KAVEH

ELECTRO KAVEH

Mfg. & Ind. Group

LV PRODUCTS CATALOGUE 2024

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Introduction :

In 1982, Electro Kaveh Manufacturing Industrial Group was established by the certificate of Ministry of Industries to produce all kinds of Electric Cam operated switches. In the same year this group did the first and primary actions to construct the factory in Kaveh industrial city. In 1986, After constructing the building and fixing and operating the machinery and equipment, and as soon as the parts were available for assembling and started its production activities formally.

In 1988, Electro Kaveh designed and Produced a Floating Switch.

In 1991, by producing all kinds of the required metal and plastic parts, this company reached self-sufficiency and then gradually and little by little succeeded to do mass-production of Electric Cam switches from 12A up to 630A in various types.

In 1996, the production line of Miniature Circuit Breakers in Electro Kaveh factory was operated and it succeeded to produce MCB switches from 2A up to 63A in SP, DP, TP and TPN types. Their design updated in 2013 and increase rated current up to 125A for AC & DC MCBs and added the RCCBs and RCBOs to KAVEH products.

In 2006, in order to give variety to the products , the company put the production of Electric Automotive parts into the program of its activities and succeeded to produce kinds of DC relays for light & heavy vehicles.

In 2011, Electro Kaveh designed and produced the Changeover Switch.

In 2013, Electro Kaveh started the MCCB production project and in 2016 produced them.

In 2015, Electro Kaveh produced the Single Phase Multi-Tariff Electronic Energy Meter.

In 2016, Electro Kaveh designed and produced the AC Contactor and Thermal Over load relay.

In 2016, Electro Kaveh Manufacturing Industrial Group by means of its 30-year experience has conformed itself with the modern world technology and has put in its programs and activities the new design of Cam switches in high protection degree (IP 65).

In 2017, Electro Kaveh designed and produced the Electronic Relays.

Cam - Operated Switch

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Cam - Operated Switch

General :

Cam - Operated Switch is a kind of switch with semi-independent manual operation that is defined in the standard as follows :

Switch: Mechanical Making and Breaking device capable of connecting to, Transmit & disconnect the circuit is in normal conditions which may include specified operating overload conditions and can also be for a certain period under abnormal conditions such as short circuit current will crossing. A Switch short-circuit currents may be able to connect, but can not break it.

Semi – independent manual operation: The action applies only to direct energy to be done manually. Manually force to a much greater extent so that it leads to increased switching Unless the operator is deliberately delayed .

Cam operated & Selector Switches from Electro Kaveh company, covers a full range of cam operated switches which are suitable for Switching circuits and power supplies, Changeover switch (power - generator), Multi-step switch (selector switch), Ammeter switch, voltmeter switch and Motor Reversing cam switches like star – triangle , … .

Rated currents from 12A up to 630A with rotation angles of 30, 45, 60 and 90 degrees, ability to install inter - lock mechanism and very high variation in the layout and arrangement of contacts in utilization category AC-23A (switching motor loads or other loads to highly inductive) in accordance with international standards IEC60947-1&3 and national standards ISIRI4835 –1&3 are been produced in Electro Kaveh Group.

The quality of Electro Kaveh Switch is far beyond the expectations and requirements of the standards. The products not only approved by famous European institutions such as the International German VDE and Semko of Sweden but also local organizations like the Niroo Research Institute (NRI) and the organizations affiliated to the Ministry of Petroleum and Ministry of Energy.

Electro kaveh has certification mandatory standard from National Iranian Standards Organization .

Cam - Operated Switch

KS Model Cam-Operated switch:

KS Model is an evolution of com-operated switches produced during several based on the experience acquired in manufacturing different kinds of switches to local foresees industry market.
In most attempts has been taken in this type of switch to add features and capabilities and advantages other its previous ones . In order to increase our loyal customer's satisfaction.

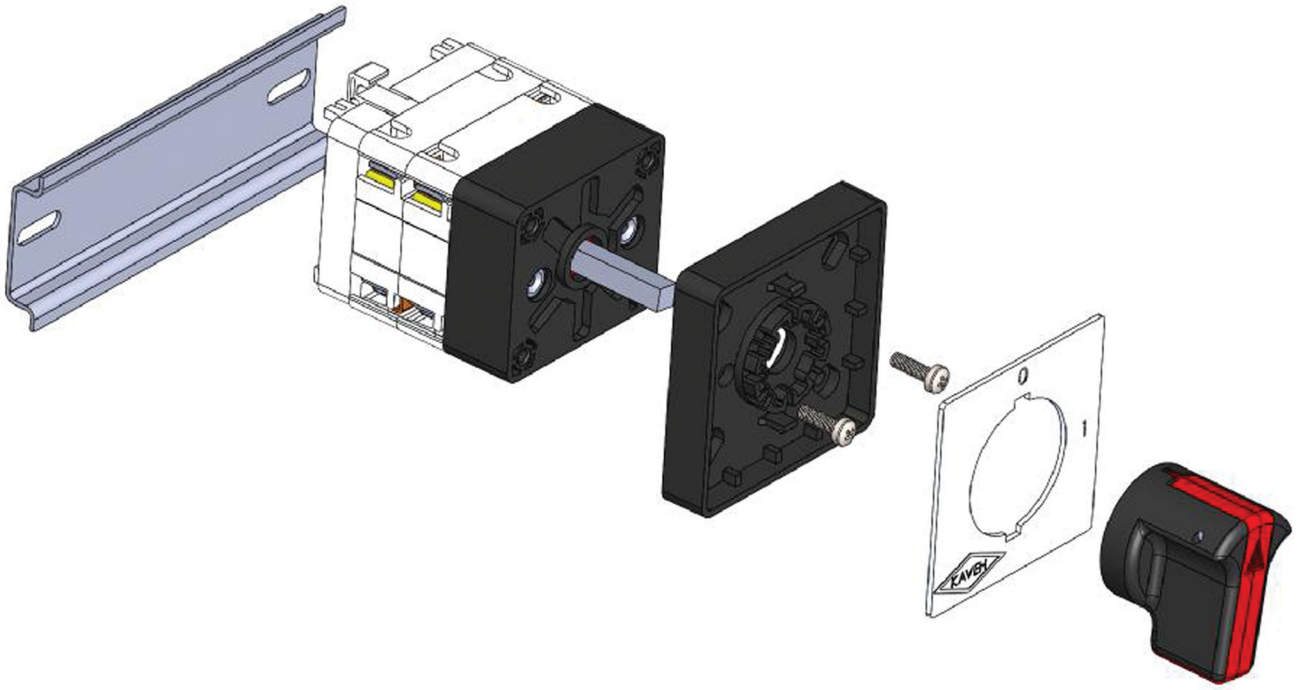
Technical features of KS Model :

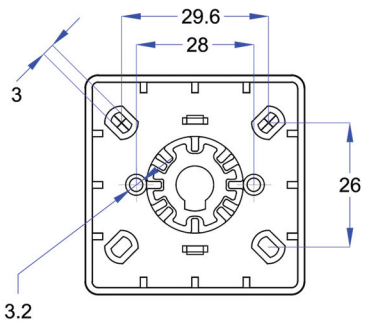
- Dimensional compatibilityfor mounting on the equipment ease of installation.
- Operation endurance in vibration condition.
- Variety of contact configuration to cover different needs ability to be installed on MCB Rail.
- Capability of locking in each position.
- Better performance longer lifetime than ever other designs.
- Ingress protection of terminal to IP20.
- Ingress protection of plate and knob to ip65.

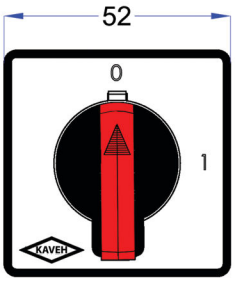
Technical Specification:

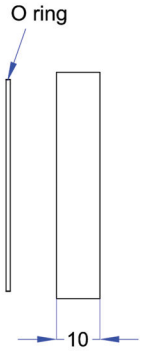
Rated Voltage (Vn)	230/400 Vac
Rated Frequency	50/60 Hz
Utilization Category	AC-23A
Rated Current (In)	12A , 16A , 20A
Thermal Current (Ith)	16A , 20A , 25A
Rated Power (400Vac)	4kW , 7.5kW , 9kW
Standard No.	IEC/EN 60947-1&3

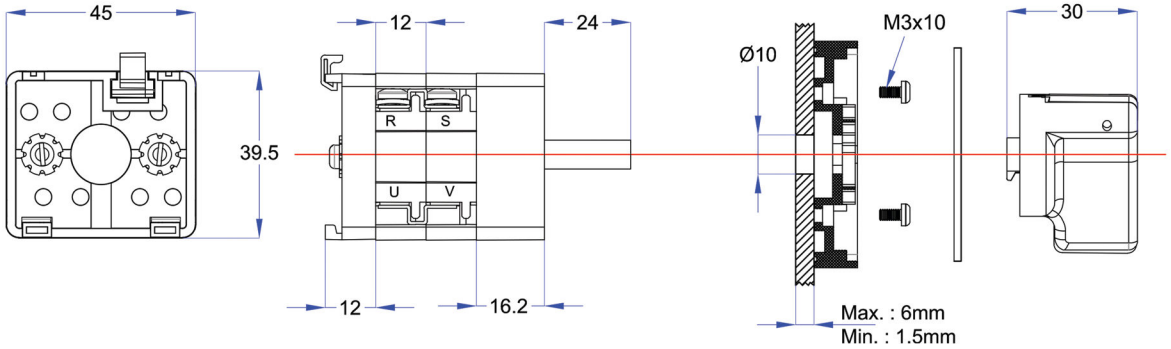
Dimension of KS Model Cam-Operated switch:







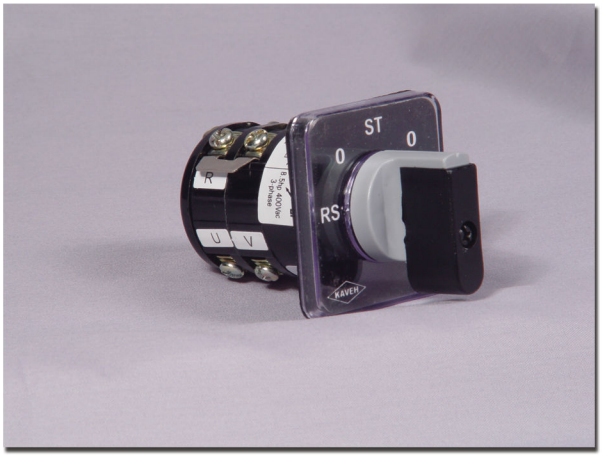




All sizes are in "mm"

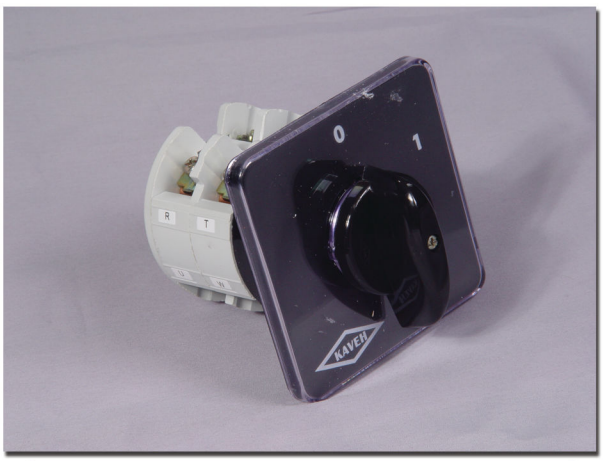
Cam - Operated Switch

KA Model Classification :



KA16.00 Series

KA25.00 Series



KA50.00 Series

KA63.00 Series

KA100.00 Series

KA200.00 Series

Cam - Operated Switch

AC Utilization Category :

Utilization Cat. / Rated Current		Power (KW)											
		12A	16A	20A	25A	32A	40A	50A	63A	100A	200A	400A	630A
Single Phase	**110V**	0.75	1.00	1.30	1.60	2.30	3.00	3.90	5.10	8.10	10.0	18.0	28.0
	230V	1.50	2.10	2.60	3.30	4.60	6.10	7.80	10.3	16.2	20.0	36.0	56.0
	400V	2.60	3.60	4.50	5.70	8.00	10.0	13.3	17.6	28.0	34.0	62.0	96.0
AC1 Non-inductive or slightly inductive loads (Resistance furnaces,lighting circuits).	**110V**	1.80	2.50	3.00	3.50	5.00	6.20	6.90	10.0	13.2	26.0	50.0	80.0
	230V	3.50	4.40	5.50	7.00	10.0	12.5	13.8	20.0	26.5	52.0	100	160
	400V	6.00	7.50	9.50	12.0	17.0	20.0	24.0	33.0	45.6	90.0	172	275
AC2 Slip-Ring Motors: Starting &Reversing the motor rapidly while the motor is running.	**110V**	1.50	2.20	2.80	3.20	4.40	5.50	6.50	8.20	13.0	23.0	44.0	70.0
	230V	3.00	4.50	5.50	6.60	8.80	11.0	13.0	16.5	26.0	46.0	88.0	140
	400V	5.10	7.40	9.00	11.7	15.2	19.0	23.0	28.5	44.0	78.0	150	240
AC3 Squirrel cage motors: Starting ,Switching OFF motors during running.	**110V**	1.30	1.80	2.20	2.50	4.00	5.10	6.00	8.00	11.0	20.0	38.0	60.0
	230V	2.20	3.70	4.00	5.50	7.50	9.00	11.0	15.0	22.0	30.0	76.0	120
	400V	3.50	5.50	7.50	10.0	15.0	16.3	18.0	22.0	37.0	45.0	130	205
AC4 Squirrel Cage motors: Starting ,Plugging , Inching.	**110V**	1.00	1.40	1.70	2.00	3.00	3.80	4.20	6.10	7.00	14.0	26.0	41.0
	230V	2.00	2.70	3.30	4.00	6.10	7.70	8.50	12.0	17.5	28.0	52.0	82.0
	400V	3.40	4.70	5.50	7.00	10.3	13.2	14.7	21.3	30.0	48.0	89.0	141
AC-21A(1) Switching of resistive loads including moderate overloads.	**110V**	2.00	2.75	3.30	4.40	5.50	6.90	8.50	11.0	17.6	32.0	57.0	90.0
	230V	4.00	5.50	6.60	8.80	11.0	13.8	17.0	22.0	35.2	64.0	114	180
	400V	6.90	9.50	11.4	15.7	19.0	24.0	28.8	38.0	60.0	108	196	310
AC-22A Switching of mixed resistive &inductive loads including moderate overloads.	**110V**	1.80	2.50	3.00	3.90	5.00	6.30	7.60	9.80	15.6	28.0	49.0	77.0
	230V	3.50	5.00	6.00	7.80	10.0	12.5	13.3	19.6	31.2	56.0	98.0	154
	400V	6.00	8.50	10.3	13.5	17.3	21.5	25.7	34.0	54.0	95.0	168	265
AC-23A Switching of motor Overloads or other Highly inductive loads.	**110V**	1.50	2.10	2.60	3.30	4.20	5.20	6.40	8.30	13.2	24.0	41.0	64.0
	230V	3.00	4.00	5.50	8.50	10.0	12.0	15.0	18.5	30.0	48.0	82.0	128
	400V	4.00	7.50	9.00	15.0	18.5	21.0	25.0	30.0	45.0	82.0	141	220

(1) - A: **Frequent Operations.** B: Infrequent Operations.

