

AF09 ... AF38 4-pole Contactors

Technical Data



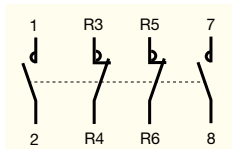
Main Pole - Utilization Characteristics according to UL / CSA

Contactor types	AF09	AF16	AF26	AF38
Standards	UL 508, CSA C22.2 N°14			
Rated operational voltage $U_{e,max}$	600 V			
UL General use rating				
600 V AC	25 A	30 A	45 A	55 A
240 V DC - 3-pole for 4 N.O. main poles	25 A	30 A	45 A	55 A
160 V DC - 2-pole for 2 N.O. / 2 N.C. main poles	20 A	20 A	45 A	55 A
Max. conductor cross-sectional area	AWG 10	AWG 10	AWG 8	AWG 6
Max. electrical switching frequency for general use	600 cycles/h			

Main Pole - Utilization Characteristics according to IEC

Contactor types	AF09	AF16	AF26	AF38
Standards	IEC 60947-1 / 60947-4-1 and EN 60947-1 / 60947-4-1			
Rated operational voltage $U_{e,max}$	690 V			
Rated frequency limits	25 ... 400 Hz			
Conventional free-air thermal current I_{th} acc. to IEC 60947-4-1, open contactors, $\leq 40^\circ\text{C}$	35 A	35 A	55 A	55 A
with conductor cross-sectional area	6 mm ²	6 mm ²	16 mm ²	16 mm ²
AC-1 Utilization category for air temperature close to contactor				
I_e / AC-1 rated operational current	$\theta \leq 40^\circ\text{C}$ 25 A	30 A	45 A	55 A
U_e max. ≤ 690 V, 50/60 Hz	$\theta \leq 60^\circ\text{C}$ 25 A	30 A	40 A	45 A
	$\theta \leq 70^\circ\text{C}$ 22 A	26 A	32 A	37 A
with conductor cross-sectional area	4 mm ²	6 mm ²	10 mm ²	16 mm ²
Short-circuit protection for contactors without thermal O/L relay - Motor protection excluded $U_e \leq 500$ V AC - gG type fuse	25 A	32 A	50 A	63 A
Rated short-time withstand current I_{cw} at 40 °C ambient temperature, in free air from a cold state	1 s 300 A	300 A	450 A	450 A
	10 s 150 A	150 A	350 A	350 A
	30 s 80 A	80 A	225 A	225 A
	1 min 60 A	60 A	150 A	150 A
	15 min 35 A	35 A	55 A	55 A
Heat dissipation per pole	I_e / AC-1 0.8 W	1.2 W	1.6 W	2.3 W
Max. electrical switching frequency	AC-1 600 cycles/h			

Remark for 4-pole contactors fitted with 2 N.O. + 2 N.C. main poles



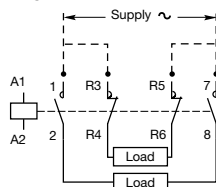
These contactors are suitable for controlling 2 separate circuits, i.e. 2 loads with 2 separate supplies, or 1 circuit comprising 2 separate loads with a single supply (see diagrams below). When the contactor operates there is no mechanical overlap between the N.O. poles and the N.C. poles: BREAK before MAKE.



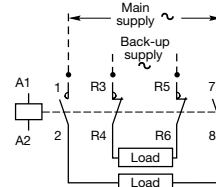
These contactors are not suitable for a reversing starter or for controlling a single load from 2 separate supplies.

