

Technical Data

IEC Ratings

Utilization categories for contactors to IEC/EN 60 947-4-1, VDE 0660 part 102			Verification of electrical endurance						Verification of rated making and breaking capacities							
Type of current	Utilization category	Typical applications	Make			Break			Make			Break				
			I_e	$\frac{I}{I_e}$	$\frac{U}{U_e}$	$\cos \phi$	I_c	$\frac{U_r}{U_e}$	$\cos \phi$	I_e	$\frac{I}{I_e}$	$\frac{U}{U_e}$	$\cos \phi$	I_c	$\frac{U_r}{I_e}$	$\cos \phi$
			A							A						
AC	AC-1	Non-inductive or slightly inductive loads, resistance furnaces	all values	1	1	0.95	1	1	0.95	all values	1.5	1.05	0.8	1.5	1.05	0.8
	AC-2	Slip-ring motors: starting, switching off	all values	2.5	1	0.65	2.5	1	0.65	all values	4	1.05	0.65	4	1.05	0.65
	AC-3	Squirrel-cage motors: starting, switching off motors during running ⁴⁾	$I_e \leq 17$	6	1	0.65	1	0.17	0.65	$I_e \leq 100$	10	1.05	0.45	8	1.05	0.45
			$I_e > 17$	6	1	0.35	1	0.17	0.35	$I_e > 100$	10	1.05	0.35	8	1.05	0.35
	AC-4	Squirrel-cage motors: starting, plugging, inching	$I_e \leq 17$	6	1	0.65	6	1	0.65	$I_e \leq 100$	12	1.05	0.45	10	1.05	0.45
			$I_e > 17$	6	1	0.35	6	1	0.35	$I_e > 100$	12	1.05	0.35	10	1.05	0.35
	AC-5A	Switching of electric discharge lamps,									3.0	1.05	0.45	3.0	1.05	0.45
	AC-5B	Switching of incandescent lamps									1.5 ²⁾	1.05 ²⁾		1.5 ²⁾	1.05 ²⁾	
	AC-6A ³⁾	Switching of transformers														
	AC-6B ³⁾	Switching of capacitor banks														
AC-7A	Slightly inductive loads in household appliances and similar applications	as specified by the manufacturer								1.5	1.05	0.8	1.5	1.05	0.8	
AC-7B	Motor loads for household applications									8.0	1.05 ¹⁾		8.0	1.05 ¹⁾		
AC-8A	Hermetic refrigerant compressor motor control with manual resetting of overload trips ⁵⁾									6.0	1.05 ¹⁾		6.0	1.05 ¹⁾		
AC-8B	Hermetic refrigerant compressor motor control with automatic resetting of overload trips ⁵⁾									6.0	1.05 ¹⁾		6.0	1.05 ¹⁾		
AC-53A	Control of squirrel-cage motors with semiconductor contactors									8.0	1.05	0.35	8.0	1.05	0.35	
			I_e	$\frac{I}{I_e}$	$\frac{U}{U_e}$	L/R	I_c	$\frac{U_r}{U_e}$	L/R	I_e	$\frac{I}{I_e}$	$\frac{U}{U_e}$	L/R	I_c	$\frac{U_r}{I_e}$	L/R
			A			ms			ms	A			ms			ms
DC	DC-1	Non-inductive or slightly inductive loads, resistance furnaces	all values	1	1	1	1	1	1	all values	1.5	1.05	1	1.5	1.05	1
	DC-3	Shunt motors: starting, plugging, inching, dynamic braking	all values	2.5	1	2	2.5	1	2	all values	4	1.05	2.5	4	1.05	2.5
	DC-5	Series motors: starting, plugging, inching, dynamic braking	all values	2.5	1	7.5	2.5	1	7.5	all values	4	1.05	15	4	1.05	15
	DC-6	Switching of incandescent lamps									1.5 ²⁾	1.05 ²⁾		1.5 ²⁾	1.05 ²⁾	
Utilization categories for control switches to IEC/EN 60 947-5-1, VDE 0660 part 200			Normal conditions of use						Abnormal conditions of use							
Type of current	Utilization category	Typical applications	Make			Break			Make			Break				
			$\frac{I}{I_e}$	$\frac{U}{U_e}$	$\cos \phi$	$\frac{I_c}{I_e}$	$\frac{U_r}{U_e}$	$\cos \phi$	$\frac{I}{I_e}$	$\frac{U}{U_e}$	$\cos \phi$	$\frac{I_c}{I_e}$	$\frac{U_r}{I_e}$	$\cos \phi$		
AC	AC-12	Control of resistive and solid state loads with isolation by optocouplers	1	1	0.9	1	1	0.9	-	-	-	-	-	-		
	AC-13	Control of solid state loads with transformer isolation	2	1	0.65	1	1	0.65	10	1.1	0.65	1.1	1.1	0.65		
	AC-14	Control of small electromagnetic loads (max. 72 VA)	6	1	0.3	1	1	0.3	6	1.1	0.7	6	1.1	0.7		
	AC-15	Control of electromagnetic loads (> 72 VA)	10	1	0.3	1	1	0.3	10	1.1	0.3	10	1.1	0.3		
				$\frac{I}{I_e}$	$\frac{U}{U_e}$	$t_{0.95}$	$\frac{I_c}{I_e}$	$\frac{U_r}{U_e}$	$t_{0.95}$	$\frac{I}{I_e}$	$\frac{U}{U_e}$	$t_{0.95}$	$\frac{I_c}{I_e}$	$\frac{U_r}{I_e}$	$t_{0.95}$	
DC	DC-12	Control of resistive and solid state loads with isolation by optocouplers	1	1	1	1	1	1	-	-	-	-	-	-		
	DC-13	Control of electromagnets	1	1	6xP ⁶⁾	1	1	6xP ⁶⁾	1.1	1.1	6xP ⁶⁾	1.1	1.1	6xP ⁶⁾		
	DC-14	Control of electromagnetic loads having economy resistors in circuit	10	1	15	1	1	15	10	1.1	15	10	1.1	15		