Cam - Operated Switch

DC Utilization Category :

Rated Current (AC-23A)		12A	16A	20A	25A	32A	40A	50A	63A	100A	200A
Utilization Cat.	**V(DC)**	**Power (KW)**									
Single Pole Switching of resistive loads	**24**	0.28	0.38	0.48	0.60	0.75	0.90	1.15	1.40	2.20	4.50
	48	0.50	0.68	0.86	1.05	1.35	1.60	2.05	2.50	3.95	8.10
	110	1.00	1.30	1.65	2.05	2.50	3.15	4.00	5.00	8.00	15.0
	250	1.50	2.00	2.50	3.10	3.85	4.80	6.10	7.75	12.0	22.5
DC -21B (1) Switching of resistive loads including moderate overloads.	**24**	0.25	0.34	0.43	0.55	0.67	0.80	1.00	1.25	2.00	4.00
	48	0.45	0.61	0.77	0.94	1.20	1.45	1.80	2.25	3.60	7.20
	110	0.90	1.15	1.50	1.80	2.25	2.80	3.60	4.50	7.20	13.5
	250	1.35	1.80	2.25	2.75	3.40	4.30	5.45	6.95	10.8	20.2
DC -22B Switching of mixed resistive & inductive loads including moderate overloads.	**24**	0.19	0.25	0.32	0.41	0.50	0.60	0.75	0.94	1.50	3.00
	48	0.34	0.45	0.58	0.70	0.90	1.10	1.35	1.69	2.70	5.40
	110	0.67	0.86	1.12	1.35	1.69	2.10	2.70	3.35	5.40	10.1
	250	1.00	1.35	1.69	2.05	2.55	3.22	4.05	5.20	8.10	15.1
DC -23B Switching of motor Overloads or other Highly inductive loads.	**24**	0.13	0.17	0.21	0.27	0.33	0.40	0.50	0.62	1.00	2.00
	48	0.22	0.30	0.38	0.47	0.60	0.77	0.90	1.13	1.80	3.60
	110	0.45	0.57	0.75	0.90	1.13	1.40	1.80	2.25	3.60	6.75
	250	0.65	0.90	1.12	1.35	1.70	2.10	2.65	3.40	5.00	10.0

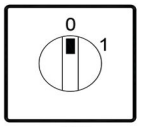
(1) - A: **Frequent Operations.** B: Infrequent Operations.

Cam - Operated Switch

Standard Diagrams :

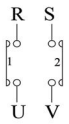
Code:01 کلیـــد تـک فـاز یکطرفـــه

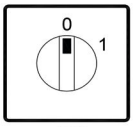
Single . Pole Switch



Code:02 کلیـــد دو فـاز یکطرفـــه

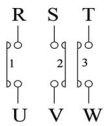
Double . Pole Switch

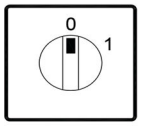




Code:03 کلیدســـه فـاز یکطرفـــه

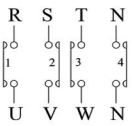
Three . Pole Switch

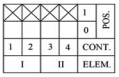


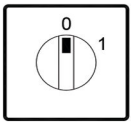


Code:04 کلیـــد سه فـاز و نـول یکطرفـــه

Four . Pole Switch

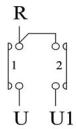


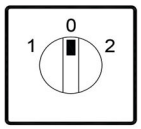




Code:05 کلیـــد تـک فـاز دو طرفـه

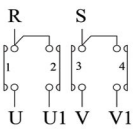
Single . Pole Line Change Over Switch

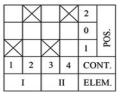


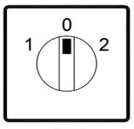


Code:06 کلیـــد دو فـاز دو طرفـه

Double . Pole Line Change Over Switch

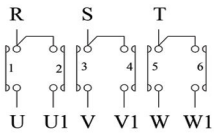


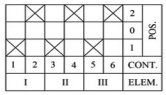


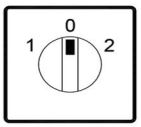


Code:07 کلیـــد سه فـاز دوطرفـه

Three . Pole Line Change Over Switch

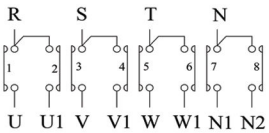


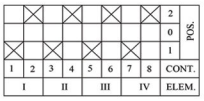


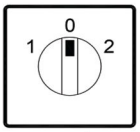


Code:07/2 N کلیـــد سه فـاز بـا نـول دوطرفـه

Four . Pole Line Change Over Switch







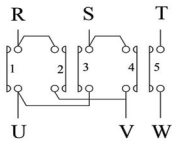
KAVEH

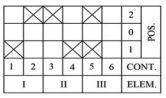
Cam - Operated Switch

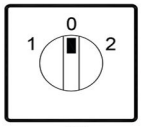
Standard Diagrams :

Code:08 کلیـــد سه فـاز چپگـــرد راســـتگرد

Three . Pole Reversing Switch

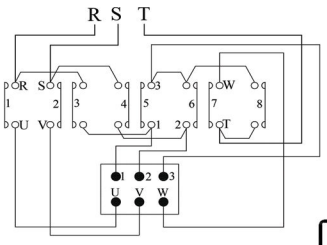


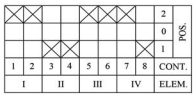


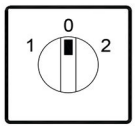


Code:09 کلیدســـــه فـاز دو ســـرعته

Pole Changing Switch

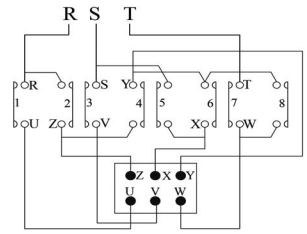


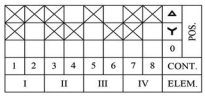


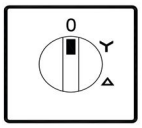


Code:10 کلیدســـــتاره مثلـــث

Star . Delta Starter

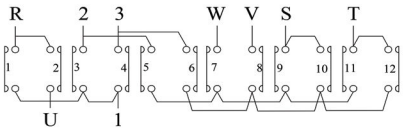


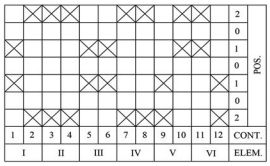


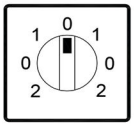


Code:11 کلیـــــدچپگرد و راســـتگرد دو ســـرعته

Pole Changing and Reversing Switch

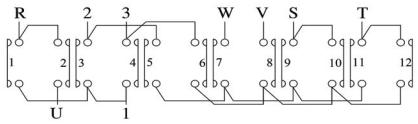


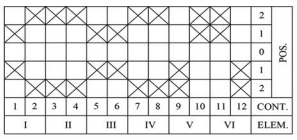


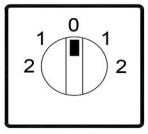


Code:11/1 کلیـــــدچپگرد و راســـتگرد دو ســـرعته بـدون صـفر

Pole Changing and Reversing Switch without "0"

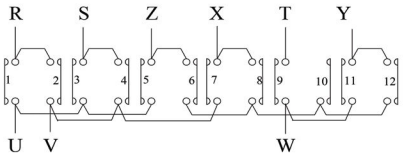


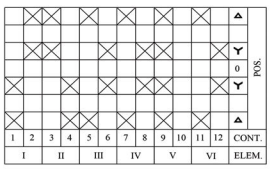


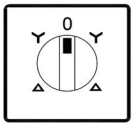


Code:12 کلیدســـــتاره مثلـــث چپگـــرد و راســـتگرد

Star . Delta Starting and Severing Switch

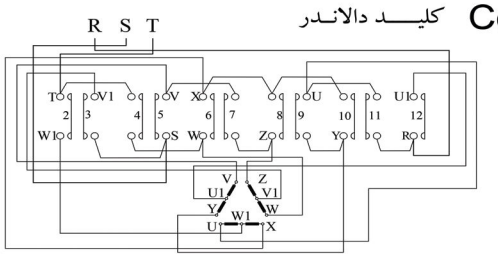


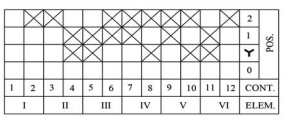


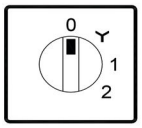


Code:13 کلیـــد دالانـدر

Pole Changing and Star . Delta Starting

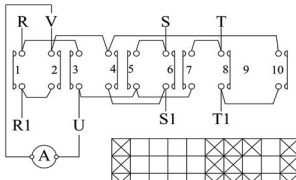


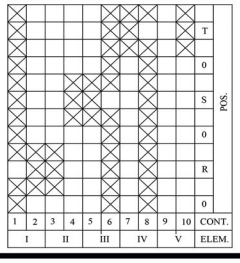


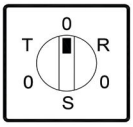


Code:14 کلیدســـنجش آمـپر بـرای آمپرمتربـــدون تـرانس کـوران

Ampermetric Change Over Switch for Direct Measure





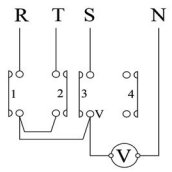


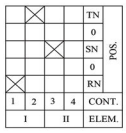
Cam - Operated Switch

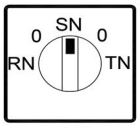
Standard Diagrams :

Code:15 کلیـــد ولـت بیـــن فـاز و نـول

Voltmetric Change Over Switch Phase - Neutral



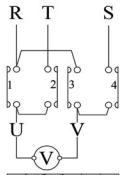


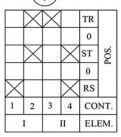


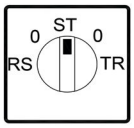
45°

Code:16 کلیـــد ولـت بیـــن فـاز و فـاز

Voltmetric Change Over Switch Phase - Phase



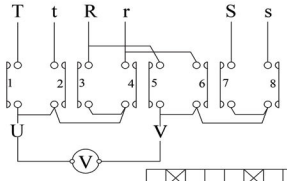


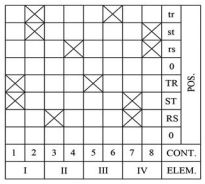


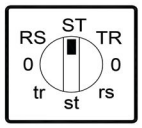
45°

Code:17 کلیـــد ولـت بیـــن فـاز و فـاز بـرای دو ولتـاژ سـه فـاز

Voltmetric Change Over Switch Phase - Phase for 2 Three-Phase Voltages



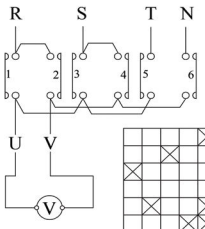


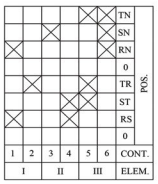


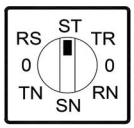
45°

Code:18 کلیـــد ولـت بیـــن فـاز و فـاز و هر فـاز و نـول

Voltmetric Change Over Switch Phase - Phase - Neutral



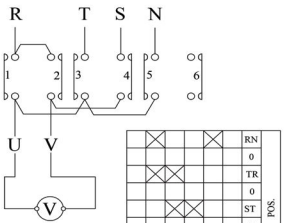


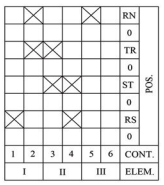


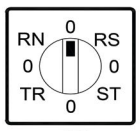
45°

Code:19 کلیـــد ولـت بیـــن یـک فـاز بـا نـول و فـاز و فـاز

Voltmetric Change Over Switch Phase - Neutral - phase - Phase



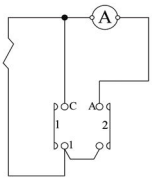


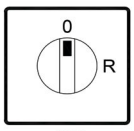


45°

Code:20 کلیـــد تـک فـاز آمپرمـــتر

Single-Pole Ampermetric Change Over Switch for 1Divider

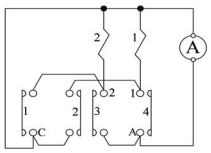


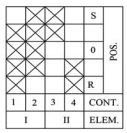


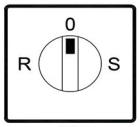
90°

Code:21 کلیـــد دو فـاز آمپرمـــتر

Single-Pole Ampermetric Change Over Switch for 2 Dividers



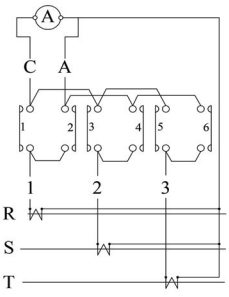


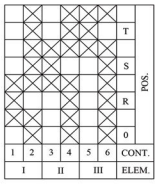


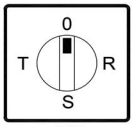
90°

Code:22 کلیـــد سـه فـاز آمپرمـــتر بـا تـرانس کـوران

Single-Pole Ampermetric Change Over Switch for 3 Dividers







90°

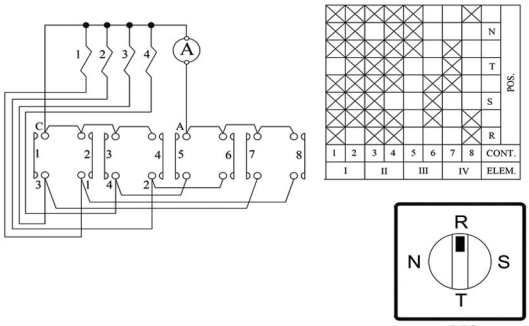
KAVEH

Cam - Operated Switch

Standard Diagrams :

Code:23 کلیـــد سه فـاز و نـول آمپرمـــتر

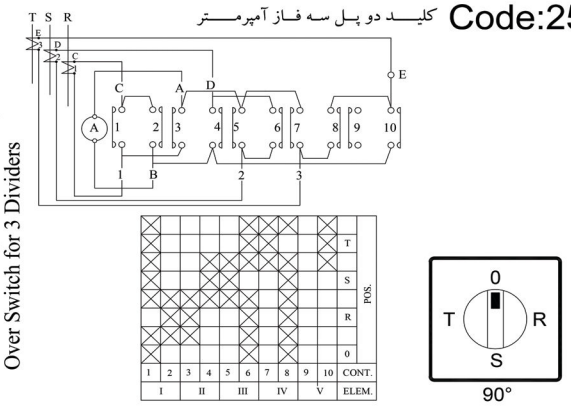
Single-Pole Ampermetric Change Over Switch for 4 Dividers



90°

Code:25 کلیـــد دو پـل سه فـاز آمپرمـــتر

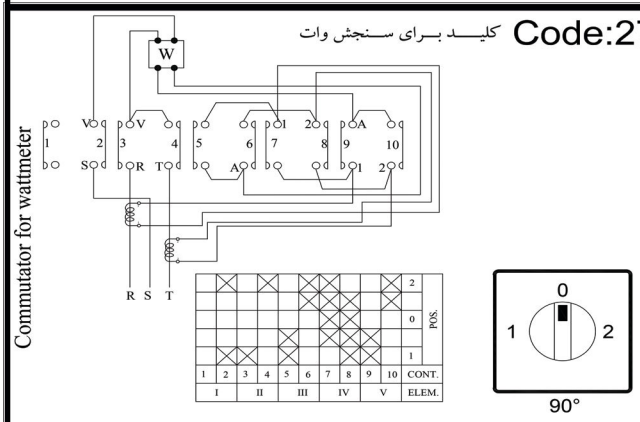
Two-Pole Ampermetric Change Over Switch for 3 Dividers