Block diagrams

– Single supply and 2 separate loads



– 2 separate supplies and 2 separate loads

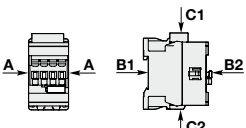


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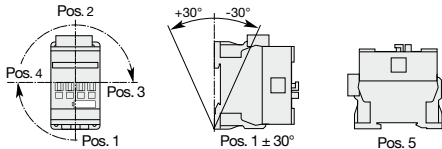
General Technical Data

Contactor types	AF09	AF16	AF26	AF38
Rated insulation voltage U_i acc. to IEC 60947-4-1 acc. to UL	690 V 600 V			
Rated impulse withstand voltage U_{imp}	6 kV			
Electromagnetic compatibility	Devices complying with IEC 60947-1 / EN 60947-1 - Environment A			
Ambient air temperature close to contactor Operation in free air Storage	-40 ... +70 °C -60 ... +80 °C			
Climatic withstand	Category B according to IEC 60947-1 Annex Q			
Operating altitude	≤ 3000 m			
Mechanical durability Number of operating cycles Max. switching frequency	10 millions operating cycles 3600 cycles/h			
Shock withstand acc. IEC 60068-2-27 and EN 60068-2-27				
Mounting position 1				
				
	Shock direction 1/2 sinusoidal shock for 11 ms: no change in contact position			
	A	B1	B2	C1
	30 g	25 g Closed position / 5 g Open position	25 g Closed position / 5 g Open position	30 g Closed position / 25 g Open position
		B2	15 g	15 g Closed position / 10 g Open position
		C1	25 g	25 g Closed position / 20 g Open position
		C2	25 g	25 g Closed position / 20 g Open position
Vibration withstand acc. to IEC 60068-2-6	5 ... 300 Hz 4 g Closed position / 2 g Open position			

Magnet System Characteristics

Contactor types	AF09	AF16	AF26	AF38
Coil operating limits acc. to IEC 60947-4-1	AC supply at $\theta \leq 60$ °C $0.85 \times U_c$ min ... $1.1 \times U_c$ max at $\theta \leq 70$ °C $0.85 \times U_c$ min ... U_c max			
	DC supply at $\theta \leq 60$ °C $0.85 \times U_c$ min ... $1.1 \times U_c$ max at $\theta \leq 70$ °C (AF) $0.85 \times U_c$ min ... U_c max - (AF..Z) $0.85 \times U_c$ min ... $1.1 \times U_c$ max			
AC control voltage 50/60 Hz	Rated control circuit voltage U_c Coil consumption Average pull-in value Average holding value			
	24 ... 500 V AC (AF) 50 VA - (AF..Z) 16 VA (AF) 2.2 VA / 2 W - (AF..Z) 1.7 VA / 1.5 W			
DC control voltage	Rated control circuit voltage U_c Coil consumption Average pull-in value Average holding value			
	12 ... 500 V DC (AF) 50 W - (AF..Z) 12 ... 16 W (AF..Z) 2 W - (AF..Z) 1.7 W			
PLC-Output control	(AF..Z) ≥ 500 mA 24 V DC			
Drop-out voltage in % of U_c min.	≤ 60 % U_c min			
Voltage sag immunity according to SEMI F47-0706	(AF..Z) conditions of use on request			
Dips withstand (level 0% according to IEC 61000-4-11) -20 °C ≤ θ ≤ +60 °C	(AF..Z) 22 ms average for $U_c = 24$... 250 V 50/60Hz			
Operating time between coil energization and: between coil de-energization and:	N.O. contact closing 40 ... 95 ms N.C. contact opening 38 ... 90 ms N.O. contact opening 11 ... 95 ms N.C. contact closing 13 ... 98 ms			

Mounting Characteristics


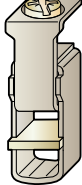








Contactor types	AF09	AF16	AF26	AF38
Mounting positions				
Mounting distances	Max. add-on N.C. auxiliary contacts: see accessory fitting details for a 4-pole contactor AF09 ... AF38			
Fixing on rail according to IEC 60715, EN 60715 by screws (not supplied)	The contactors can be assembled side by side. 35 x 7.5 mm or 35 x 15 mm 2 x M4 screws placed diagonally			

