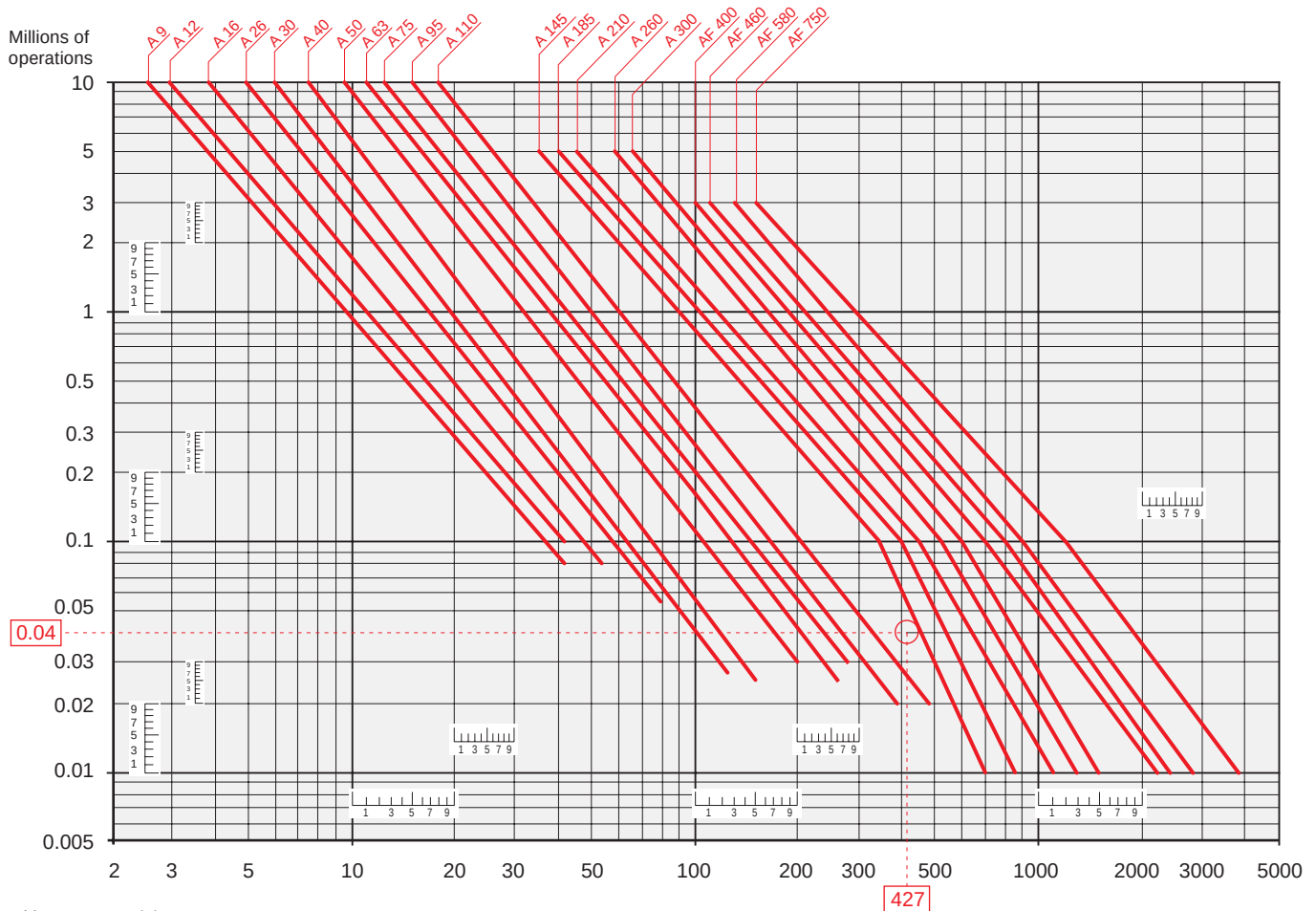
Across the line
contactors

1

Electrical Durability for AC-2 or AC-4 Utilization Category - $440\text{ V} < U_e \leq 690\text{ V}$. Ambient Temperature $\leq 55\text{ }^{\circ}\text{C}$

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 $2.5 \times I_e$ for AC-2 and $6 \times I_e$ for AC-4, keeping in mind that I_e is the motor rated operational current (I_e = motor full-load current).



Breaking current I_c (A)

Example:

Motor power 59 kW for AC-4 - $U_e = 600\text{ V}$ utilization – Electrical durability required = 0.04 million operations.

As stated on page 0/0: 59 kW, 600 V corresponds to $I_e = 71.1\text{ A}$.

For AC-4: $I_c = 6 \times I_e = 426.6\text{ A}$ - Select the A 145 contactor at intersection "O" (427 A / 0.04 million operations) on the curves (AC-4 - $440\text{ V} < U_e \leq 690\text{ V}$).

IEC Technical data

AL9 — AL40

Electrical durability

Consult
factory

IEC Technical data

EK110 — EK1000

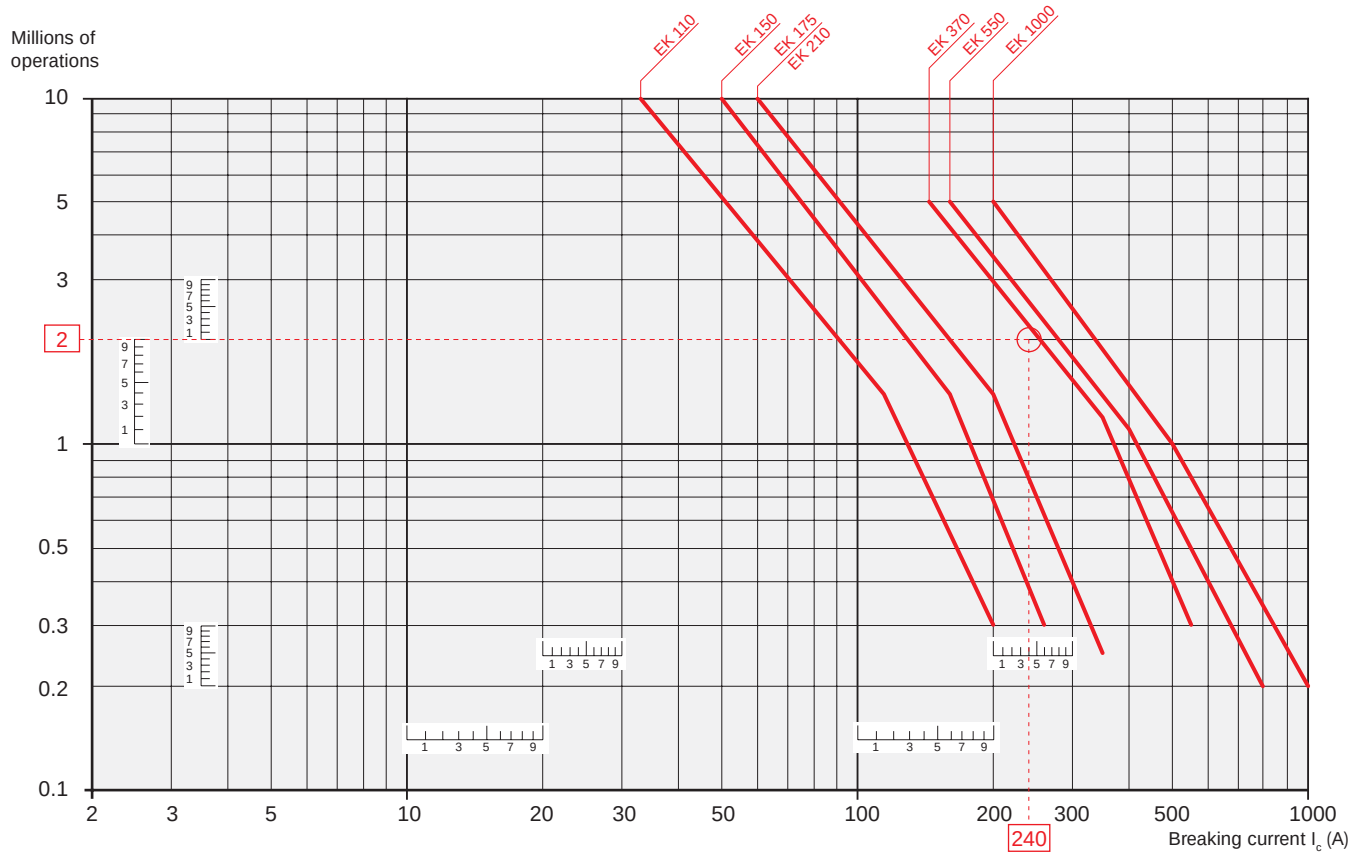
Electrical durability

Across the line
contactors

1

Electrical Durability for AC-1 Utilization Category. Ambient Temperature $\leq 55\text{ }^{\circ}\text{C}$

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:

$I_c / \text{AC-1} = 240\text{ A}$ – Electrical durability required = 2 million operations.