90°

Code:27 کلیـــد بـــرای ســنجش وات

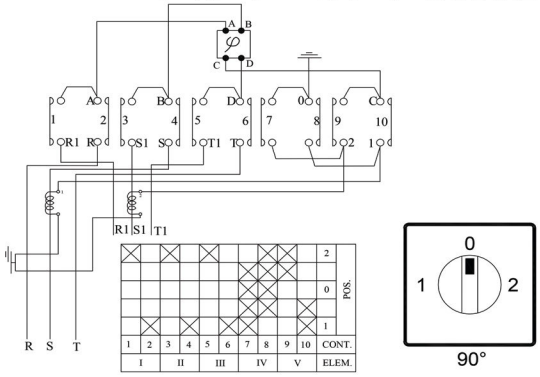
Commutator for wattmeter



90°

Code:28 کلیـــد بـــرای ســنجش ضـــریب تـــوان

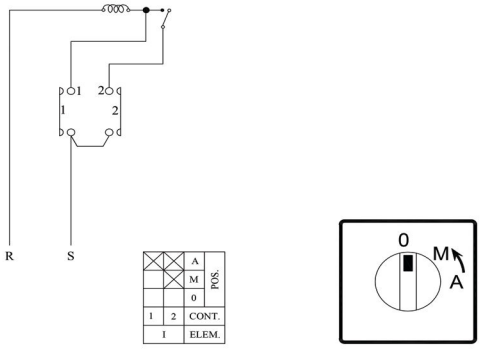
Commutator for Power-factor meter



90°

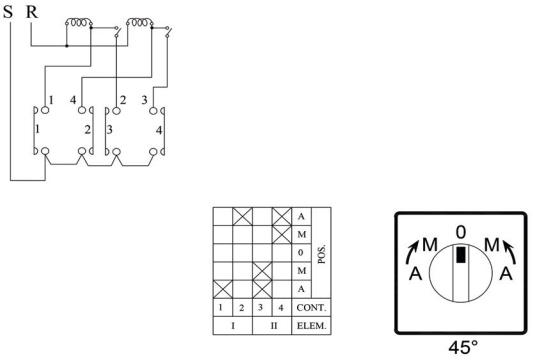
Code:29 کلیـــد کنـــترل دســـتی اســـتارت خور

Commutator for remote control switch operation



Code:30 کلیـــد کنـــترل دســـتی اســـتارت خور چپگـــرد و راســـتگرد

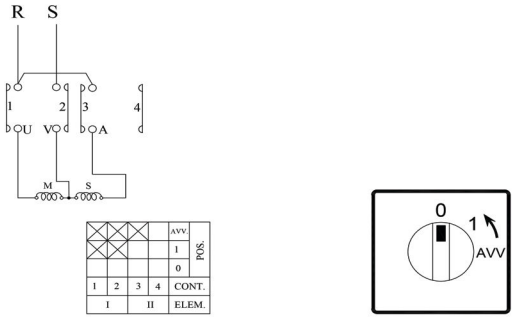
Commutator for remote control Reverser- operation



45°

Code:31 کلیـــد تـــک فـاز بـا فـاز کمکـــی فرمـــان

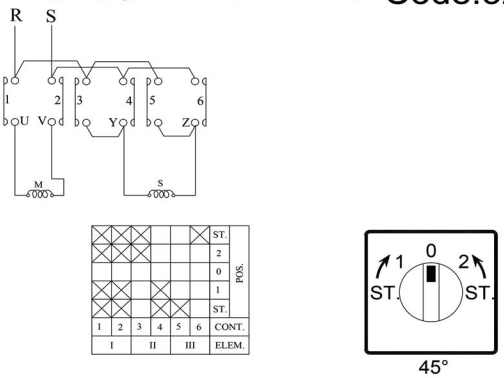
Switch for Single - phase motor with auxiliary phase



45°

Code:32 کلیـــد تـــک فـاز بـا فـاز کمکـــی فرمـــان چپگـــرد وراســـتگرد

Reverser for Single - phase motor with auxiliary phase



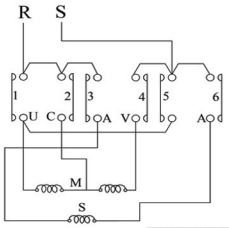
45°

Cam - Operated Switch

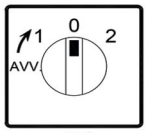
Standard Diagrams :

Code:33 کلید تک فاز دو طرفه با فاز کمکی فرمان

Pole change Switch for Single - phase motor with auxiliary phase



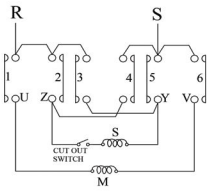
						2
						0
						1
					AVV	POS.
1	2	3	4	5	6	CONT.
I		II		III		ELEM.



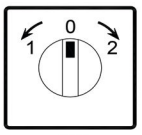
45°

Code:34 کلید تک فاز چپگرد و راستگرد با قطع کننده گریز از مرکز

Reverser for Single - Phase Motor With Centrifugal Cut-Out Switch



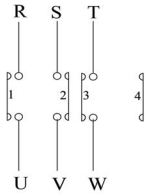
						2
						0
						1
						POS.
1	2	3	4	5	6	CONT.
I		II		III		ELEM.



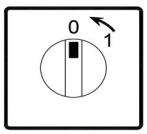
60°

Code:35 کلیدسه فاز یکطرفه خود برگشت

Three pole switch with break self-return



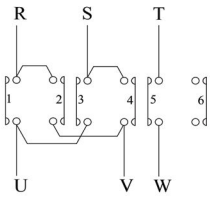
				1
				0
				POS.
1	2	3	4	CONT.
I		II		ELEM.



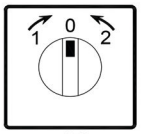
45°

Code:36 کلید سه فاز چپگرد و راستگرد خود برگشت

Three Pole Reverser With Break Self - Return



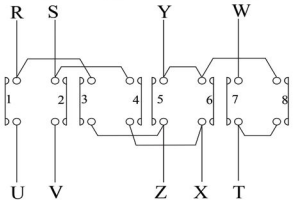
						2
						0
						1
						POS.
1	2	3	4	5	6	CONT.
I		II		III		ELEM.



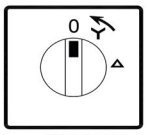
45°

Code:37 کلید ستاره مثلث خود برگشت از ستاره به صفر

Star- delta starter with self-return to o position from star position



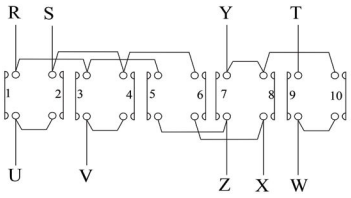
							Δ	POS.
							Y	
							0	
1	2	3	4	5	6	7	8	CONT.
I		II		III		IV		ELEM.



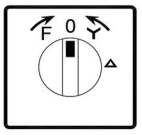
30°-90°

Code:38 کلید ستاره مثلث با ترمز در جهت مقابل جریان

Star- delta starter with counter current break

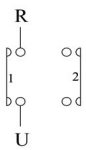


								Δ		POS.
								Y		
								0		
								F		
1	2	3	4	5	6	7	8	9	10	CONT.
I		II		III		IV		V		ELEM.

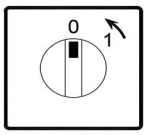


Code:39 کلید تک فاز یکطرفه خودبرگشت

1 Pole Switch With Break Self-Return 2 Positions



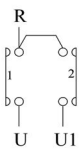
		1	
		0	POS.
1	2	CONT.	
I		ELEM.	



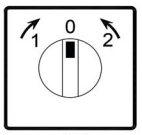
45°

Code:40 کلید تک فاز دو طرفه خودبرگشت

1 Pole Switch With Break Self-Return 3 Positions



		2	
		0	
		1	POS.
1	2	CONT.	
I		ELEM.	



45°

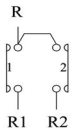
KAVEH

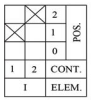
Cam - Operated Switch

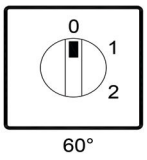
Selector Switch Diagrams :

Code:CM012 کلیـــد تـــک فـــاز دو حالتـــه بـــا صـــفر

1 Pole Changeover Switch 2
Positions,with"0"

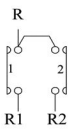


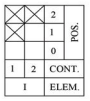


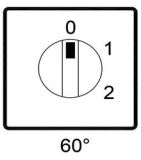


Code:CM012/1 کلیـــد تـــک فـــاز دو حالتـــه بـــا صـــفر در حالیکـــه کنتاکتهـــــای قبلـــی وصـل هســـتند

1Pole Changeover Switch 2Positions,with "0" whereas previous contacts are connected

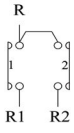


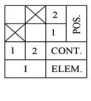


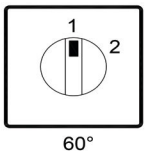


Code:CM12 کلیـــد تـــک فـــاز دو حالتـــه بـــدون صـــفر

1 Pole Changeover Switch 2
Positions,without"0"

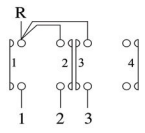


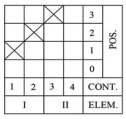


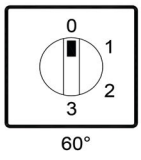


Code:CM013 کلیـــد تـــک فـــاز سه حالتـــه بـــا صـــفر

1 Pole Changeover Switch 3
Positions,with"0"

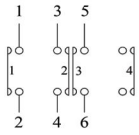


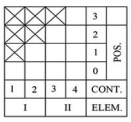


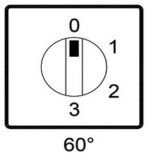


Code:CM013/1 کلیـــد تـــک فـــاز سه حالتـــه بـــا صـــفر در حالیکـــه کنتاکتهـــــای قبلـــی وصـل هســـتند

1Pole Changeover Switch 3Positions,with "0" whereas previous contacts are connected

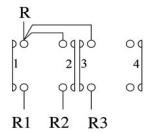


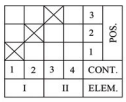


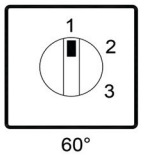


Code:CM13 کلیـــد تـــک فـــاز سه حالتـــه بـــدون صـــفر

1 Pole Changeover Switch 3
Positions,without"0"

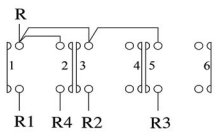


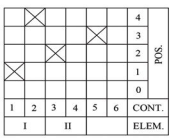


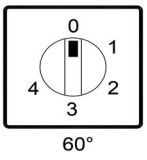


Code:CM014 کلیـــد تـــک فـــاز چهار حالتـــه بـــا صـــفر

1 Pole Changeover Switch 4
Positions,with"0"

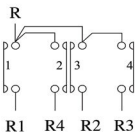


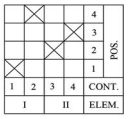


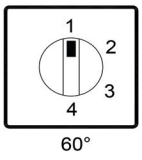


Code:CM14 کلیـــد تـــک فـــاز چهار حالتـــه بـــدون صـــفر

1 Pole Changeover Switch
4 Positions,without"0"





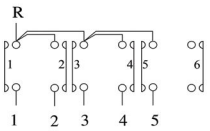


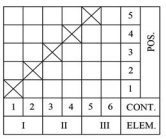
Cam - Operated Switch

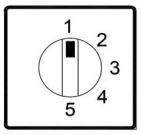
Selector Switch Diagrams :

Code:CM15 کلیـــد تـک فـاز پنـج حالتـه بـدون صـفر

1 Pole Changeover Switch 5
Positions,without"0"



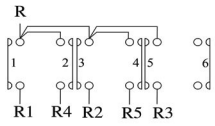


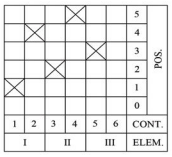


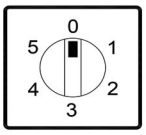
45°

Code:CM015 کلیـــد تـک فـاز پنـج حالتـه بـا صـفر

1 Pole Changeover Switch 5
Positions,with"0"



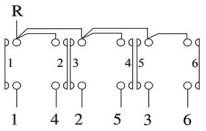


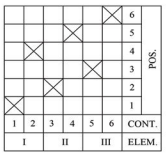


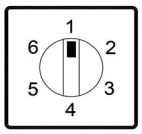
60°

Code:CM16 کلیـــد تـک فـاز شـش حالتـه بـدون صـفر

1 Pole Changeover Switch 6
Positions,without"0"



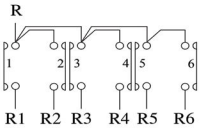


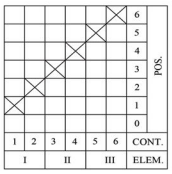


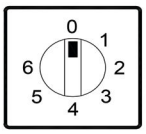
60°

Code:CM016 کلیـــد تـک فـاز شـش حالتـه بـا صـفر

1 Pole Changeover Switch 6
Positions,with"0"



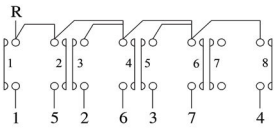


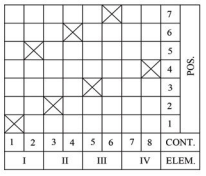


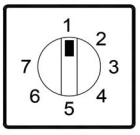
45°

Code:CM17 کلیـــد تـک فـاز هفـت حالتـه بـدون صـفر

1 Pole Changeover Switch 7
Positions,without"0"



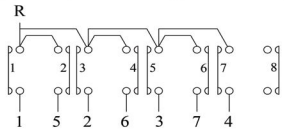


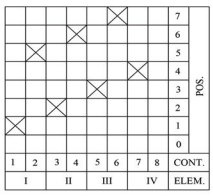


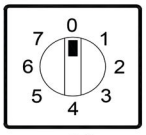
45°

Code:CM017 کلیـــد تـک فـاز هفـت حالتـه بـا صـفر

1 Pole Changeover Switch 7
Positions,with"0"



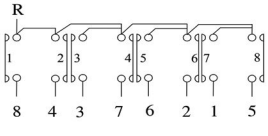


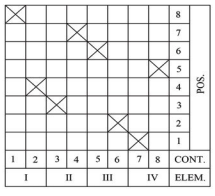


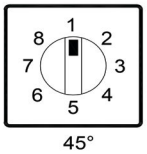
45°

Code:CM18 کلیـــد تـک فـاز هشـت حالتـه بـدون صـفر

1 Pole Changeover Switch 8
Positions,without"0"



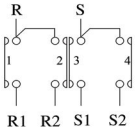


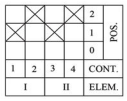


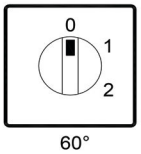
45°

Code:CM022 کلیـــد دو فـاز دو حالتـه بـا صـفر

2 Poles Changeover Switch
2 Positions,with"0"







60°

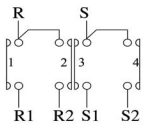
KAVEH

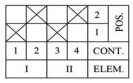
Cam - Operated Switch

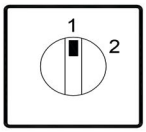
Selector Switch Diagrams :

