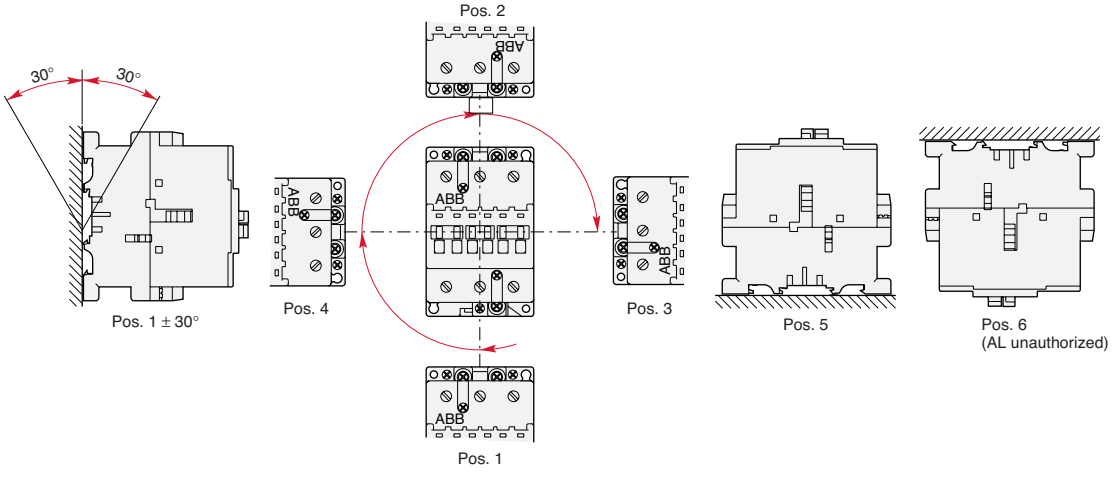
UL & CSA Technical data
A/AE9 – A/AE/AF110, AL9 – AL40
AC & DC operated

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	35	50	60	65	65	85	105	—	—
Resistive heating applications	600VAC	15	15	20	35	50	60	65	65	85	105	—	—
CSA Elevator ratings													
220 – 240VAC	3 phase	—	—	5	—	—	10	—	15	—	20	—	—
440 – 480VAC	3 phase	—	—	10	—	—	20	—	30	—	30	—	—
550 – 600VAC	3 phase	—	—	10	—	—	20	—	30	—	40	—	—
230VAC	1 phase	—	—	2	—	—	5	—	7.5	—	10	—	—
Auxiliary contacts													
NEMA rating	AC	A600	A600	A600	A600	A600	A600	—	A600	A600	A600	A600	A600
AC rated voltage	VAC	600	600	600	600	600	600	—	600	600	600	600	600
AC thermal rated current	A	10	10	10	10	10	10	—	10	10	10	10	10
AC maximum volt-ampere making	VA	7200	7200	7200	7200	7200	7200	—	7200	7200	7200	7200	7200
AC maximum volt-ampere breaking	VA	720	720	720	720	720	720	—	720	720	720	720	720
NEMA rating	DC	P600	P600	P600	P600	P600	P600	—	P600	P600	P600	P600	P600
DC rated voltage	VDC	600	600	600	600	600	600	—	600	600	600	600	600
DC thermal rated current	A	5	5	5	5	5	5	—	5	5	5	5	5
DC Maximum make-break	A	0.2	0.2	0.2	0.2	0.2	0.2	—	0.2	0.2	0.2	0.2	0.2
Approximate weight													
Contactor	lbs.	0.7	0.7	0.7	1.01	1.2	2.25	2.25	2.25	2.25	2.25	3.5	5
Starter	lbs.	1.04	1.04	1.04	1.35	1.54	3	—	3	3	3	6	7
Terminal wire range	AWG	18-10	18-10	18-10	12-8	8-4	8-4	8-1	8-1	8-1	8-1	6-2/0	6-2/0
Number of wires per phase		2	2	2	2	2	2	1	1	1	1	1	1
Maximum short circuit ratings													
MCCB,MCP, Amps/kA	480VAC	50/35	50/35	50/35	100/35	150/65	150/65	—	150/85	250/85	250/85	250/85	250/85
MCCB,MCP, Amps/kA	600VAC	10/35	10/35	10/35	100/35	150/25	150/25	—	—	—	—	250/35	250/35
Fuse,Amps — type/kA	600VAC	30J/200	30J/200	30J/200	60J/200	60J/200	100J/200	—	100J/200	200J/200	200J/200	200J/200	200J/200