Using the AC-1 curves above select the EK 370 contactor at intersection "O" (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:

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

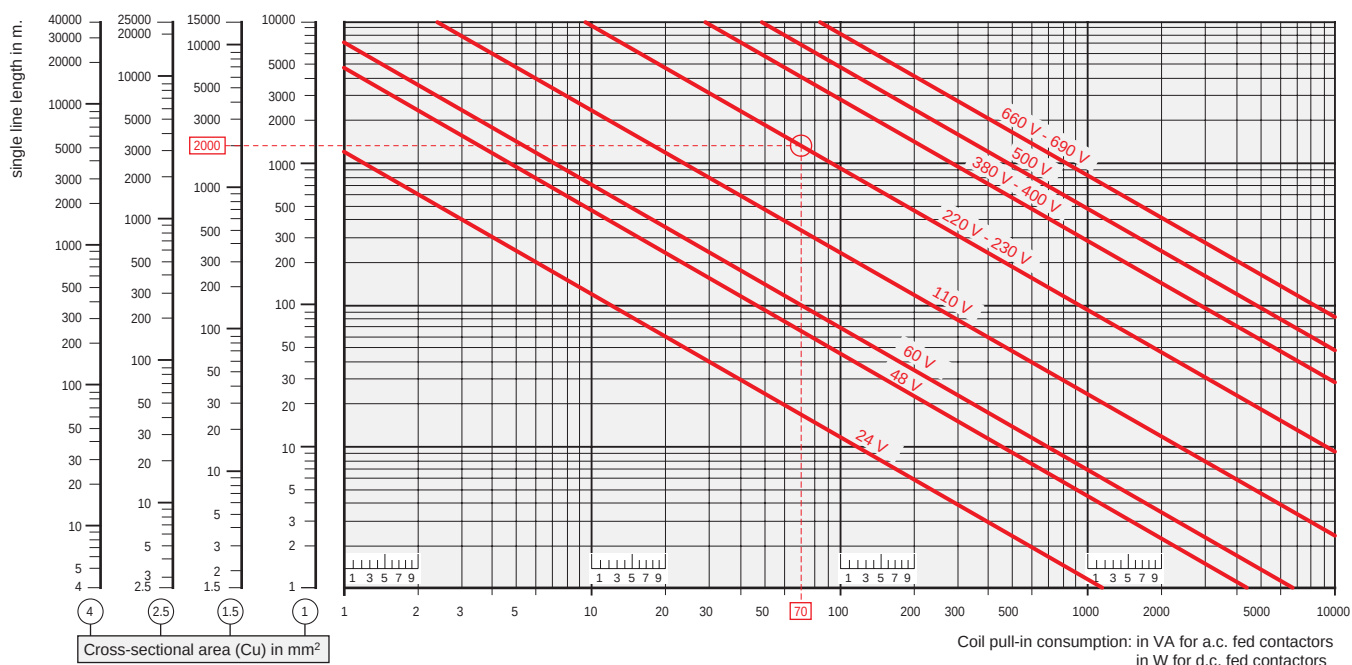
The graph has been drawn for a max. line voltage drop of 5 %.

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

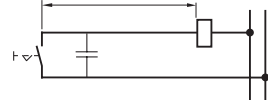
Coil voltage: 230 V 50 Hz, contactor coil pull-in power consumption: 70 VA,
control circuit conductor cross-sectional area: Cu 1.5 mm².

Max. permissible length: 2000 m.

IEC Technical data

Influence of the length of conductors used in contactor control circuits

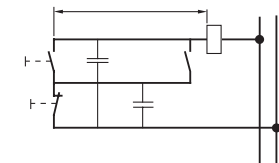
Single control line length



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_e).

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:

$$\text{sizing of parallel resistor: } R_p = \frac{10^3}{C} \quad (\text{with } C \text{ in } \mu\text{F})$$

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).

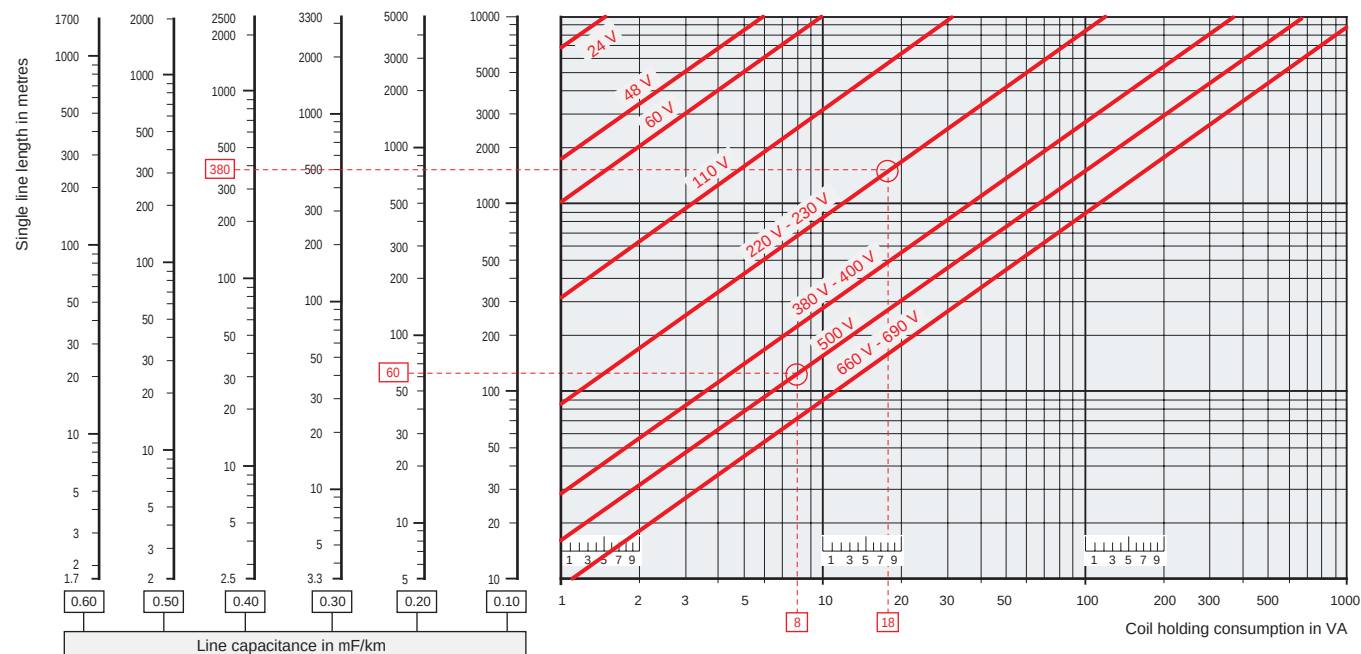
Wiring diagrams A and B opposite show two supply and coil control wiring examples.

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_e = 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_e = 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.

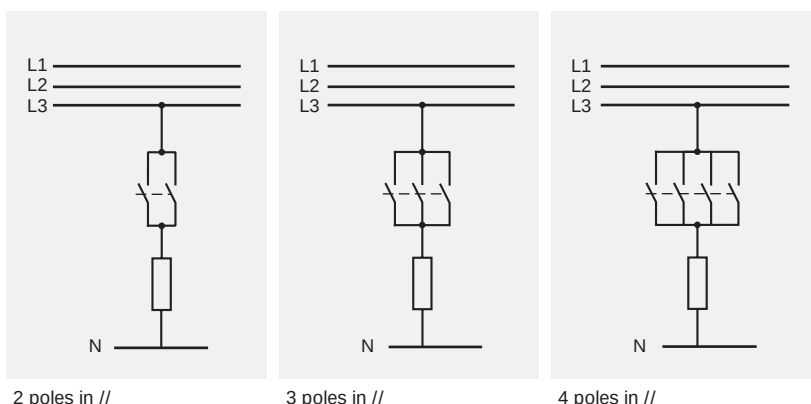
Remarks:

- Parallel connection of main poles to increase the d.c. resistive load is not acceptable.
- Parallel connection of main poles doesn't 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

Across the line
contactors

1

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)

Switching frequency

Current flow time per cycle

Factor to be applied to the current I_e / AC-1

Permissible current: $2.7 \times 22 =$

22 A

2 operations/h

20 s

2.7

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 U_c 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 U_c

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 occurred, 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 : $L/R = \text{mH}/\text{Ohm} = \text{ms}$.

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

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

Alternating current:	AC-12 AC-13 AC-14 AC-15	Control of resistive loads and solid state loads with isolation by opto couplers. Control of solid state loads with transformer isolation. Control of small electromagnetic loads (≤ 72 VA). Control of electromagnetic loads (> 72 VA).
Direct current:	DC-12 DC-13 DC-14	Control of resistive loads and solid state loads with isolation by opto couplers. Control of electromagnets. 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 – 415V ^①		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.

