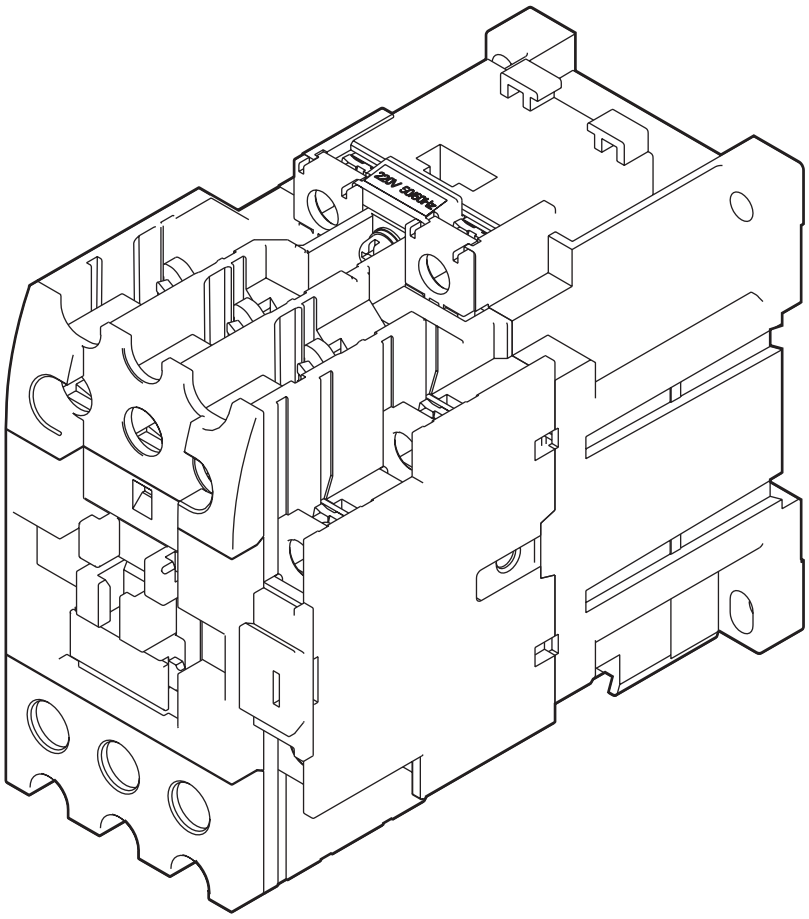
Power contactors / motor protection switches



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Important note

This document explains the relevant principles for assembling and designing power contactors and motor protection switches and their accessories.

The contents of this document are based on the currently applicable rules and regulations as well as our own test findings. No generally applicable legal obligation shall be derived from the contents of this document.

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EV series Power contactors

Power contactors are used for switching motors and power control circuits and can be controlled by a whole number of control circuits.

Hager provides a complete contactor portfolio for commercial markets, such as buildings, infrastructures, shops and warehouses.

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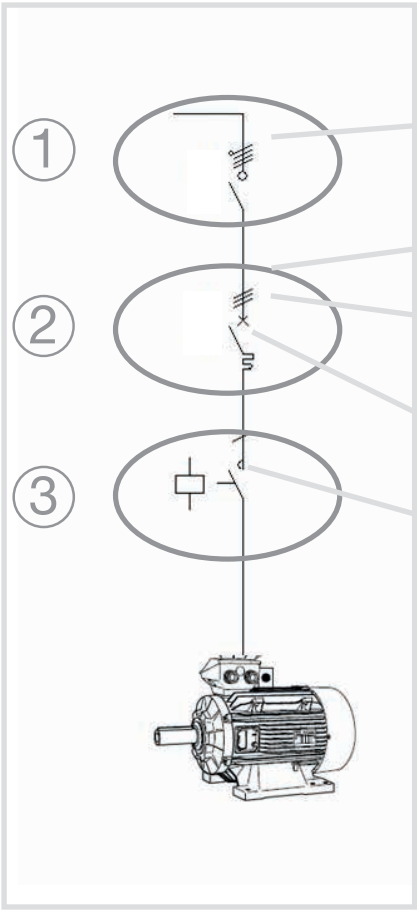
All-in-one solution

Power contactors are used for switching motors and power control circuits and can be controlled by a whole number of control circuits.

Hager provides a complete contactor portfolio for commercial markets, such as buildings, infrastructures, shops and warehouses.

Fundamental structure

The fundamental structure and functioning of a combination of power contactor and/or fuse / motor protection switch / thermal relay is described and depicted.



Function	Application
Separator	Grid separator for safety maintenance
Overload protection	In case of motor overload or blockage I<10 In
Short-circuit protection	In case of defective motor winding insulation 10 In< I <50 In In case of grid short circuit with I defect >50 In
Phase loss	Grid separation in case of overload due to phase loss
Control	Start / stop motor

Image 1: Fundamental structure of a motor protection control circuit

The fundamental structure of a contactor power circuit (Image 1) is divided into three blocks:

- **Separator** ① --> is realised with fuses, e.g. Neozed fuse element
- **Protector** ② --> there are three different types of protection for humans and machine
  overload protection --> is realised with motor protection switches or the **EVB Series** thermal relay
  short circuit protection --> is realised with a **MM Series** motor protection switch or switchable fuse element
  phase loss protection --> is realised with motor protection switches or a thermal relay
- **Controller** ③ --> is realised with **EV Series** power contactors, e.g. EV040

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The application cases that have occurred are shown once again in the table below in connection with the device specifications.

	SBN / HA switch disconnector	L90 Fuse switch disconnector	MM2 / MMN3 magnetic protection switch	MM5xxN motor protection switch	EVxx power contactor	EVBxx motor protection relay
Disconnecting connections	■	■	■	■	-	-
Overload protection	-	-	-	■	-	■
Short-circuit protection	-	■	■	■	-	-
Phase loss	-	-	■	■	-	■
Control	-	-	-	max. 40 manual actuations per hour	■	-

Table 1: Overview of devices and their protective / controlling action

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Basic knowledge

General

Standard IEC 60947-4-1. is the basis for designing and using power contactors, motor protection switches and their combination.

Contactors that meet this standard usually do not have to be able to switch off short circuit currents. Power contactor therefore have to be operated with a suitable circuit-breaker at all times.

The standard also contains the requirements for

- contactors with accompanying overload and/or circuit breakers
- starters with accompanying but separately arranged circuit breakers and/or with separately arranged circuit breakers and integrated overload protective devices
- contactors or starters that are combined with their circuit breakers under specified conditions. Such combinations, e.g. combined starters or starters with circuit breakers, are measured as one unit.

Coordinating protection – allocation types

The two allocation types, type 1 and type 2, need to be mentioned in direct connection with “Table 1: Overview of devices and their protective / controlling action”.

Standard IEC 60947-4-1 (VDE 0660-102) lists two allocation types, which determine the maximum permissible measurement short circuit current before the destruction of the switching devices. The allocation type describes the permissible degree of damage of a device after a short circuit.

Each device combination is allocated to an allocation type. The allocation type depends on the condition of the components after triggering a circuit breaker due to a fault.

Allocation type Protection coordination	Effect of a short circuit fault	Measures to be implemented after a fault
Type 1	The contactor or motor starter - must not endanger humans and machinery in the event of a short circuit - do not have to be suitable for continued operation without repair and parts replacement. It may be necessary to replace a product for continued operation	Qualified maintenance service. After a short circuit, it may be impossible to guarantee operation with having to replace parts.
Type 2	The contactor or motor starter - must not endanger humans and machinery in the event of a short circuit - do not have to be suitable for continued operation - the contacts could stick together slightly. The device is reset by manually moving the slider.	Only slight measures are required for continued use after a short circuit.

Table 2: Securely protect motors and loads (protection coordination)

Example: Power contactors / motor protection switches device combination

The circuit breaker allocation type 1/2 is explained with the blue output and product data.

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				Circuit breaker allocation type							
				MM501N - MM514N				MM520N - MM526N			
Motor characteristics				Type 1		Type 2		Type 1		Type 2	
Voltage	Output AC-3	Current consumption	Contactor	MSS In (A)	Circuit breaker Iq (kA)	MSS In (A)	Circuit breaker Iq (kA)	MSS In (A)	Circuit breaker Iq (kA)	MSS In (A)	Circuit breaker Iq (kA)
415 V	0.55kW	1.5 A	EV00710C; EV00701C; EV00710D; EV00710E	MM506N 1.6 A	150 kA	MM506N 1.6 A	50 kA				
	0.75kW	1.8 A	EV00710C; EV00701C; EV00710D; EV00710E	MM507N 2.5 A	150 kA	MM507N 2.5 A	50 kA				
	1.1kW	2.6 A	EV00710C; EV00701C; EV00710D; EV00710E	MM508N 4 A	150 kA	MM508N 4 A	50 kA				
	1.5kW	3.5 A	EV00710C; EV00701C; EV00710D; EV00710E	MM508N 4 A	150 kA	MM508N 4 A	50 kA				
	2.2kW	4.8 A	EV00710C; EV00701C; EV00710D; EV00710E	MM509N 6.3 A	150 kA	MM509N 6.3 A	50 kA				
	3kW	6.4 A	EV01810C; EV01810D; EV01810E			MM510N 10 A	50 kA				
			EV00710C; EV00701C; EV00710D; EV00710E	MM510N 10 A	150 kA						
	4kW	8.2 A	EV01810C; EV01810D; EV01810E			MM510N 10 A	50 kA				
			EV00910C; EV00901C; EV00910D; EV00910E	MM510N 10 A	150 kA						

Table 3: Circuit breaker allocation type

Motor data: P = 3 kW, I_N = 6,4 A

Device combination: Power contactor / motor protection switch

► **The corresponding protection coordination tables are included in the appendix (“Coordination table for 3pole contactors with motor protection switch” on page 51).**

As shown in the blue area, two combinations of contactor and motor protection switch must be used for a current consumption of 6.4 A.

The first and most obvious variant to use is one with a 7 A contactor and motor protection switch of 6.3 – 10 A. In the event of a short circuit with a very high short circuit current, this combination could cause the contactor contacts to weld together (type 1 protection coordination). This combination can be used, but it has to be remembered that the contactor may have to be replaced if a fault occurs.

The second variant consists of a 17 A contactor and the same 6.3 – 10 A motor protection switch. In this combination, damage from high short circuit currents is rather low. The system can be restarted after a simple check.

In both cases, the short circuit is safely switched off. Type 2 allocation combinations are therefore better and the system is ready again quicker following a short circuit.

Allocation type 1 combinations generally are the more cost-efficient solution.

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Usage categories

The loads and purposes of contactors are stated with the usage categories **AC-x** or **DC-x** or simply “Usage cases / switching tasks” in connection with the specification of the rated operating current or motor output and rated voltage in accordance with IEC 60947. Usage categories help to find the correct contactor for the respective switching task.

A high load on the switching contacts is not based on the switch-on current, but on the switch-off current.

AC	Alternating current usage categories	Switching capacity I/I_e		Electrical lifecycle I/I_e	
		On	Off	On	Off
AC-1	non-inductive or slightly inductive loads	1.5	1.5	1	1
AC-3	Squirrel cage motors: Start. Switch off whilst running	10	8	6	1
AC-5a	Switching gas discharge lamps	3	3	-	-
AC-5b	Switching light bulbs	1.5	4	-	-
AC-15	Controlling electromagnetic load for alternating current (> 72VA)	10	10	10	1

Table 4: Usage category, test criteria

General difference “consumer protection”

Two different types of “consumer protection” generally have to be regarded.

There is the directly installed protection. In this variant, the overload protection and/or circuit breaker is installed in the main power circuit of the consumer (Image 2).

In the other variant, the contactor is installed indirectly. This means that the overload protection and short circuit protectionon are installed as separate components in the control circuit and therefore only the main power circuit and/or load is disconnected from the grid if a fault occurs (Image 4).

Example: Motor protection switch + power contactor

In this example, the motor protection switch (F1) protects the motor (M1) against overloads and short circuits >I. A preliminary fuse is not required in this case.

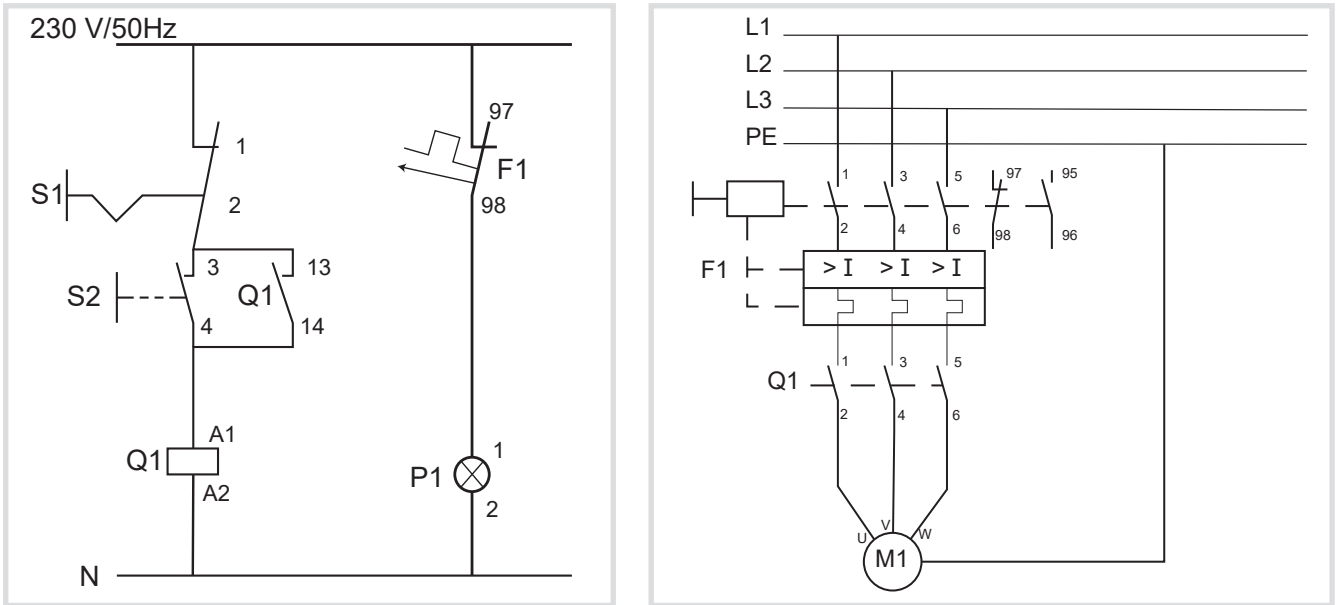

Image 2: Direct consumer protection

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S1 Emergency-stop switch (locking)
S2 On-switch
Q1 Motor contactor / load contactor
F1 Motor protection switch (adjusted to consumer / load contactor)
M1 Asynchronous motor

Image 3: Motor protection switch / contactor

Example: Fuse + power contactor + motor protection relay

The motor is protected with a motor protection relay (B1). The protection is for overload only. If an overload is detected, the opening contact (B1 (95/96)) switches off the load contactor and therefore indirectly the motor (M1) in the main power circuit. The motor is protected against short circuits with the preliminary fuses (F1-3).

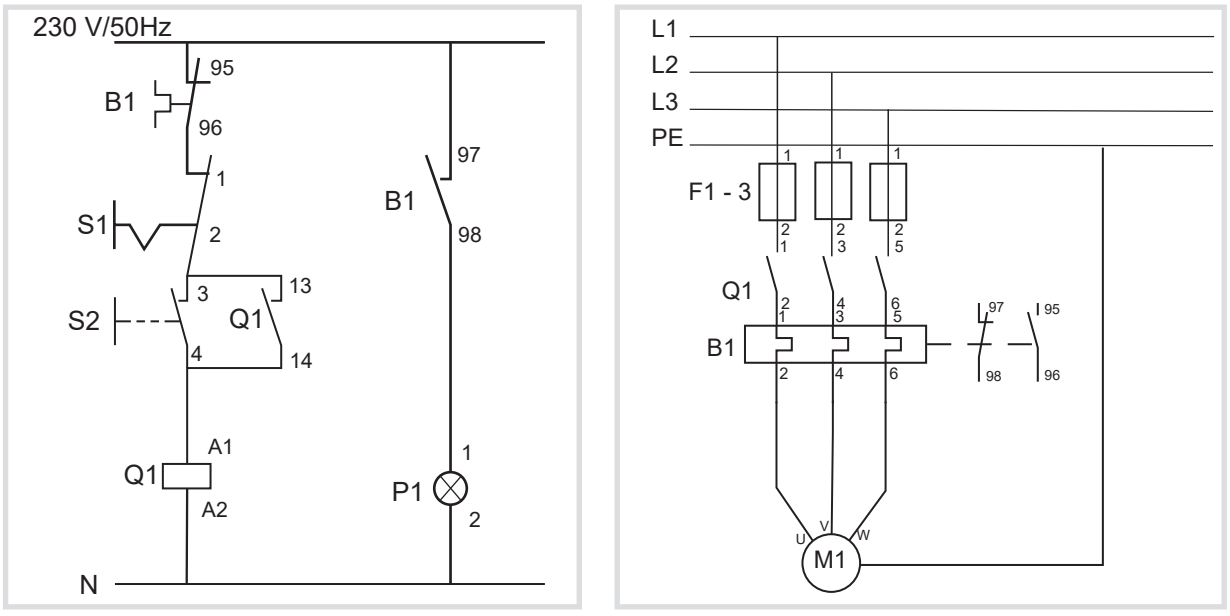

Image 4: Indirect load protection

S1 Emergency-stop switch (locking)
S2 On-switch
Q1 Motor contactor / load contactor
B1 Motor protection relay (adjusted to consumer / load contactor)
F1-3 Preliminary fuses (circuit breaker)
M1 Asynchronous motor

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Image 5: Fuse element / contactor / motor protection relay

General power contactor description

What is a power contactor, commonly also called contactor?

A power contactor / contactor or also load contactor is an electrically or electromagnetically actuated switch for electric outputs that is remotely operated / triggered. The contactor is similar in structure and function to a relay. The contactor has two switching positions only (ON/OFF) and switches in a monostable manner in ordinary conditions without implementing special measures.