Code:CM22 کلیـــد دوفـاز دو حالتـــه بـدون صـــفر

2 Poles Changeover Switch
2 Positions,without"0"

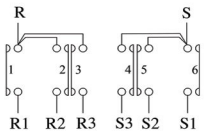


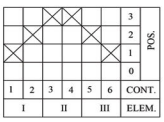


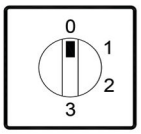


Code:CM023 کلیـــد دو فـاز سه حالتـــه بـا صـــفر

2 Poles Changeover Switch
3 Positions,with"0"

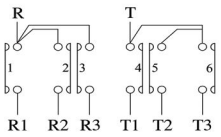


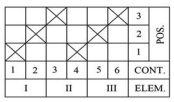


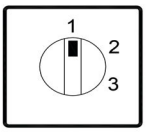


Code:CM23 کلیـــد دو فـاز سه حالتـــه بـدون صـــفر

2 Poles Changeover Switch
3 Positions,without"0"

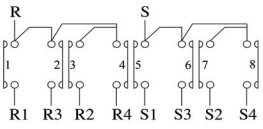


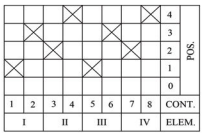


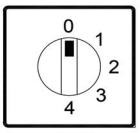


Code:CM024 کلیـــد دو فـاز چهار حالتـــه بـا صـــفر

2 Poles Changeover Switch
4 Positions,with"0"

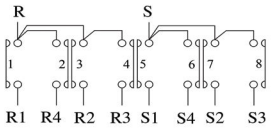


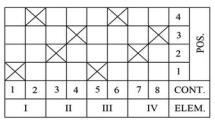


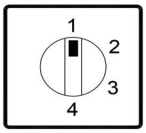


Code:CM24 کلیـــد دو فـاز چهار حالتـــه بـدون صـــفر

2 Poles Changeover Switch
4 Positions,without"0"

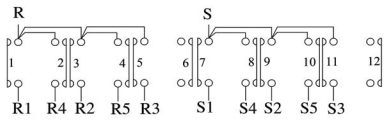


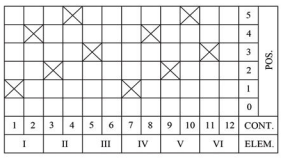


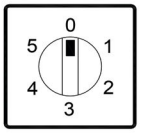


Code:CM025 کلیـــد دو فـــازپنج حالتـــه بـا صـــفر

2 Poles Changeover Switch
5 Positions,with"0"

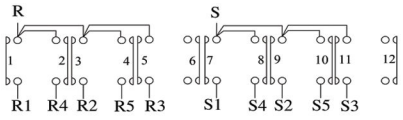


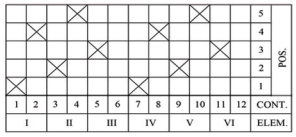


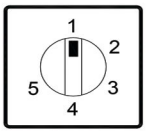


Code:CM25 کلیـــد دو فـاز پنج حالتـــه بـدون صـــفر

2 Poles Changeover Switch
5 Positions,without"0"

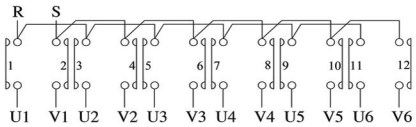


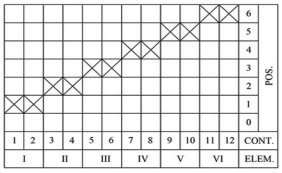


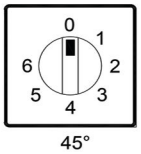


Code:CM026 کلیـــد دو فـاز شش حالتـــه بـا صـــفر

2 Poles Changeover Switch
6 Positions,with"0"







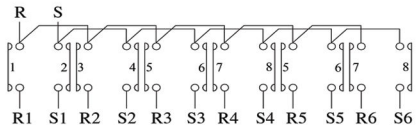
Cam - Operated Switch

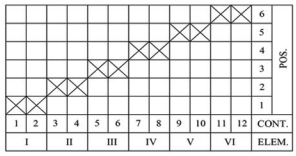
Selector Switch Diagrams :

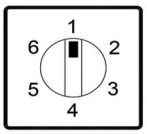
Code:CM26

کلیـــد دو فـاز شش حالتـــه بـدون صـــفر

2 Poles Changeover Switch
6 Positions,without"0"



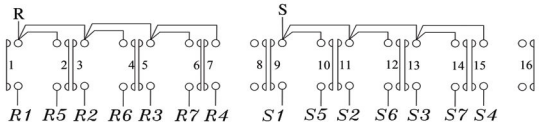


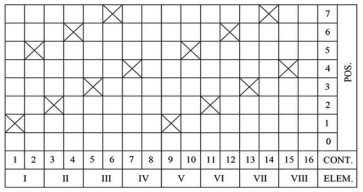


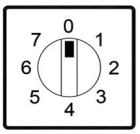
Code:CM027

کلیـــد دو فـاز هفت حالتـــه بـا صـــفر

2 Poles Changeover Switch
7 Positions,with"0"



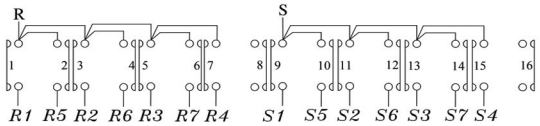


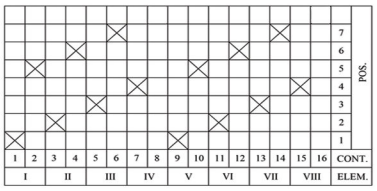


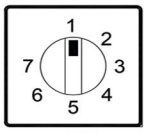
Code:CM27

کلیـــد دو فـاز هفت حالتـــه بـدون صـــفر

2 Poles Changeover Switch
7 Positions,without"0"



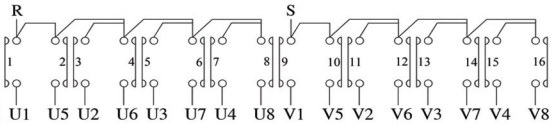


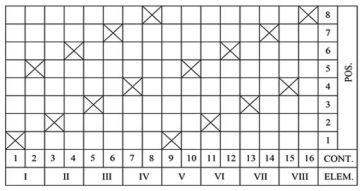


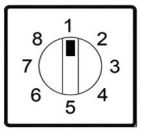
Code:CM28

کلیـــد دو فـاز هشت حالتـــه بـدون صـــفر

2 Poles Changeover Switch
8 Positions,without"0"



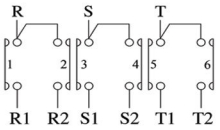


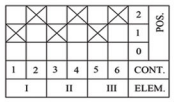


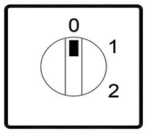
Code:CM032

کلیـــد سه فـاز دو حالتـــه بـا صـــفر

3 Poles Changeover Switch
2 Positions,with"0"



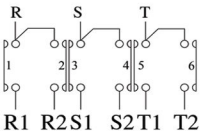


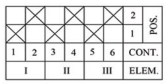


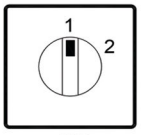
Code:CM32

کلیـــد سه فـاز دو حالتـــه بـدون صـــفر

3 Poles Changeover Switch
2 Positions,without"0"



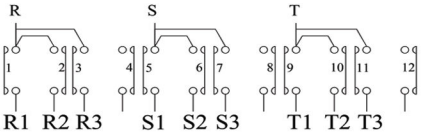


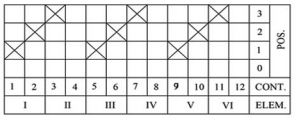


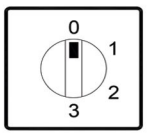
Code:CM033

کلیـــد سه فـاز سه حالتـــه بـا صـــفر

3 Poles Changeover Switch
3 Positions,with"0"



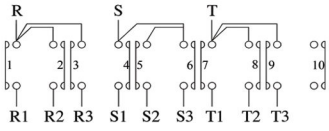


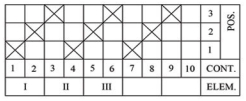


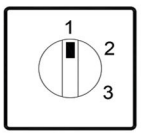
Code:CM33

کلیـــد سه فـاز سه حالتـــه بـدون صـــفر

3 Poles Changeover Switch
3 Positions,without"0"







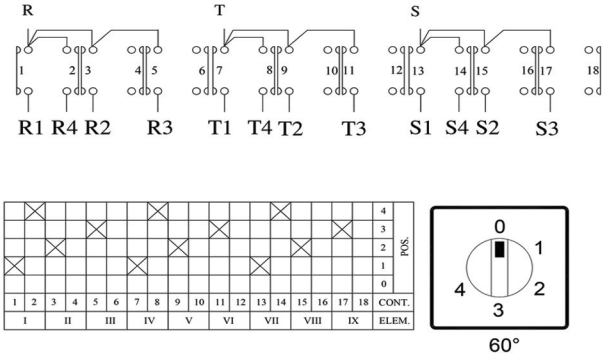
KAVEH

Cam - Operated Switch

Selector Switch Diagrams :

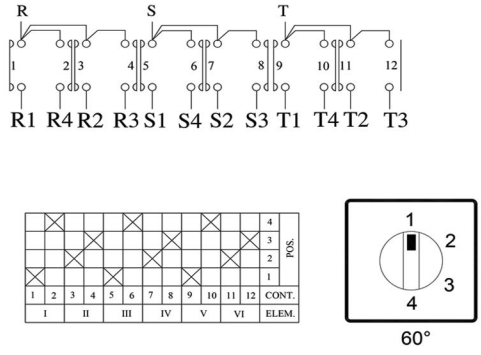
Code:CM034 کلیـــد سه فـاز چهار حالتـه بـا صـفر

3 Poles Changeover Switch
4 Positions,with"0"



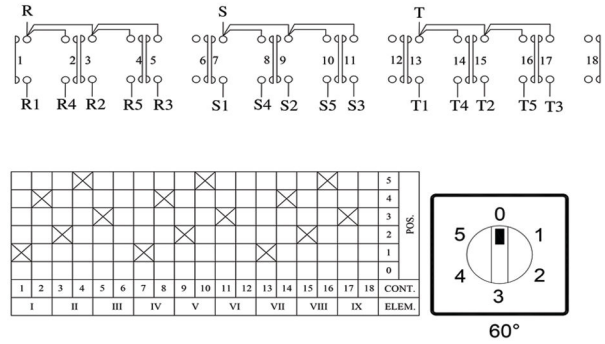
Code:CM34 کلیـــد سه فـاز چهار حالتـه بـدون صـفر

3 Poles Changeover Switch
4 Positions,without"0"



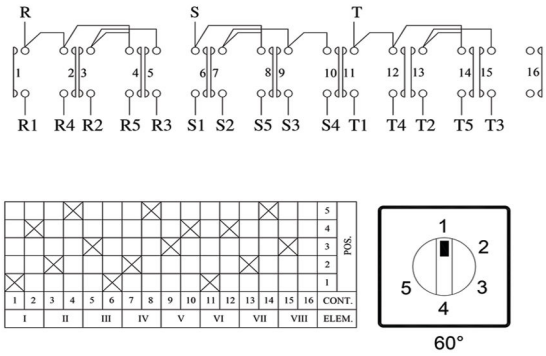
Code:CM035 کلیـــد سه فـاز پنـج حالتـه بـا صـفر

3 Poles Changeover Switch
5 Positions,with"0"



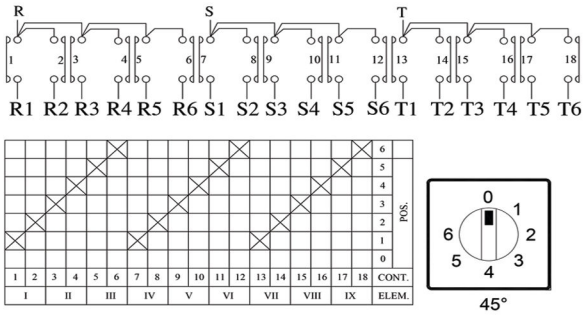
Code:CM35 کلیـــد سه فـاز پنـج حالتـه بـدون صـفر

3 Poles Changeover Switch
5 Positions,without"0"



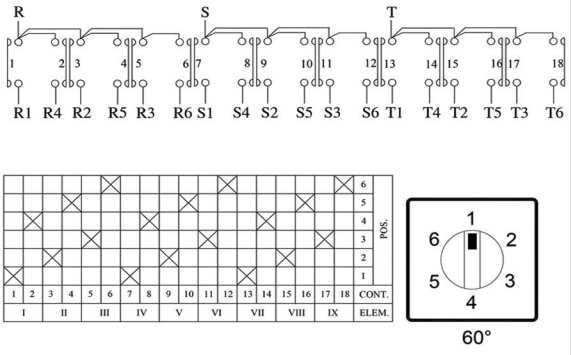
Code:CM036 کلیـــد سه فـاز شش حالتـه بـا صـفر

3 Poles Changeover Switch
6 Positions,with"0"



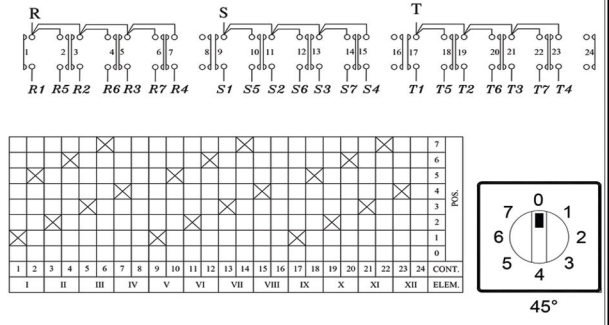
Code:CM36 کلیـــد سه فـاز شش حالتـه بـدون صـفر

3 Poles Changeover Switch
6 Positions,without"0"



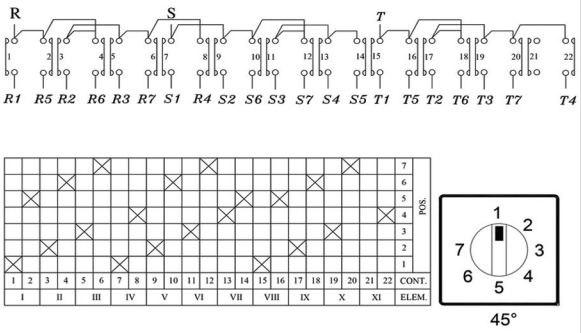
Code:CM037 کلیـــد سه فـاز هفـت حالتـه بـا صـفر

3 Poles Changeover Switch
7 Positions,with"0"



Code:CM37 کلیـــد سه فـاز هفـت حالتـه بـدون صـفر

3 Poles Changeover Switch
7 Positions,without"0"

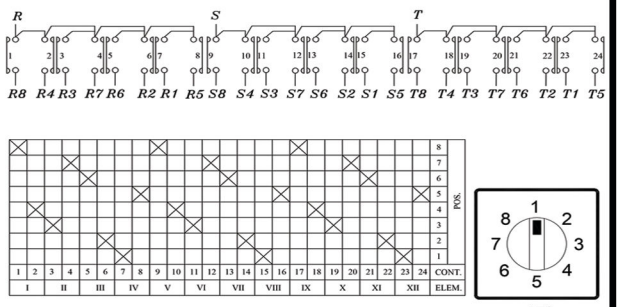


Cam - Operated Switch

Selector Switch Diagrams :

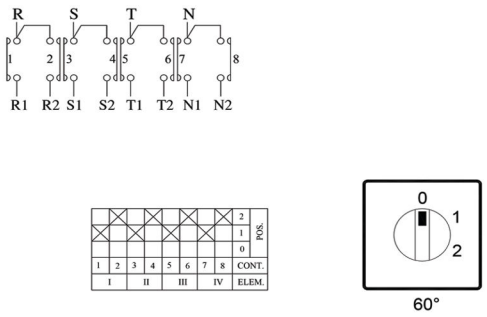
Code:CM38 کلیـــد سه فـاز هشت حالتـــه بـدون صـــفر