Mounting positions

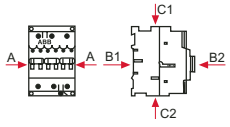


UL & CSA Technical data
A/AF145 – AF750
AC & DC operated

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

UL/CSA & IEC Technical data
A/AE9 — A/AE/AF/TAE110

Contactor types: A..., AE... / AF..., TAE...		9 –	12 –	16 –	26 –	30 –	40 –	45 45	50 50	63 63	75 75	95 95	110 110
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										-40 to +70	
Climatic withstand		acc. to IEC 60068-2-30 and 60068-2-11 - UTE C 63-100 specification II										acc. to IEC 68-2-30	
Operating altitude	m	≤ 3000											
Shock withstand acc. IEC 60068-2-27 and EN 60068-2-27 Mounting position 1 (see page 1.50)		1/2 sinusoidal shock for 11 ms: no change in contact position											
		Shock direction	Making position	Breaking position									
		A	20 g	20 g									
		B1	10 g	5 g ①									
		B2	15 g ②	15 g ②									
		C1	20 g	20 g									
		C2	20 g	20 g								Not valid for DIN-rail mounting	



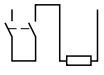
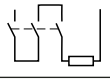
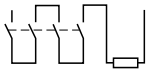
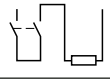
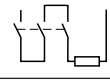
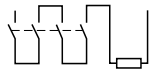
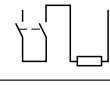
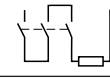
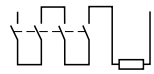
① 3 g for AF 45-22, AE 45-22, AF 75-22 and AE 75-22.
② 10 g for AF 45-22, AE 45-22, AF 75-22 and AE 75-22.

IEC Technical data
DC circuit switching
A/AE9 — GAE75

General

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

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

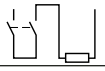
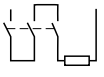
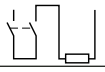
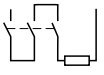
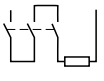
a.c. operated contactors **a.c. / d.c. operated (electronic coil interface)** **d.c. operated contactors**			**A9 – AE9**	**A12 – AE12**	**A16 – AE16**	**A26 – AE26**	**A30 – AE30**	**A40 – AE40**	**A45 AF45 AE45**	**A50 AF50 AE50**	**A63 AF63 AE63**	**A75 AF75 AE75**	**GA75 – GAE75**
Utilization category DC-1, L/R ≤ 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 ≤ 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 ≤ 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.

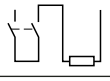
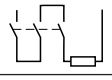
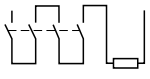
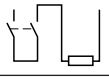
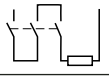
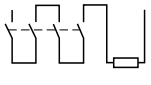
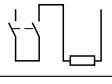
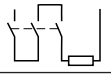
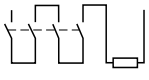
a.c. operated contactors **a.c. / d.c. operated (electronic coil interface)** **d.c. operated contactors**			**A95** **AF95** **AE95**	**A110** **AF110** **AE110**	**A145** **AF145** **–**	**A185** **AF185** **–**	**A210** **AF210** **–**	**A260** **AF260** **–**	**A300** **AF300** **–**	**–** **AF400** **–**	**–** **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 ≃ 1 ms), inductive loads such as shunt motors (L/R ≃ 2 ms) or series motors (L/R ≃ 7.5 ms).
- The addition of a resistor in parallel with an inductive winding helps in the elimination of the arcs.
- All the poles required for breaking must be connected in series between the load and the source polarity not linked to earth (or chassis).