3pole power contactors

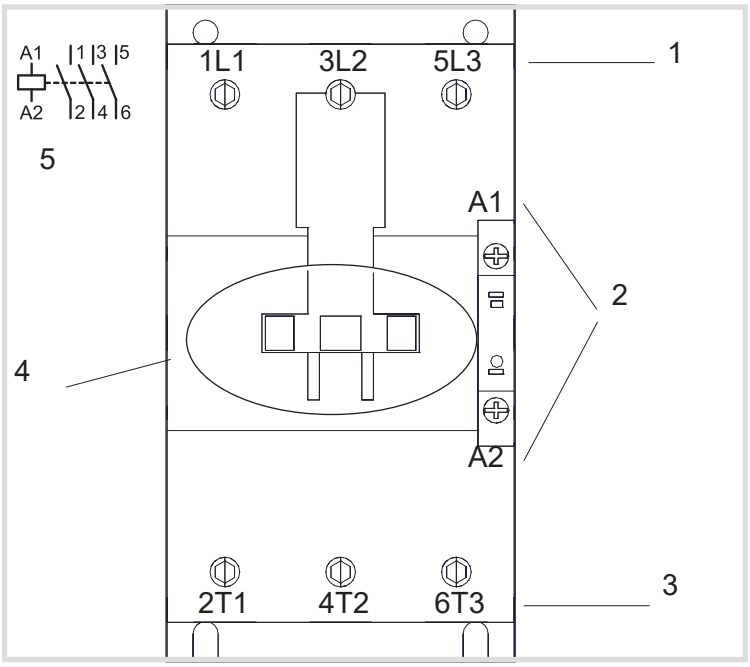

Image 6: Power contactor principle diagram

(1) Main contacts / input contacts
(2) Coil connection (control contacts)
(3) Main contacts / output contacts
(4) Holder for additional auxiliary switch components
(5) Power contactor switching symbol

The difference between a contactor and relay is that the contactor can switch much higher loads.

Contactors are used to remotely switch loads (motors / lighting systems / heating systems) on or off.

The following image (Image 7) shows a contact diagram for 3pole power contactors. The diagram shows the 3P+1 contact variant for a contactor size 1/2.

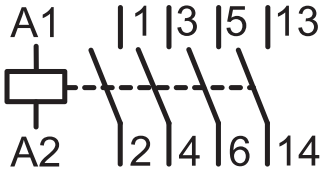

Image 7: Contact diagram for contactor size 1/2

Coil connection / control contact A1/A2
Main contacts / input contacts 1/3/5
Main contacts / output contacts 2/4/6
Auxiliary contact / opening auxiliary contact NC 13/14

The following example shows a diagram of a lighting system controller in a logistics hall.
By operating the push-button (8), the contactor(s) is (are) triggered in the switching cabinet (7). The contactor is actuated and the lighting strips (6) are switched on through the closed control contacts.

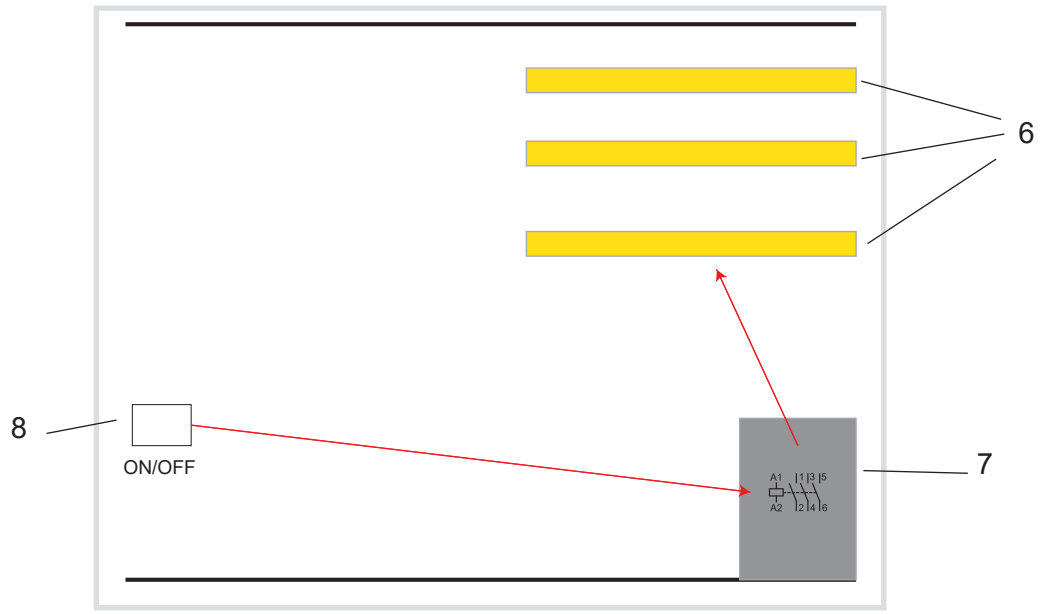

Image 8: Example of the application of contactor switching
Switching several lighting strips in a warehouse on/off

(6) Strip lights
(7) Current distributor with power contactor (EVL lamp contactor)
(8) On/off switch

4pole power contactors

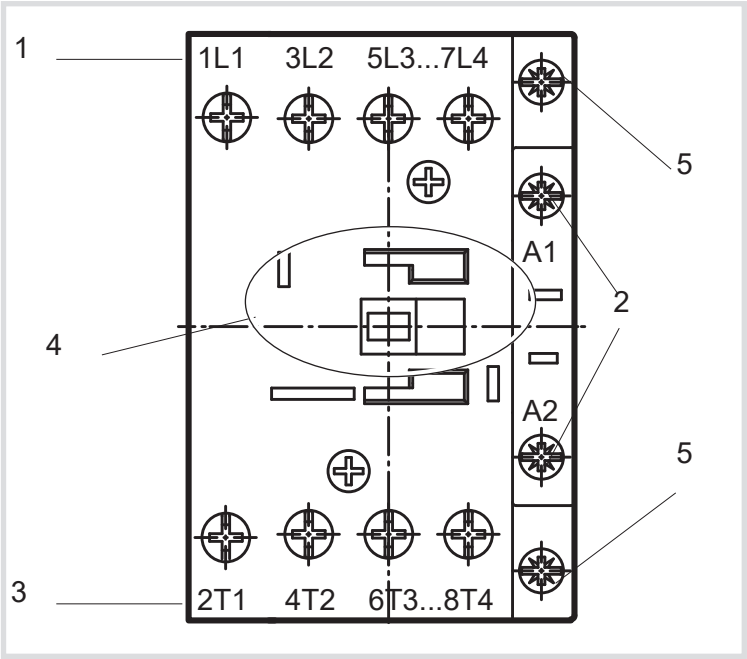

Image 9: 4P power contactor principle diagram

(1) Main contacts / input contacts
(2) Coil connection (control contacts)
(3) Main contacts / output contacts
(4) Holder for additional auxiliary switch components
(5) Auxiliary contacts

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General motor protection switch description

A motor protection switch is conventional motor protection. The motor protection switch protects electric motors against thermal overload that can occur due to mechanical overload or in the event of failure of one or two phase conductors. Most motor protection switches have 3 poles and are used for monitoring three-phase motors that should not be connected to the grid without a motor protection switch or motor protection relay.

To protect the motor, an OR-linked trigger is initiated through thermal-mechanical (bi-metal), thermal-electrical (PTC) or electronic monitoring of the currents in the three input wires. A thermal trigger of the motor protections switch, which protects against overheating, is often combined with an electromagnetic trigger, which protects against short circuits.

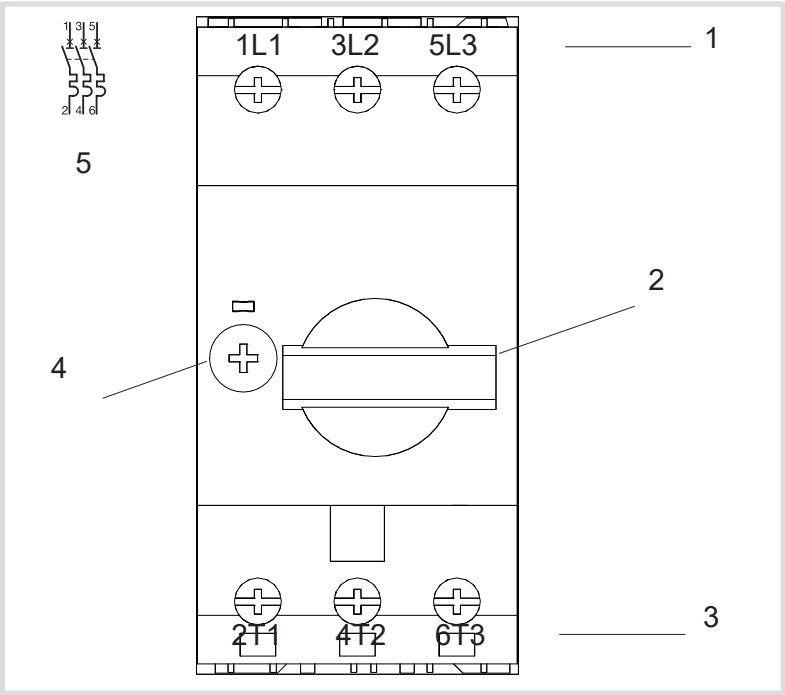

Image 10: Motor protection switch principle diagram

(1) Main contacts / input contacts
(2) Rotary toggle (on/off)
(3) Main contacts / output contacts
(4) Adjustable overload trigger
(5) Motor protections switch switching symbol

If the motor protection switch has been triggered, the motor stopped and additional hazards removed, the system switches on again either automatically or by manually pressing an unlock button. If the motor protection switch is to assume the protection function in the event of overload and short circuit for the wire and motor, the device has to be installed at the start of the motor infeed wire in accordance with the DIN VDE 0113 standard. The selection of a suitable motor protection switch depends on the rated current of the electric motor to be connected.

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General description of motor protection relay

The motor protection relay works on the same principle as a motor protection switch. However, motor protection relays do not directly switch off the motor. In the event of a fault, in other words when the motor overloads – not a short circuit – at least one opening contact or several opening / closing contacts (auxiliary contacts) are triggered. The “single” opening contact switches the power contactor of the connected motor off in most cases. The additional auxiliary contacts are generally suitable for switching off additional power contactors or for displaying an error message.

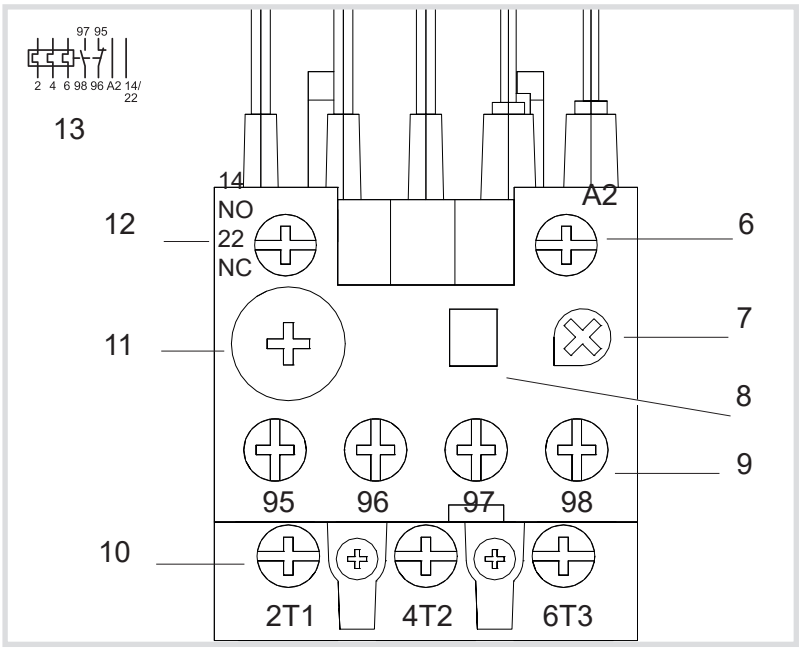

Image 11: Motor protection relay principle diagram

(6) A2 control contact of the power contactor
(7) Reset button (manual / automatic)
(8) Test button
(9) Auxiliary contacts
(10) Main contacts / output contacts
(11) Adjustable overload trigger
(12) Connection for auxiliary contacts of the power contactor
(13) Motor protections relay switching symbol

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Product description

Power contactors

This section describes Hager's power contactor product portfolio. A power contactor / contactor or also load contactor is an electrically or electromagnetically actuated switch for electric outputs that is remotely operated / triggered. The contactor is similar in structure and function to a relay. The contactor has two switching positions only (ON/OFF) and switches in a monostable manner in ordinary conditions without implementing special measures. The power contactors are different with regard to

- Size (dimensions)
- Coil connection voltage (230 AC/24 V AC/24 V DC)
- Contact variants

Three-pole power contactor structure

Image 12: 3P power contactor principle diagram

For more information on the functioning of a 3pole power contactor go to “General power contactor description” on page 12.

The 3pole power contactors of the **EVxxx** series differ in size (dimensions) as well as the resulting current rating. Hager's product portfolio comprises four sizes. The power contactors also have different numbers of contacts.

	Size 1	Size 2	Size 3	Size 4
Dimensions (W x H x D) mm	45 x 68 x 75	45 x 85 x 98	55 x 115 x 132	90 x 170 x160
Current A (AC-3 400 V)	7 ... 15.5	8 ... 38	40 ... 72	80 ... 170
Number of contacts	3P + 1	3P + 1	3P	3P

Table 5: 3pole power contactor size

The size 1 and 2 devices (up to max. 38 A) have three main contacts (3P) and an additionally integrated auxiliary contact (+1). In the size 3 and 4 variants (up to max. 170 A), auxiliary contacts can be added with an additional auxiliary switch component.

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4pole power contactor structure

Image 13: 4P power contactor principle diagram

For more information on the functioning of a 3pole power contactor go to “General power contactor description” on page 12.

The 4pole power contactors of the EVxxx series also differ in size (dimensions) as well as the resulting current rating. However, these power contactors (4P) have a fourth main contact to which the neutral wire can be connected. Hager's product portfolio comprises four sizes. The power contactors also have different numbers of contacts.

	Size 1	Size 2	Size 3	Size 4
Dimensions (W x H x D) mm	45 x 68 x 75	58 x 85 x 98	85 x 115 x 132	133 x 170 x160
Current A (AC-1 690 V)	22	32 ... 45	63 ... 80	125 ... 200
Number of contacts	4P	4P + 1	4P	4P

Table 6: 4pole power contactor size

Coil tension

The power contactors provided by Hager can be triggered with three different input currents, 230/240 V AC, 24 V AC and 24 V DC. All AC and DC-triggered devices have the same dimensions.

Coil tension	230 / 240 V AC (50/60 Hz)	24 V AC (50/60 Hz)	24 V DC
Item number ending	EVxxxxxC	EVxxxxxD	EVxxxxxE

Table 7: Coil tension overview – item number

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Power contactor coding table

E	V		0	0	7		C

Product type
EV = power contactor for Europe

Product family
= 3pole contactor
L = 3pole contactor for lighting
N = 4pole contactor
R = auxiliary contactor

Coil voltage
C = 230 VAC
D = 24 VAC
E = 24 VDC

Auxiliary contact type
empty = no integrated auxiliary contact
10 = 1 NO
01 = 1 NC
11 = 1 NO / 1 NC
40 = 4 NO
31 = 3 NO / 1 NC
22 = 2 NO / 2 NC

Reference code	3pole AC-3	4pole AC-1	3pole AC-5b *
004	4 A	-	-
007	7 A	45A	45A
009	9 A	50A	50A
012	12 A	63A	63A
014	14 A	65A	65A
015	15.5 A	72 A	72 A
018	18 A	80A	80A
021	21A	95A	95A
022	22A	115A	115A
025	25A	125A	125A
027	27A	150A	150A
032	32A	160A	160A
038	38A	170A	170A
040	40A	200A	200A

for lighting systems

Accessories

Hager also provides the corresponding accessories for the power contactors. Various components are available as accessories for every size.

– **EV000x series** auxiliary switch components

Auxiliary switch components are additional modules of varying sizes, depending on the dimensions. They are locked onto the front of the contactor.

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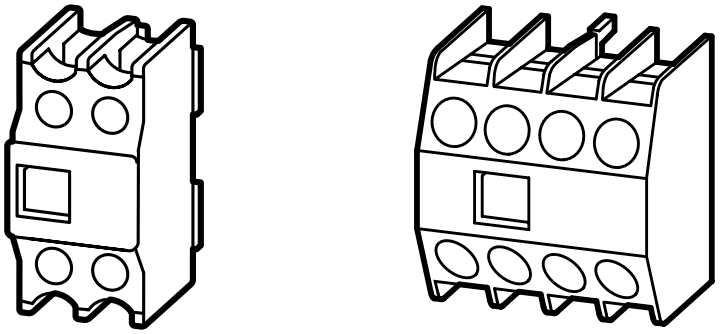

Image 14: 2pole auxiliary switch component (left) / 4pole (right)

			Auxiliary contacts							
			Size 1+2	Size 1+2	Size 3+4	Size 3+4	Size 1+2	Size 1+2	Size 1+2	Size 1+2
Contactor			EVA001	EVA002	EVA003	EVA004	EVA005	EVA006	EVA007	EVA008
3P	EV00710	Size1	x	x			x	x	x	x
	EV00910		x	x			x	x	x	x
	EV01210		x	x			x	x	x	x
	EV01510		x	x			x	x	x	x
	EV00701						x	x	x	x
	EV00901						x	x	x	x
	EV01201						x	x	x	x
	EV01501						x	x	x	x
	EV01810	Size2	x	x			x	x	x	x
	EV02510		x	x			x	x	x	x
	EV03210		x	x			x	x	x	x
	EV03810		x	x			x	x	x	x
	EV040	Size3			x	x				
	EV050				x	x				
	EV065				x	x				
	EV072				x	x				
	EV080	Size 4			x	x				
	EV095				x	x				
	EV115				x	x				
	EV150				x	x				
	EV170				x	x				
3P L	EVL14	Size2	x	x			x	x	x	x
	EVL21		x	x			x	x	x	x
	EVL27		x	x			x	x	x	x
4P	EVN22	Size1	x	x			x	x	x	x
4P+1	EVN32	Size 2/4P	x	x			x	x	x	x
	EVN45		x	x			x	x	x	x
4P	EVN63	Size 3/4P			x	x				
	EVN80				x	x				
	EVN125	Size 4/4P			x	x				
	EVN160				x	x				
	EVN200				x	x				
4 P relay	EVR00440 C/D/E	Size1					x	x	x	x
	EVR00431 C/D/E						x	x	x	x
	EVR00422 C/D						x	x	x	x
	EVR00422E						x			

Table 8: Auxiliary switch component compatibility list

– Motor protection switch and contactor adapter to contactors EVA801, ...2, ...3

These adapters create rigid mechanical connections between the power contactor and motor protection switch. The component is suitable for size 1/2 power contactors.