3 Poles Changeover Switch
8 Positions,without"0"



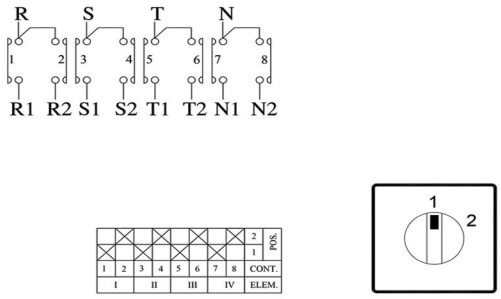
Code:CM042 کلیـــد چهار پـل دو حالتـــه بـا صـــفر

4 Poles Changeover Switch
2 Positions,with"0"



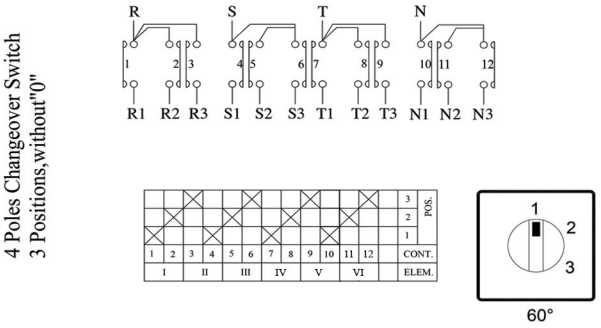
Code:CM42 کلیـــد چهار پـل دو حالتـــه بـدون صـــفر

4 Poles Changeover Switch
2 Positions,without"0"



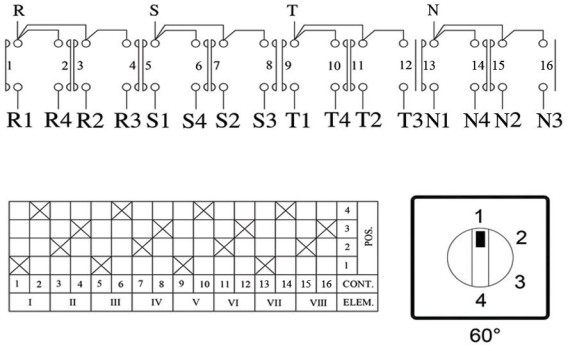
Code:CM43 کلیـــد چهار پـل سه حالتـــه بـدون صـــفر

4 Poles Changeover Switch
3 Positions,without"0"



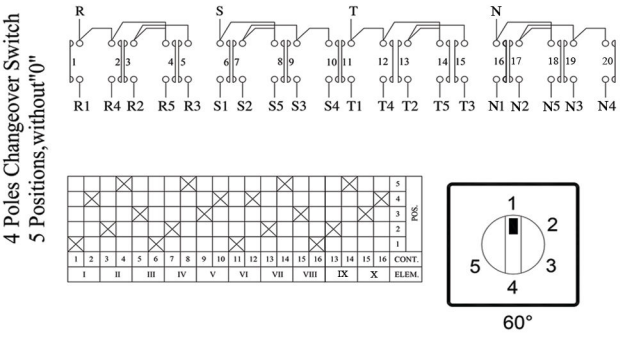
Code:CM44 کلیـــد چهار پـل چهار حالتـــه بـدون صـــفر

4 Poles Changeover Switch
4 Positions,without"0"



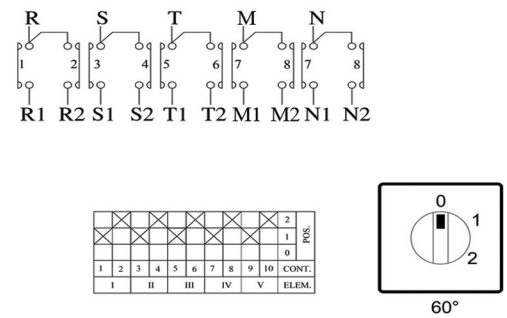
Code:CM45 کلیـــد چهار پـل پنـــج حالتـــه بـدون صـــفر

4 Poles Changeover Switch
5 Positions,without"0"



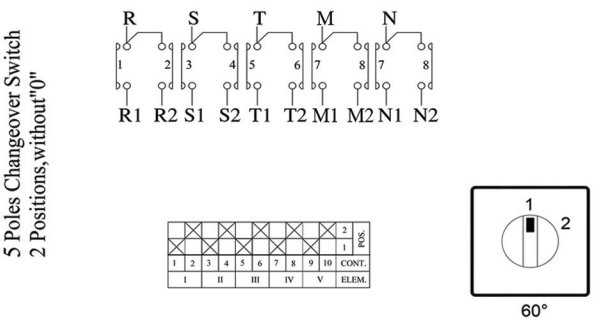
Code : CM052 کلیـــد پنج پل، دو حالتـــه بـا صـــفر

5 Poles Changeover Switch
2 Positions,with"0"



Code:CM52 کلیـــد پنج پـل دو حالتـــه بـدون صـــفر

5 Poles Changeover Switch
2 Positions,without"0"

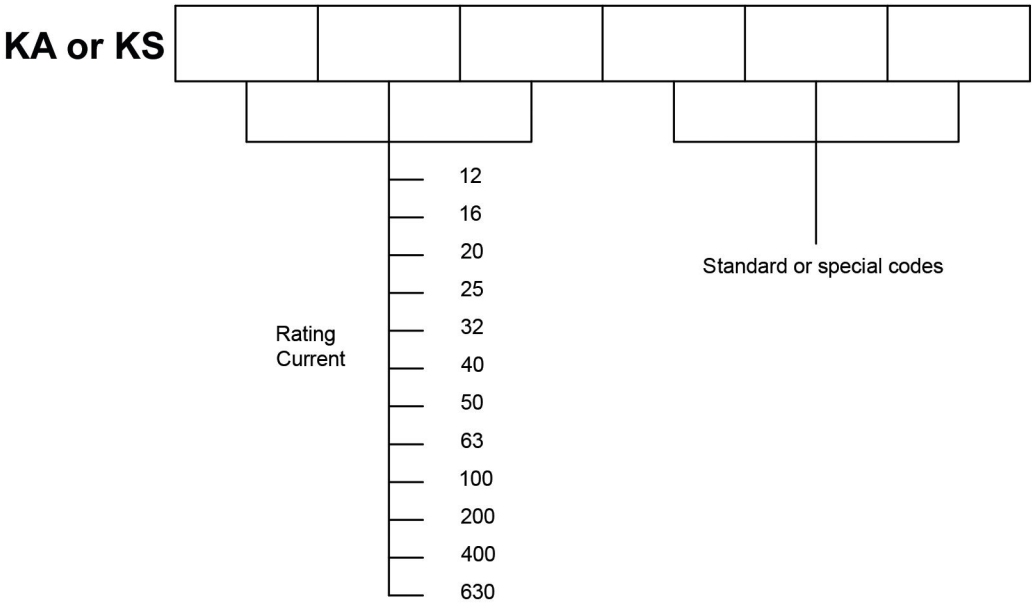


KAVEH

Ordering Information :

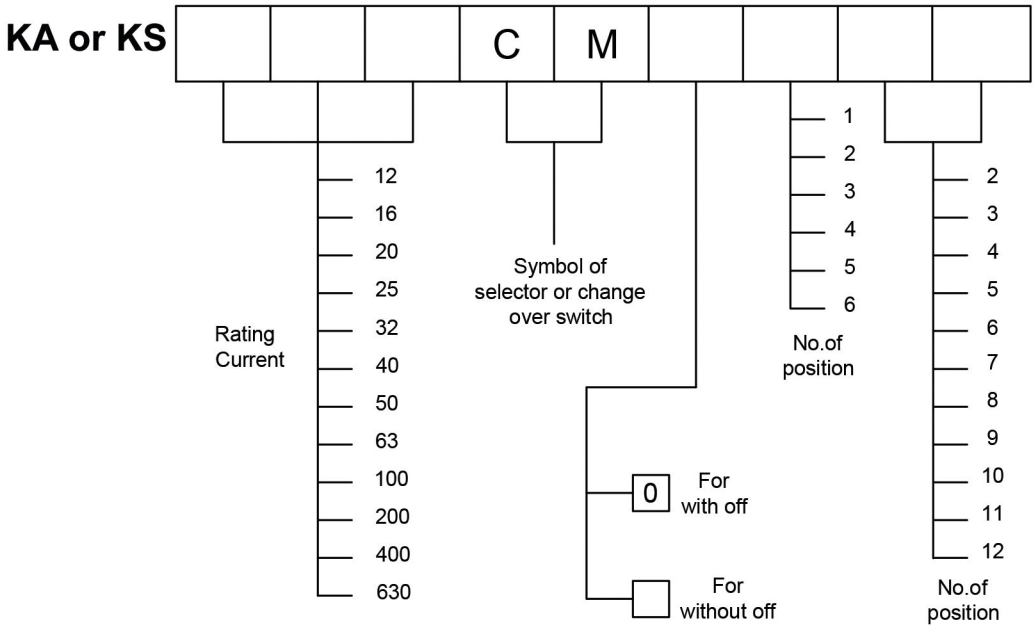
Standard and special switches in according AC-23A (AC3)

Standard switch , available for prompt delivery in flush and rear mounting version A... The diagram number forms part of the switches ,in the last two position. For example :A three - pole linechange - over switch (diagram 07)in 25A Series (A.2500) is identified by the type number 2507.



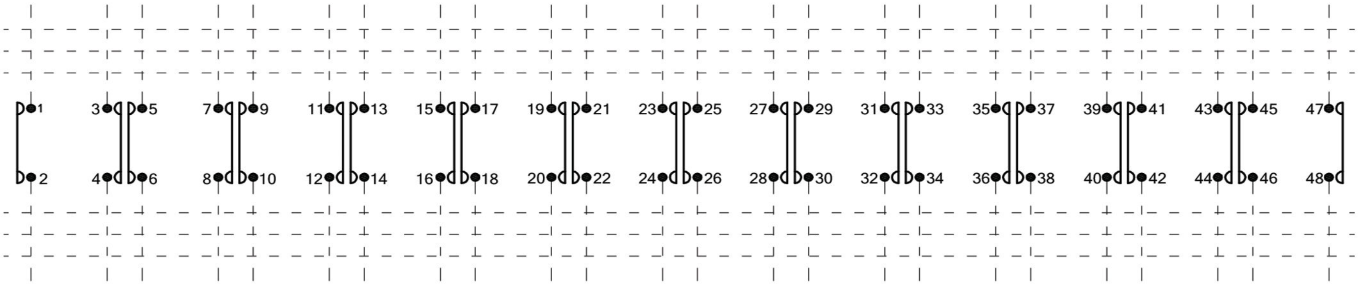
Selector and changeover switches in according AC-23A(AC3)

For example:A three - pole changeover switch 2 position,without off in 16A is identified by the number 16CM32.



Order sheet for Special :

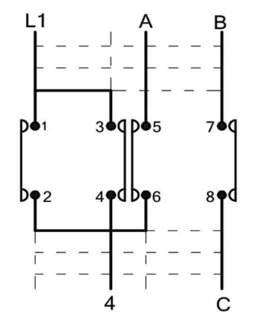
External Connection & Terminals Symbol

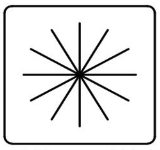


Internal Function

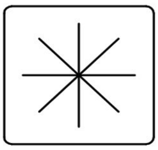
POSITION																								
ELEMENT	1		2		3		4		5		6		7		8		9		10		11		12	
CONTACT	1 - 2	3 - 4	5 - 6	7 - 8	9 - 10	11 - 12	13 - 14	15 - 16	17 - 18	19 - 20	21 - 22	23 - 24	25 - 26	27 - 28	29 - 30	31 - 32	33 - 34	35 - 36	37 - 38	39 - 40	41 - 42	43 - 44	45 - 46	47 - 48

Example





30° ☐ 60° ☐



45° ☐ 90° ☐

Symbol	Meaning	Symbol	Meaning
☐	Open Contact	☒	Closed contact
☒☒	Closed contact with break in current between positions	☒☒	Closed contact with out break in current between positions
	short-circuited contacts		spring-return (1, 2)
	open contact with advanced closing		

Series	Dimention of Plate	
12 A to 20 A	52 x 52 mm	☐
12 A to 25 A	64 x 64 mm	☐
12 A to 40 A	75 x 75 mm	☐
	PADLOCK PLATE 75x75 mm	☐
40 A to 100 A	105 x 105 mm	☐
	PADLOCK PLATE 105x105 mm	☐
100 A to 630A	130 x 130 mm	☐

Without Back Plate ☐

Metal Back Plate ☐

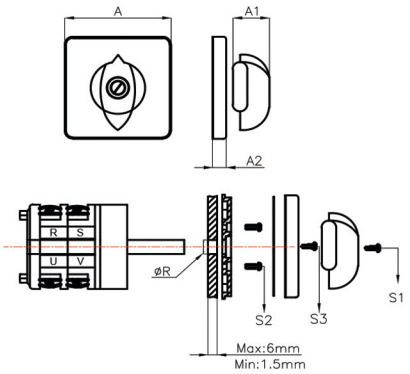
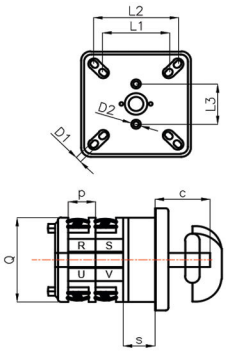
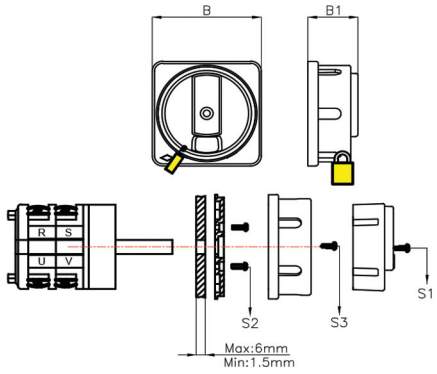
Plastic Back Plate ☐

Customer :	Date :	Dwg.No. :
Current Rating (A) :	Voltage(V) :	Series :
Version :	Quantity :	Packing :

Note : _

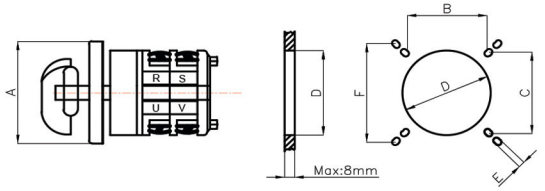
Cam - Operated Switch

Dimensions for KA Model Switches :