AF09 ... AF38 4-pole Contactors

Technical Data



Connecting Characteristics

Contactor types	AF09	AF16	AF26	AF38
Main terminals				
	Screw terminals with cable clamp		Screw terminals with double connector 2x (5.5 width x 6.8 depth)	
Connecting capacity (min. ... max.)				
Main conductors (poles)				
 Rigid	solid ($\leq 4 \text{ mm}$)	1 x 1 ... 6 mm ²		1.5 ... 16m ²
	stranded ($\geq 6 \text{ mm}^2$)	2 x 1 ... 6 mm ²		1.5 ... 16m ²
 Flexible with non insulated ferrule		1 x 0.75 ... 6 mm ²		1.5 ... 16m ²
		2 x 0.75 ... 6 mm ²		1.5 ... 16m ²
 Flexible with insulated ferrule		1 x 0.75 ... 4 mm ²		1.5 ... 16m ²
		2 x 0.75 ... 2.5 mm ²		1.5 ... 16m ²
 Bars or lugs		L < 9.6 mm		
Capacity according to UL/CSA		1 or 2 x AWG 16 ... 10		AWG 16 ... 6
Stripping length		10 mm		12 mm
Auxiliary conductors				
 Rigid solid		1 x 1 ... 2.5 mm ²		
		2 x 1 ... 2.5 mm ²		
 Flexible with non insulated ferrule		1 x 0.75 ... 2.5 mm ²		
		2 x 0.75 ... 2.5 mm ²		
 Flexible with insulated ferrule		1 x 0.75 ... 2.5 mm ²		
		2 x 0.75 ... 1.5 mm ²		
 Bars or lugs		L < 8 mm		
Capacity according to UL/CSA		1 or 2 x AWG 18 ... 14		
Stripping length		10 mm		
Degree of protection				
acc. to IEC 60947-1 / EN 60947-1 and IEC 60529 / EN 60529				
Main terminals		IP20		
Coil terminals		IP20		
Screw terminals				
(delivered in open position, screws of unused terminals must be tightened)				
Main terminals		M3.5		M4.5
Coil terminals		M3.5		
Screwdriver type				
Flat \varnothing 5.5 / Pozidriv 2				
Tightening torque				
Main pole terminals		1.5 Nm / 13 lb.in		2.5 Nm / 22 lb.in
Coil terminals		1.2 Nm / 11 lb.in		

AF09 ... AF38 Contactors

DC Circuit Switching

General


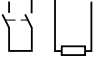
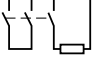
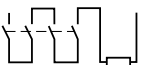

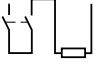
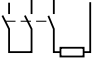

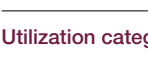

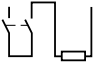

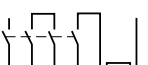

The arc switching on DC is more difficult than on AC.

- For selecting a contactor it is essential to determine the current, the voltage and the L/R time constant of the controlled load.
- For information, typical time constant values are quoted hereafter: non inductive loads such as resistance furnaces ($L/R \approx 1$ 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, the operating voltage U_e and the pole coupling details.
Ampere values quoted in these tables are valid for a $-25 \dots +70$ °C temperature close to the contactors, as long as these values do not exceed the AC-1 Ampere values for the corresponding ambient temperature.
- Max. switching frequency: 300 cycles/h.