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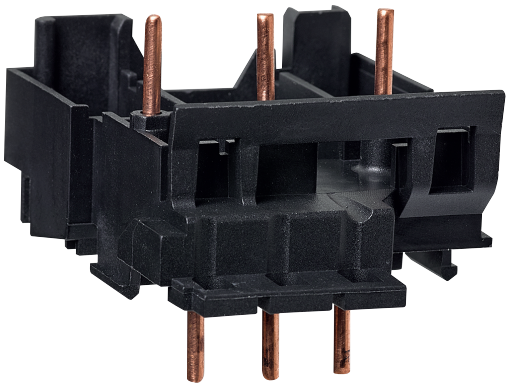

Image 15: Adapter

			Assembling link		
			Size 1	Size 2	Size 3
Contactor			EVA801	EVA802	EVA803
3P	EV00710	Size1	x		
	EV00910		x		
	EV01210		x		
	EV01510		x		
	EV00701		x		
	EV00901		x		
	EV01201		x		
	EV01501		x		
	EV01810	Size2		x	
	EV02510			x	
	EV03210			x	
	EV03810			x	
	EV040	Size3			x
	EV050				x
	EV065				x
	EV072				x

Table 9: Adapter compatibility list

Conventional wiring between the contactor and motor protection switch must be used for size 3/4 power contactors.

- Mechanical interlock EVA101, ...2, ...3, ...4

  Two contactors can be mechanically locked with one another with these devices (right / left direction of movement). The sizes of the contactors and related mechanical interlock must be observed.

Image 16: Mechanical interlock

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			Mechanical interlock			
			Size 1	Size 2	Size 3	Size 4
Contactor			EVA101	EVA102	EVA103	EVA104
3P	EV00710	Size1	x			
	EV00910		x			
	EV01210		x			
	EV01510		x			
	EV00701		x			
	EV00901		x			
	EV01201		x			
	EV01501		x			
	EV01810	Size2		x		
	EV02510			x		
	EV03210			x		
	EV03810			x		
	EV040	Size3			x	
	EV050				x	
	EV065				x	
	EV072				x	
	EV080	Size 4				x
	EV095					x
	EV115					x
	EV150					x
	EV170					x
3P L	EVL14	Size2		x		
	EVL21			x		
	EVL27			x		
4P	EVN22	Size1	x			
4P+1	EVN32	Size 2/4P		x		
	EVN45			x		
4P	EVN63	Size 3/4P			x	
	EVN80				x	
	EVN125	Size 4/4P				x
	EVN160					x
	EVN200					x
4 P relay	EVR00440 C/D/E	Size1	x			
	EVR00431 C/D/E		x			
	EVR00422 C/D		x			
	EVR00422E		x			

Table 10: Contactor compatibility list – mechanical interlock

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– RC quenching circuit – RC quenching circuit protection switch

A RC quenching circuit, or simply RC element, is a simple yet effective circuit, primarily for the protection of switching contacts (contactor / relay coils).

Image 17: RC element

The RC element consists of a series circuit with resistor and condenser (Image 18). When switching off electromagnetic coils, damaging high voltages are created that can destroy the components. Such RC element circuit (protection circuit) reduces such voltage peaks and therefore protects the coil's switching contacts.

The protection circuit consists of components that do not impact ordinary operating processes but are able to divert fluctuation voltages or parasitic currents.

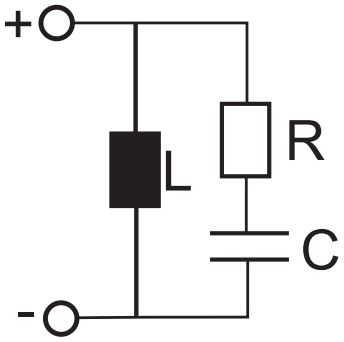

Image 18: Protection circuit with RC element

		RC protection circuit					
		Size 1	Size 2	Size 3	Size 1	Size 2	Size 3
Contactor		EVA201	EVA202	EVA203	EVA204	EVA205	EVA206
EV007	Size 1 / 3P	C			D		
EV009	Size 1 / 4P	C			D		
EV012		C			D		
EV015		C			D		
EVN22		C			D		
EV018	Size 2 / 3P		C			D	
EV025	Size 2 / 4P		C			D	
EV032			C			D	
EV038			C			D	
EVN32			C			D	
EVN45			C			D	
EV040	Size 3 / 3P			C			D
EV050	Size 3 / 4P			C			D
EV065				C			D
EV072				C			D
EVN63				C			D
EVN80				C			D

Table 11: RC element compatibility list

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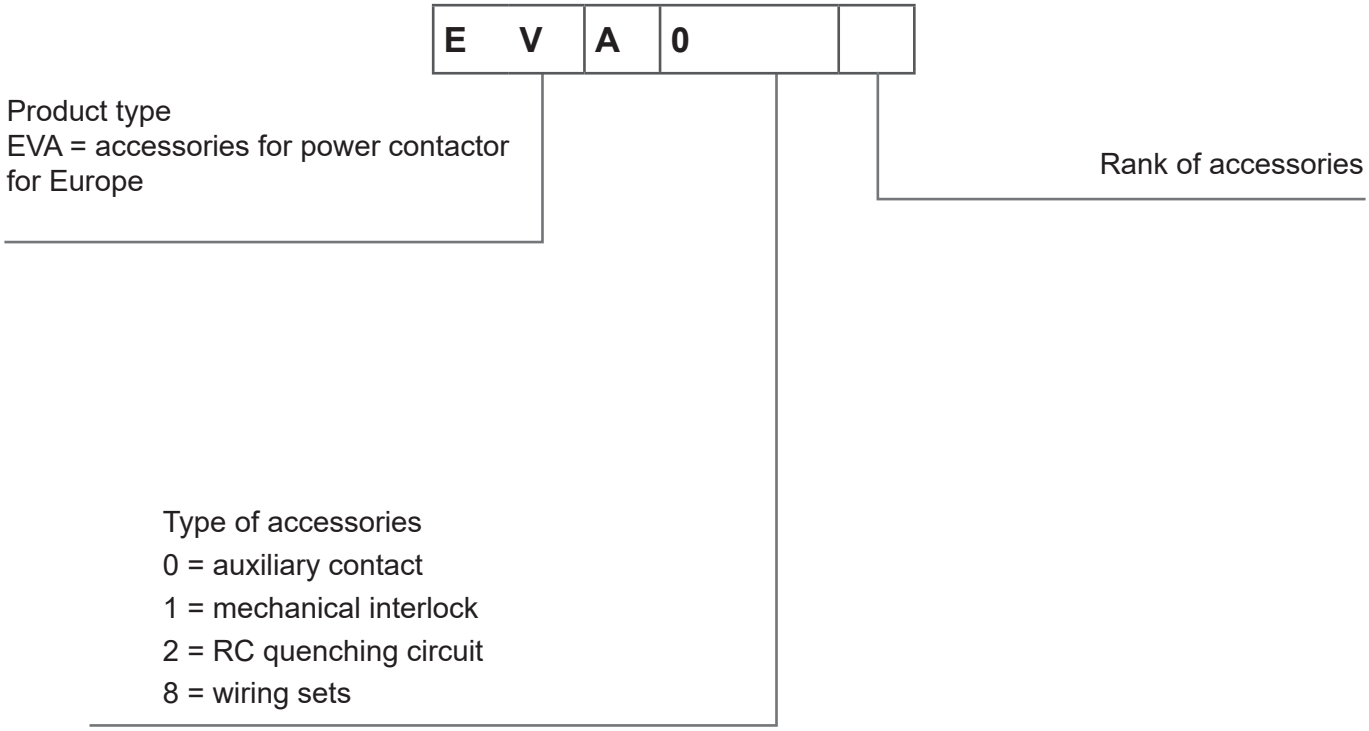
Accessories coding table



Structure of power contactors for lighting systems

In addition to the 3pole and 4pole power contactors, Hager provides special contactors for triggering **EV-Lxxx series** lighting systems. These devices are specially designed for high current peaks that primarily occur at the moment a device is switched on. These 3pole variant is available in one size and covers the output range from 14 ... 27 A.

	Size 2
Dimensions (W x H x D) mm	45 x 85 x 98
Current A (AC-5b 400 V)	14 ... 27
Number of contacts	4P

Table 12: 3pole light contactor size

Especially when triggering lighting systems, it has to be ensured that the maximum number of light sources and the resulting switch-on current are adjusted to match the respective contactor. For this purpose, Table 13 is shown with a selection of different light sources with the power contactors to be used.

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		EVL014	EVL021	EVL027
Permissible compensation capacity	C_{max} [µF]	470	470	470
Incandescent lamps	I_e [A]	14	21	27
Mixed lamps	I_e [A]	12	16	23
Fluorescent lamps, conventional throttle starter circuit	I_e [A]	20	26	35
Fluorescent lamps with lead-lag circuit (series compensation)	I_e [A]	20	26	35
Electronic ballast,, LED lamps	I_e [A]	12	18	20
High-pressure mercury vapour lamps	I_e [A]	12	18	20
Halogen metal vapour lamps	I_e [A]	12	18	20
High-pressure sodium vapour lamps	I_e [A]	12	18	20
High-pressure sodium vapour lamps	I_e [A]	7.5	10	12

Table 13: Power contactor for lighting systems

For compensated lamps, the total capacities must not exceed the maximum permissible condenser load (Cmax).

The values in the table apply per flow path in the contactor.

Auxiliary contactor structure

Auxiliary contactors are designed for use with low loads and for realising logical links in the controller structure. Power contactors, on the other hand, are designed for switching extremely currents. Auxiliary contactors can also be used for triggering power contactors and switching small consumers or display or alarm devices.

Image 19: 4 A auxiliary contactor

	Size 1
Dimensions (W x H x D) mm	45 x 68 x 75
Current A (AC-15 230 V)	4
Number of auxiliary contacts	4P

Table 14: 4pole power contactor size

Coil tension

The auxiliary contactors provided by Hager can be triggered with three different input currents, 230/240 V AC, 24 V AC and 24 V DC. All AC and DC-triggered devices have the same dimensions.

Coil tension	230 / 240 V AC (50/60 Hz)	24 V AC (50/60 Hz)	24 V DC
Item number ending	EVR004xxC	EVR004xxD	EVR004xxE

Table 15: Coil tension overview – item number

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The auxiliary contactors are available with different contact variants (Table 16).

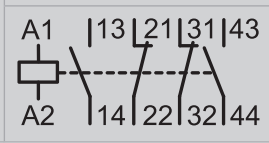
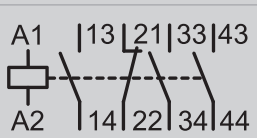
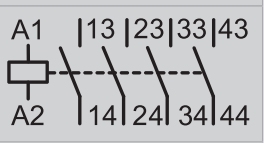
	Coil tension			Contact variants		
				2S / 2Ö	3S / 1Ö	4S
				2NC/2NO	3NC/1NO	4NC
	230 V AC	24V AC	24 V DC			
EVR00422C	X			X		
EVR00422C	X			X		
EVR00422D		X		X		
EVR00422D		X		X		
EVR00422E			X	X		
EVR00422E			X	X		
EVR00431C	X				X	
EVR00431C	X				X	
EVR00431D		X			X	
EVR00431D		X			X	
EVR00431E			X		X	
EVR00431E			X		X	
EVR00440C	X					X
EVR00440C	X					X
EVR00440D		X				X
EVR00440D		X				X
EVR00440E			X			X
EVR00440E			X			X

Table 16: Auxiliary contactor contact variants

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Motor protection switch structure

Motor protection switches, or also thermo-magnetic motor protection switches, protect one-phase or three-phase motors against excessive currents caused by thermal triggers and against excessive short circuit currents caused by magnetic triggers.

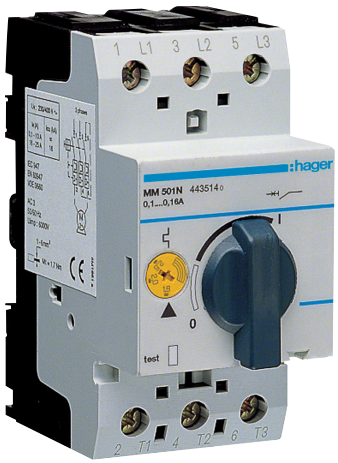

Image 20: Motor protection switch

	Size 1	Size 2
Dimensions (W x H x D) mm	45 x 93 x 94	45 x 150 x 160
Current I_r [A]	0.1 ... 32	10 ... 63

Table 17: Motor protection switch size

For more information on the functioning of a motor protection switch go to “General motor protection switch description” on page 15.

The motor protection switch is manually switched on with the rotary switch. It is manually switched off with the rotary switch, automatically with the thermo-magnetic protection device or with a remote trigger. The remote trigger is engaged into the side of the motor protection switch. The motor protection switch is available in two sizes.

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Coding table

MM	5	01	N	1

Rank of accessories

Product type
EVA = accessories for power contactor
for Europe

	Current I_{rth}[A]
01	0.1 to 0.16
02	0.16 to 0.25
03	0.25 to 0.4
04	0.4 to 0.63
05	0.63 to 1.0
06	1.0 to 1.6
07	1.6 to 2.5
08	2.5 to 4
09	4 to 6.3
10	6.3 to 10
11	10 to 16
12	16 to 20
13	20 to 25
14	25 to 32
20	10 to 16
21	16 to 25
22	25 to 32
23	32 to 40
24	40 to 50
25	50 to 58
26	55 to 63

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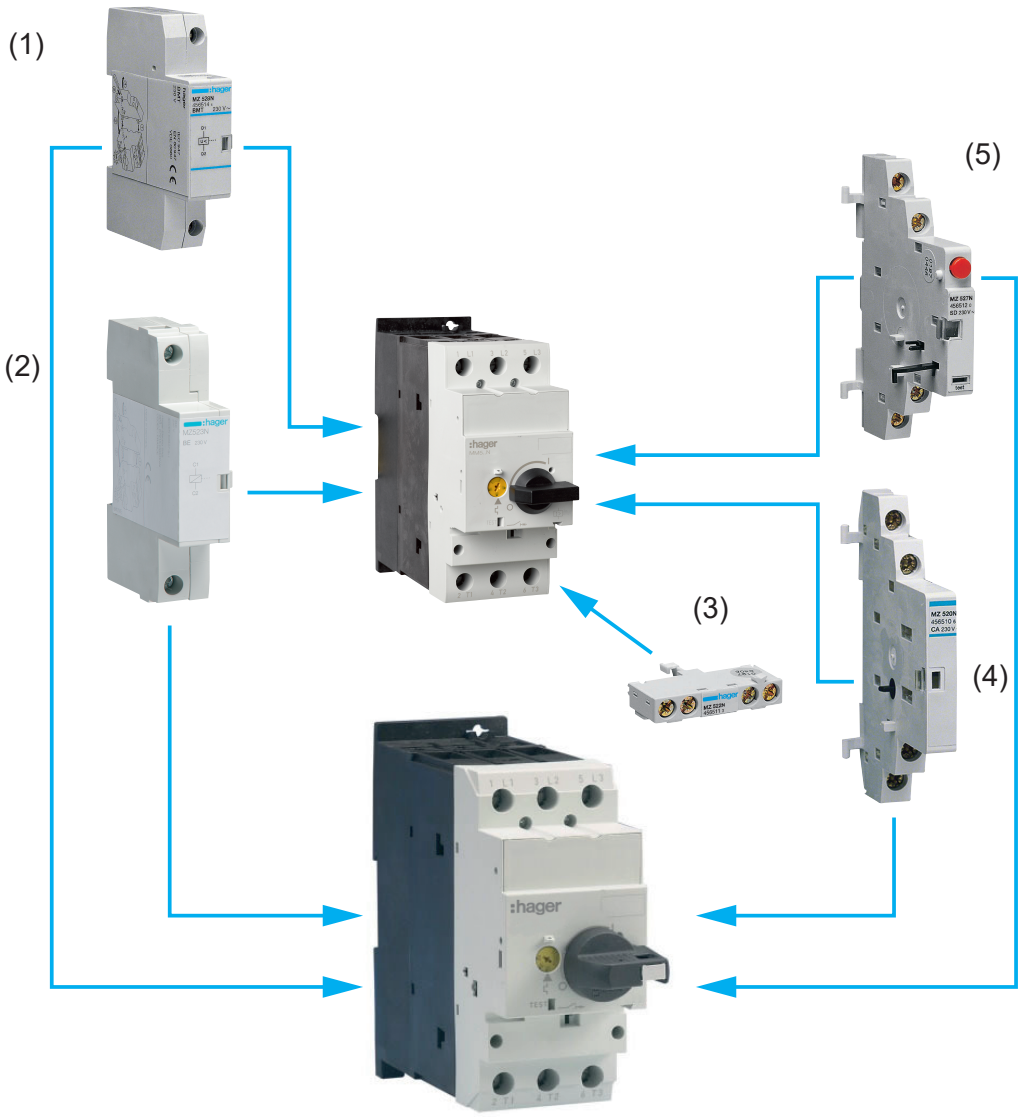

Image 21: Motor protection switch overview diagram

The following accessories can also be added to the device:

(1) Operating current trigger 230 V (MZ523N)

(2) Undervoltage trigger 230 and 400 V (MZ528N and MZ529N)

(3) / (4) Auxiliary contacts (MZ520N and MZ522N)

(5) Error notification contact (MZ527N)

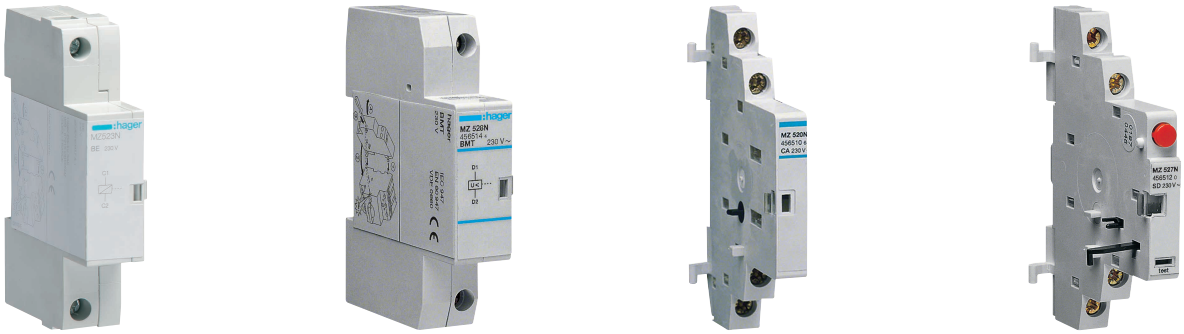

Image 22: Operating current trigger / undervoltage trigger / auxiliary contact / error notification contact

The motor protection switch can also be installed in a separate housing (Image 23) and therefore installed next to the switching cabinet, for instance.