A.C. operated contactors			AL9	AL12	AL16	AL26	AL30	AL40
Utilization category DC-1, L/R ≤ 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 ≤ 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 ≤ 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
A/AE9 — A/AE/AF/TAE110

Main Pole - Utilization 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
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	mm²	4	4	4	6	16	16	35	35	50	50	50	70	
Rated operational current I_e / AC-1 for air temperature close to contactor														
U_e max. 690 V ø ≤ 40 °C		A	25	27	30	45	55	60	70	100	115	125	145	160
ø ≤ 55 °C		A	22	25	27	40	55	60	60	85	95	105	135	145
ø ≤ 70 °C ③		A	18	20	23	32	39	42	50	70	80	85	115	130
with conductor cross-sectional area	mm²		2.5	4	4	6	10	16	25	35	50	50	50	70
Utilization 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
AE9 — AE110
TAE — TAE110

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									ø ≤ 55 °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	
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.

Mounting characteristics

Contactor types: A..., AE... / AF..., TAE...	9 –	12 –	16 –	26 –	30 –	40 –	45 45	50 50	63 63	75 75	95 95	110 110
Mounting positions	see "Conditions for use"											
Mounting distances	The contactors can be assembled side by side											
Mounting												
on DIN rail according to IEC 715 and EN 50022 / EN 50023	35 x 7.5 mm 35 x 15 mm						35 x 15 mm 75 x 25 mm				75 x 25 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
		> 55 °C unauthorized	–
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	–	–
TAE 45 ... TAE 110	1, 1 ± 30°, 2, 3, 4, 5	≤ 55 °C	U_c min. ... U_c max.
		> 55 °C unauthorized	–
	6 unauthorized	–	–

Notes for 4-pole contactors

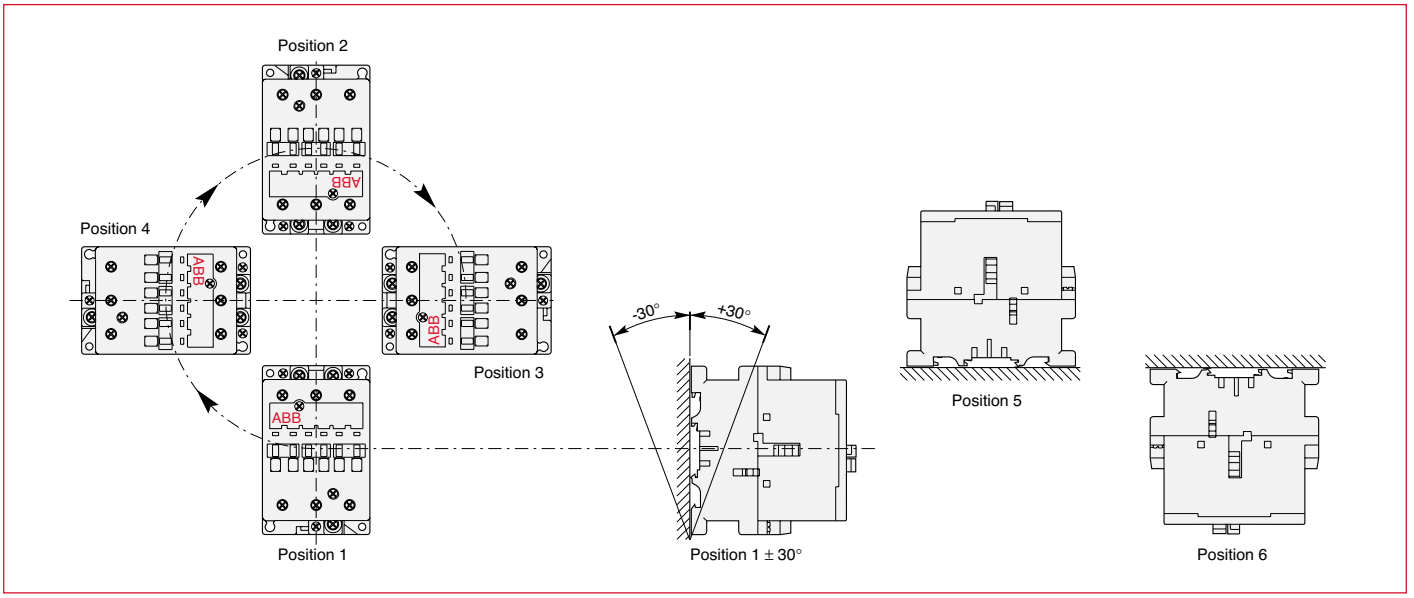
Whatever the coil voltage: Pos. 5 unauthorized for A 45-22-00, AE 45-22-00, A 75-22-00, AE 75-22-00 contactors.