Selection Table

Contactor types	AF09	AF12	AF16	AF26		AF30	AF38			
	3 or 4-pole			3-pole	4-pole	3-pole	3-pole	4-pole		
Utilization category DC-1, L/R ≤ 1 ms										
	≤ 72 V	25 A	27 A	30 A	45 A	45 A	50 A	50 A	55 A	
	110 V	10 A	15 A	20 A	—	—	—	—	—	
	220 V	—	—	—	—	—	—	—	—	
	≤ 72 V	25 A	27 A	30 A	45 A	45 A	50 A	50 A	55 A	
	110 V	25 A	27 A	30 A	45 A	45 A	50 A	50 A	55 A	
	220 V	10 A	15 A	20 A	—	—	—	—	—	
	≤ 72 V	25 A	27 A	30 A	45 A	45 A	50 A	50 A	55 A	
	110 V	25 A	27 A	30 A	45 A	45 A	50 A	50 A	55 A	
	220 V	25 A	27 A	30 A	45 A	45 A	50 A	50 A	55 A	
	≤ 72 V	25 A	—	30 A	—	45 A	—	—	55 A	
	110 V	25 A	—	30 A	—	45 A	—	—	55 A	
	220 V	25 A	—	30 A	—	45 A	—	—	55 A	
	440 V	10 A	—	20 A	—	—	—	—	—	
Utilization category DC-3, L/R ≤ 2 ms										
	≤ 72 V	25 A	27 A	30 A	45 A	—	50 A	50 A	—	
	110 V	6 A	7 A	8 A	—	—	—	—	—	
	220 V	—	—	—	—	—	—	—	—	
	≤ 72 V	25 A	27 A	30 A	45 A	—	50 A	50 A	—	
	110 V	25 A	27 A	30 A	45 A	—	50 A	50 A	—	
	220 V	6 A	7 A	8 A	—	—	—	—	—	
	≤ 72 V	25 A	27 A	30 A	45 A	—	50 A	50 A	—	
	110 V	25 A	27 A	30 A	45 A	—	50 A	50 A	—	
	220 V	25 A	27 A	30 A	45 A	—	50 A	50 A	—	
	≤ 72 V	25 A	—	30 A	—	—	—	—	—	
	110 V	25 A	—	30 A	—	—	—	—	—	
	220 V	25 A	—	30 A	—	—	—	—	—	
	440 V	6 A	—	8 A	—	—	—	—	—	
	Utilization category DC-5, L/R ≤ 7.5 ms									
		≤ 72 V	9 A	12 A	16 A	20 A	—	25 A	25 A	—
110 V		4 A	4 A	4 A	—	—	—	—	—	
220 V		—	—	—	—	—	—	—	—	
	≤ 72 V	25 A	27 A	30 A	45 A	—	50 A	50 A	—	
	110 V	10 A	15 A	20 A	45 A	—	50 A	50 A	—	
	220 V	4 A	4 A	4 A	—	—	—	—	—	
	≤ 72 V	25 A	27 A	30 A	45 A	—	50 A	50 A	—	
	110 V	25 A	27 A	30 A	45 A	—	50 A	50 A	—	
	220 V	9 A	12 A	16 A	20 A	—	25 A	25 A	—	
	≤ 72 V	25 A	—	30 A	—	—	—	—	—	
	110 V	25 A	—	30 A	—	—	—	—	—	
	220 V	10 A	—	20 A	—	—	—	—	—	
	440 V	4 A	—	4 A	—	—	—	—	—	

Motor Rated Operational Powers and Currents

The currents given below concern standard three-phase four-pole cage motors (1500 r.p.m. at 50 Hz, 1800 r.p.m. at 60 Hz). These values are given for guidance and may vary according to the motor manufacturer and depending on the number of poles.