Image 23: Motor protection switch housing

		Compatible	
Item number		MM51xN	MM52xN
KD302M	Phase bar 3P fork 10mm² 63A 2 motor protection switch	x	
KD303M	Phase bar 3P fork 10mm² 63A 3 motor protection switch	x	
KD304M	Phase bar 3P fork 10mm² 63A 4 motor protection switch	x	
MZ520N	Auxiliary contact 1S+1Ö 3,5A 230V	x	x
MZ521N	Surface-mounted housing for IP54 motor protection switch	x	
MZ522N	Front auxiliary contact for 1S motor protection switch	x	x
MZ523N	Operating current trigger motor protection switch 230V AC	x	x
MZ527N	Signal contact 2 S 3A AC1 220/500V	x	x
MZ528N	Undervoltage trigger 230V AC	x	x
MZ529N	Undervoltage trigger 400V AC	x	x
MZ530N	Surface-mounted “emergency stop” mushroom button	x	
MZ531N	Surface-mounted “emergency stop” button with key	x	

Image 24: Motor protection switch compatibility list

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Motor protection relay structure

The motor protection relay works on the same principle as a motor protection switch. However, motor protection relays do not directly switch off the motor. In the event of a fault, in other words when the motor overloads – not a short circuit – at least one opening contact or several opening / closing contacts (auxiliary contacts) are triggered. The “single” opening contact switches the power contactor of the connected motor off in most cases. The additional auxiliary contacts are generally suitable for switching off additional power contactors or for displaying an error message.

Image 25: Motor protection relays

The motor protection relays provided by Hager are available in four sizes and can be fixed directly to the power contactor of the same size.

For more information on the functioning of a motor protection relay go to “General description of motor protection relay” on page 16.

	Size 1	Size 2	Size 3	Size 4
Dimensions (W x H x D) mm	45 x 68 x 75	58 x 85 x 98	85 x 115 x 132	133 x 170 x160
Current A (AC-1 690 V)	22	32 ... 45	63 ... 80	125 ... 200
Number of contacts	4P	4P + 1	4P	4P

Table 18: Motor protection relay size

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			Accessories			
			Motor protection relays			
			Size 1	Size 2	Size 3	Size 4
			0.1 ... 16 A	4 ... 32 A	24 ... 75 A	50 ... 175 A
Contactor			EVBxxxA	EVBxxxB	EVBxxxC	EVBxxxD
3P	EV00710	Size1	x			
	EV00910		x			
	EV01210		x			
	EV01510		x			
	EV00701		x			
	EV00901		x			
	EV01201		x			
	EV01501		x			
	EV01810	Size2		x		
	EV02510			x		
	EV03210			x		
	EV03810			x		
	EV040	Size3			x	
	EV050				x	
	EV065				x	
	EV072				x	
	EV080	Size 4				x
	EV095					x
	EV115					x
	EV150					x
	EV170					x

Table 19: Motor protection relay compatibility list

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Coding table
Motor protection relays

E	V	B	00016	A

Product type
EV = power contactor for Europe

Product family
B = motor protection relay

Size
A = size 1
B = size 2
C= size 3
D= size 4

Max. operating current at AC-3 400 V

Reference code	Max. operating current AC-3 400 V
00016	0.16 A
00024	0.24 A
0004	0.4 A
0006	0.6 A
001	1 A
0016	1.6 A
0024	2.4 A
004	4 A
006	6 A
010	10 A
012	12 A
016	16 A
024	24 A
035	32 A
040	40 A
050	50 A
057	57 A
065	65 A
070	70 A
075	75 A
100	100 A
125	125 A
150	150 A
175	175 A

for lighting systems

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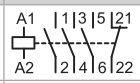
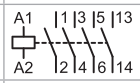
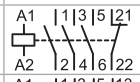
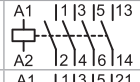
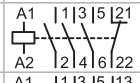
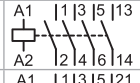
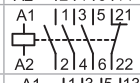
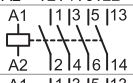
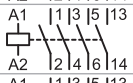
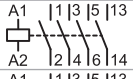
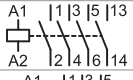
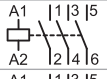
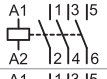
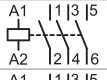
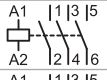
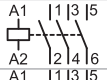
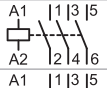
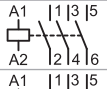
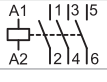
Appendix

Power contactor overview

3pole power contactors

	Ie [A] at AC-3 400 V	Pe [kW] at AC-3 400 V	Switching symbols	230 V AC order no.	24 V AC order no.	24 V DC order no.
3pole power contactors	7	3		EV00701C	-	-
	7	3		EV00710C	EV00710D	EV00710E
	9	4		EV00901C	-	-
	9	4		EV00910C	EV00910D	EV00910E
	12	5.5		EV01201C	-	-
	12	5.5		EV01210C	EV01210D	EV01210E
	15.5	7.5		EV01501C	-	-
	15.5	7.5		EV01510C	EV01510D	EV01510E
	18	7.5		EV01810C	EV01810D	EV01810E
	25	11		EV02510C	EV02510D	EV02510E
	32	15		EV03210C	EV03210D	EV03210E
	38	18.5		EV03810C	EV03810D	EV03810E
	40	18.5		EV040C	EV040D	EV040E
	50	22		EV050C	EV050D	EV050E
	65	30		EV065C	EV065D	EV065E
	72	37		EV072C	EV072D	EV072E
	80	37		EV080C	-	-
	95	45		EV095C	-	-
	115	55		EV115C	-	-
	150	75		EV150C	-	-
	170	90		EV170C	-	-

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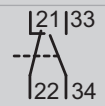
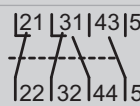
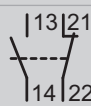
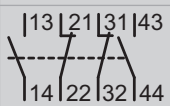
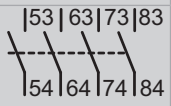
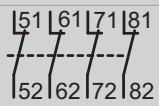
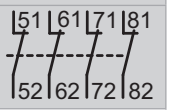
Auxiliary contacts							
EVA001	EVA002	EVA003	EVA004	EVA005	EVA006	EVA007	EVA008
							
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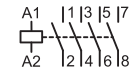
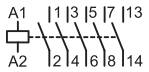
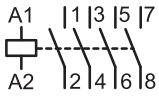
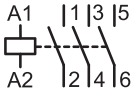
4pole power contactors

	Ie [A] at AC-1 40°C	Ie [A] at AC-1 50°C	Switching symbols	230 V AC order no.	24 V AC order no.	24 V DC order no.
4pole power contactors	22	21		EVN022C	EVN022D	EVN022E
	32	30		EVN03210C	EVN03210D	EVN03210E
	45	41		EVN04510C	EVN04510D	EVN04510E
	63	60		EVN063C	EVN063D	EVN063E
	80	76		EVN080C	EVN080D	EVN080E
	125	116		EVN125C	-	-
	160	150		EVN160C	-	-
	200	188		EVN200C	-	-

3pole lamp load contactors

	Ie = Ith [A] at 60°C 3P AC-1	Pe [kW] at AC-5b 220 - 400 V	Switching symbols	230 V AC order no.	24 V AC order no.	24 V DC order no.
Lamp load contactors for lighting applications	24	14		EVL014C	EVL014D	-
	35	21		EVL021C	EVL021D	-
	40	27		EVL027C	EVL027D	-

Auxiliary contactors

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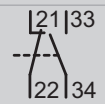
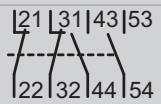
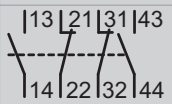
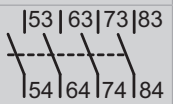
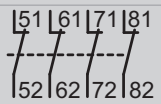
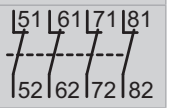
Auxiliary contacts

EVA001	EVA002	EVA003	EVA004	EVA005	EVA006	EVA007	EVA008
							
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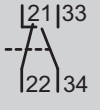
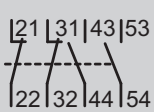
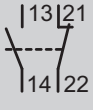
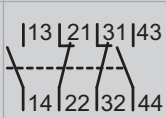
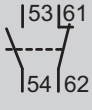
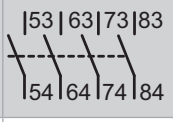
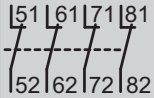
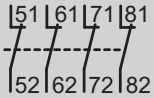
Auxiliary contacts

EVA001	EVA002	EVA003	EVA004	EVA005	EVA006	EVA007	EVA008
							
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Auxiliary contacts

EVA001	EVA002	EVA003	EVA004	EVA005	EVA006	EVA007	EVA008

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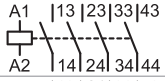
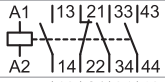
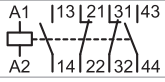
	Ie = Ith [A] at 60°C 1P	Ie [A] at AC-15 220 - 400 V	Switching symbols	230 V AC order no.	24 V AC order no.	24 V DC order no.
Auxiliary contactors	16	4		EVR00440C	EVR00440D	EVR00440E
	16	4		EVR00431C	EVR00431D	EVR00431E
	16	4		EVR00422C	EVR00422D	EVR00422E

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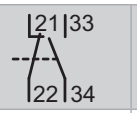	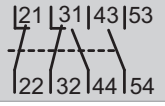	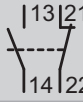	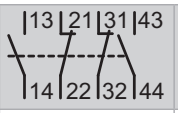		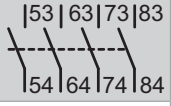	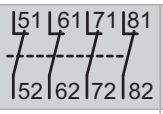	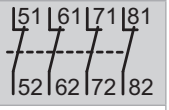
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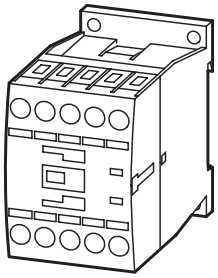
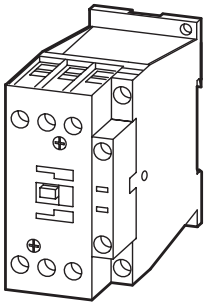
Output overview

3pole power contactors





EV	007	009	012	015	018	025	032	038
Rated operating voltage	kW	kW	kW	kW	kW	kW	kW	kW
AC-3								
Three-phase motor rated operating output 50 - 60 Hz								
220 V - 230 V	2.2	2.5	3.5	4	5	7.5	10	11
380 V - 400 V	3	4	5.5	7.5	7.5	11	15	18.5
440 V	4.5	5.5	7.5	8.4	10.5	15.5	20	21
500 V	3.5	4.5	7	7.5	12	17.5	23	24
660 V/690 V	3.5	4.5	6.5	7	11	14	17	21
AC-4								
Three-phase motor rated operating output 50 – 60 Hz								
220 V - 230 V	1	1.5	2	2	2.5	3.5	4	4
380 V - 400 V	2.2	2.5	3	3	4.5	6	7	7
440 V	2.4	3	3.6	3.6	5.5	7	8	8
500 V	2.5	2.8	3.5	3.5	6	8	9	9
660 V/690 V	2.9	3.6	4.4	4.4	6.5	8.5	10	10
AC-1								
Rated operating output at ohmic load, 40 °C								
220 V - 230 V	8	8	8	8	15	17	17	17
380 V - 400 V	14	14	14	14	26	29	29	29
440 V	16	16	16	16	30	34	34	34
500 V	19	19	19	19	34	38	38	38
660 V/690 V	25	25	25	25	45	51	51	51
1000 V	–	–	–	–	–	–	–	–
conventional thermal current	A	A	A	A	A	A	A	A
I_{th} = I_e open at 40 °C	22	22	22	22	40	45	45	45

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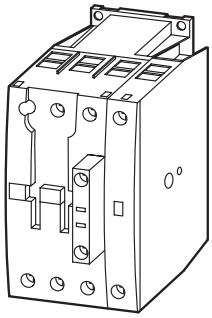

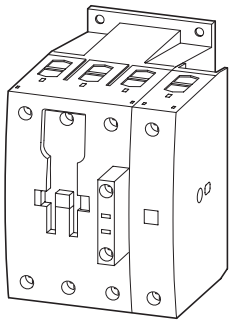

050	065	072	080	095	115	150	170
kW	kW	kW	kW	kW	kW	kW	kW
15.5	20	22	25	30	37	48	52
22	30	37	37	45	55	75	90
32	41	44	51	60	75	95	105
36	47	50	58	70	85	110	120
30	35	35	63	75	90	96	96
6	7	7	11.5	16	17	20	20
10	12	12	20	26	28	33	33
12	14	14	25	32	35	41	41
13	16	16	29	36	40	47	47
14	17	17	26	35	43	48	48
30	37	37	42	49	61	72	85
53	65	65	72	85	105	125	150
58	71	71	80	94	116	138	170
66	81	81	90	107	132	156	194
91	111	111	125	148	182	216	268
–	–	–	–	–	–	–	–
A	A	A	A	A	A	A	A
80	98	98	110	130	160	190	225

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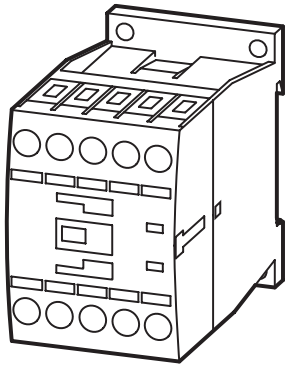
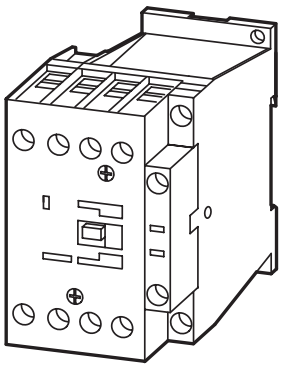
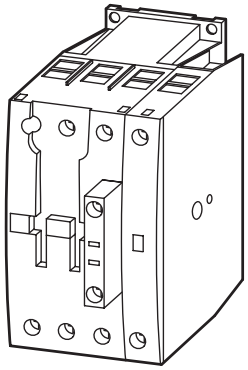
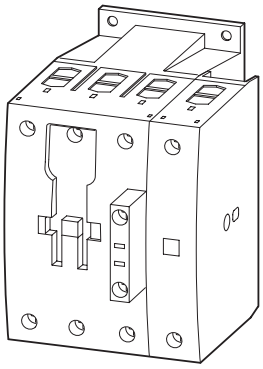
4pole power contactors





EVN	022	032	045
Catalogue page			
conventional thermal current	A	A	A
AC-1 $I_{th} = I_e$ open at 40 °C			
up to 690 V	22	32	45





063	080	125	160	200
A	A	A	A	A
63	80	125	160	200

Power dissipation table

Type	Total output loss of all contacts at in [W]	Coil holding power AC-actuated [W]	Coil holding power DC-actuated [W]
EV00701*	0.3	1.4	
EV00710*	0.3	1.4	3.0
EV00901*	0.6	1.4	
EV00910*	0.9	1.4	4.5
EV01201*	0.9	1.4	
EV01210*	1.5	1.4	4.5
EV01501*	1.5	1.4	
EV01510*	2.4	1.4	4.5
EV01810*	2.1	2.1	0.9
EV02510*	4.2	2.1	0.9
EV03210*	6.6	2.1	0.9
EV03810*	9.3	2.1	0.9
EV040*	6.6	4.1	1.0
EV050*	9.9	4.1	1.0
EV065*	17.1	4.1	1.0
EV072*	21	4.1	1.0
EV080*	9	5.8	
EV095*	12.6	5.8	
EV115*	18.9	2.3	
EV150*	32.1	2.3	
EV170*	41.1	2.3	
EVN022*	3	4	4.5
EVN03210*	6.6	8	0.9
EVN04510*	13.2	8	0.9
EVN063*	16.5	16	1.0
EVN080*	25.8	16	1.0
EVN125*	22.2	3.1	
EVN160*	36.3	3.1	
EVN200*	57	3.1	
EVL014*	7.9	2.1	
EVL021*	10.8	2.1	
EVL027*	10.3	2.1	
EVR00422*	1	1.4	1.4
EVR00431*	1.5	1.4	1.4
EVR00440*	2	1.4	1.4

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Line drawing – technical dimensions

3pole power contactors

EV007... - EV015...

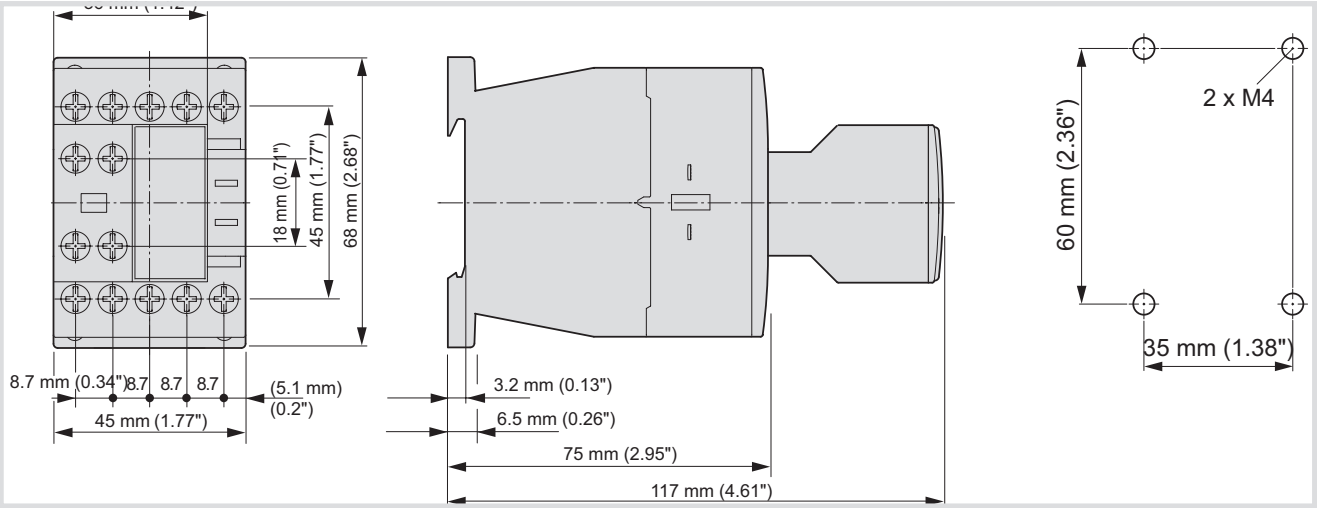

Image 26: 3pole power contactor (EV007... - EV012...)

EV018... - EV038...