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 □.

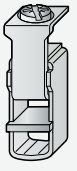
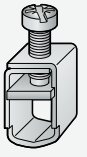
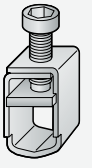
For mounting position 6 or ambient temperature of 55 to 70 °C the information given on this page remains applicable.

Mounting Positions (see the above table for authorized positions)



IEC Technical data
A/AE9 — AF/TAE110

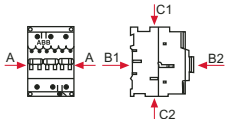
Connecting Characteristics

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 ≤	8			10	–	–	–	–	–	–	30 ②	
l mm >	3.7			4.2	–	–	–	–	–	–	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 ≤	8			①	8							
l mm >	3.7			①	3.7							
Degree of protection acc. to IEC 60947-1 / EN 60947-1 and IEC 60529 / EN 60529	Protection against direct contact acc. to VDE 0106 - Part. 100											
– Main terminals	IP 20						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 ≤ 8 and l > 3.7 for coil terminal - L ≤ 10 and l > 4.2 for built-in auxiliary terminals.
② With LW 110 enlargement piece. See page 1.31.

UL/CSA & IEC Technical data
AL9 — AL40

Contactor types:	AL	AL9	AL12	AL16	AL26	AL30	AL40
Rated insulation voltage U_i							
according to IEC 60947-4-1	V				1000		
according to UL/CSA	V				600		
Rated impulse withstand voltage $U_{imp.}$	kV				8		
Standards					Devices complying with international standards IEC 60947-1 / 60947-4-1 and European standards EN 60947-1 / 60947-4-1		
Air temperature close to contactor					see "Conditions for use" page 1.50, for control voltage limits and authorized mounting positions		
– fitted with thermal O/L relay	°C				-25 to +55		
– without thermal O/L relay	°C				-40 to +70 (55 max. for TAE... contactors)		
– for storage	°C				-60 to +80		
Climatic withstand					acc. to IEC 60068-2-30 and 60068-2-11 - UTE C 63-100 specification II		
Operating altitude	m				≤ 3000		
Shock withstand acc. IEC 60068-2-27 and EN 60068-2-27 Mounting position 1 (see page 1.50)							