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General Information

Utilization categories for switch disconnectors, disconnectors, switches and fuse combination units			Verification of electrical endurance					Verification of rated making and breaking capacities								
to IEC/EN 60 947-3, VDE 0660 part 107			Make		Break			Make		Break						
Type of current	Utilization category	Typical applications	I_e	$\frac{I}{I_e}$	$\frac{U}{U_e}$	$\cos \varphi$	I_c	$\frac{U_r}{U_e}$	$\cos \varphi$	I_e	$\frac{I}{I_e}$	$\frac{U}{U_e}$	$\cos \varphi$	I_c	$\frac{U_r}{I_e}$	$\cos \varphi$
AC	AC-20A (B) ⁸⁾	Connecting and disconnecting under no-load conditions	all values	7)	7)	7)	7)	7)	7)	all values	7)	1.05	7)	7)	1.05	7)
	AC-21A (B) ⁸⁾	Switching of resistive loads, including slight overloads	all values	1	1	0.9	1	1	0.95	all values	1.5	1.05	0.95	1.5	1.05	0.95
	AC-22A (B) ⁸⁾	Switching of mixed resistive and inductive loads, including slight overloads	all values	1	1	0.8	1	1	0.8	all values	3	1.05	0.65	3	1.05	0.65
	AC-23A (B) ⁸⁾	Switching of motor loads and other highly inductive loads	all values	1	1	0.65	1	1	0.65	$I_e \leq 100$	10	1.05	0.45	8	1.05	0.45
										$I_e > 100$	10	1.05	0.35	8	1.05	0.35
			I_e	$\frac{I}{I_e}$	$\frac{U}{U_e}$	L/R	$\frac{I_c}{I_e}$	$\frac{U_r}{U_e}$	L/R	I_e	$\frac{I}{I_e}$	$\frac{U}{U_e}$	L/R	$\frac{I_c}{I_e}$	$\frac{U_r}{I_e}$	L/R
			A			ms			ms	A			ms			ms
DC	DC-20A (B) ⁸⁾	Connecting and disconnecting under no-load conditions	all values	7)	7)	7)	7)	7)	7)	all values	7)	1.05	7)	7)	1.05	7)
	DC-21A (B) ⁸⁾	Switching of resistive loads, including slight overloads	all values	1	1	1	1	1	1	all values	1.5	1.05	1	1.5	1.05	1
	DC-22A (B) ⁸⁾	Switching of mixed resistive and inductive loads, including slight overloads (e.g. shunt motors)	all values	1	1	2	1	1	2	all values	4	1.05	2.5	4	1.05	2.5
	DC-23A (B) ⁸⁾	Switching of highly inductive loads (e.g. series motors)	all values	1	1	7.5	1	1	7.5	all values	4	1.05	15	4	1.05	15

- Notes:**
- ¹⁾ $\cos \varphi = 0.45$ for $I_e \leq 100$ A; $\cos \varphi = 0.35$ for $I_e > 100$ A.
 - ²⁾ The tests are to be carried out with an incandescent lamp load
 - ³⁾ The test data are to be derived from the test values for AC-3 or AC-4 according to Table VIII, EN 60 947-4-1.
 - ⁴⁾ AC-3 category may be used for occasional inching (jogging) or plugging for limited time periods, e.g. for setting up a machine. during such limited time periods, the number of such operations should not exceed five per minute or ten in any ten minute period.
 - ⁵⁾ A hermetic refrigerant compressor motor is a combination consisting of a compressor and a motor, both of which are enclosed in the same housing, with no external shaft or shaft seals and with the motor operating in the refrigerant.
 - ⁶⁾ The value "6xP" results from an empirical relationship which is found to represent most DC magnetic loads to an upper limit of P = 50W, where 6xP = 300ms. Loads with a rated power consumption greater than 50W are assumed to consist of smaller loads in parallel. 300 ms is therefore an upper limit, irrespective of the power consumption value.
 - ⁷⁾ If the switching device has a making and/or breaking capacity, the figures for the current and the power factor (time constants) must be stated by the manufacturer.
 - ⁸⁾ A: frequent actuation
B: occasional actuation