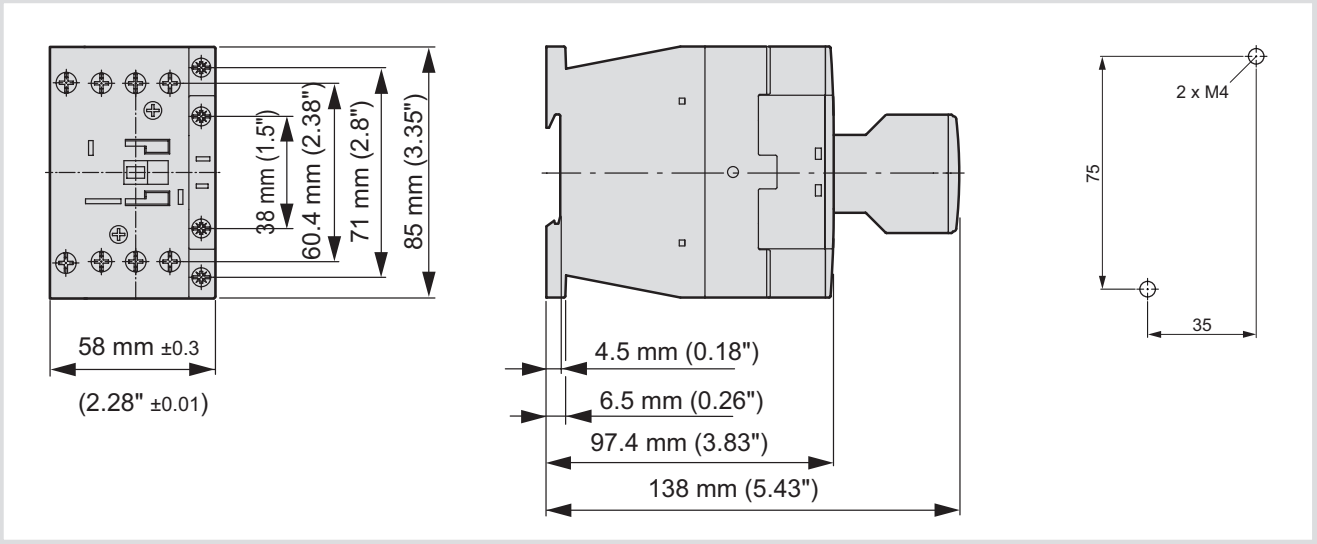

Image 27: 3pole power contactor (EV018... - EV038...)

EV040... - EV072...

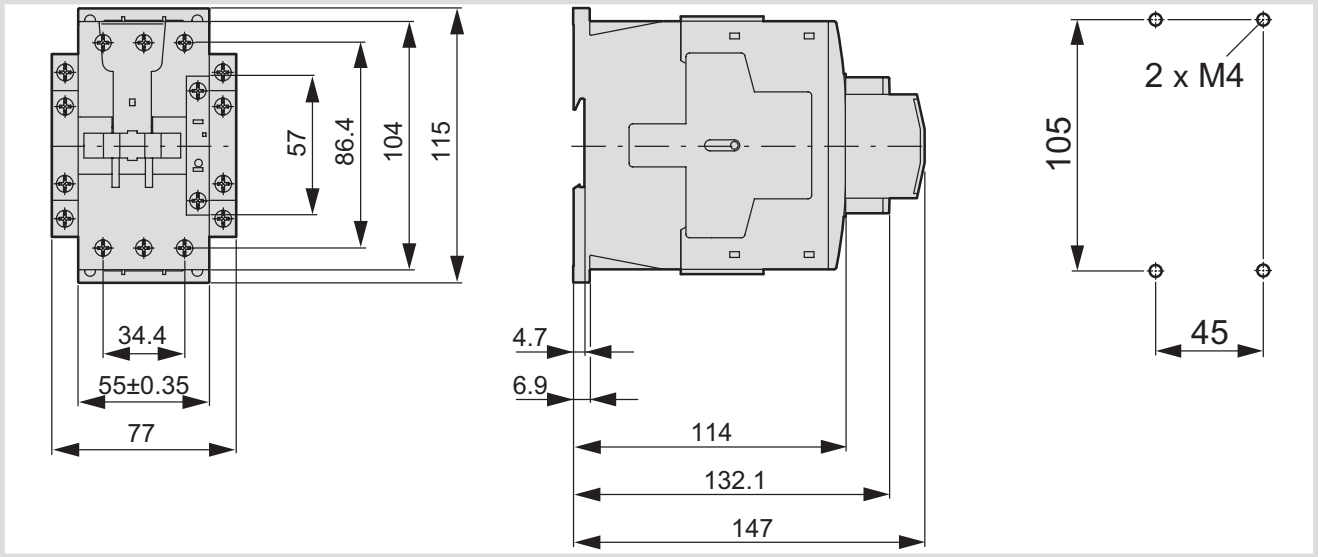

Image 28: 3pole power contactors (EV040... - EV072...)

EV080... - EV170...

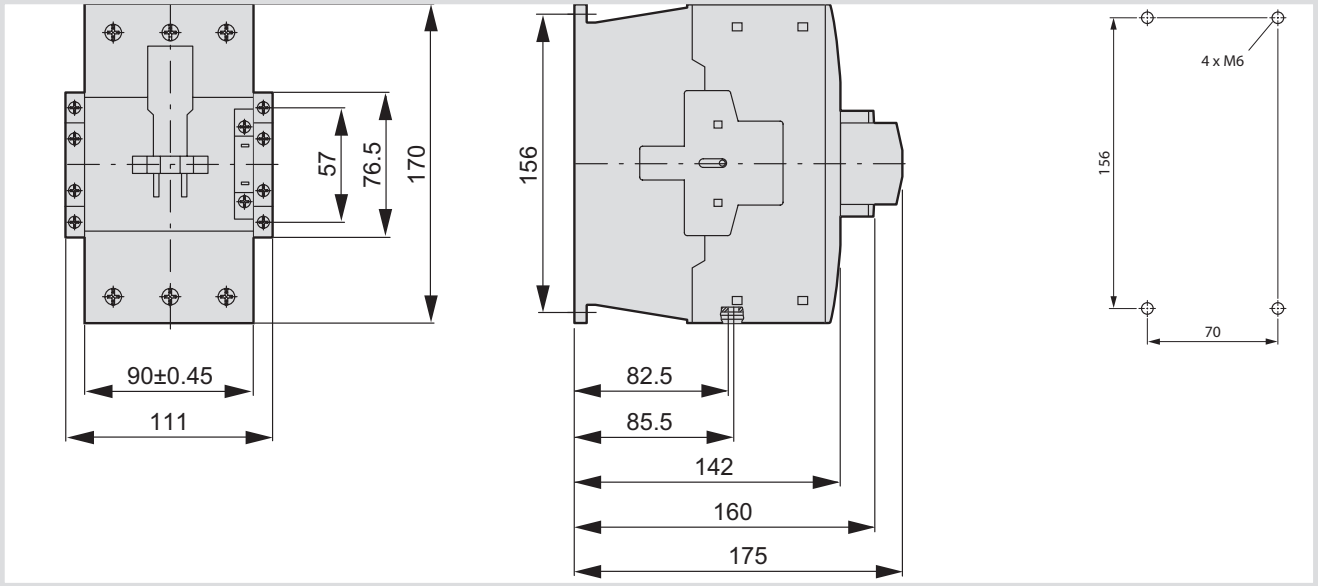

Image 29: e3pole power contactor (EV080... - EV170...)

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4pole power contactors

EVN022

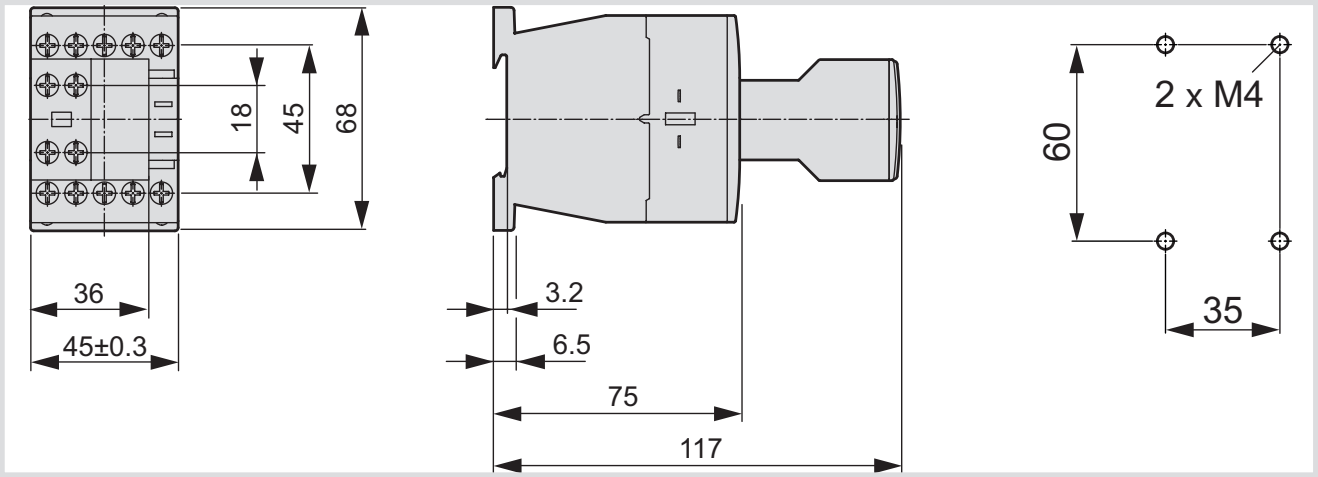

Image 30: 4pole power contactors (EVN022)

EVN032... - EVN045...

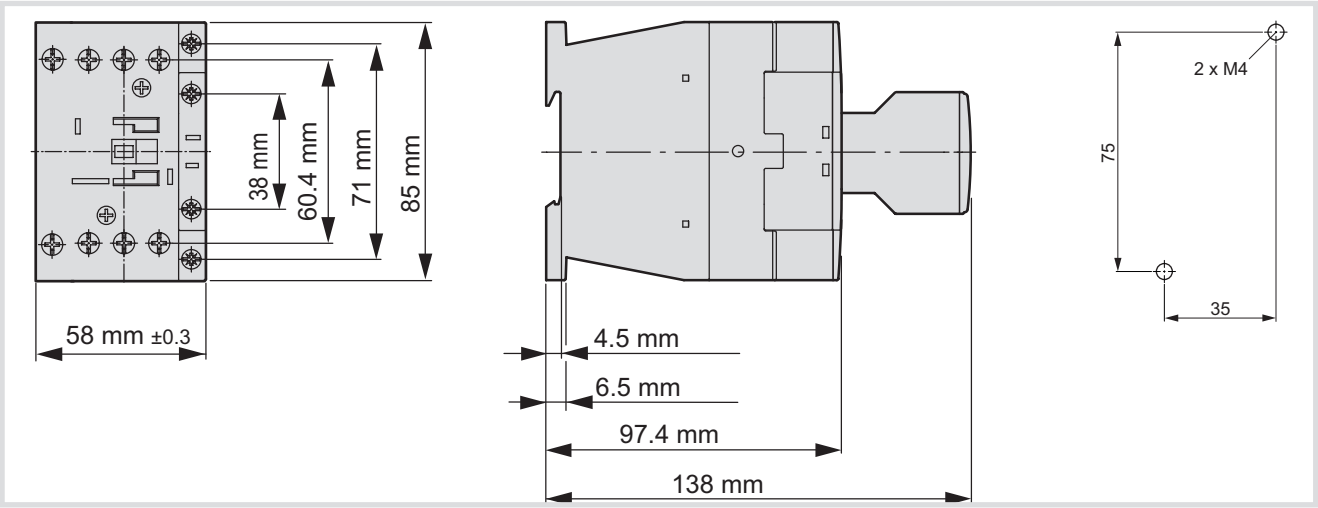

Image 31: 4pole power contactors (EVN032... - EVN045)

EVN063... - EVN080...

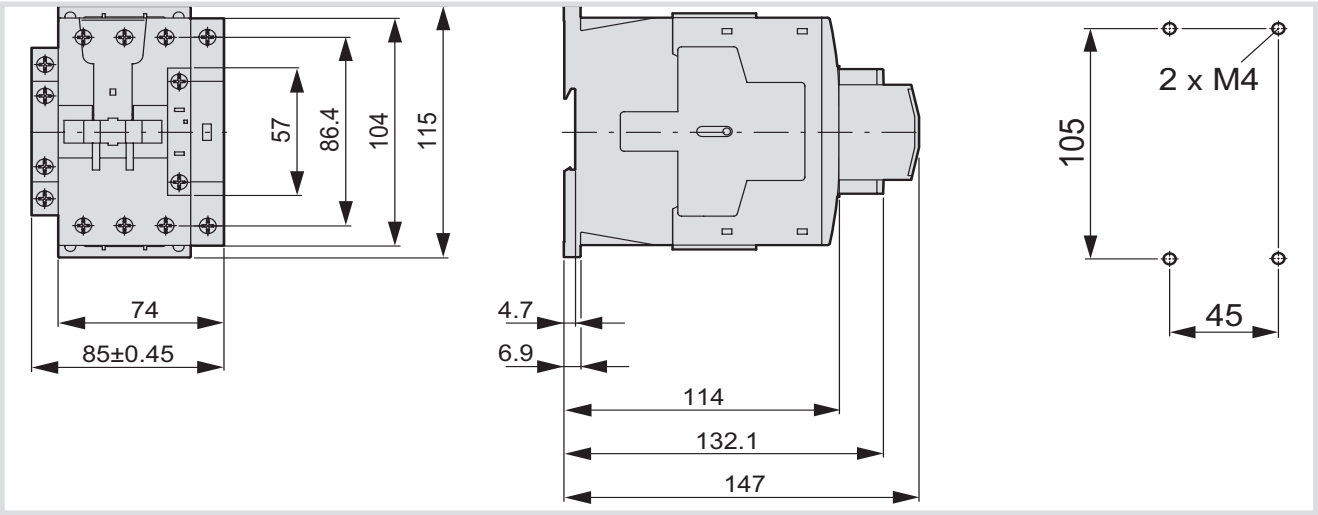

Image 32: 4pole power contactors (EVN063... - EVN080...

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EVN125... - EVN200...

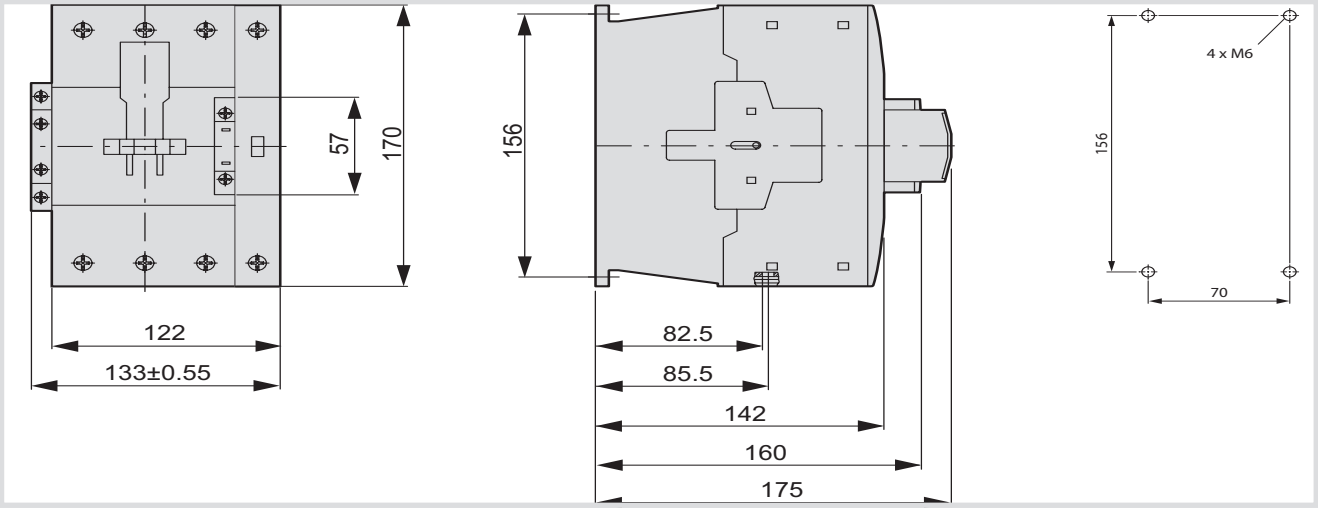


Image 33: 4pole power contactors (EVN125... - EVN200...)

Lamp contactors for lighting applications
EVL...

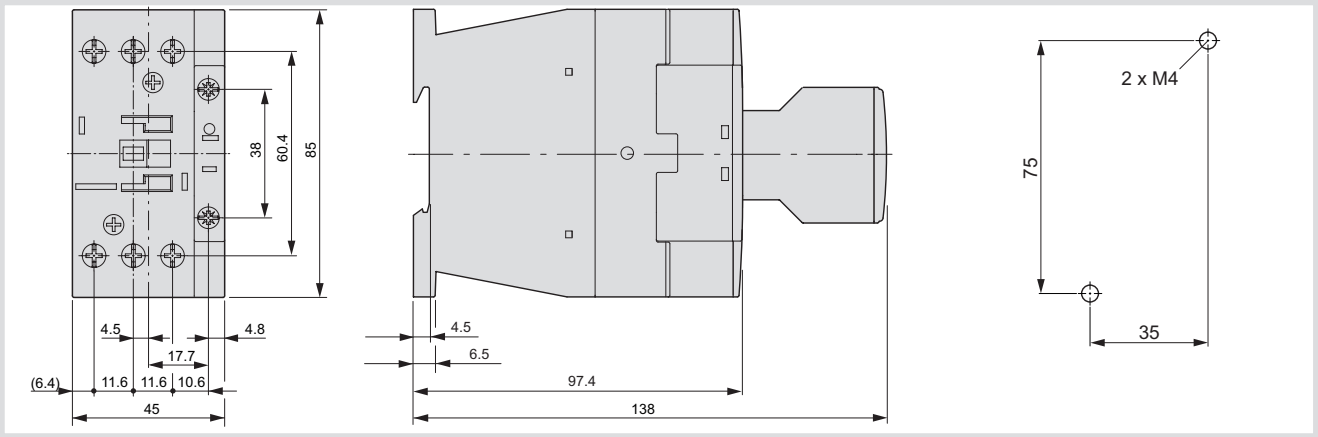
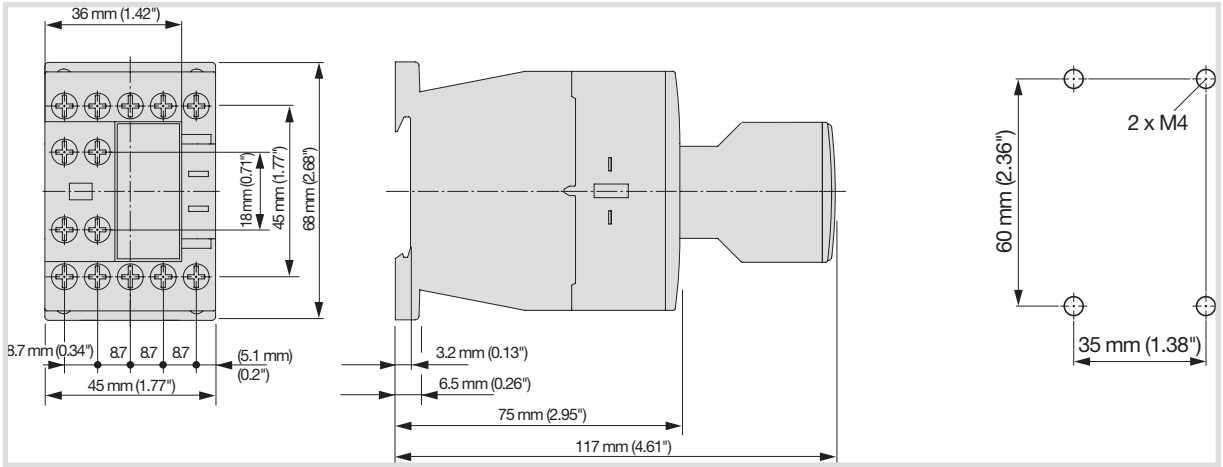