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

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

IEC Technical data
AL9 — AL40

Main Pole - Utilization Characteristics

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

IEC Technical data
AL9 — AL40, TAL9 – TAL40

Magnet system characteristics for AL contactors

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

Magnet System Characteristics for TAL... Contactors

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

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

Built-in Auxiliary Contacts - Utilization Characteristics

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

IEC Technical data
AL9 — AL40

Mounting characteristics

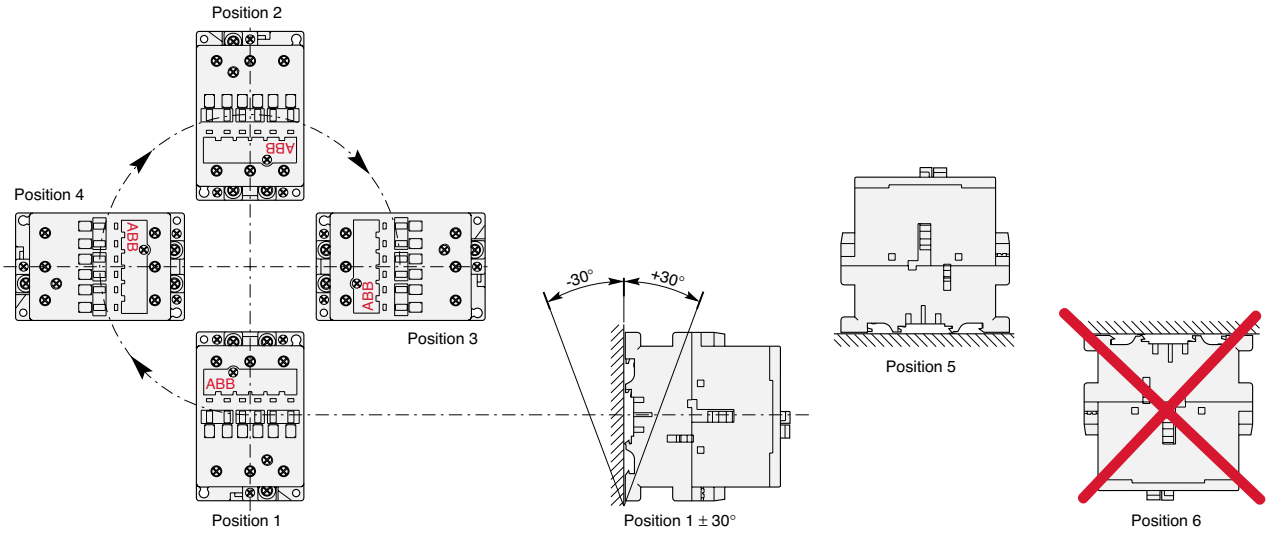
Contactor types: AL	AL9 AL12 AL16 AL26 AL30 AL40
Mounting positions	see "Conditions for use"
Mounting distances	The contactors can be assembled side by side
Mounting	
on DIN rail according to IEC 715 and EN 50022 / EN 50023	35 x 7.5 mm 35 x 15 mm
by screws (not supplied)	2 x M4

Conditions for Use

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

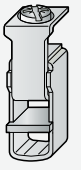
Contactors	Mounting position	Ambient temperature	Control voltage
AL9 – AL40	1, 1 ± 30°, 2, 3, 4, 5 55 ... 70 °C	≤ 55 °C U_c	0.85 ... 1.1 x U_c
	6 (Unauthorized)		

Mounting Positions (see the above table for authorized positions)



IEC Technical data
AL9 — AL40

Connecting Characteristics

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

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

IEC Technical data
Contactor electrical durability and Utilization categories

General

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

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

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

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

Curve Utilization Mode

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

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

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

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

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

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

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

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

A 50-30-00

AF 460-30-11

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

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

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

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

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

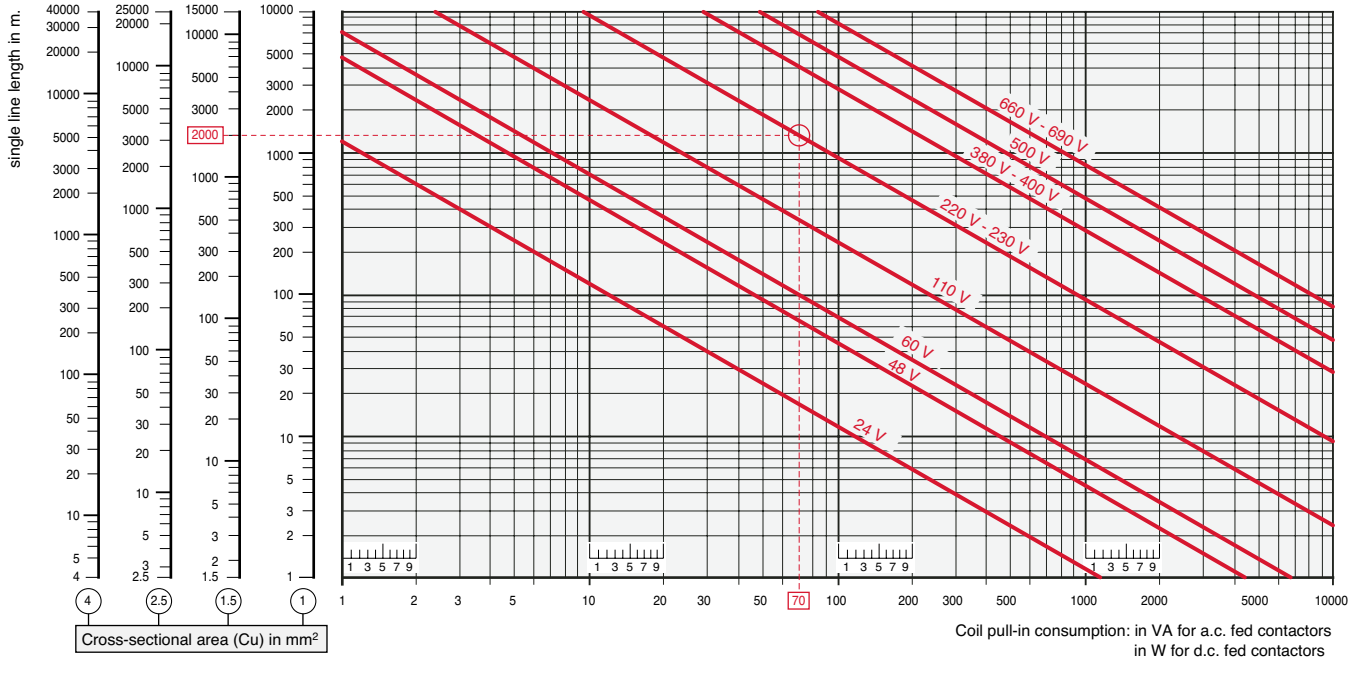
- the coil pull-in consumption.
- the supply voltage.
- the connecting wire cross-sectional area.