Plastic Plate Version	Installation Diagram	Pad Lock Plate Version
		

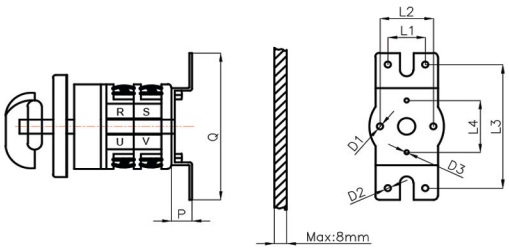
Series	A	A1	A2	B	B1	R	C	P	S	Q	L1	L2	L3	D1	D2	S1	S2	S3
A16.00	52	19	7	52	24	10	22	12	16	39	—	37	28	4	4	2.9x9.5	3.5x10	2.9x6.5
	64	20	9	75	28	10	24	12	16	39	—	47	28	4	4	2.9x9.5	3.5x10	2.9x6.5
	75	20	9	75	28	10	24	18	20	58	44	59	28	4	4	2.9x9.5	3.5x10	2.9x6.5
A25.00	64	20	9	75	28	10	24	18	20	58	—	47	28	4	4	2.9x9.5	3.5x10	2.9x6.5
	75	20	9	75	28	10	24	18	20	58	44	59	28	4	4	2.9x9.5	3.5x10	2.9x6.5
	105	30	11	105	40	10	24	18	20	58	—	85	28	5.5	5.5	4x10	3.5x12	2.9x11
A50.00	105	30	11	105	40	12	36	18.3	20	73	—	85	40	5.5	5.5	4x10	5x12	2.9x11
A63.00	105	30	11	105	40	12	36	25	30	84	—	85	40	5.5	5.5	4x10	5x12	2.9x11
A100.00	130	42	13	—	—	16.5	46	30	30	110	—	110	89	5.5	5.5	5x20	5x25	2.9x13
A200.00	130	42	13	—	—	16.5	46	39	30	110	—	110	89	5.5	5.5	5x20	5x25	2.9x13

Chase Assembly Of Plastic Or Pad -Lock Plate



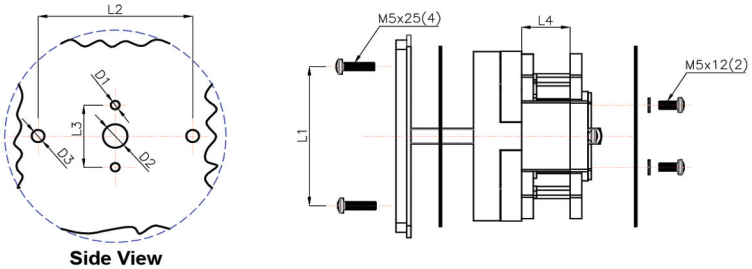
Series	A	B	C	D	E	F
A16.00	52	36	36	40	4	36
	64	48	48	40	4	48
	75	44	44	40	4	58
A25.00	64	48	48	58	4	58
	75	44	44	58	5.5	85
	105	85	85	58	5.5	85
A50.00	105	85	85	73	5.5	85
A63.00	105	85	85	84	5.5	85
A100.00	130	95	95	110	5.5	110
A200.00	130	95	95	110	5.5	110

Metal Back Plate Assembly



Series	L1	L2	L3	L4	D1	D2	D3	Q	P
A16.00	18	27	60	28	4	5	4	71	10
A25.00	18	27	60	28	4	5	4	71	10
A50.00	26	40	87	40	5.3	5.3	5.3	99	12.5
A63.00	26	40	87	40	5.3	5.3	5.3	99	12.5

Assembly Template



Side View

Series	L1	L2	L3	L4	D1	D2	D3
A100.00	89.5	96	40	30	5.5	15	10
A200.00	89.5	96	40	40	5.5	15	10

All sizes are in"mm".

Cam - Operated Switch

Accessories :

1- Handles & Install Plates

General Type :
Transparent Plates :
52 , 64 , 75 , 105 & 130 mm
with Black Knob , IP40.
In = 16A upto 630A.

B&G (2Pcs) Type :
Transparent Plates :
52, 64, 75 mm with Black and
Gray Knob , IP40.
In = 16A upto 40A.

Lock Type :
Yellow plates : 52,75,105 & 130 mm
with Red padlock knob
(Max. 3 padlocks) , IP40.
In = 16A upto 630A.

Handwheel Type :
Transparent Plates :
130 x 130 mm , IP40
with Black Handwheel.
In = 100A upto 630A.

2- Thermoplastic Enclosure Boxes :

Protection degree upto IP65 .
Front or Lateral lever drive .
Small Box Size : 120 x 95 x 77 mm (L x W x D).
Large Box Size : 190 x 135 x 114 mm (L x W x D).

Handles & Install plates type :
BLU : Lock type & Front. , **BLS :** Lock type & Lateral.
BPU : Genral type & Front. , **BPS :** General type & Lateral.
BCS : Black Lever Length from Lateral.

3- Mechanical door Inter lock

Handles and Install Plates with Inter Lock

Size of Plates :
52 x52, 64x64, 75x75, 105x105mm

Handel type :
General, B&G, Lock, Black lever length

4- Transparent Terminal Cover :

Transparent cover on main switches body for avoiding accessibility on electrical Sections and prevent dusts.
There are 3 types: 16,25,63A series.

5- Base mount by Metal Bracket (MBP):

The MBP assembly is the switch which enables the user to mount the Switch to internal plate of switch cabinet. This bracket can be mount to switch up to 63A types.
There are 2 sizes :
Small: 12A upto 40A.
Large: 50A upto 63A.
For upper types, this possibility is considered generally & no need for this bracket.

Miniature Circuit Breaker

CONTENTS

Miniature Circuit Breaker

General :

Miniature switch as a circuit breaker in most homes today and protect sensitive systems for phones and safety of persons and equipment against overload and short circuit currents are used to.
Miniature Circuit Breaker structure is as follows:
Base & Cover : All parts inside are MCB and must be insulated with a Min. voltage of 2500 V and a thermal resistance of 960°C with a flare (Normally the Bakelite,melamine or a particular type of polyamide).
Magnet : Copper coil , fixed and mobile core made of ferromagnetic materials , springs , fittings and ... is composed that Several times of the rated current MCB (the MCB type lighting or motor or hard motor is than 3 times the rated current is equal to 20) or short-circuit reacts and MCB will cause immediate trip . The standard MCB for each rated current, its own magnet.
Handel : Means for inserting a MCB is plugged in or disconnected mode.
Bi-Metal : Overload Relay used in MCBs is a kind of Bi-metal . When the MCB is generated by a miniature screws, precision switch nominal current is set by the factory polish . It works off the circuit against overload relay is responsible .
Arc chamber : Is composed of parallel metal plates, are separated by a layer of insulation, when trip into small spark to ignite dangerous sparks and noise and helps prevent overheating. The MCBs are usually of poor quality and cheap price, there's this piece is perhaps the simplest or most basic way to identify it, is the MCB to weight loss.
Springs and connectors : These components must be mechanically and possesses a special structure and are resistant to corrosion.
Terminals : Stainless conductors must be designed to be comfortable in it.

Use protective equipment to avoid dangers such as fires in a circuit, overload and short circuit caused the error occurred in the system is required . One of these devices due to the unique characteristics such as being used after each cut, etc. used today, has three phase synchronous automatic trip Switch-es, are or miniaturized .Usually two types of AC and DC will be produced.

Miniature Circuit Breakers Kaveh three types of alternating current brightness (B) and motor (C) and (D) in a variety of single-pole, single pole with neutral (1P+N), two-poles, three-poles, three poles and neutral (3P+N) and the four bridges are produced.
Currently, two international standards IEC/EN 60898-1 and IEC/EN 60947-2 in accredited facilities and building miniature Circuit Breakers are used. In IRAN, the national standard for Miniature Circuit Breakers is ISIRI2611-1 foundation developed the standard IEC/EN 60898-1.
It should be noted that the AC MCB in DC circuit cannot be used under any circumstances that the risks, such as failure to stop short time (due to union contacts) includes, It's a slow burn also added several contacts resulting in improper connection of fixed &moving contacts and the heat is generated.
DC Miniature Circuit Breakers, in addition to having a natural magnet for the relay to operate on direct current is magnetic. So we can also use the DC MCBs in AC circuits .

Miniature Circuit Breaker

Technical Information (AC) :

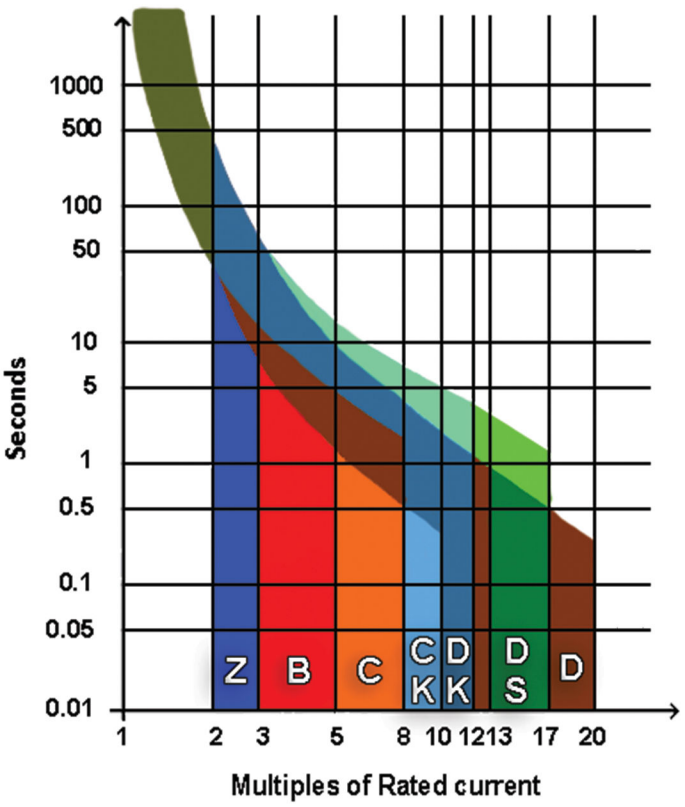
	Description	Unit	Specification of KAVEH MCB					
			IEC/EN 60898-1			IEC/EN 60947-2		
Electrical Features	Rated current I_n	A	2 , 4 , 6 , 10 , 16 , 20 , 25 , 32 , 40 , 50 , 63 , 80 , 100 , 125					
	Poles	n	1P , 1P+N , 2P , 3P , 3P+N , 4P					
	Rated voltage U_e	V	230 / 400					
	Insulation voltage U_i	V	500					
	Rated frequency	Hz	50 / 60					
	Rated breaking capacity I_{cu}	A	4500 , 6000 , 10000 , 15000					
	Energy limiting class	n	3					
	Rated impulse withstand voltage Uimp	V	4000					
	Dielectric test voltage at ind. Freq. for 1 min.	KV	2.5					
	Pollution degree	n	3					
	Maximum Power loss per pole	W	2A(2.1 W) , 4A(2.3 W) , 6A(2.6 W) , 10A(2.7 W)					
		W	16A(3.2 W) , 20A(3.5 W) ,25A(3.9 W) , 32A(4.5 W)					
		W	40A(5.9 W) , 50A(7.5 W) , 63A(9.8 W)					
	Thermo-magnetic release characteristic		B	C	D	Z	K	S
			3-5 I_n	5-10 I_n	10-20 I_n	2 - 3 I_n	8 - 12 I_n	13 - 17 I_n
Mechanical Features	Electrical life	Cycle	6000 for In≤ 32A , 4000 for In>32A					
	Mechanical life	Cycle	20000					
	Contact position indicator		Yes					
	protection degree		IP 20					
	Reference temperature for setting of thermal element	°C	30					
	Ambient temperature (with daily averages ≤ 35°C)	°C	- 5 ... +40 (Special application please refer to P03 for temperature compensation correction)					
	Storage temperature	°C	-25 ... +70					
	Vibration	g	5					
	Shock	mm	40mm free fall					
Installation	Terminal connection type		Cable / U - type busbar / Pin - type busbar					
	Terminal size top/bottom for flexible cables	mm^2	25 (Upto 63A) , 50 (80A to 125A)					
		AWG	18 - 3 , 3 - 1					
	Terminal size top/bottom for rigid cables	mm^2	35 (Upto 63A) , 70 (80A to 125A)					
		AWG	16 - 2 , 2 - 00					
	Tightening torque	N.m	2.5 (Upto 63A) , 3 (80A to 125A)					
		in-lbs.	22 , 26.5					
	Installation position		Vertical / Horizontal					
	Mounting		on DIN rail EN60715 (35mm) by means of fast clip device					
	Connection		From top and bottom					
	Base & Cover material		Moulded, Flame retardant thermoplastic in accordance IEC60695					
Combination with Accessories	Auxiliary contact		Yes					
	Shunt release		Yes					
	Under voltage release		Yes					
	Alarm contact		Yes					

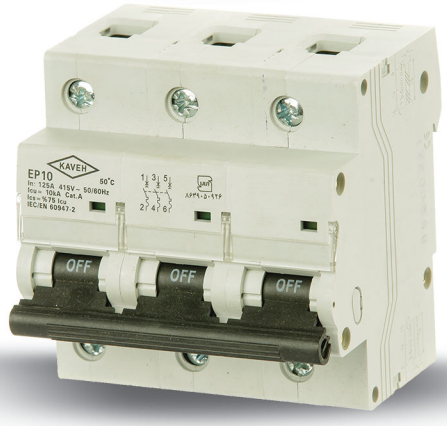
Miniature Circuit Breaker

Technical Information (DC) :

	Description	Unit	Specification of KAVEH MCB IEC/EN 60898-1		
Electrical Features	Rated current I_n	A	1 , 2 , 4 , 6 , 10 , 16 , 20 , 25 , 32 , 40 , 50 , 63		
	Poles	n	1P , 2P		
	Rated voltage U_e	V	240		
	Insulation voltage U_i	V	500		
	Rated breaking capacity (Icu)	KA	6 , 10		
	Rated breaking capacity (Icn)	A	6000		
	Energy limiting class	n	3		
	Rated impulse withstand voltage Uimp	V	6000		
	Dielectric test voltage at ind. Freq. for 1 min.	KV	2.5		
	Pollution degree	n	3		
	Power loss per pole	W	1A(1.5 W) ,2A(2.2 W) ,4A(2.6 W) ,6A(2.5 W) ,10A(2.5 W)		
		W	16A(3 W) , 20A(3.2 W) ,25A(3.9 W) , 32A(4.5 W)		
		W	40A(6.1 W) , 50A(7.8 W) , 63A(9.8 W)		
	Thermo-magnetic release characteristic		B	C	D
			3 - 5 I_n	5 - 10 I_n	10 - 20 I_n
Mechanical Features	Electrical life	Cycle	4000		
	Mechanical life	Cycle	20000		
	Contact position indicator		Yes		
	protection degree		IP 20		
	Reference temperature for setting of thermal element	°C	30		
	Ambient temperature (with daily averages ≤ 35°C)	°C	- 5 ... +40 (Special application please refer to P03 for temperature compensation correction)		
	Storage temperature	°C	-25 ... +70		
	Vibration	g	5		
	Shock	mm	40mm free fall		
Installation	Terminal connection type		Cable / U - type busbar / Pin - type busbar		
	Terminal size top/bottom for flexible cables	mm^2	25		
		AWG	18 - 3		
	Terminal size top/bottom for rigid cables	mm^2	35		
		AWG	16 - 2		
	Tightening torque	N.m	2.5		
		in-lbs.	22		
	Installation position		Vertical / Horizontal		
	Mounting		on DIN rail EN60715 (35mm) by means of fast clip device		
	Connection		From top and bottom		
	Base & Cover material		Moulded, Flame retardant thermoplastic in accordance IEC60695		
Combination with Accessories	Auxiliary contact		Yes		
	Shunt release		Yes		
	Under voltage release		Yes		
	Alarm contact		Yes		

Tripping Characteristic Curve:





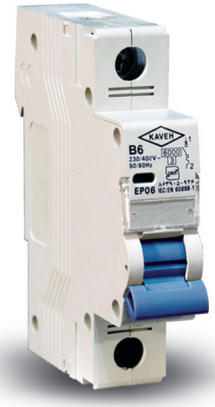
Tripping Curve of KAVEH Miniature Circuit Breakers (IEC60898-1 & IEC60947-2)