Image 34: Lamp contactor dimensions

Auxiliary contactors with auxiliary switch component
EVR004xxC / EVR004xxD / EVR004xxE with EVA005 ... EVA008



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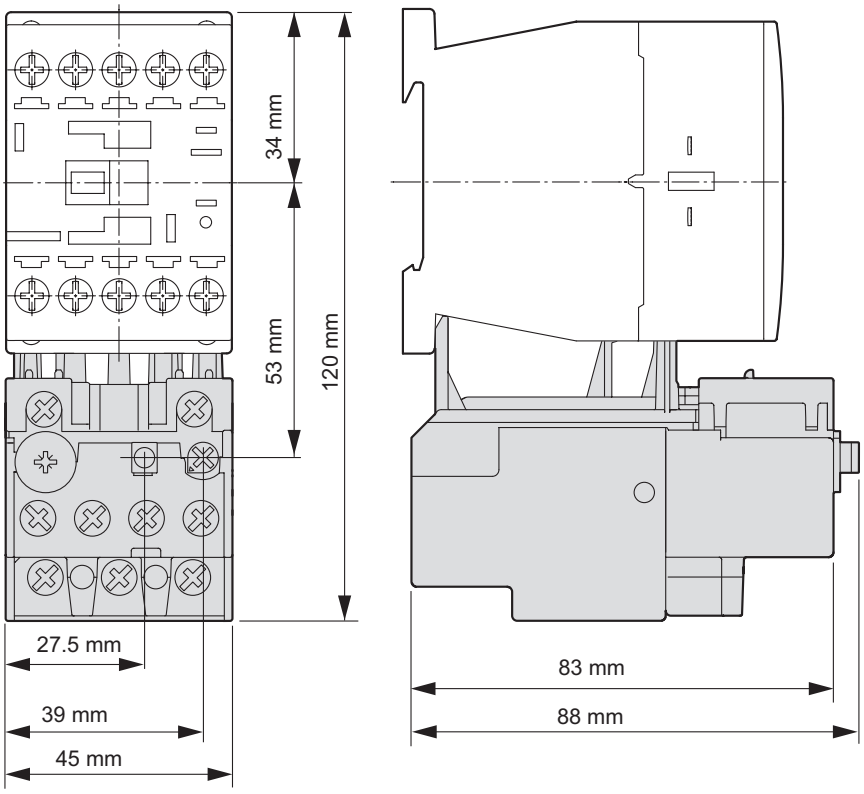

Image 35: EVBxxxA

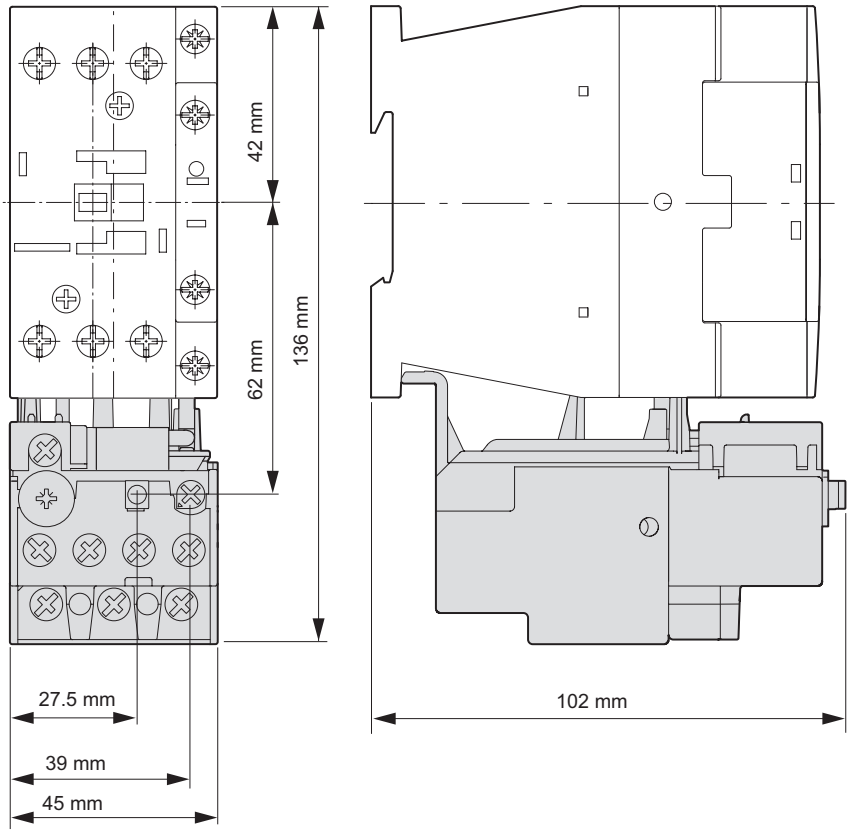

Image 36: EVBxxxB

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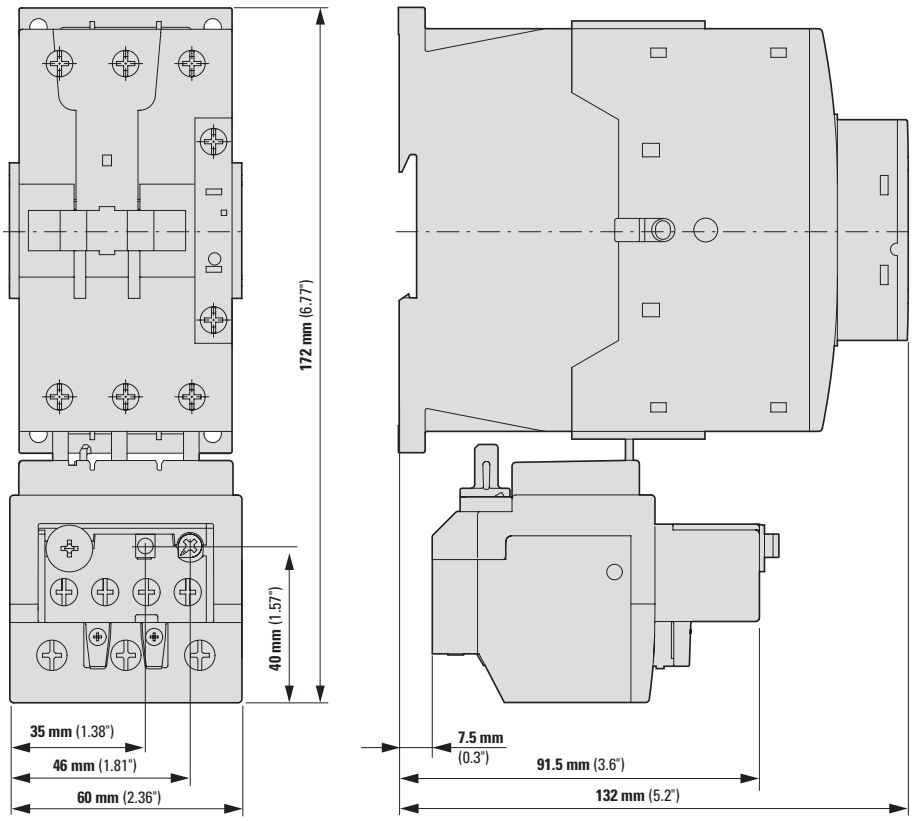

Image 37: EVBxxxC

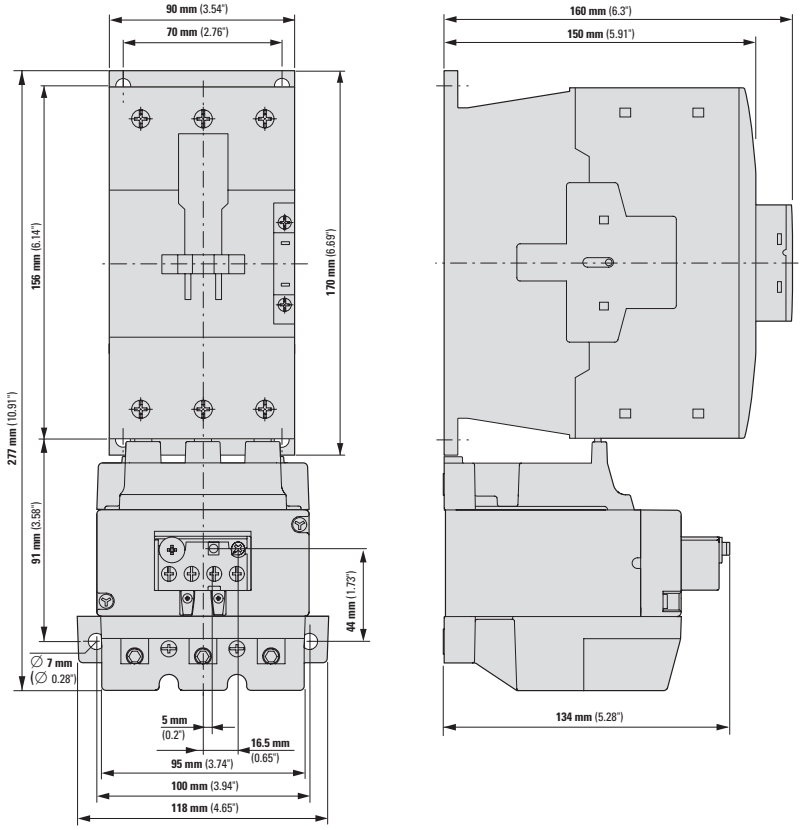

Image 38: EVBxxxD

Coordination table

Coordination table for 3pole contactors with motor protection switch

				Circuit breaker allocation type							
				MM501N - MM514N				MM520N - MM526N			
Motor characteristics				Type 1		Type 2		Type 1		Type 2	
Voltage	Output AC-3	Current consumption	Contactor	MSS In (A)	Circuit breaker Iq (kA)	MSS In (A)	Circuit breaker Iq (kA)	MSS In (A)	Circuit breaker Iq (kA)	MSS In (A)	Circuit breaker Iq (kA)
415 V	0.06kW	0.21 A	EV00710C; EV00701C; EV00710D; EV00710E	MM502N 0.25 A	150 kA	MM502N 0.25 A	50 kA				
	0.09kW	0.3 A	EV00710C; EV00701C; EV00710D; EV00710E	MM503N 0.4 A	150 kA	MM503N 0.4 A	50 kA				
	0.12kW	0.4 A	EV00710C; EV00701C; EV00710D; EV00710E	MM504N 0.63 A	150 kA	MM504N 0.63 A	50 kA				
	0.18kW	0.58 A	EV00710C; EV00701C; EV00710D; EV00710E	MM504N 0.63 A	150 kA	MM504N 0.63 A	50 kA				
	0.25kW	0.8 A	EV00710C; EV00701C; EV00710D; EV00710E	MM505N 1 A	150 kA	MM505N 1 A	50 kA				
	0.37kW	1.1 A	EV00710C; EV00701C; EV00710D; EV00710E	MM506N 1.6 A	150 kA	MM506N 1.6 A	50 kA				
	0.55kW	1.5 A	EV00710C; EV00701C; EV00710D; EV00710E	MM506N 1.6 A	150 kA	MM506N 1.6 A	50 kA				
	0.75kW	1.8 A	EV00710C; EV00701C; EV00710D; EV00710E	MM507N 2.5 A	150 kA	MM507N 2.5 A	50 kA				
	1.1kW	2.6 A	EV00710C; EV00701C; EV00710D; EV00710E	MM508N 4 A	150 kA	MM508N 4 A	50 kA				
	1.5kW	3.5 A	EV00710C; EV00701C; EV00710D; EV00710E	MM508N 4 A	150 kA	MM508N 4 A	50 kA				
	2.2kW	4.8 A	EV00710C; EV00701C; EV00710D; EV00710E	MM509N 6.3 A	150 kA	MM509N 6.3 A	50 kA				
	3kW	6.4 A A	EV01810C; EV01810D; EV01810E			MM510N 10 A	50 kA				
			EV00710C; EV00701C; EV00710D; EV00710E	MM510N 10 A	150 kA						
	4kW	8.2 A A	EV01810C; EV01810D; EV01810E			MM510N 10 A	50 kA				
			EV00910C; EV00901C; EV00910D; EV00910E	MM510N 10 A	150 kA						
	5.5kW	10.9 A	EV01810C; EV01810D; EV01810E	MM511N 16 A	50 kA	MM511N 16 A	50 kA	MM520N 16 A	50 kA	MM520N 16 A	50 kA
	7.5kW	14.6 A	EV01810C; EV01810D; EV01810E	MM511N 16 A	50 kA	MM511N 16 A	50 kA	MM520N 16 A	50 kA	MM520N 16 A	50 kA
	11kW	20.9 A	EV02510C; EV02510D; EV02510E	MM513N 25 A	50 kA	MM513N 25 A	50 kA	MM521N 25 A	50 kA	MM521N 25 A	50 kA
	15kW	28.2 A	EV03210C; EV03210D; EV03210E	MM514N 32 A	50 kA	MM514N 32 A	50 kA	MM522N 32 A	50 kA	MM522N 32 A	50 kA
	18.5kW	34.8 A	EV040C; EV040D; EV040E					MM523N 40 A	50 kA	MM523N 40 A	50 kA
	22kW	39.6 A	EV050C; EV050D; EV050E					MM524N 50 A	50 kA	MM524N 50 A	50 kA
	30kW	53.4 A	EV065C; EV065D; EV065E					MM525N 58 A	50 kA	MM525N 58 A	50 kA
	34kW	59.8 A	EV065C; EV065D; EV065E					MM526N 63 A	50 kA	MM526N 63 A	50 kA

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Coordination table for 3pole contactors with motor protection switch

				Circuit breaker allocation type							
				MM501N - MM514N				MM520N - MM526N			
Motor characteristics				Type 1		Type 2		Type 1		Type 2	
Voltage	Output AC-3	Current consumption	Contactor	MSS In (A)	Circuit breaker Iq (kA)	MSS In (A)	Circuit breaker Iq (kA)	MSS In (A)	Circuit breaker Iq (kA)	MSS In (A)	Circuit breaker Iq (kA)
230 V L + N	0.06kW	0.7 A	EV00710C; EV00701C; EV00710D; EV00710E	MM505N 1 A	150 kA	MM505N 1 A	50 kA				
	0.09kW	0.97 A	EV00710C; EV00701C; EV00710D; EV00710E	MM506N 1.6 A	150 kA	MM506N 1.6 A	50 kA				
	0.12kW	1.17 A	EV00710C; EV00701C; EV00710D; EV00710E	MM506N 1.6 A	150 kA	MM506N 1.6 A	50 kA				
	0.18kW	1.57 A	EV00710C; EV00701C; EV00710D; EV00710E	MM507N 2.5 A	150 kA	MM507N 2.5 A	50 kA				
	0.25kW	1.99 A	EV00710C; EV00701C; EV00710D; EV00710E	MM507N 2.5 A	150 kA	MM507N 2.5 A	50 kA				
	0.37kW	2.93 A	EV00710C; EV00701C; EV00710D; EV00710E	MM508N 4 A	150 kA	MM508N 4 A	50 kA				
	0.55kW	4.02 A	EV00710C; EV00701C; EV00710D; EV00710E	MM509N 6.3 A	150 kA	MM509N 6.3 A	50 kA				
	0.75kW	5.15 A	EV00710C; EV00701C; EV00710D; EV00710E	MM509N 6.3 A	150 kA	MM509N 6.3 A	50 kA				
	1.1kW	7.38 A A	EV01810C; EV01810D; EV01810E			MM510N 10 A	50 kA				
			EV00710C; EV00701C; EV00710D; EV00710E	MM510N 10 A	150 kA						
	2.2kW	14.05 A	EV01810C; EV01810D; EV01810E	MM511N 16 A	50 kA	MM511N 16 A	50 kA	MM520N 16 A	50 kA	MM520N 16 A	50 kA
	3kW	17.83 A	EV02510C; EV02510D; EV02510E					MM521N 25 A	50 kA	MM521N 25 A	50 kA

Table 20: Coordination table for 3pole contactors with motor protection switch

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Coordination table for 3pole contactor with fuses and motor protection relay