IEC Motor power kW	Motor nominal current: standardized values in orange-violet colour (according to IEC 60947-4-1 Annex G)									
	220 V	230 V	240 V	380V	400 V	415 V	440 V	500 V	660 V	690 V
	A	A	A	A	A	A	A	A	A	A
0.06	0.37	0.35	0.34	0.21	0.2	0.19	0.18	0.16	0.13	0.12
0.09	0.54	0.52	0.50	0.32	0.3	0.29	0.26	0.24	0.18	0.17
0.12	0.73	0.7	0.67	0.46	0.44	0.42	0.39	0.32	0.24	0.23
0.18	1	1	1	0.63	0.6	0.58	0.53	0.48	0.37	0.35
0.25	1.6	1.5	1.4	0.9	0.85	0.82	0.74	0.68	0.51	0.49
0.37	2.0	1.9	1.8	1.2	1.1	1.1	1.0	0.88	0.67	0.64
0.55	2.7	2.6	2.5	1.6	1.5	1.4	1.3	1.2	0.91	0.87
0.75	3.5	3.3	3.2	2.0	1.9	1.8	1.7	1.5	1.15	1.1
1.1	4.9	4.7	4.5	2.8	2.7	2.6	2.4	2.2	1.7	1.6
1.5	6.6	6.3	6.0	3.8	3.6	3.5	3.2	2.9	2.2	2.1
2.2	8.9	8.5	8.1	5.2	4.9	4.7	4.3	3.9	2.9	2.8
3	11.8	11.3	10.8	6.8	6.5	6.3	5.7	5.2	4.0	3.8
4	15.7	15	14.4	8.9	8.5	8.2	7.4	6.8	5.1	4.9
5.5	20.9	20	19.2	12.1	11.5	11.1	10.1	9.2	7.0	6.7
7.5	28.2	27	25.9	16.3	15.5	14.9	13.6	12.4	9.3	8.9
11	39.7	38	36.4	23.2	22	21.2	19.3	17.6	13.4	12.8
15	53.3	51	48.9	30.5	29	28.0	25.4	23	17.8	17
18.5	63.8	61	58.5	36.8	35	33.7	30.7	28	22.0	21
22	75.3	72	69	43.2	41	39.5	35.9	33	25.1	24
30	100	96	92	57.9	55	53	48.2	44	33.5	32
37	120	115	110	69	66	64	58	53	40.8	39
45	146	140	134	84	80	77	70	64	49.1	47
55	177	169	162	102	97	93	85	78	59.6	57
75	240	230	220	139	132	127	116	106	81	77
90	291	278	266	168	160	154	140	128	97	93
110	355	340	326	205	195	188	171	156	118	113
132	418	400	383	242	230	222	202	184	140	134
160	509	487	467	295	280	270	245	224	169	162
200	637	609	584	368	350	337	307	280	212	203
250	782	748	717	453	430	414	377	344	261	250
315	983	940	901	568	540	520	473	432	327	313
355	1109	1061	1017	642	610	588	535	488	370	354
400	1255	1200	1150	726	690	665	605	552	418	400
500	1545	1478	1416	895	850	819	745	680	515	493
560	1727	1652	1583	1000	950	916	832	760	576	551
630	1928	1844	1767	1116	1060	1022	929	848	643	615
710	2164	2070	1984	1253	1190	1147	1043	952	721	690
800	2446	2340	2243	1417	1346	1297	1179	1076	815	780
900	2760	2640	2530	1598	1518	1463	1330	1214	920	880
1000	3042	2910	2789	1761	1673	1613	1466	1339	1014	970

UL / CSA Motor power hp	Motor nominal current: standardized values (according to IEC 60947-4-1 Annex G and UL 508)				
	208 V	220-240 V	380-415 V	440-480 V	550-600 V
	A	A	A	A	A
1/2	2.4	2.2	1.3	1.1	0.9
3/4	3.5	3.2	1.8	1.6	1.3
1	4.6	4.2	2.3	2.1	1.7
1-1/2	6.6	6	3.3	3	2.4
2	7.5	6.8	4.3	3.4	2.7
3	10.6	9.6	6.1	4.8	3.9
5	16.7	15.2	9.7	7.6	6.1
7-1/2	24.2	22	14	11	9
10	30.8	28	18	14	11
15	46.2	42	27	21	17
20	59.4	54	34	27	22
25	74.8	68	44	34	27
30	88	80	51	40	32
40	114	104	66	52	41
50	143	130	83	65	52
60	169	154	103	77	62
75	211	192	128	96	77
100	273	248	165	124	99
125	343	312	208	156	125
150	396	360	240	180	144
200	528	480	320	240	192
250	-	604	403	302	242
300	-	722	482	361	289
350	-	828	560	414	336
400	-	954	636	477	382
450	-	1030	-	515	412
500	-	1180	786	590	472

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Contactors 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 $I_c = I_e$ for category AC-1. The curve corresponding to category AC-1 represents the electrical durability variation of standard contactors in relation to the breaking current I_c .