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

Coil pull-in consumption (average value)

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

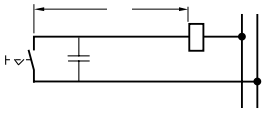
Permissible single length for the control circuit conductors on contactor closing:
Depending on the coil pull-in power consumption on the supply voltage and on the control circuit conductor cross-sectional area.



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

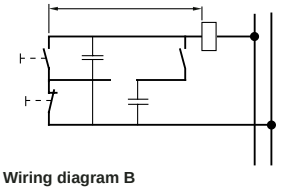
IEC Technical data
Influence of the length of conductors used in contactor control circuits

Single control line length



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

Single control line length



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

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

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

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

This may be caused by the following factors:

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

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

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

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

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

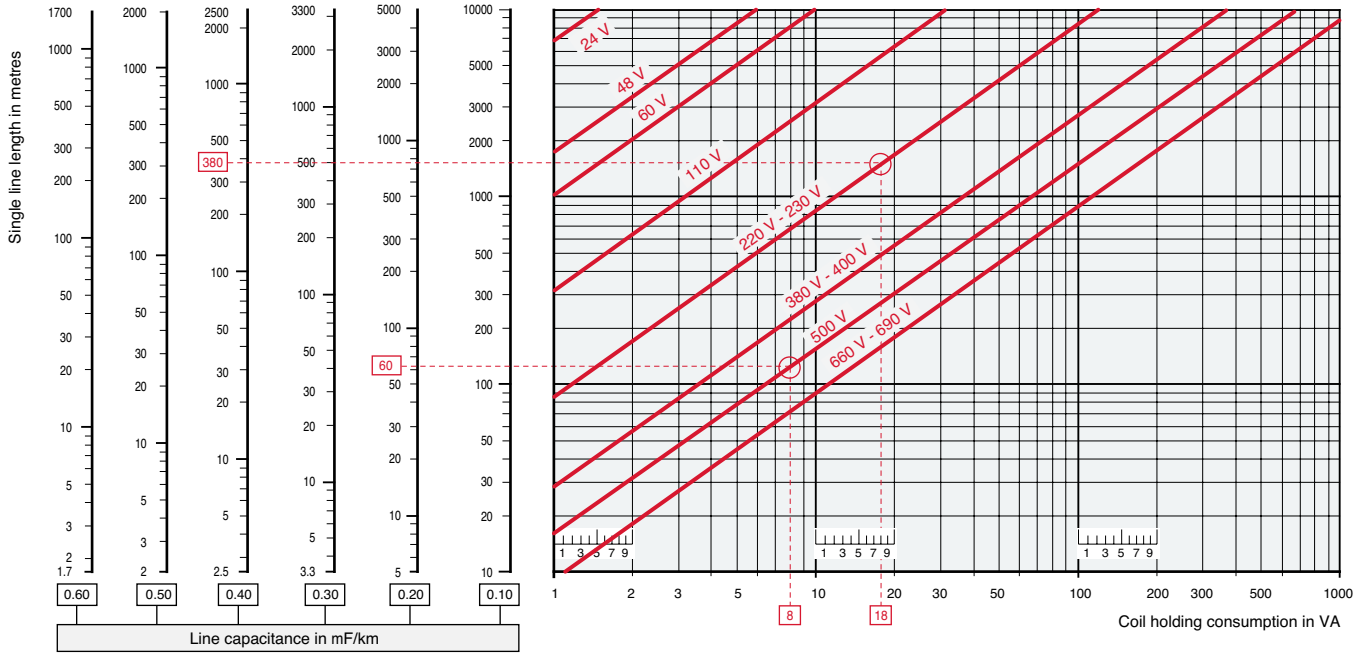
- the coil holding consumption VA.
- the supply voltage.
- the capacity in µF/km (depending on the control layout).