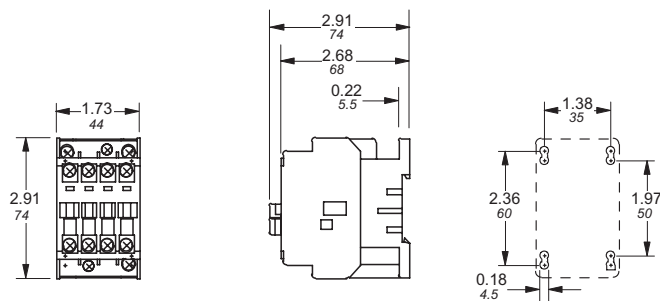
Approximate dimensions 3 pole contactors, A/AE9 – A/AE26

Across the line
contactors

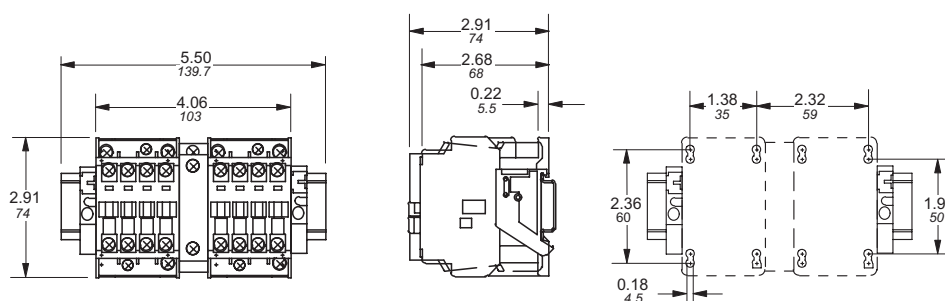
1

00.00 Inches
00.00 [Millimeters]

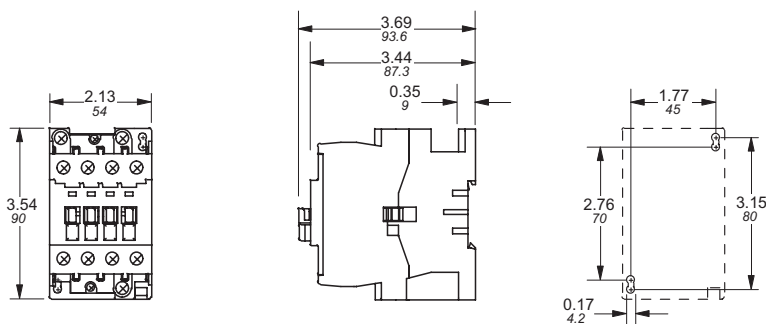
A/AE9 – A/AE16 — Contactor, 3 pole



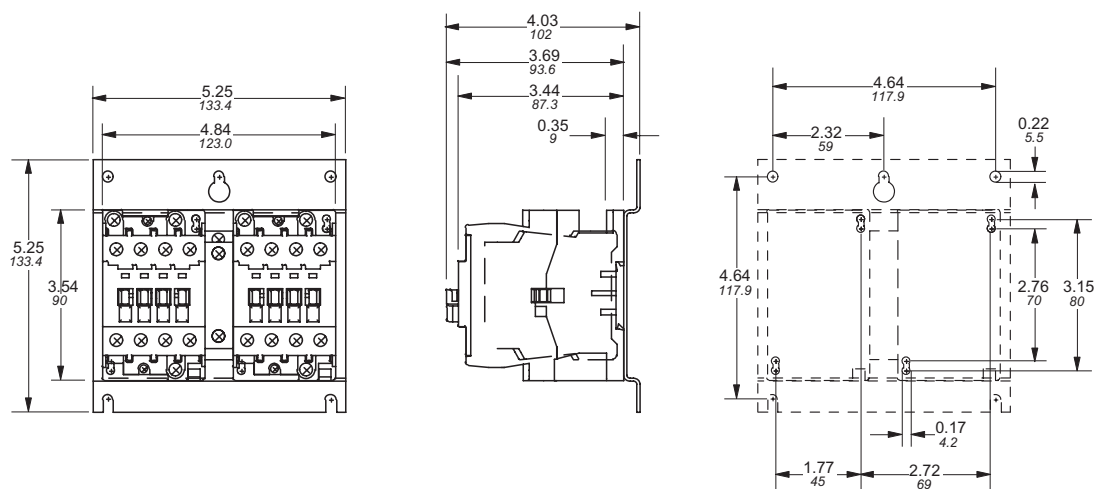
A/AE9 – A/AE16 + VM5 or VE5 — Mechanically interlocked contactor, 3 pole



A/AE26 — Contactor, 3 pole



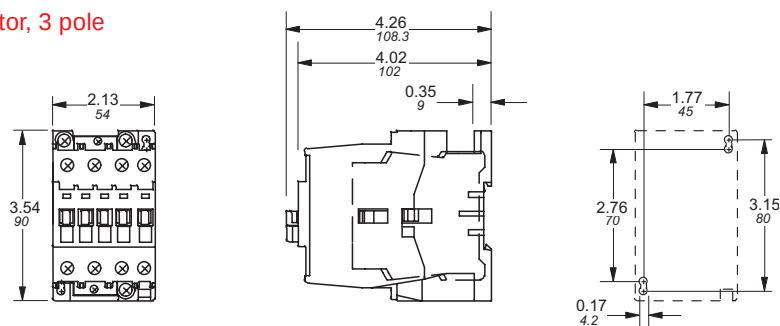
A/AE26 + VM5 or VE5 — Mechanically interlocked contactor, 3 pole



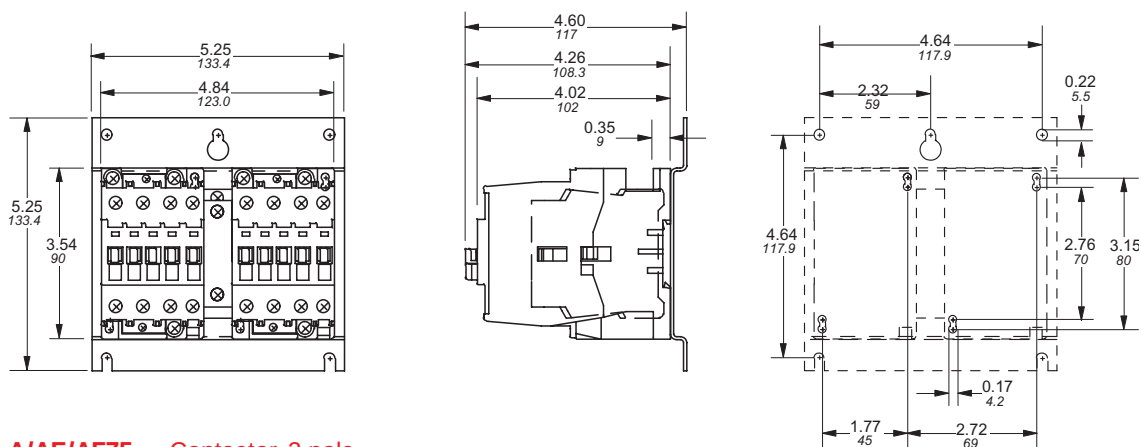
Approximate dimensions 3 pole , A/AE30 – A/AE/AF75

00.00 00.00 Inches
[Millimeters]

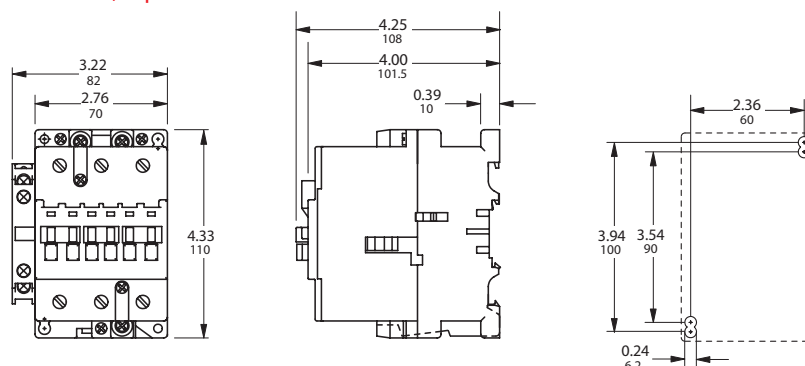
A/AE30 & A/AE40 — Contactor, 3 pole



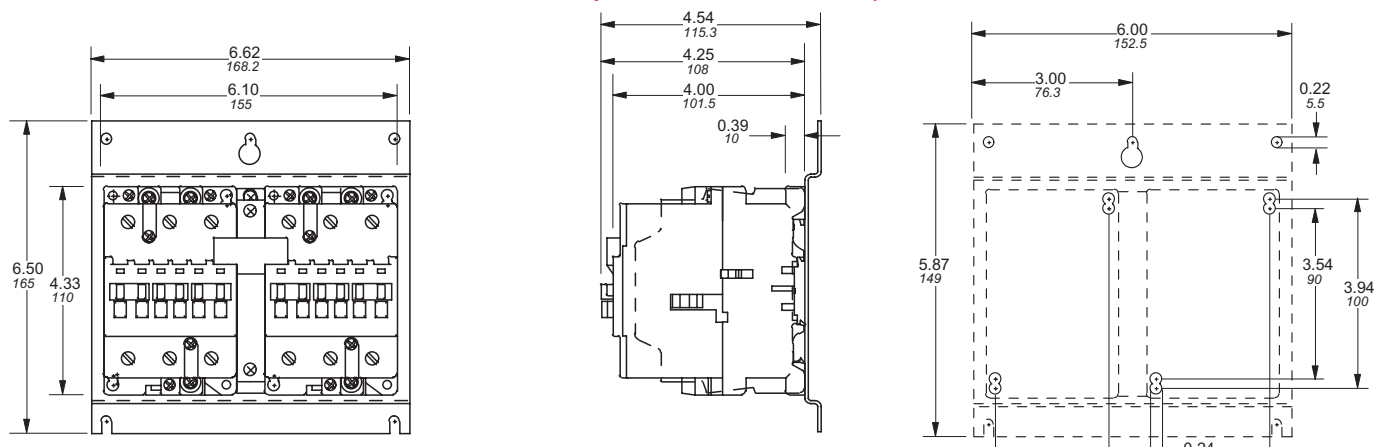
A/AE30 & A/AE40 + VM5 or VE5 — Mechanically interlocked contactor, 3 pole