Electrical durability is expressed in millions of operating cycles.

Curve Utilization Mode

Electrical durability forecast and contactor selection for category AC-1

- Note the characteristics of the load to be controlled:
 - Operational voltage U_e
 - Current normally drawn I_e
 - Utilization category AC-1
 - Breaking current $I_c = I_e$ for AC-1
- 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 ($I_c ; N$).

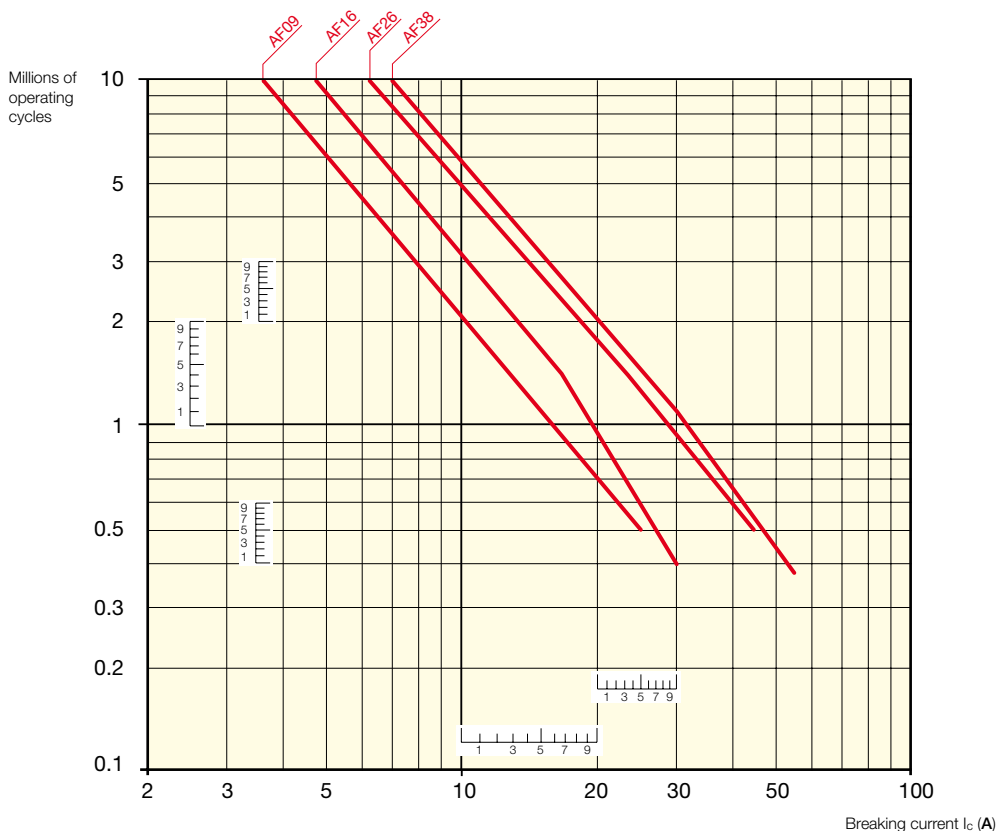
Case of uninterrupted duty

For uninterrupted duty, some verifications of preventing maintenance are necessary to check the functionality of the concerned product (consult us). 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.

Electrical Durability for AC-1 Utilization Category - $U_e \leq 690$ V. Ambient Temperature ≤ 60 °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.

Maximum electrical switching frequency: see "Technical Data".



AF09 ... AF38 4-pole contactors AC-1 electrical durability