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

Coil holding consumption (average value)

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

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



Examples:

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

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

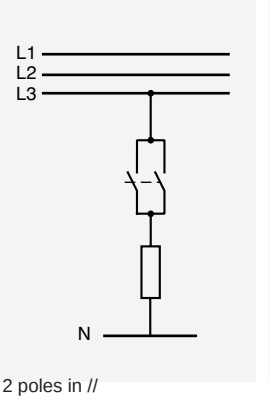
IEC Technical data
Parallel connection of main poles

Parallel Connection of Main Poles

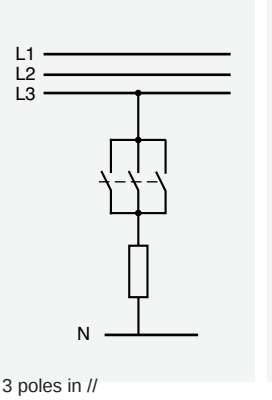
Purpose: Increasing the a.c. resistive load.
Remarks:
– Parallel connection of main poles to increase the d.c. resistive load is not acceptable.
– Parallel connection of main poles does'nt increase the breaking capacity.

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

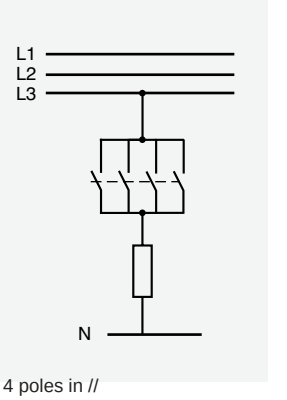
The table below shows the uprating factor for I_e / AC-1 max. in relation to the number of poles in parallel and for a max. switching frequency.



2 poles in //



3 poles in //



4 poles in //

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

IEC Technical data
Temporary or intermittent duty

Utilization of Contactors for Temporary / Intermittent Duty

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

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

Example:

A 9 contactor (intermittent duty, resistive load)

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

Technical data
Technical terms and definitions

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

Ambient temperature
Temperature of the air surrounding the unit.

Circuits
• Auxiliary circuit

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

• Control circuit

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

• Main circuit

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

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

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

Endurance / durability
• Electrical endurance

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

• Mechanical endurance

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

• Type 1 co-ordination

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

• Type 2 co-ordination

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

Switching frequency
Number of operating cycles per hour.

Time
• Closing time

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

• Opening time

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

• Minimal operation time

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

• Short time current permissible

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

• Time constant

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

Standards

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

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

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

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

• Main changes and additions in the new standards are:

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

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

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

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

Utilization categories

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

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

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

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

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

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

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

Switching of capacitor banks

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

Switching of transformers

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

Switching of lighting circuits

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

IEC 947-4-1 contains two standard utilization categories

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

UL/CSA Technical data
Motor data

Ampere ratings of 3 phase, AC induction motors

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

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