A/AE/AF50 – A/AE/AF75 — Contactor, 3 pole



A/AE/AF50 – A/AE/AF75 + VM5 or VE5 — Mechanically interlocked contactor, 3 pole



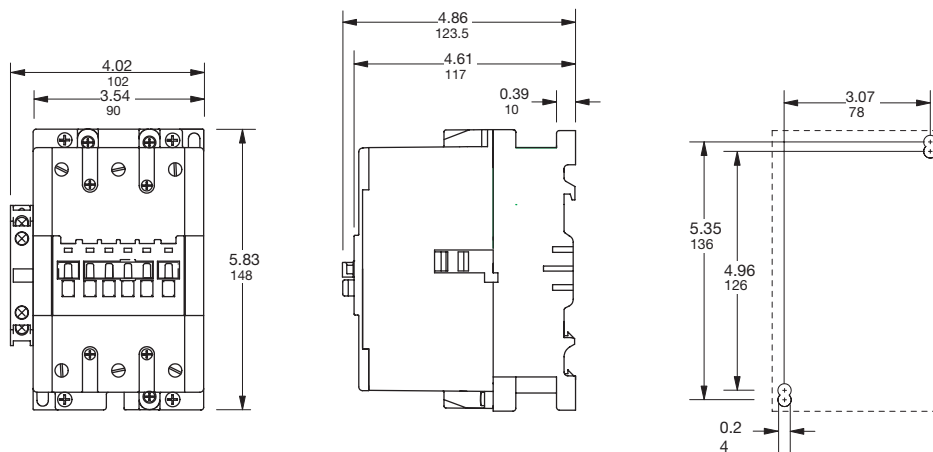
Approximate dimensions 3 pole, A/AE/AF95 & A/AE/AF110

Across the line
contactors

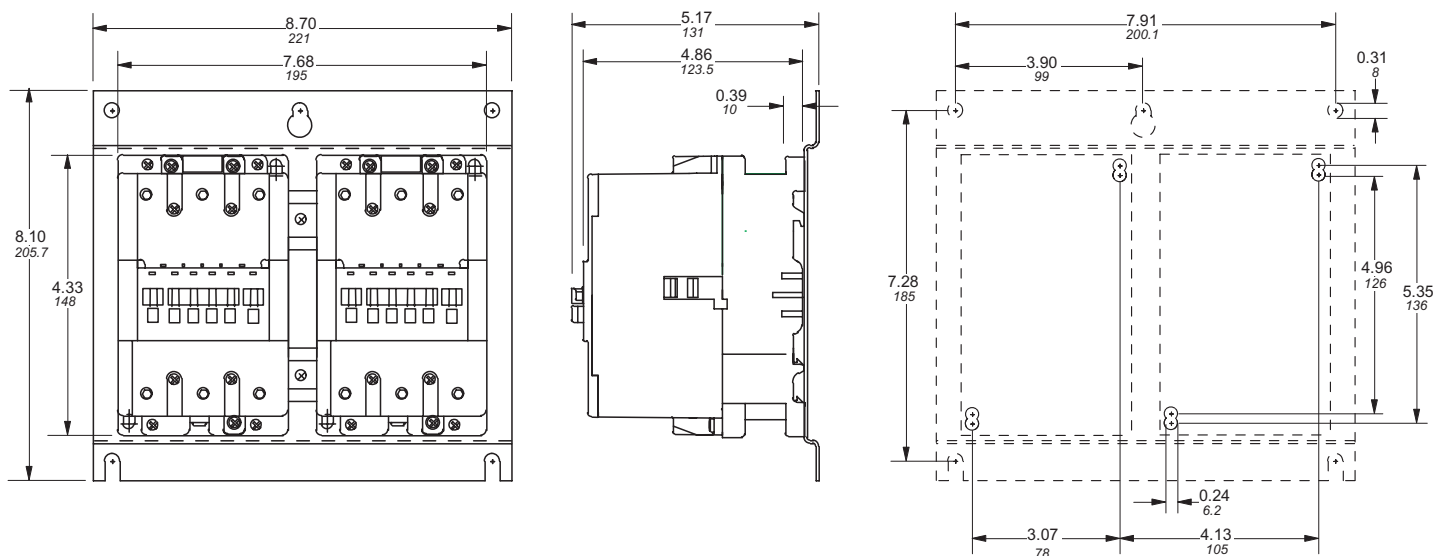
1

00.00 — Inches
00.00 — [Millimeters]

A/AE/AF95 & A/AE/AF110 — Contactor, 3 pole



A/AE/AF95 & A/AE/AF110 + VE5 — Mechanically interlocked contactor, 3 pole

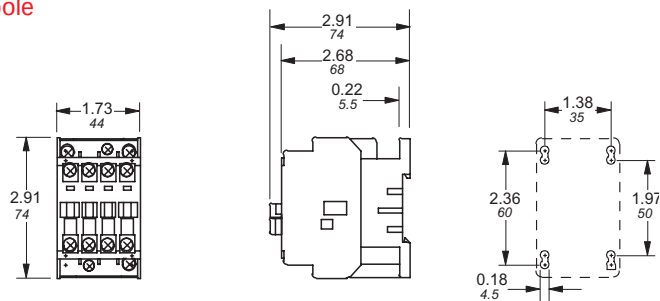


Approximate dimensions

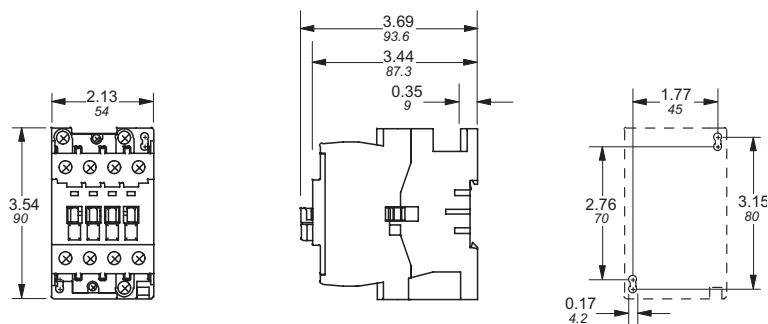
4 pole contactors, A/AE9 – A/AE/AF75

00.00 00.00 Inches
[Millimeters]

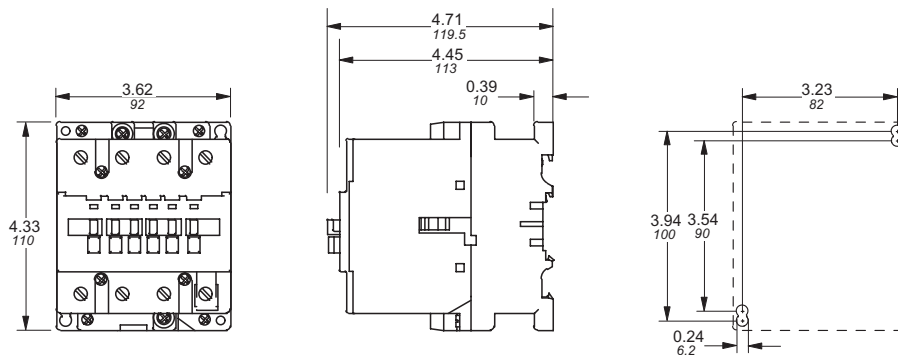
A/AE9 – A/AE16 — Contactor, 4 pole



A/AE26 — Contactor, 4 pole



A/AE/AF45 – A/AE/AF75 — Contactor, 4 pole

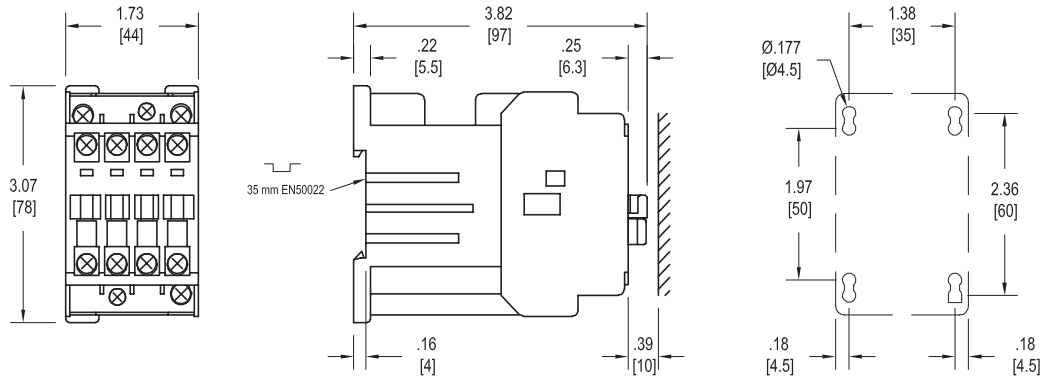


Approximate dimensions 3 & 4 pole contactors, AL9 – AL40

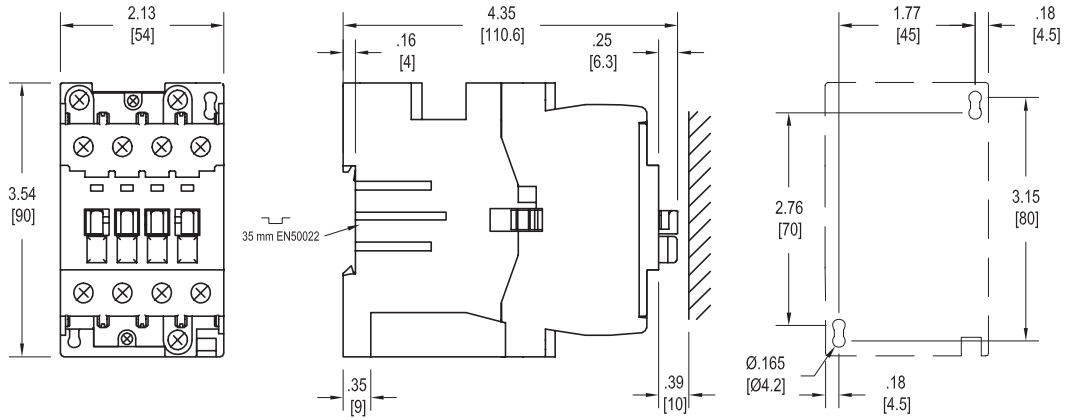
Across the line
1

00.00
00.00 Inches
[Millimeters]