Moeller equipment is designed for the world's markets

All equipment is manufactured and tested in accordance with national and international standards and regulations, the most important of which are listed below:

IEC 60 439
Low-voltage switchgear and controlgear assemblies

IEC 60 947-..., EN 60 947-...
Low voltage switchgear and controlgear

VDE 0660

IEC 60 664
Insulation co-ordination including clearances and creepage distances for equipment

VDE 0110

IEC 60 364-...
Electrical installations of buildings

VDE 0100

IEC 60 204-..., EN 60 204-...
Electrical equipment of industrial machines

VDE 0113

VDE 0105
Operation of electrical power installations

IEC 60 536
Protection against electric shock

VDE 0106

Key

I= Current made
 I_c = Current broken
 I_e = Rated operational current
U= Voltage
 U_e = Rated operational voltage
 U_r = Recovery voltage
 $t_{0.95}$ = Time in ms to reach 95% of the steady-state current
P= $U_e \times I_e$ = rated power consumption in Watts

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Degree of protection given to electrical apparatus by enclosures and covers, in accordance with IEC 60 529

	1st numeral		2nd numeral
	Protection of persons against contact with live parts	Protection of equipment against solid foreign bodies and dust	Protection of equipment against ingress of liquid
IP 00	No protection	No protection	No protection
IP 20	Protection against accidental contact with fingers	Protection against solid particles > 12mm diameter	No protection
IP 41	Protection against accidental contact with tools, etc.	Protection against solid particles > 1 mm diameter	Drops of condensed water have no harmful effect
IP 43	Protection against accidental contact with tools, etc.	Protection against solid particles > 1 mm diameter	No harmful effect from rain or water sprayed from vertical to 30° from horizontal
IP 54	Complete protection	No harmful deposits of dust in the interior	No harmful effect from splashing water, any direction
IP 55	Complete protection	No harmful deposits of dust in the interior	No harmful effect from hosed water
IP 65	Complete protection	Complete dust protection (dust-proof)	No harmful effect from hosed water
IP 66	Complete protection	Complete dust protection (dust-proof)	No harmful effect from temporary flooding
IP 67	Complete protection	Complete dust protection (dust-proof)	No harmful effect from being immersed in water
IP 68	Complete protection	Complete dust protection (dust-proof)	No harmful effect from being immersed in water for an indeterminate period
IP 69K	Complete protection	Complete dust protection (dust-proof)	No harmful effects from water directed against the enclosure under very high pressure and from any direction (high pressure/ steam jet hoses, 80 - 100 bar)

Protection against electric shock to IEC 60 536

IEC 60 536 covers the erection of electrical equipment and its arrangement in electrical installations with rated voltages up to 1000 V AC and 1500 V DC, with regard to protection against direct contact where operating elements such as pushbuttons and switches are located in the vicinity of live parts.

"Finger-proofing" relates only to the operating device, and only in the normal direction of operation. A clearance of at least 30 mm radius must be ensured from the centre point of the device to any live parts.

Degree of protection IP 20 is superior to "finger-proofing" in that it embodies protection against contact with electrical apparatus in any direction. Devices which are "finger-proof" and have degree of protection IP 00 can be provided with further protection against contact in the form of shrouding, if so desired.

Damp heat, constant to IEC 60 068 Part 2 - 3

In this test, the effects of a constant high level of humidity ($93 \pm 2/_{-3}$) % and a constant air temperature (40 ± 2)° C are observed over a prescribed duration.

Damp heat, cyclic to IEC 60 068, Part 2 - 30, Test Db

This test is used to assess the suitability of electrical products for operation and storage at high relative humidity levels combined with cyclical temperature fluctuations.

A test cycle consists of 12 hours at (40 ± 2)° C, with relative humidity of (93 ± 3)° C, and 12 hours at (25 ± 3)°C, with relative humidity of at least 95%.

Ambient temperature

Ambient temperature is the temperature of the room (e.g. factory bay or switchgear room), in which the open or enclosed device is installed, and with the proviso that this temperature must not be significantly influenced by heat losses from the device.

Cross reference for various IEC, UL/NEMA and CSA standards

Type of equipment	Standard numbers		
	IEC/EN	UL/NEMA	CSA
Contactors	60 947-4	508 / ICS-2	C 22.2-14 / E 14
Circuit breakers	60 947-2	489 / AB 1	C 22.2-5
Air break switches	60 947-3	98 / KS 1	C 22.2-4
Control switches	60 947-5	508 / ICS-2	C 22.2-14 / E 14
Motor starters	60 947-2	508 / ICS 2	C 22.2-14 / E 14
Machine tool assembly	60 204	508A* / ICS-2	C 22.2-14 / E 14
Motor control center	60 439	845 / ICS-2	C 22.2-14 / E 14
Enclosures	60 529	508 / 50 / 250	C 22.2-94

* Based on NFPA-79

1-866-595-9616
1-630-595-9515



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