					Short circuit protectionallocation type							
					aM fuse				gL/gG fuse			
Motor characteristics					Type 1		Type 2		Type 1		Type 2	
Voltage	Output AC-3	Current con-sumption	Contactor	Motor protection relay	Fuse in (A)	Circuit breaker Iq (kA)	Fuse in (A)	Circuit breaker Iq (kA)	Fuse in (A)	Circuit breaker Iq (kA)	Fuse in (A)	Circuit breaker Iq (kA)
415 V	0.09kW	0.3 A	EV00710C; EV00701C; EV00710D; EV00710E	EVB0004A	2A	100kA	2A	100kA	25A	100kA	2A	100kA
	0.12kW	0.4 A		EVB0006A	2A	100kA	2A	100kA	25A	100kA	2A	100kA
	0.18kW	0.58 A	EV00710C;EV00701C;	EVB0006A	2A	100kA	2A	100kA	25A	100kA	2A	100kA
	0.25kW	0.8 A	EV00710D;EV00710E	EVB001A	2A	100kA	2A	100kA	25A	100kA	4A	100kA
	0.37kW	1.1 A	EV00710C;EV00701C;	EVB0016A	2A	100kA	2A	100kA	25A	100kA	4A	100kA
	0.55kW	1.5 A	EV00710D;EV00710E	EVB0016A	2A	100kA	2A	100kA	25A	100kA	4A	100kA
	0.75kW	1.8 A	EV00710C;EV00701C;	EVB0024A	2A	100kA	2A	100kA	25A	100kA	6A	100kA
	1.1kW	2.6 A	EV00710D;EV00710E	EVB004A	4A	100kA	4A	100kA	25A	100kA	6A	100kA
	1.5kW	3.5 A	EV00710C;EV00701C;	EVB004A	4A	100kA	4A	100kA	25A	100kA	6A	100kA
	2.2kW	4.8 A	EV00710D;EV00710E	EVB006A	6A	100kA	6A	100kA	25A	100kA	10A	100kA
	3kW	6.4 A	EV00710C;EV00701C; EV00710D;EV00710E EV00710C;EV00701C; EV00710D;EV00710E EV00710C;EV00701C; EV00710D;EV00710E EV00710C;EV00701C; EV00710D;EV00710E EV00710C;EV00701C; EV00710D;EV00710E EV00710C;EV00701C; EV00710D;EV00710E	EVB010A	10A	100kA	10A	100kA	35A	100kA	16A	100kA
	4kW	8.2 A	EV00910C; EV00901C; EV00910D; EV00910E	EVB010A	10A	100kA	10A	100kA	35A	100kA	20A	100kA
	5.5kW	10.9 A A	EV01210C; EV01201C; EV01210D; EV01210E	EVB012A	16A	100kA			35A	100kA		
			EV01810C; EV01810D; EV01810E	EVB016B			16A	100kA			25A	100kA
	7.5kW	14.6 A A	EV01510C; EV01501C; EV01510D; EV01510E	EVB016A	16A	100kA			63A	100kA		
			EV01810C; EV01810D; EV01810E	EVB016B			16A	100kA			32A	100kA
	11kW	20.9 A	EV02510C; EV02510D; EV02510E	EVB024B	25A	100kA	25A	100kA	100A	100kA	40A	100kA
	15kW	28.2 A	EV03210C; EV03210D; EV03210E	EVB032B	32A	100kA	32A	100kA	125A	100kA	63A	100kA
	18.5kW	34.8 A	EV040C; EV040D; EV040E	EVB040C			40A	100kA			63A	100kA
	22kW	39.6 A	EV050C; EV050D; EV050E	EVB057C	50A	100kA	50A	100kA	160A	100kA	80A	100kA
	30kW	53.4 A	EV065C; EV065D; EV065E	EVB057C	63A	100kA	63A	100kA	160A	100kA	100A	100kA
	37kW	65.1 A A	EV072C; EV072D; EV072E	EVB075C	80A	100kA	80A	100kA	160A	100kA	125A	100kA
			EV080C	EVB070D	80A	100kA	80A	100kA	250A	100kA	125A	100kA
	45kW	78.3 A	EV095C	EVB100D	80A	100kA	80A	100kA	250A	100kA	160A	100kA
	55kW	95.7 A	EV115C	EVB100D	100A	100kA	100A	100kA	250A	100kA	200A	100kA
	75kW	129.1 A	EV150C	EVB150D	160A	100kA	160A	100kA	250A	100kA	200A	100kA
	90kW	154.9 A	EV170C	EVB175D	160A	100kA	160A	100kA	400A	100kA	250A	100kA

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Coordination table for 3pole contactor with fuses and motor protection relay

					Short circuit protectionallocation type							
					aM fuse				gL/gG fuse			
Motor characteristics					Type 1		Type 2		Type 1		Type 2	
Voltage	Output AC-3	Current con-sumption	Contactor	Motor protection relay	Fuse in (A)	Circuit breaker Iq (kA)	Fuse in (A)	Circuit breaker Iq (kA)	Fuse in (A)	Circuit breaker Iq (kA)	Fuse in (A)	Circuit breaker Iq (kA)
230 V L + N	0.06kW	0.7 A	EV00710C; EV00701C; EV00710D; EV00710E	EVB001A	2A	100kA	2A	100kA	25A	100kA	4A	100kA
	0.09kW	0.97 A		EVB0016A	2A	100kA	2A	100kA	25A	100kA	4A	100kA
	0.12kW	1.17 A	EV00710C;EV00701C;EV00710D;EV00710E	EVB0016A	2A	100kA	2A	100kA	25A	100kA	4A	100kA
	0.18kW	1.57 A		EVB0024A	2A	100kA	2A	100kA	25A	100kA	6A	100kA
	0.25kW	1.99 A	EV00710C;EV00701C;EV00710D;EV00710E	EVB0024A	2A	100kA	2A	100kA	25A	100kA	6A	100kA
	0.37kW	2.93 A		EVB004A	4A	100kA	4A	100kA	25A	100kA	6A	100kA
	0.55kW	4.02 A	EV00710C;EV00701C;EV00710D;EV00710E	EVB006A	6A	100kA	6A	100kA	25A	100kA	10A	100kA
	0.75kW	5.15 A		EVB006A	6A	100kA	6A	100kA	25A	100kA	10A	100kA
	1.1kW	7.38 A	EV00710C;EV00701C;EV00710D;EV00710E	EVB010A	10A	100kA	10A	100kA	35A	100kA	16A	100kA
			EV00710C;EV00701C;EV00710D;EV00710E									
			EV00710C;EV00701C;EV00710D;EV00710E									
			EV00710C;EV00701C;EV00710D;EV00710E									
			EV00710C;EV00701C;EV00710D;EV00710E									
	1.5kW	9.79 A	EV01210C; EV01201C; EV01210D; EV01210E	EVB012A	16A	100kA			35A	100kA		
	2.2kW	14.05 A A	EV01510C; EV01501C; EV01510D; EV01510E	EVB016A	16A	100kA			63A	100kA		
			EV01810C; EV01810D; EV01810E	EVB016B			16A	100kA			32A	100kA
	3kW	17.83 A	EV02510C; EV02510D; EV02510E	EVB024B	25A	100kA	25A	100kA	100A	100kA	40A	100kA

Table 21: Coordination table for 3pole contactor with fuses and motor protection relay

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Coordination table for 4pole contactors with fuses

	Ie AC-1 to 690V	maximum fuse size for coordination Type 2, at 400 V (gG/gL 500 V fuse)	maximum fuse size for coordination Type 2, at 690 V (gG/gL 690 V fuse)	maximum fuse size for coordination Type 1, at 400 V (gG/gL 500 V fuse)	maximum fuse size for coordination Type 1, at 690 V (gG/gL 690 V fuse)
EVN022C	22 A	20 A	20 A	35 A	25 A
EVN022D	22 A	20 A	20 A	35 A	25 A
EVN022E	22 A	20 A	20 A	35 A	25 A
EVN03210D	32 A	35 A	35 A	63 A	50 A
EVN03210E	32 A	35 A	35 A	63 A	50 A
EVN04510C	45 A	35 A	35 A	100 A	50 A
EVN04510D	45 A	35 A	35 A	100 A	50 A
EVN04510E	45 A	35 A	35 A	100 A	50 A
EVN063D	63 A	63 A	50 A	125 A	80 A
EVN080C	80 A	80 A	63 A	160 A	80 A
EVN080D	80 A	80 A	63 A	160 A	80 A
EVN125C	125 A	160 A	160 A	250 A	200 A
EVN160C	160 A	160 A	160 A	250 A	200 A
EVN200C	200 A	250 A	200 A	250 A	200 A

	Ie AC-1 to 690V	maximum fuse size for coordination Type 2, up to 500 V (gG/gL 1000 V fuse)	maximum fuse size for coordination Type 2, at 690 V (gG/gL 690 V fuse)	maximum fuse size for coordination Type 1, up to 500 V (gG/gL 1000 V fuse)	maximum fuse size for coordination Type 1, at 690 V (gG/gL 690 V fuse)
EVN03210C	32 A	35 A	35 A	63 A	50 A
EVN063C	63 A	63 A	50 A	125 A	80 A
EVN063E	63 A	63 A	50 A	125 A	80 A
EVN080E	80 A	80 A	63 A	160 A	80 A

Table 22: Coordination table for 4pole power contactors with fuse

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Coordination table for lamp load contactors with fuses

	maximum fuse size for circuit breaker at 400 V (gG/gL 500 V fuse)
EVL014C	63 A
EVL014D	63 A
EVL021C	100 A
EVL021D	100 A
EVL027C	125 A
EVL027D	125 A

Table 23: Coordination table for lamp contactors with fuses

Circuit breaker for auxiliary contactors and auxiliary contacts

	maximum fuse size for circuit breaker up to 500 V
EVR00440C	10 A gG/gL
EVR00440D	10 A gG/gL
EVR00440E	10 A gG/gL
EVR00431C	10 A gG/gL
EVR00431D	10 A gG/gL
EVR00431E	10 A gG/gL
EVR00422C	10 A gG/gL
EVR00422D	10 A gG/gL
EVR00422E	10 A gG/gL
EVA001	10 A gG/gL
EVA002	10 A gG/gL
EVA003	16 A gG/gL
EVA004	16 A gG/gL
EVA005	10 A gG/gL
EVA006	10 A gG/gL
EVA007	10 A gG/gL
EVA008	10 A gG/gL

Table 24: Circuit breaker for auxiliary contactors and auxiliary contacts

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Motor protection switch overview

	Adjustment range		Rated permanent current I_u [A]	max. rated operating output [kW] at AC-3				
	Overload trigger I_r [A] 	Short circuit trigger I_m [A] 		220 V 230 V 240 V P [kW]	380 V 400 V 415 V P [kW]	440 V P [kW]	500 V P [kW]	660 V 690 V P [kW]
MM5xxN motor protection switch – allocation type “1” and “2” Size 1								
MM501N	0.1 ... 0.16	2.5	0.16	-	-	-		0.06
MM502N	0.16 ... 0.25	3.9	0.25	-	0.06	0.06	0.06	0.12
MM503N	0.24 ... 0.4	6.2	0.4	0.06	0.09	0.12	0.12	0.18
MM504N	0.4 ... 0.63	9.8	0.63	0.09	0.12	0.18	0.25	0.25
MM505N	0.63 ... 1	15.5	1	0.12	0.25	0.25	0.37	0.55
MM506N	1 ... 1.6	24.8	1.6	0.25	0.55	0.55	0.75	1.1
MM507N	1.6 ... 2.5	38.8	2.5	0.37	0.75	1.1	1.1	1.5
MM508N	2.5 ... 4	62	4	0.75	1.5	1.5	2.2	3
MM509N	4 ... 6.3	97.7	6.3	1.1	2.2	3	3	4
MM510N	6.3 ... 10	155	10	2.2	4	4	4	7.5
MM511N	10 ... 16	248	16	4	7.5	9	9	12
MM512N	16 ... 20	310	20	5.5	9	11	12.5	15
MM513N	20 ... 25	388	25	5.5	12.5	12.5	15	22
MM514N	25 ... 32	496	32	7.5	15	15	22	30

Table 25: Motor protection switch size 1 (0.1 ... 32 A)

	Adjustment range		Rated permanent current I_u [A]	max. rated operating output [kW] at AC-3				
	Overload trigger I_r [A] 	Short circuit trigger I_m [A] 		220 V 230 V 240 V P [kW]	380 V 400 V 415 V P [kW]	440 V P [kW]	500 V P [kW]	660 V 690 V P [kW]
MM52xN motor protection switch – allocation type “1” and “2” Size 2								
MM520N	10 ... 16	248	16	4	7.5	9	9	12.5
MM521N	16 ... 25	388	25	5.5	12.5	12.5	15	22
MM522N	24 ... 32	496	32	7.5	15	17.5	22	22
MM523N	32 ... 40	620	40	11	20	22	24	30
MM524N	40 ... 50	775	50	14	25	30	30	45
MM525N	50 ... 58	899	58	17	30	37	37	55
MM526N	55 ... 65	1008	65	18.5	34	37	45	55

Table 26: Motor protection switch size 2 (10 ... 65 A)

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Motor protection switch

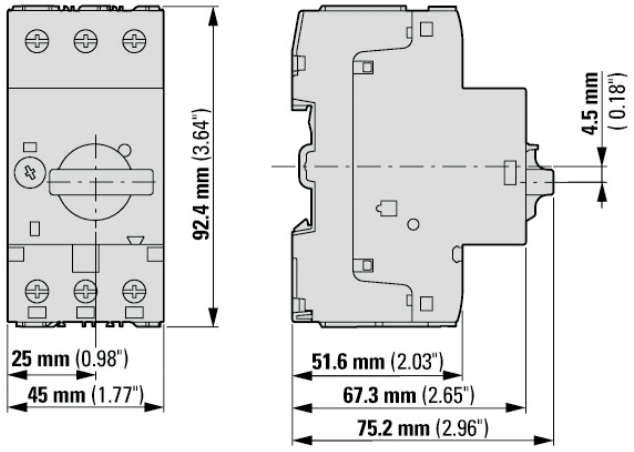

Image 39: Motor protection switch size 1

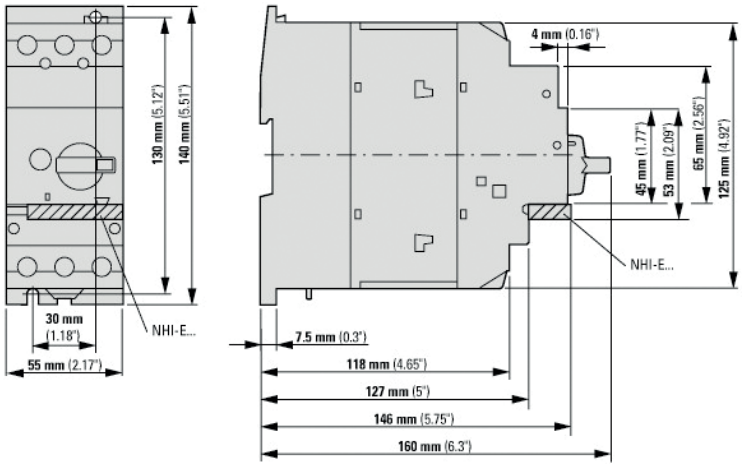

Image 40: Motor protection switch size 2

Motor protection switch housing

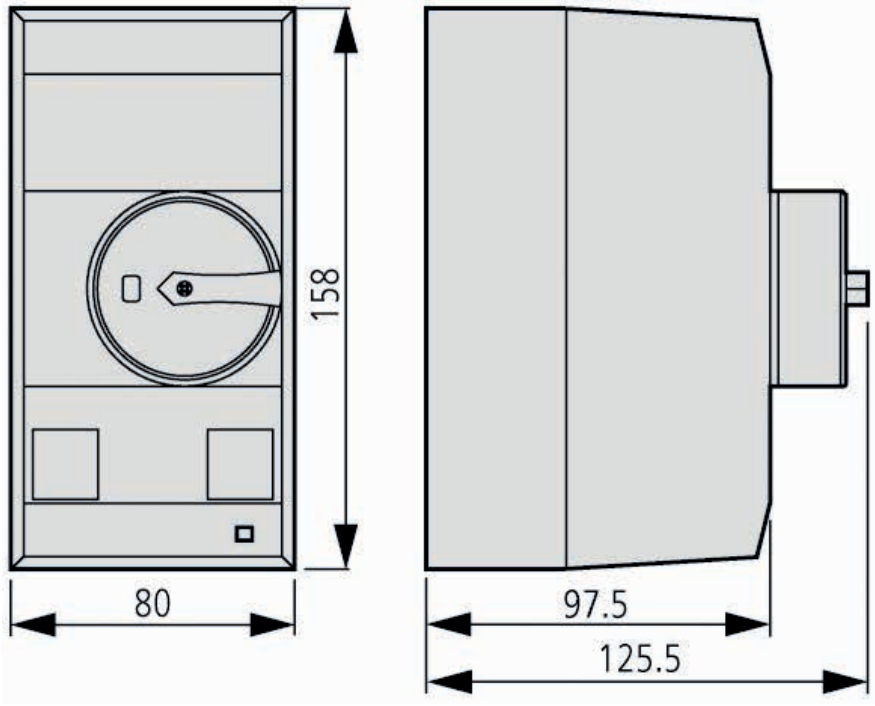

Image 41: Motor protection switch housing

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Emergency off switch

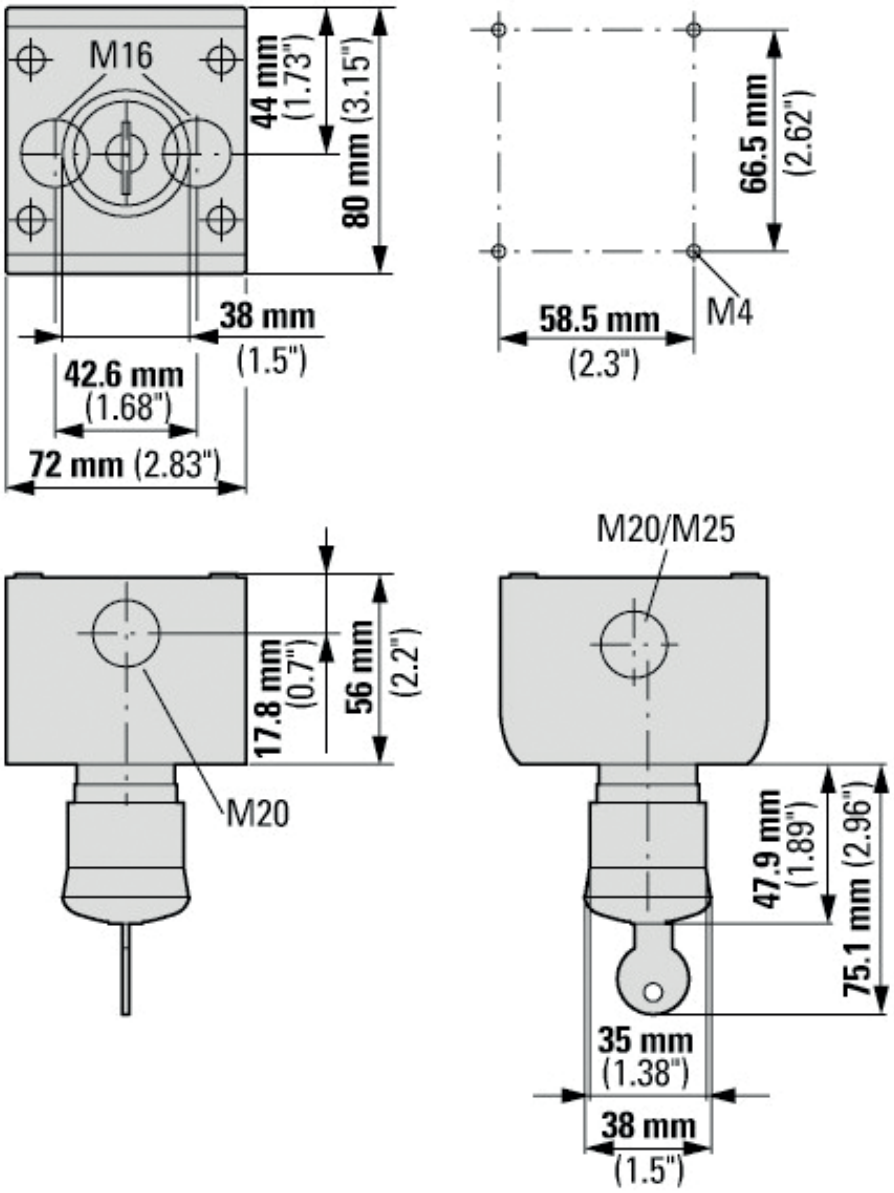
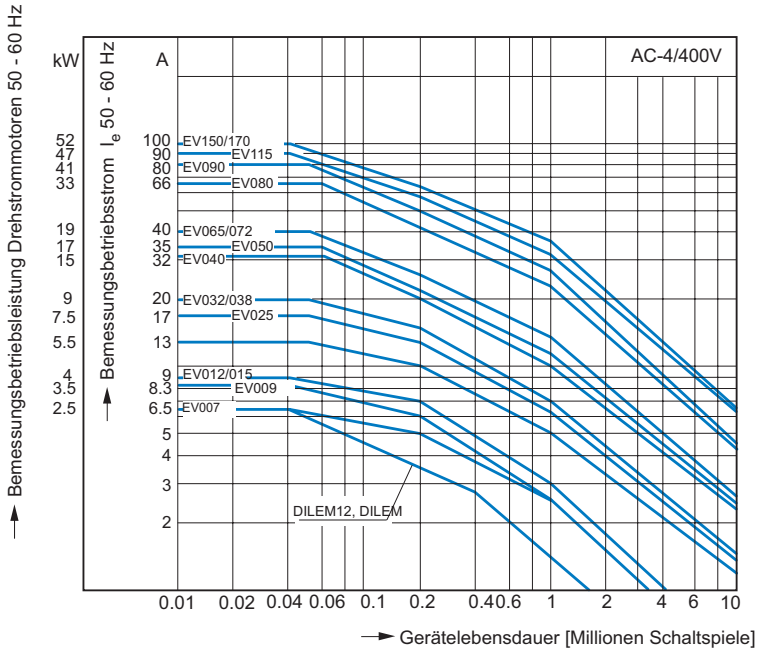