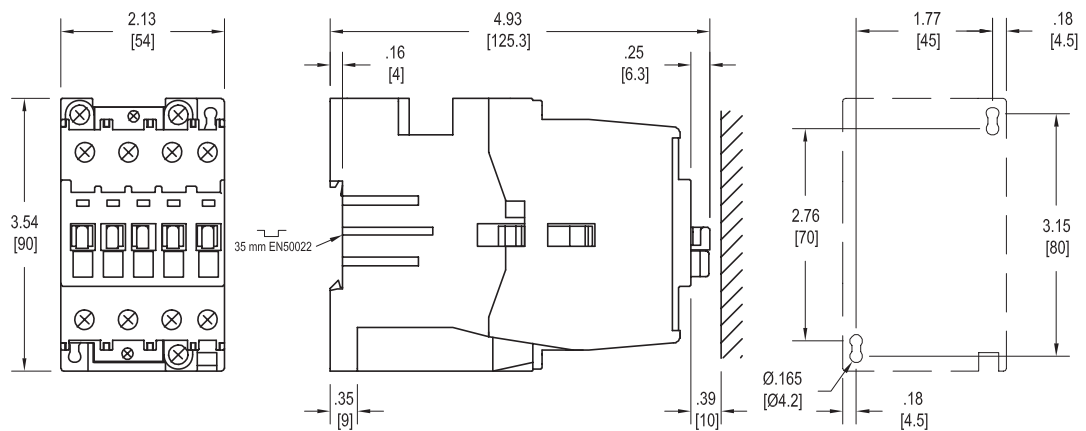
AL9, AL12,, AL16 — Contactor, 3 & 4 pole



AL26 — Contactor, 3 & 4 pole



AL30, AL40 — Contactor, 3 pole



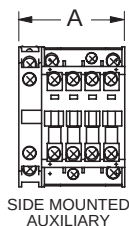
Approximate dimensions

Accessories for A/AE9 – A/AE/AF110

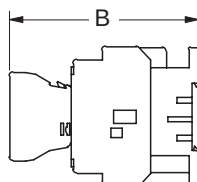
00.00 00.00 Inches
[Millimeters]

A/AE9 – A/AE40

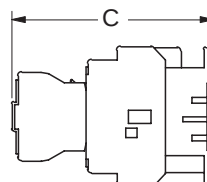
A/AE/AF50 – A/AE/AF110



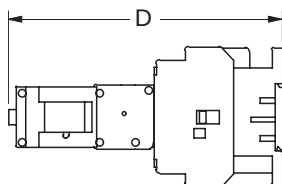
SIDE MOUNTED
AUXILIARY



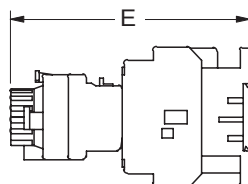
SINGLE POLE
TOP MOUNTED
AUXILIARY



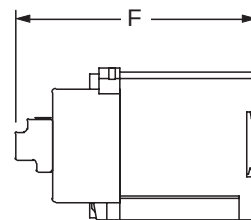
FOUR POLE
TOP MOUNTED
AUXILIARY



ON-POSITION
LATCH



PNEUMATIC
TIMER



MECH INTERLOCK D.C.
OPERATED

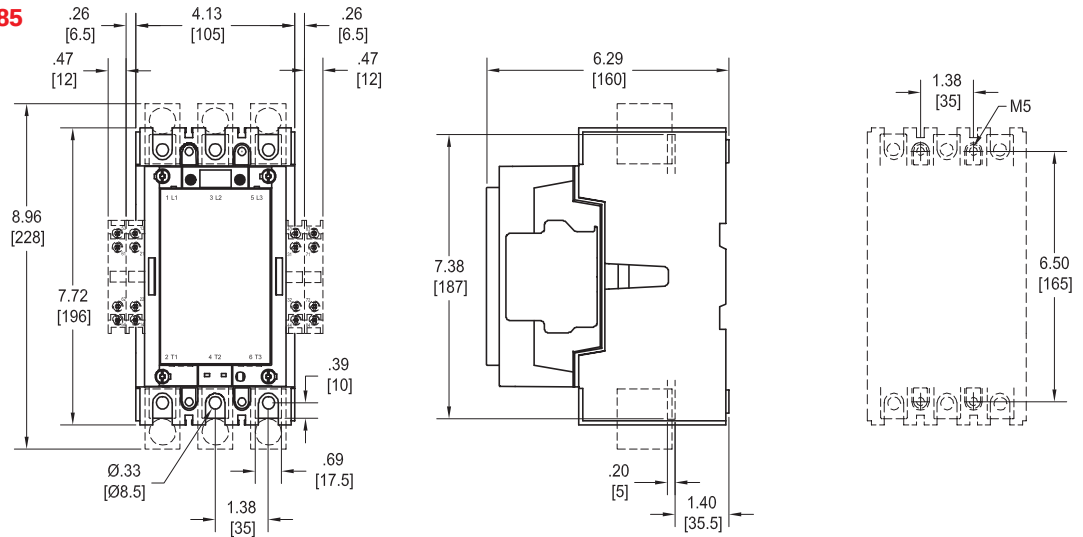
TYPE		A	B	C	D	E	F
A/AE9-16	IN	2.20	3.96	4.21	5.71	5.00	—
	MM	56	100.5	107	145	127	—
A/AE26	IN	2.20	4.72	4.97	6.47	5.76	—
	MM	56	119.8	126.3	164.3	146.3	—
A/AE30-40	IN	2.20	5.30	5.55	7.05	6.34	—
	MM	56	134.5	141	179	161	—
A/AE/AF50-75	IN	3.23	5.27	5.52	7.03	6.32	—
	MM	82	133.9	140.3	178.5	160.4	—
A/AE/AF45	IN	4.09	5.73	5.98	7.48	6.77	—
	MM	104	145.5	152	190	172	—
A/AE/AF95-110	IN	4.02	5.91	6.16	—	—	—
	MM	102	150	156.5	—	—	—

Approximate dimensions A/AF145 – A/AF185

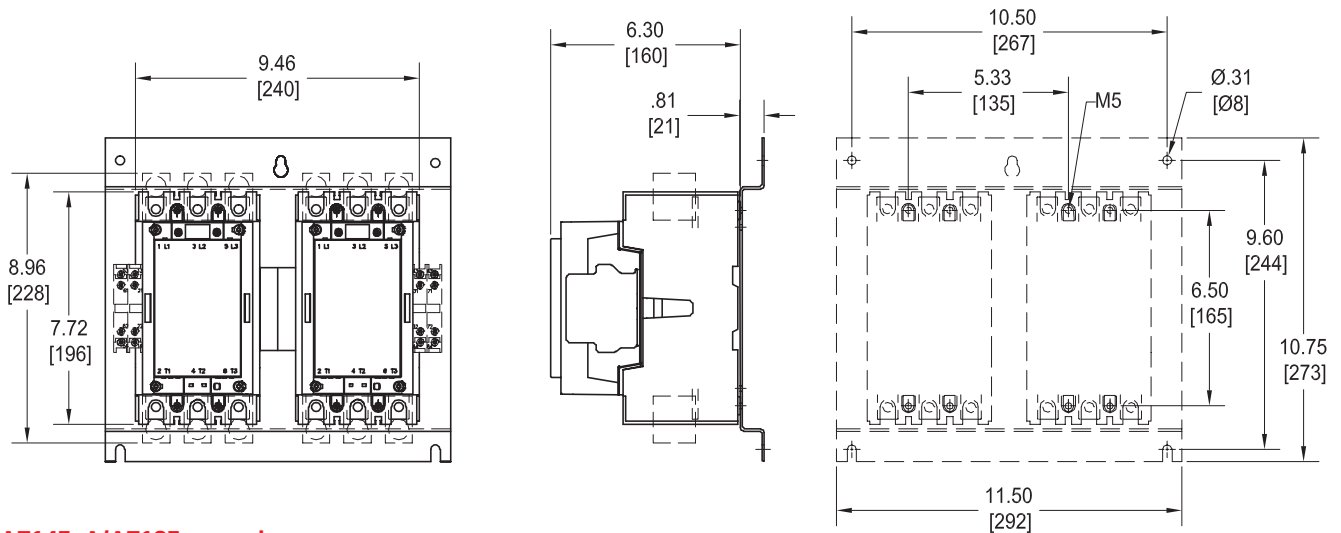
Across the line
1

00.00
00.00 Inches
[Millimeters]