As per Standard	Thermal Tripping				Magnetic Tripping		
	Notripping current	Tripping current	Tripping current	Time Limits	Hold Current	Rapidly trip Current	Time Limits
IEC60898-1	I_1	I_2	I_3		I_4	I_5	
B	1.13 I_n	1.45 I_n	2.55 I_n	> 1h < 1h I_n≤32A,1<t≤60s I_n>32A,1<t≤120s	3 I_n	5 I_n	> 0.1s ≤ 0.1s
C	1.13 I_n	1.45 I_n	2.55 I_n	> 1h < 1h I_n≤32A,1<t≤60s I_n>32A,1<t≤120s	5 I_n	10 I_n	> 0.1s ≤ 0.1s
D	1.13 I_n	1.45 I_n	2.55 I_n	> 1h < 1h I_n≤32A,1<t≤60s I_n>32A,1<t≤120s	10 I_n	20 I_n	> 0.1s ≤ 0.1s

As per Standard	Thermal Tripping				Magnetic Tripping		
	Notripping current	Tripping current	Tripping current	Time Limits	Hold Current	Rapidly trip Current	Time Limits
IEC60947-2	I_1	I_2	I_3		I_4	I_5	
Z	1.05 I_n	1.30 I_n	1.50 I_n	> 1h < 1h I_n≤63A,1<t≤60s I_n>63A,1<t≤120s	2 I_n	3 I_n	> 0.2s ≤ 0.2s
K	1.05 I_n	1.30 I_n	2.50 I_n	> 1h < 1h I_n≤63A,1<t≤60s I_n>63A,1<t≤120s	8 I_n	12 I_n	> 0.2s ≤ 0.2s
S	1.05 I_n	1.30 I_n	2.50 I_n	> 1h < 1h I_n≤63A,1<t≤60s I_n>63A,1<t≤120s	13 I_n	17 I_n	> 0.2s ≤ 0.2s

Miniature Circuit Breaker

Isolating Switches :



Rated current I_e	A	16 , 20 , 25 , 32 , 40 , 50 , 63 , 80 , 100 , 125
Rated voltage U_e	V	240 / 415 AC (110/220VDC)
Poles	n	1P , 2P , 3P , 4P
Utilization category		AC - 22A / DC - 22B
Insulation voltage U_i	V	690
Rated frequency	Hz	50 / 60
Rated making & breaking capacity		$3I_e$, $1.05U_e$, PF=0.65
Rated short - circuit making capacity Icn		$20I_e$, t = 0.1s
Rated impulse withstand voltage Uimp	V	6000
Dielectric test voltage at ind. Freq. for 1 min.	KV	2.5
Pollution degree	n	3
Icw		$12I_e$, t=1s
Electrical life	Cycle	1500
Mechanical life	Cycle	8500
Contact position indicator		Yes
protection degree		IP 20
Reference standard No.		IEC60947-3
Ambient temperature (with daily averages ≤ 35°C)	°C	- 15 ... +55
Storage temperature	°C	-25 ... +70
Vibration	g	6
Shock	mm	40mm free fall
Terminal connection type		Cable / U - type busbar / Pin - type busbar
Terminal size top/bottom for flexible cables	mm^2	25 (Upto 63A) , 50 (80A to 125A)
	AWG	18 - 3 , 3 - 1
Terminal size top/bottom for rigid cables	mm^2	35 (Upto 63A) , 70 (80A to 125A)
	AWG	16 - 2 , 2 - 00
Tightening torque	N.m	2.5 (Upto 63A) , 3 (80A to 125A)
	in-lbs.	22 , 26.5
Installation position		Vertical / Horizontal
Mounting		on DIN rail EN60715 (35mm) by means of fast clip device
Connection		From top and bottom
Base & Cover material		Moulded, Flame retardant thermoplastic in accordance IEC60695

Miniature Circuit Breaker

Accessories:

General :

Standard No.	Confirming to EN/IEC 60947-5-1
Rated Insulation Voltage Ui	500 VAC
Rated Voltage Un	230 VAC
Electric Endurance	30000 Cycle
Mechanical Endurance	40000 Cycle
Dielectric Strength	2000VAC / 1Minute
Protection Degree	IP20

OF Auxiliary Contact :

	AC	DC
Contact Capacity	3A / 400V	1A / 125V
	6A / 230V	2A / 48V
	6A / 125V	3A / 24V
Dielectric Strength	2000VAC / 1Minute	

Mounted on the Left side of the MCB

SD Alarming Contact :

Send out signal when the circuit breaker pail to trips.
Mechanical indicator on the front panel, which can indicate failure trip.
Screw-type thread pressed terminal, can connect with 1 or 2 conducting wire of 2.5mm 2 Max. cross sectional area.
Obvious marks upon terminal.
Mounted on the Left side of the MCB. Indication "ON" , "OFF" status of combined MCB.

MX Shunt trip :

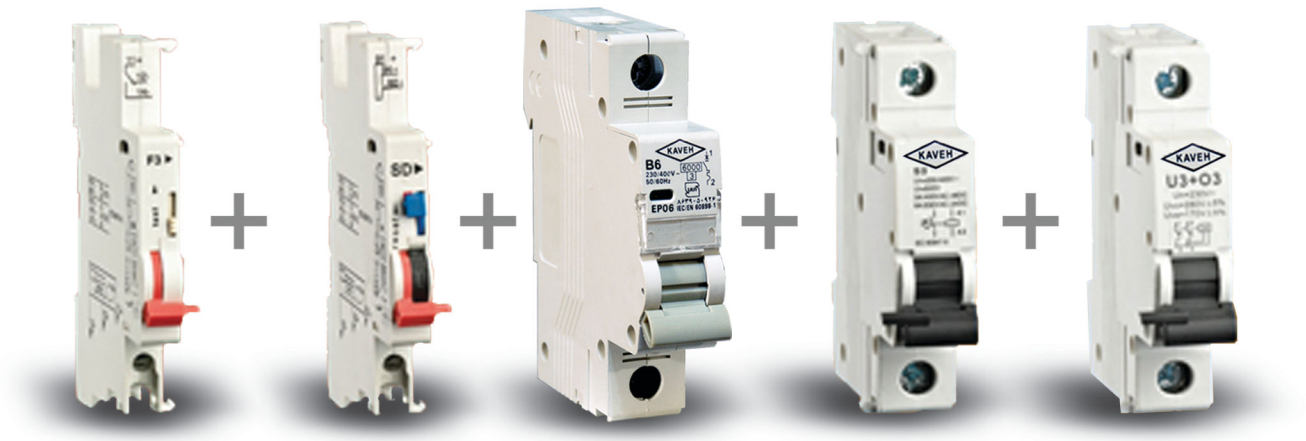
Rated Insulation Voltage Ui	500VAC	
Rated Power Voltage Us	125VAC , 230VAC , 400VAC	
Operate Voltage Range	70% ~ 100% Us	
Contact Capacity	AC	DC
	3A / 400V	1A / 125V
	6A / 230V	2A / 48V
	9A / 125V	3A / 24V
Dielectric Strength	2000VAC / 1Minute	

Mounted on the Right side of the MCB/RCBO, used to trip the combined MCB/RCBO by remote controlling device.

MN Over-Voltage / Under-Voltage trip :

Rated Voltage Ue	230VAC
Rated Insulation Voltage Ui	500VAC
Over-Voltage tripping range	280VAC ± 5%
Under-Voltage tripping range	170VAC ± 5%

Mounted on the Right side of circuit breaker, actuate the combined device to trip in case of under-voltage or over-voltage, effectively prevent the device from closing operation under abnormal power voltage condition.

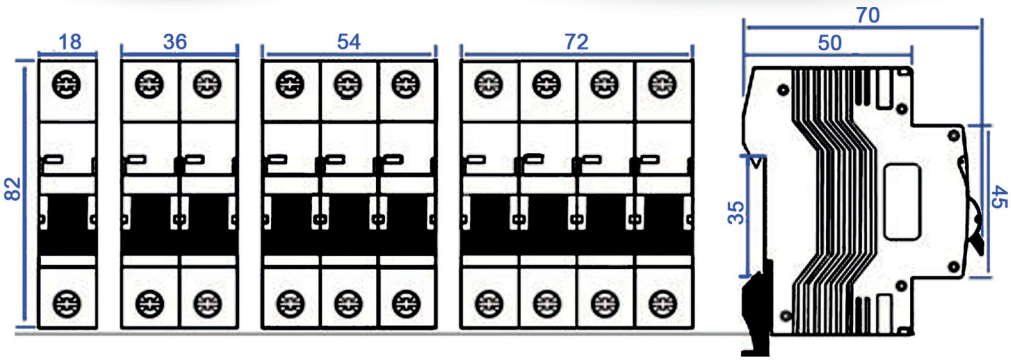


OF SD MCB MX MN

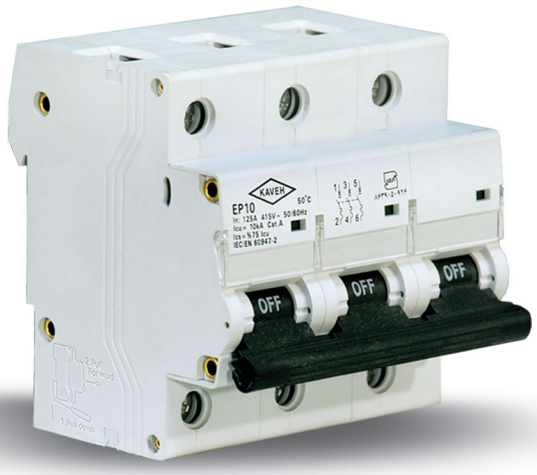
Miniature Circuit Breaker

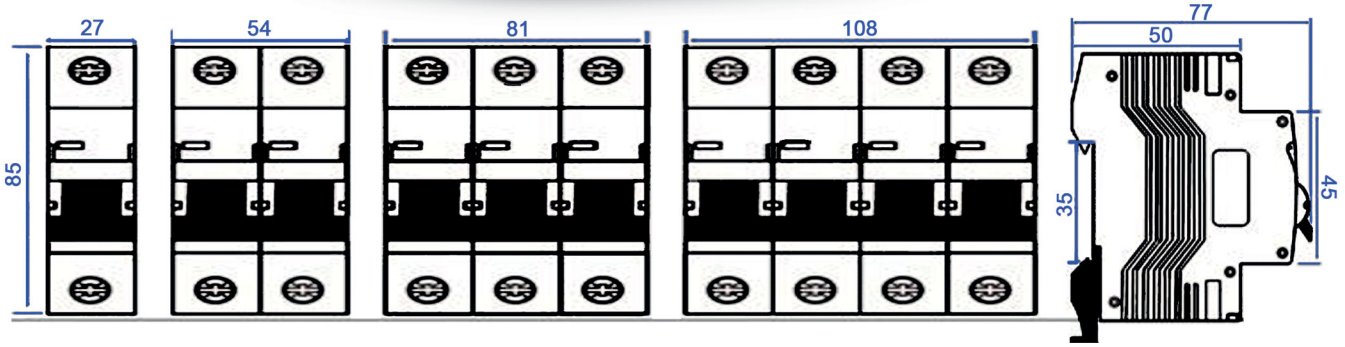
Dimensions :

Dimension of MCBs from 1A upto 63A



Dimension of MCBs from 80A upto 125A



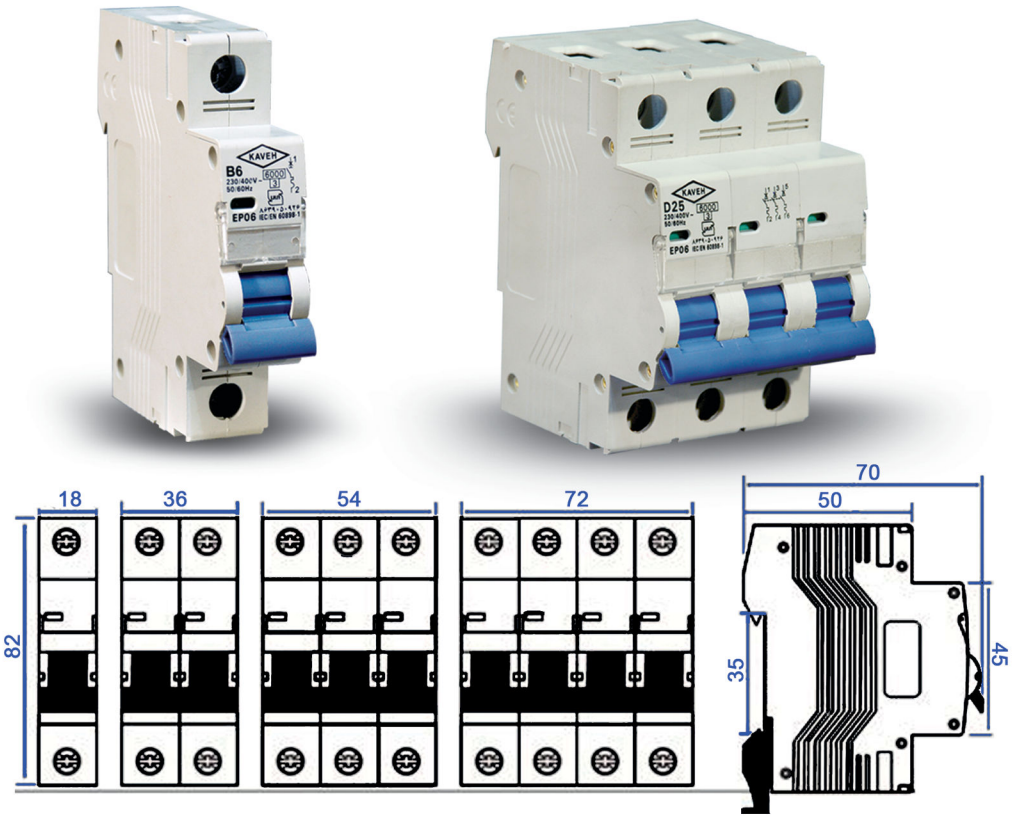


KAVEH

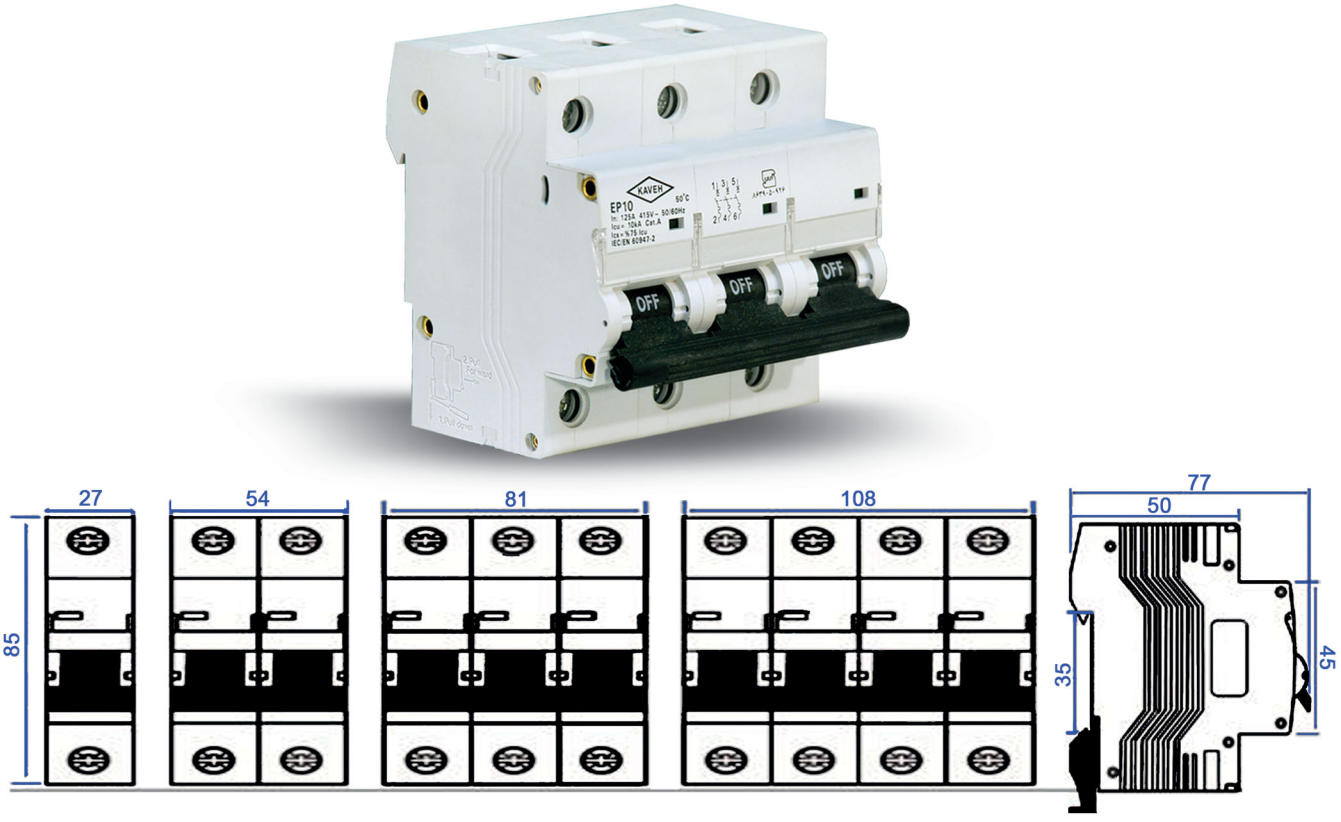
Miniature Circuit Breaker

Dimensions :