Image 42: Emergency off switch

3pole power contactor characteristics

Normal switching conditions



Squirrel cage motors

Operations identification

Switch-on: from standing

Switch off: whilst running

Short electrical designation

Switch-on: up to 6 x motor rated current

Switch-off: up to 1 x motor rated current

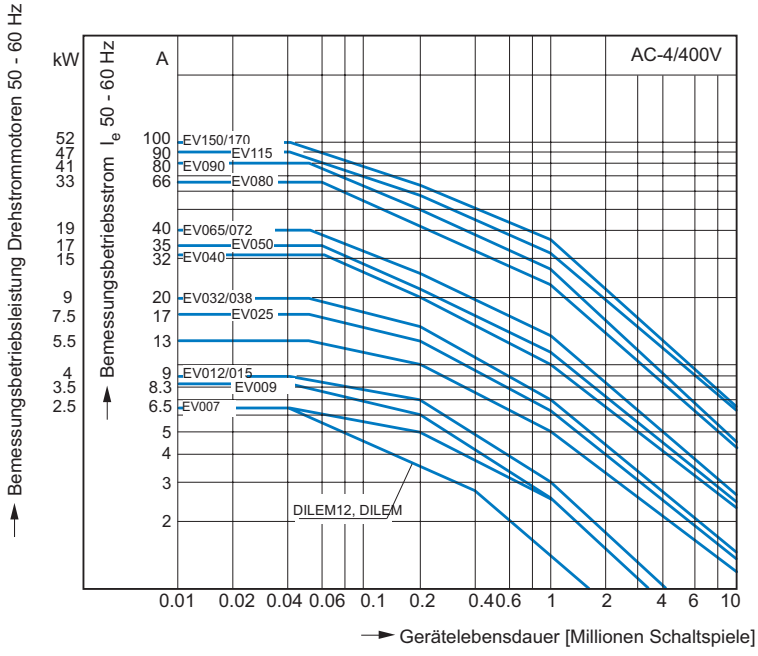
Usage category

100 % AC-3

Typical uses

- Compressors
- Pumps
- Extractor fans
- Flaps
- Lifts
- Escalators
- Conveyor belts
- Bucket conveyors
- Mixers
- Agitators
- Centrifuges
- Air conditioning systems
- General drives on machine tools and processing machines

Normal switching conditions



Squirrel cage motors

Operations identification

Tipping, counterflow breaking, reversing

Short electrical designation

Switch-on: up to 6 x motor rated current

Switch-off: up to 6 x motor rated current

Usage category

100 % AC-4

Typical uses

- Printing machines
- Wire drawing machines
- Centrifuges
- Special drives on machine tools and processing machines

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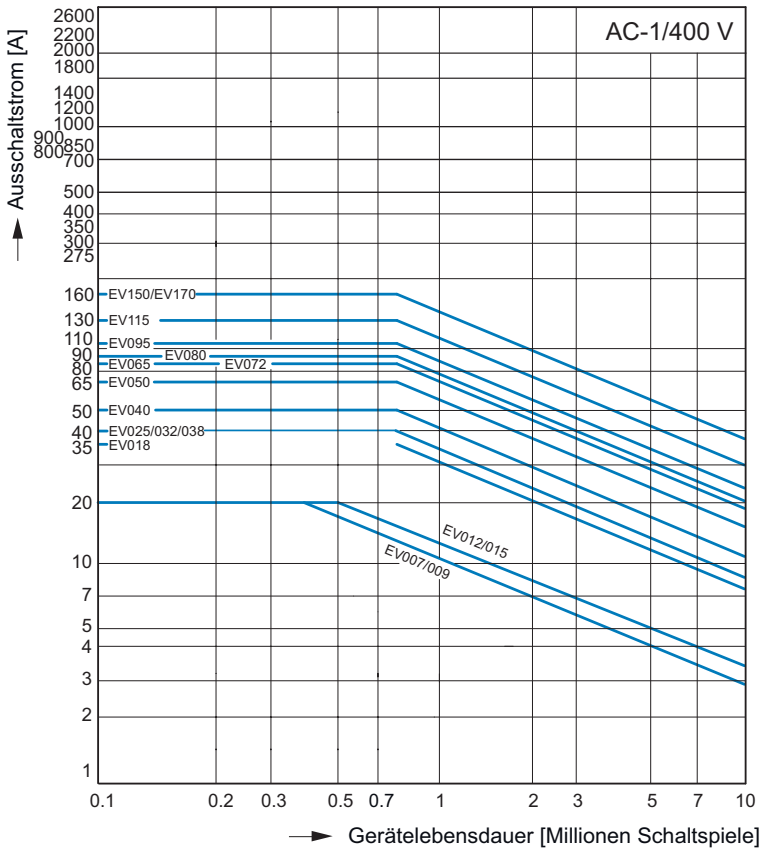
Switching conditions for non-motorised 3pole consumers



Operations identification

Non-inductive or slightly inductive load

Short electrical designation

Switch-on: 1 x rated current

Switch off: 1 x rated current

Usage category

100 % AC-1

Typical uses

Electrical heat

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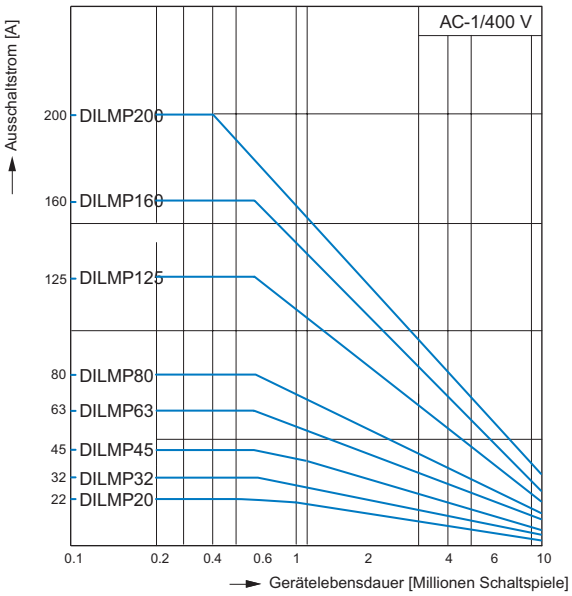
4pole power contactor characteristics

Switching conditions for non-motorised 4pole consumers



Operations identification

Non-inductive or slightly inductive load

Short electrical designation

Switch-on: 1 x rated current

Switch off: 1 x rated current

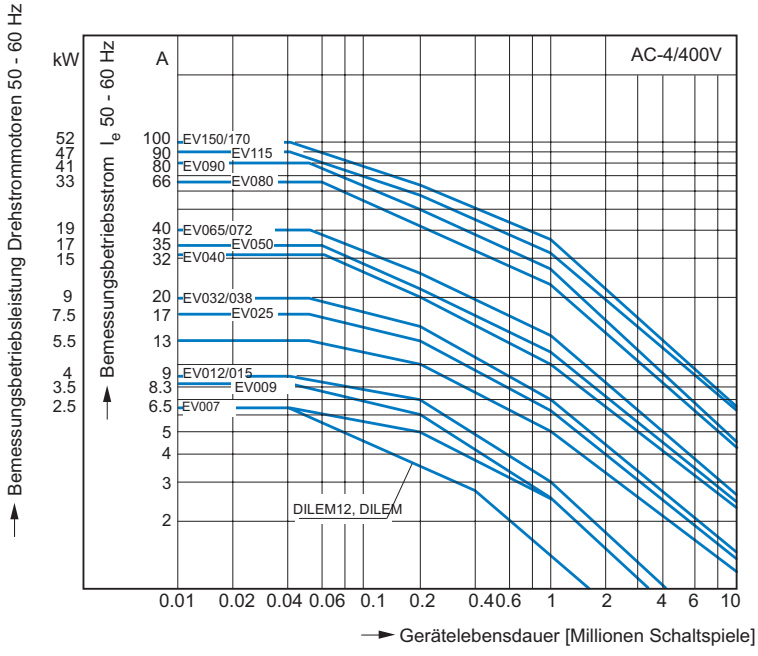
Usage category

100 % AC-1

Typical uses

- Electrical heat

Normal switching conditions



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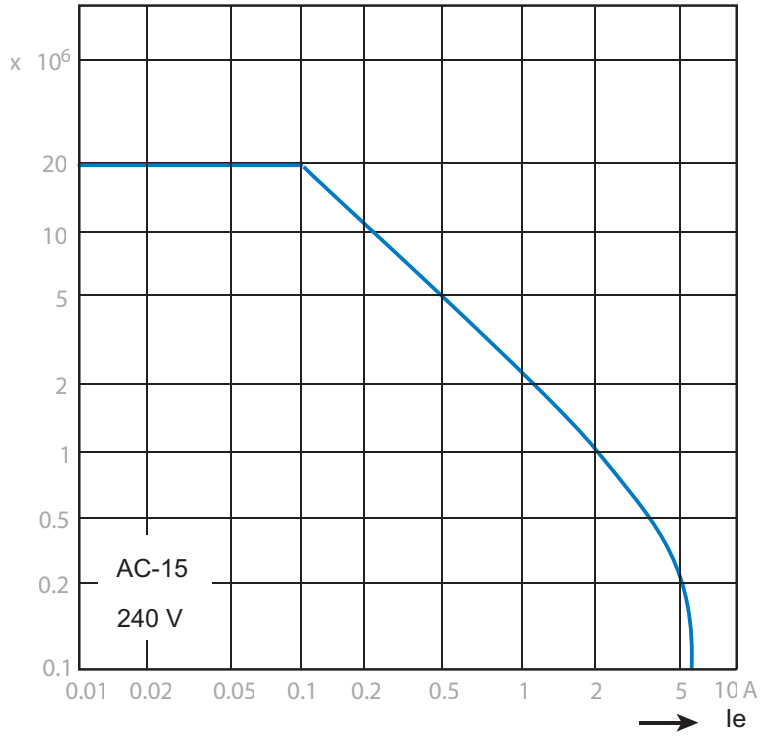
EVR characteristics

Device lifecycle (switching cycles)

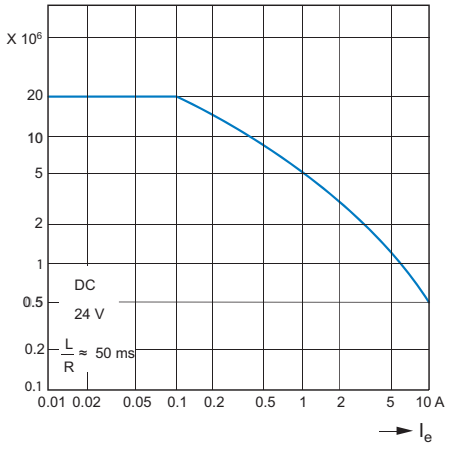
I_e = rated operating current



EVR DC1 [1] s

Device lifecycle (switching cycles)

I_e = rated operating current



1) Three flow paths in line

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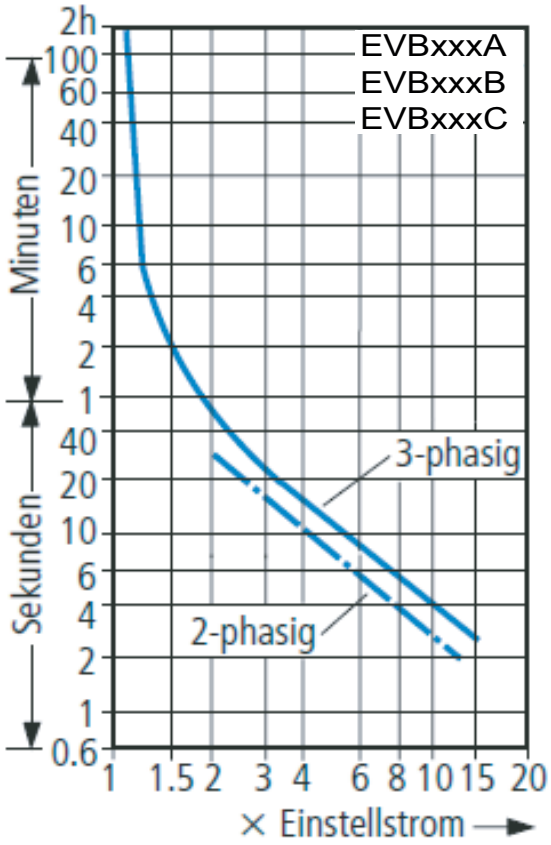
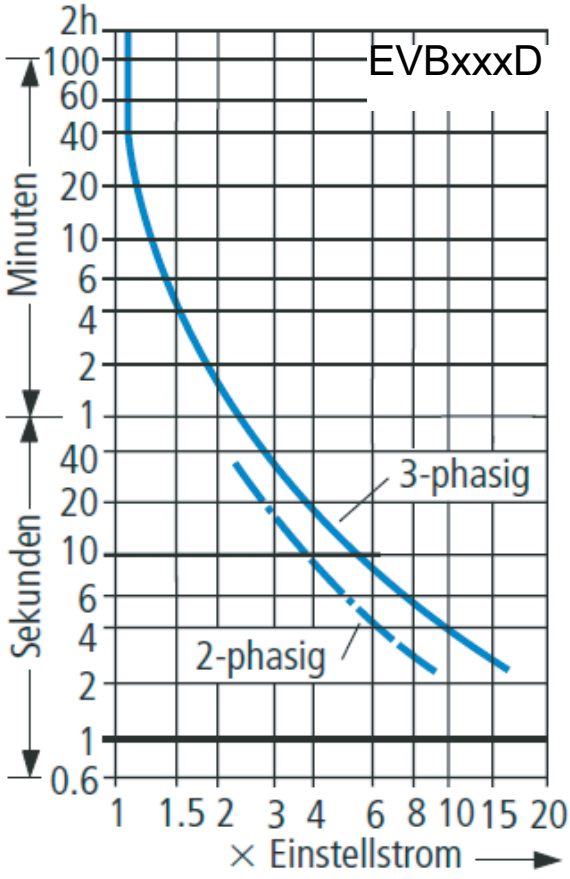
EVBxxxA, EVBxxxB, EVBxxxC characteristic



EVBxxxD characteristic



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Product relations

Contactor			Accessories																					
			Thermal relay				Auxiliary contacts										Mechanical interlock				Adapter			
			Size 1 EVBxxxA	Size 2 EVBxxxB	Size 3 EVBxxxC	Size 4 EVBxxxD	Size 1+2 EVA001	Size 1+2 EVA002	Size 3+4 EVA003	Size 3+4 EVA004	Size 1+2 EVA005	Size 1+2 EVA006	Size 1+2 EVA007	Size 1+2 EVA008	Size 1 EVA101	Size 2 EVA102	Size 3 EVA103	Size 4 EVA104	Size 1 EVA801	Size 2 EVA802	Size 3 EVA803
3P	EV00710	Size 1	X				X	X			X	X	X	X	X				X		
	EV00910		X				X	X			X	X	X	X	X				X		
	EV01210		X				X	X			X	X	X	X	X				X		
	EV01510		X				X	X			X	X	X	X	X				X		
	EV00701		X								X	X	X	X	X				X		
	EV00901		X								X	X	X	X	X				X		
	EV01201		X								X	X	X	X	X				X		
	EV01501		X								X	X	X	X	X				X		
	EV01810	Size 2		X			X	X			X	X	X	X		X				X	
	EV02510			X			X	X			X	X	X	X		X				X	
	EV03210			X			X	X			X	X	X	X		X				X	
	EV03810			X			X	X			X	X	X	X		X				X	
	EV040	Size 3			X				X	X							X				X
	EV050				X				X	X							X				X
	EV065				X				X	X							X				X
	EV072				X				X	X							X				X
	EV080	Size 4				X			X	X								X			
	EV095					X			X	X								X			
	EV115					X			X	X								X			
	EV150					X			X	X								X			
	EV170					X			X	X								X			
3P L	EVL14	Size 2					X	X			X	X	X	X		X					
	EVL21						X	X			X	X	X	X		X					
	EVL27						X	X			X	X	X	X		X					
4P	EVN22	Size 1					X	X			X	X	X	X	X						
4P+1	EVN32	Size 2/4P					X	X			X	X	X	X		X					
	EVN45						X	X			X	X	X	X		X					
4P	EVN63	Size 3/4P							X	X							X				
	EVN80								X	X							X				
	EVN125	Size 4/4P							X	X								X			
	EVN160								X	X								X			
	EVN200								X	X								X			
4P relay	EVR00440 C/D/E	Size 1									X	X	X	X	X						
	EVR00431 C/D/E										X	X	X	X	X						
	EVR00422 C/D										X	X	X	X	X						
	EVR00422E										X				X						

Contactor		RC quenching circuit						
		Size 1 EVA201	Size 2 EVA202	Size 3 EVA203	Size 4 EVBxxD	Size 2 EVA205	Size 3 EVA206
EV007	Size 1 / 3P Size 1 / 4P	C			D		
EV009		C			D		
EV012		C			D		
EV015		C			D		
EVN22		C			D		
EV018	Size 2 / 3P Size 2 / 4P		C			D	
EV025			C			D	
EV032			C			D	
EV038			C			D	
EVN32			C			D	
EVN45			C			D	
EV040	Size 3 / 3P Size 3 / 4P			C			D
EV050				C			D
EV065				C			D
EV072				C			D
EVN63				C			D
EVN80				C			D

6LE007069B

Manufacturer address

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