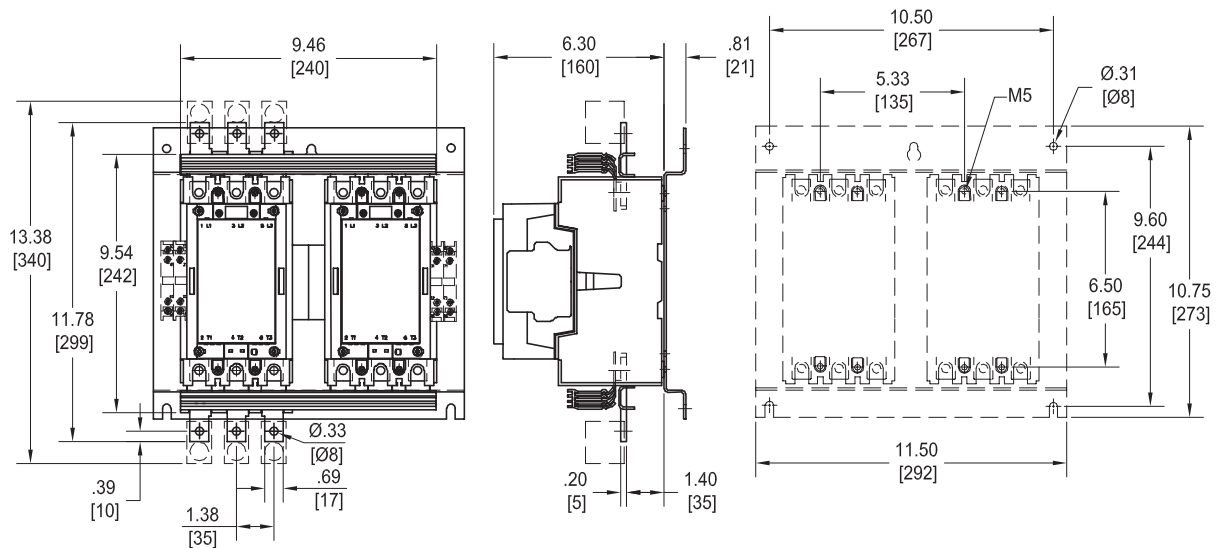
A/AF145 & A/AF185



A/AF145, A/AF185 with mechanical interlock



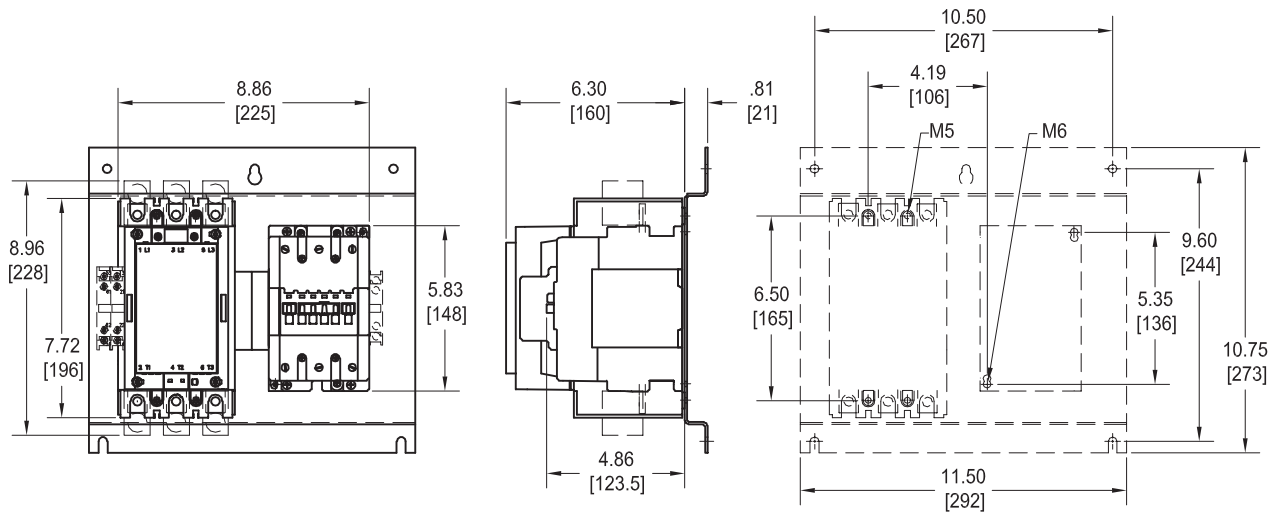
A/AF145, A/AF185 reversing



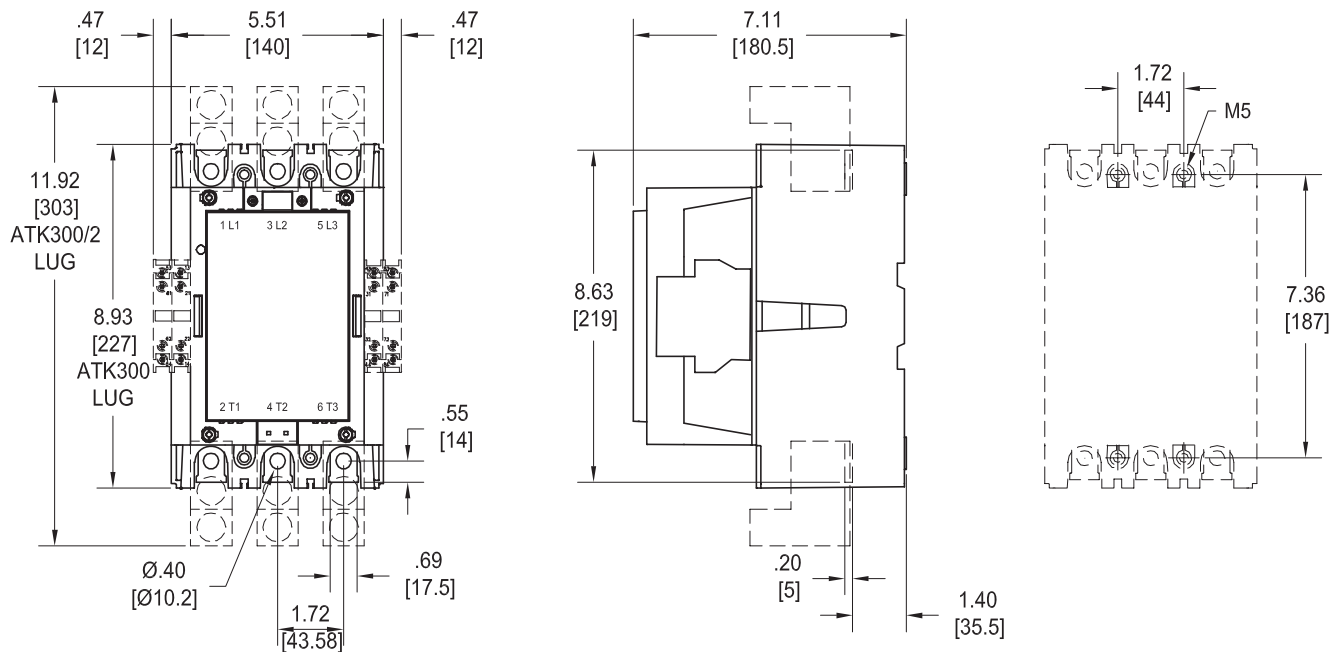
Approximate dimensions A/AF145 – A/AF300

00.00 00.00 Inches
[Millimeters]

A/AF145 – A/AE/AF95-110 mechanically interlocked



A/AF210, A/AF260, A/AF300



← 00.00 → Inches
00.00 [Millimeters]

12.20 [310]

11.92 [303]

ATK300/2 LUG

8.93 [227]

ATK300 LUG

1T1 3T2 5T3

2T1 4T2 6T3

7.11 [180.5]

.81 [21]

13.25 [336]

6.71 [170]

M5

Ø.31 [Ø8]

10.60 [269]

7.36 [187]

11.75 [298]

14.25 [362]

/AF210, A/AF260, A/AF300 reversing +TA450

[illegible]

Technical drawings of the ATK300/2 LUG terminal block, showing front, side, and top views with dimensions in inches and millimeters.

Front View Dimensions:

- Overall Width: 10.84 [275.3]
- Overall Height: 11.92 [303]
- Height to Lug Center: 8.93 [227]
- Height to Lug Bottom: 7.72 [196]
- Height to Lug Top: 8.96 [228]

Side View Dimensions:

- Overall Depth: 7.11 [180.5]
- Mounting Flange Thickness: 0.81 [21]
- Base Thickness: 6.28 [160]

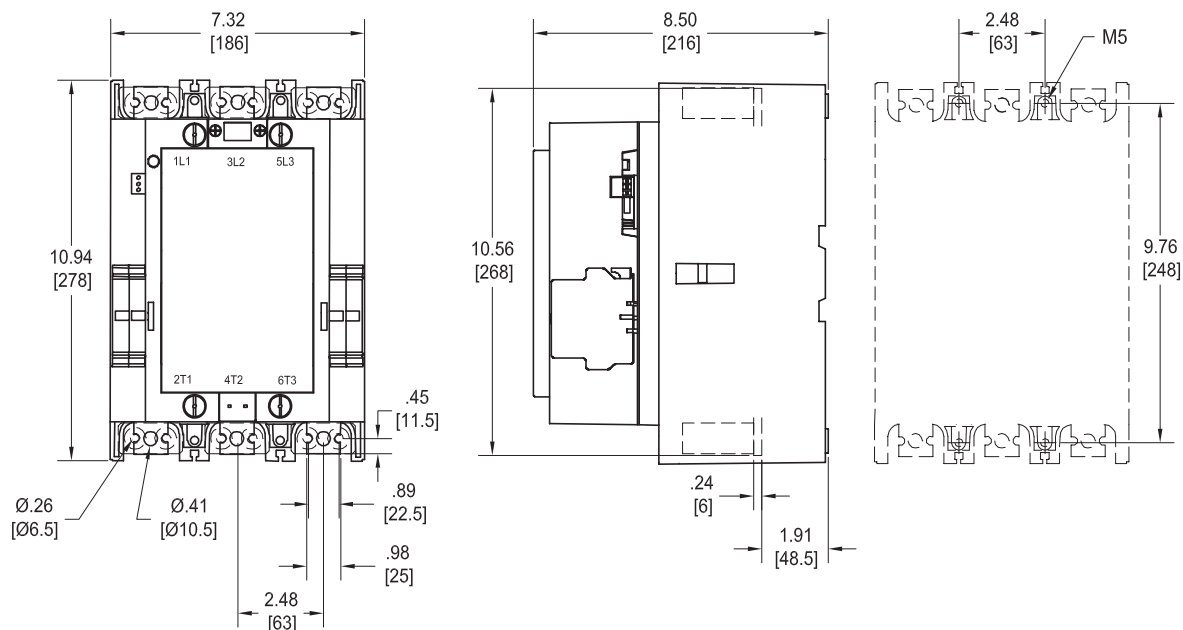
Top View Dimensions:

- Overall Width: 14.25 [362]
- Overall Height: 11.75 [298]
- Distance between Lug Centers: 6.17 [157]
- Distance from Edge to Lug Center: 7.36 [187]
- Distance from Edge to Lug Bottom: 6.50 [165]
- Distance from Edge to Lug Top: 10.60 [269]
- Mounting Hole Diameter: M5

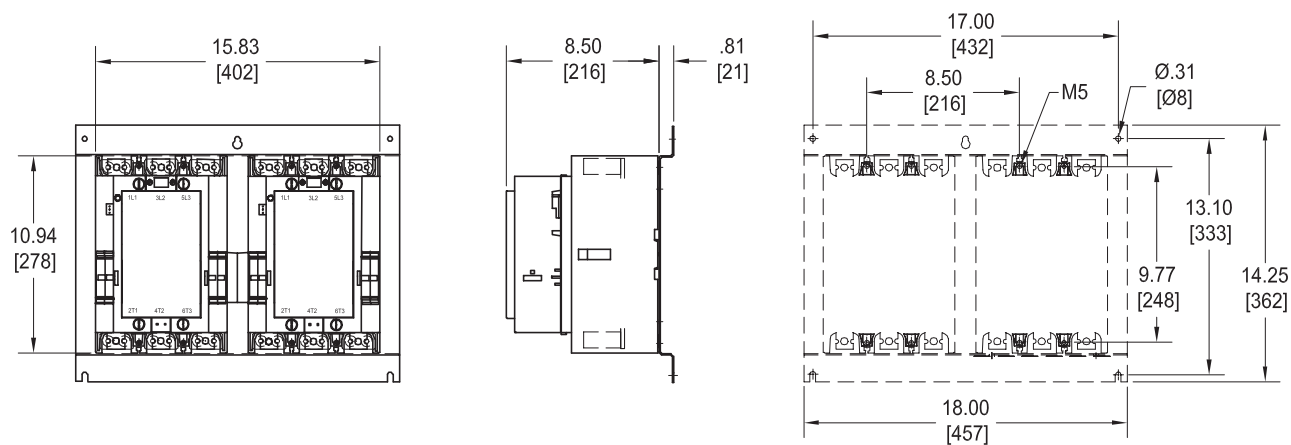
Approximate dimensions AF400 – AF460

00.00 00.00 Inches
[Millimeters]

AF400, AF460



AF400, AF460 with mechanical interlock

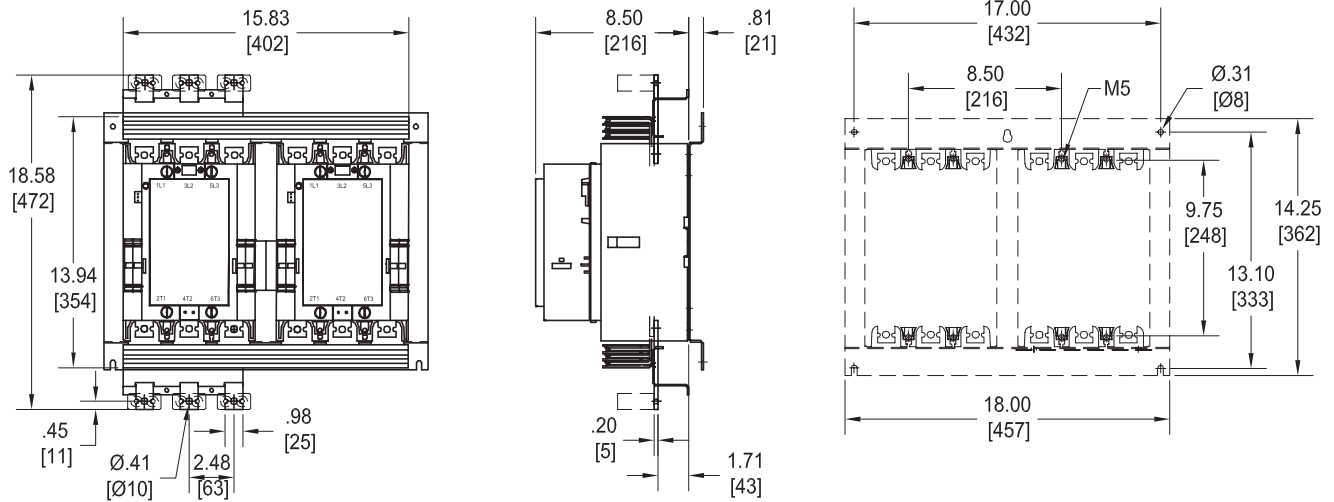


Approximate dimensions AF400 – AF750

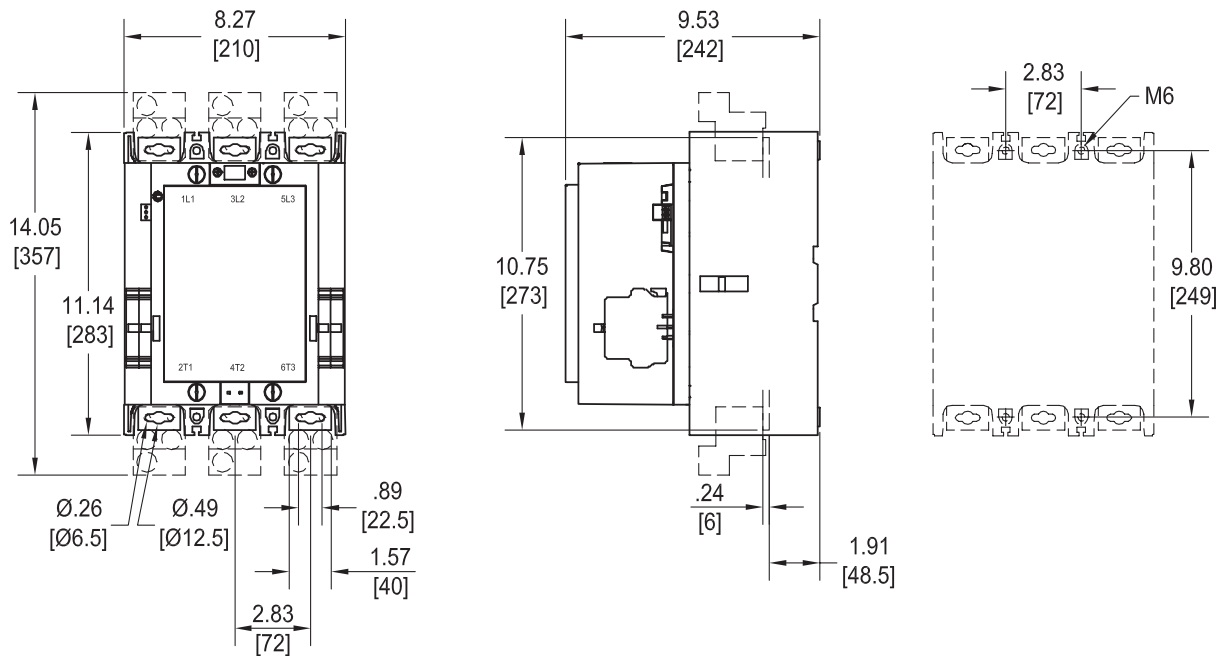
Across the line
1

00.00 Inches
00.00 [Millimeters]

AF400, AF460 reversing



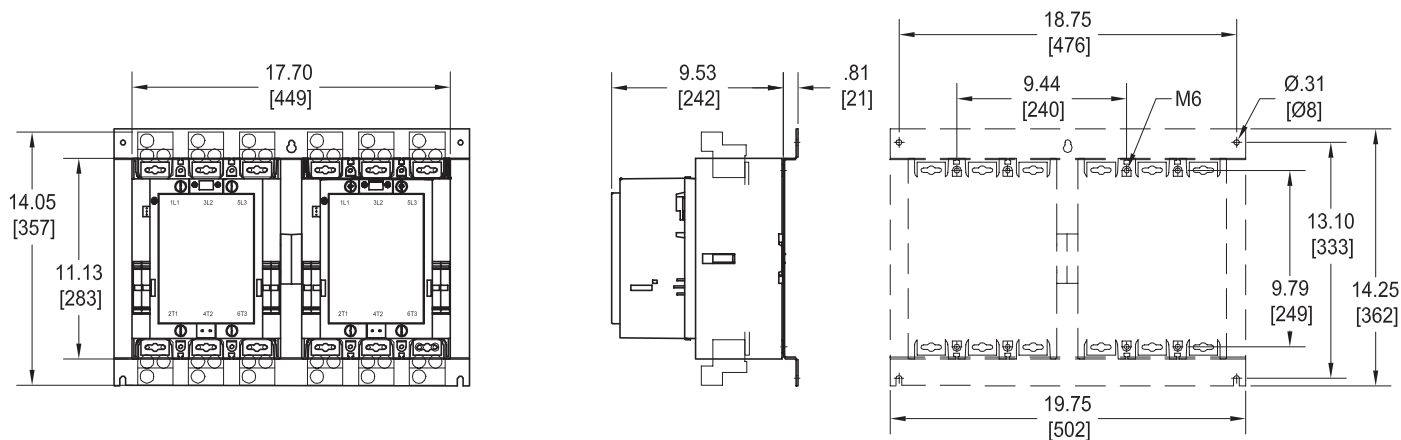
AF580 – AF750



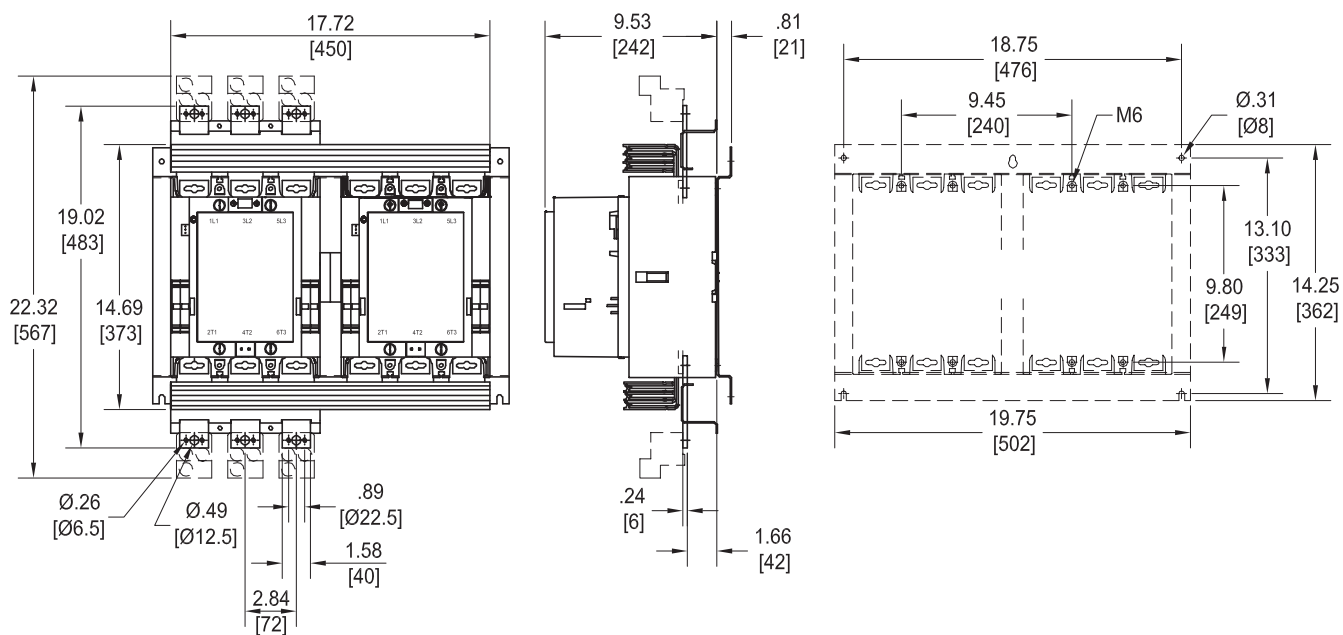
Approximate dimensions AF580 – AF750

00.00 00.00 Inches
[Millimeters]

AF580 – AF750 with mechanical interlock



AF580 – AF750 reversing



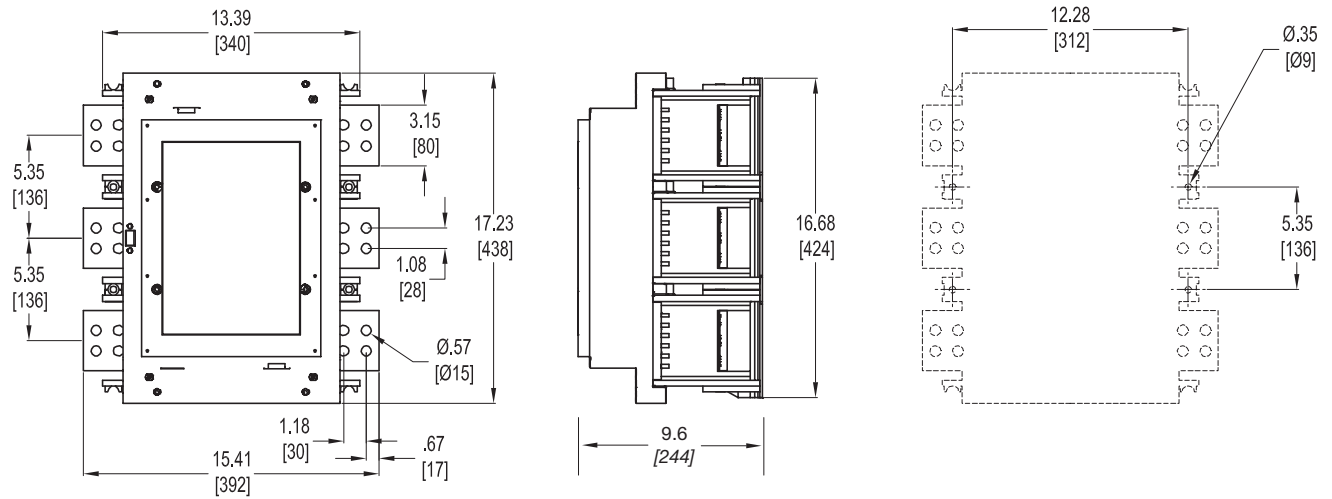
Approximate dimensions AF1350 – AF1650

Across the line
contactors

1

00.00 Inches
00.00 [Millimeters]

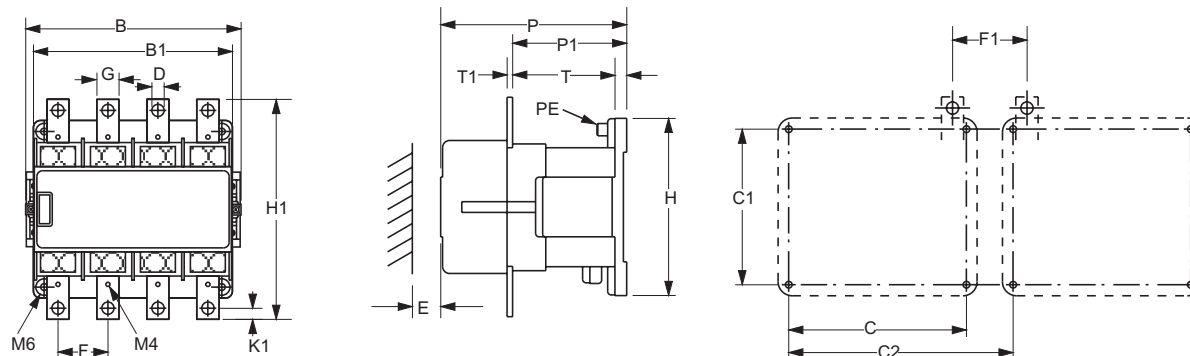
AF1350 – AF1650



Approximate dimensions

EK110 – EK550, 4 pole, non-reversing

00.00 00.00 Inches
[Millimeters]



		B	B1	C	C1	D	E	F	F1	G	H	H1	K1	P	P1	T	T1
EK 110	in	6.50	5.35	4.72	5.51	0.26	1.57	1.61	1.69	0.59	6.14	6.14	0.30	6.08	4.03	0.39	0.16
	mm	165	136	120	140	6.6	40	41	43	15	156	156	7.5	154.5	102.3	10	4
EK 150	in	6.50	5.35	4.72	5.51	0.43	1.57	1.65	1.65	0.79	6.14	6.77	0.39	6.08	4.03	0.39	0.16
	mm	165	136	120	140	11	40	42	42	20	156	172	10	154.5	102.3	10	4
EK 175	in	7.91	6.93	6.30	5.51	0.43	0.59	1.77	2.64	0.79	6.14	7.80	0.39	6.77	4.20	0.39	0.20
	mm	201	176	160	140	11	15	45	67	20	156	198	10	172	106.7	10	5
EK 210	in	7.91	6.93	6.30	5.51	0.43	0.59	1.77	2.64	0.79	6.14	7.80	0.39	6.77	4.20	0.39	0.20
	mm	201	176	160	140	11	15	45	67	20	156	198	10	172	106.7	10	5
EK 370	in	10.63	9.61	8.66	7.87	0.43	1.57	2.64	2.76	0.98	8.78	10.71	0.49	8.88	5.49	0.91	0.24
	mm	270	244	220	200	11	40	67	70	25	223	272	12.5	225.5	139.5	23	6
EK 550	in	10.63	9.61	8.66	7.87	0.43	1.57	2.64	2.76	0.98	8.78	10.71	0.49	8.88	5.49	0.91	0.24
EK 1000	mm	270	244	220	200	11	40	67	70	25	223	272	12.5	225.5	139.5	23	6