Dimension of Isolating switches from 16A upto 63A



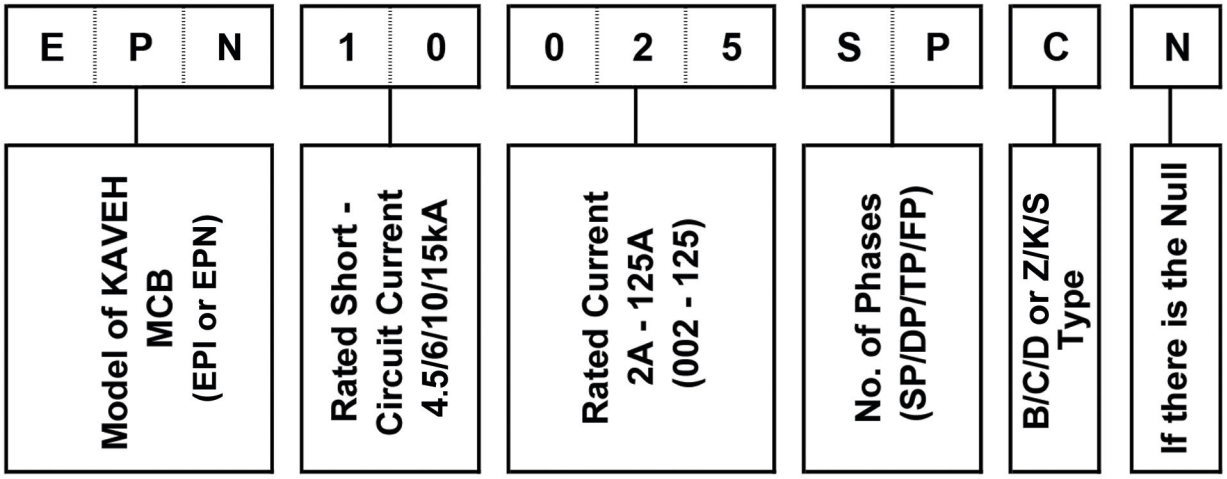
Dimension of Isolating switches from 80A upto 125A



Miniature Circuit Breaker

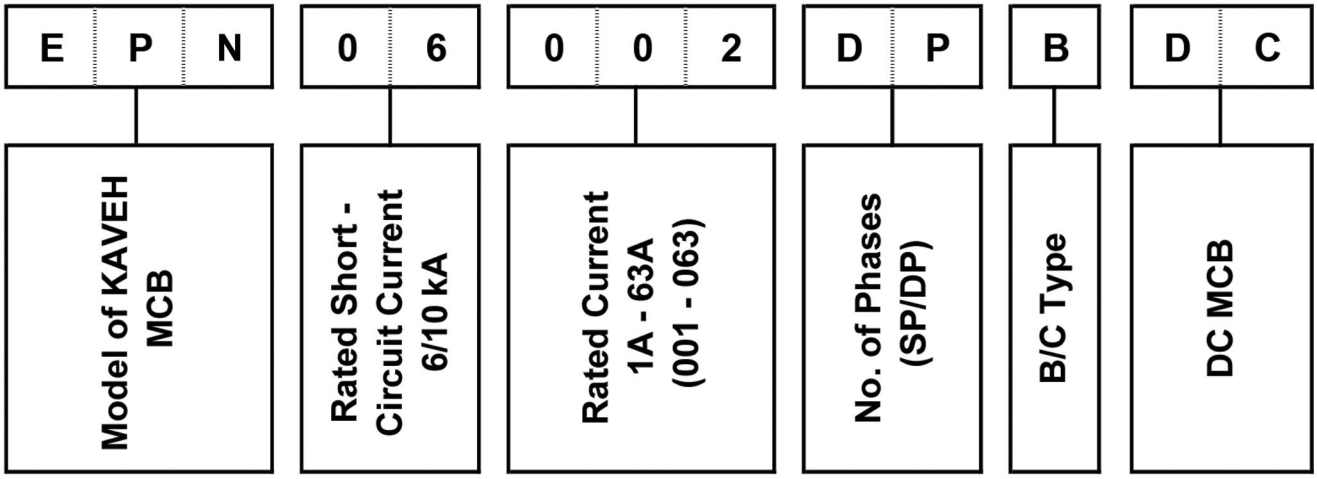
Ordering Information:

- AC MCB



Example : AC MCB , EPN Model , 10kA , 25A and C type , Single pole + Null

- DC MCB



Example : DC MCB , 6kA , 2A and B type , Double pole

Residual Current Circuit Breaker

CONTENTS

Residual Current Circuit Breaker

General :

Nothing is enjoyed at the cost of human safety and when it comes to electrical devices, there can be no compromises. The KAVEH range of human safety devices protect all the appliances present in your homes by efficient power distribution and effective earthing wherever required. Better monitoring and control is now possible with just the installation of these devices from KAVEH. The range of devices which are used for human safety do not let the residual current harm the users. They provide protection from various factors such as overload, short circuit, faulty equipment etc. Built using the best materials, these equipment last for longer periods compared to any of their counterparts and serve their purpose effectively. The product range includes RCCB & RCBO. You can choose from this range the ones that match your requirement the best.

Residual current circuit breaker (RCCB) :

KAVEH has been the pioneer in launching the most innovative electrical products from past many decades. It has become a household name for switchgear given to its high quality products backed by best-in-class technology. For protection of circuit, equipment's and human safety, we rely on protection devices, such as, MCBs, RCCBs, surge protection devices, etc. To see the complete range of best switchgear by KAVEH, browse online.

Usage of electrical equipment's calls for electric current which always has its set of risks. Essentially, incorrect use of an electrical device, poorly insulated equipment, and faulty wires lets current to flow through the wrong path to the earth, resulting in leakage current. Earth leakage causes electrical shocks and risk of fire, which can be prevented by RCCB, also called Earth Leakage Circuit Breaker (ELCB).

Residual Current Circuit Breaker (RCCB) is a mechanical switching device intended to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the leakage current attains a given value under predefined conditions. Using KAVEH higher rating RCCBs, you can provide due protection against electric shocks and fire caused by earth faults.

Available online in Double Pole (DP) & Four Pole (FP) versions, the Residual Current Circuit Breaker is the best device for ensuring human safety against electrical shocks due to leakage current. Get higher rating RCCB for high-load applications for best protection. KAVEH offers the best quality RCCB in DP and FP versions, in different ratings, to meet different electrical requirements.

Residual current circuit breaker with overload & Short circuit (RCBO):

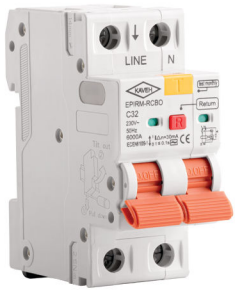
Based inside of IRAN, KAVEH is a renowned brand for switches, switchgear and electronic products,. It has always been the pioneer in introducing the latest switchgear to ensure human safety and protection against earth leakage faults, over currents, overload and short circuit. To ensure the safety of your loved ones and protection of your electronic equipment, you must install quality switchgear in your building. Browse online to know more!

In its range of human safety devices , KAVEH has introduced the latest RCBO which is a single composite device to provide protection against over currents, short circuits and earth leakage faults. The Residual Current Circuit Breaker with Overload and Short Circuit Protection (RCBO) comes in the same width and profile as that of a standard MCB. It is designed for use in domestic, commercial and industrial distribution systems at the most downstream circuit for ensuring high degree of protection to the user for a particular circuit.

Check online to know more about its detailed features and technical specifications . Made in accordance with IEC 61009-1 specifications, the RCBO by KAVEH is available in the rating from 16A to 63A. The Residual Current Circuit Breaker with Overload and Short Circuit Protection is offered in Single Pole & Neutral (1P+N) version. To ensure human safety against fault currents and protection of electronic system, the RCBO is a great device.

Residual Current Circuit Breaker

Products Overview of Residual Current Protective Devices

Product name	RCCB		RCBO	
Product range	EPR-M		EPR-M	EPR-E
Product picture				
Standard	IEC/EN 61008 1		IEC/EN 61009-1	IEC/EN 61009-1
Number of poles	2 (1P+N)	4 (3P+N)	1P+N	1P+N
Electrical characteristics				
Rated current(A) In	16~63		16~63	6~40
Rated voltage(V)	240VAC	415VAC	240VAC	240VAC
Rated residual current(mA)	30,100,300		30	30
Breaking capacity(kA)	———		6	10
Overload protection function	Without		With	With
Tripping curve	———		B,C	C
Residual current operating characteristic	AC		AC	AC
Residual current protection mode	Electro-magnetic		Electro-magnetic	Electronic/ Electro-magnetic

EPR-M Series
Residual Current Circuit Breaker

Technical data

Standard	EN / IEC61008-1
Rated conditional short-circuit current, Inc	6kA
Protection	Ground fault
Rated current, In	25,32,40,50,63A
Number of poles	2(1+N),4(3+N)pole
Rated sensitivity currents, I△n	30,100,300mA
Rated residual non-operating current	0.5 X I△n
Rated impulse withstand voltage Uimp	4000V
Rated voltages 2pole	240VAC
4pole	415VAC
Ambient temperature (°C)	-25~+40,Max. 95%humidity
Residual current off-time at I△n	≤0.1s
Rated residual current making & breaking capacity, I△m	500A for In=16,25,32,40,50A 630A for In=63A
Type of trip	Electro-magnetic release
Type of terminal	Lug type and Pin type
Terminal capacity	Cables up to 25mm²
Protection degree	IP20
Installation	35mm DIN rail

EPR-M Series
Residual Current Circuit Breaker

1. Life

In	Operating cycles		Operating frequency (operations/h)
	On-load operating cycles	Off-load operating cycles	
16,25,32	2000	2000	240
40,50,63	2000	1000	120

2. Breaking time of residual current

Max.breaking time					
In (A)	I△n(A)	I△n	2I△n	5I△n	5A,10A,20A,50A,100A,200A,500A
16,25,32,40,50,63	0.03,0.1,0.3	0.1s	0.08s	0.04s	0.04s

3. Wiring

The suitable conductors should be used for connection,see table below for relative parameters.

Rated current In (A)	Nominal cross section area of lead (mm^2)	Tightening torque (N.m)
16,25	4	2.5
32	6	2.5
40	10	2.5
50	16	2.5
63	16	2.5

4. Features

When designing residual current devices, manufacturing technology and type of routine tests, the IEC / EN 61008 standards were considered. Important features are:

Up to date design

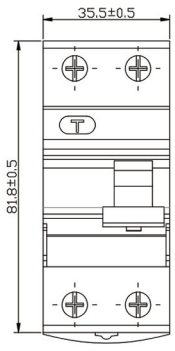
User-friendly connection of conductors and busbars

Resistance to current surges; unwanted tripping excluded

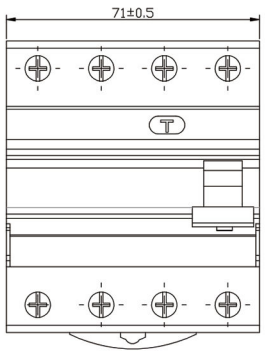
Simple and solid fixing to a 35 mm mounting rail in compliance with EN 60715

Additional colour display of main contacts position (red:contacts closed, green:contacts open)

5. Overall and mounting dimensions



EPRM-2



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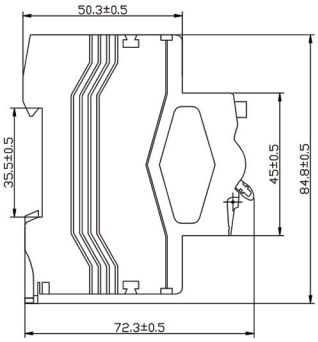


EPR-E Series (Electronic)

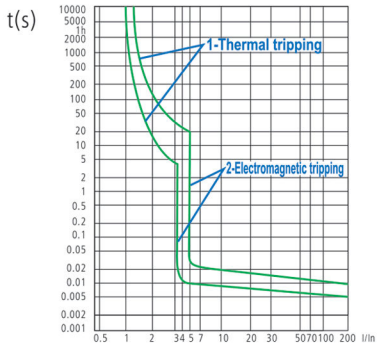
Residual Current Operated Circuit Breaker(RCBO)

Technical data

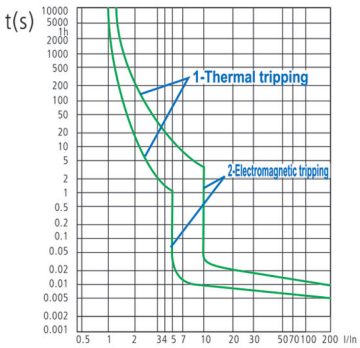
Standard	EN / IEC61009-1
Breaking Capacity	10KA
Number of poles	1P+N(1 module)
Rated current ,In	25, 32, 40A
Rated voltage	240VAC
Rated Tripping Current	30,100,300mA
Residual current off time	≤0.1s
Characteristic	B,C Curve
Electrical endurance	4000
Mechanical endurance	10000
Ambient temperature (°C)	-25~+40, Max. 95%humidity
Connection terminal	Flexible conductor 16mm² Rigid conductor 25mm²
Type of terminal	Lug type and Pin type
Width	17.8mm

EPR-E Series (Electronic)
Residual Current Operated Circuit Breaker(RCBO)

1. Curves



B type



C type

2. Breaking time of residual current

In (A)	I△n (A)	Max. Breaking times			
		I△n	2I△n	5I△n	5A, 10A, 20A, 50A, 100A, 200A, 500A
6~40	0.03,0.1,0.3	0.1s	0.08s	0.04s	0.04s

3. Wiring

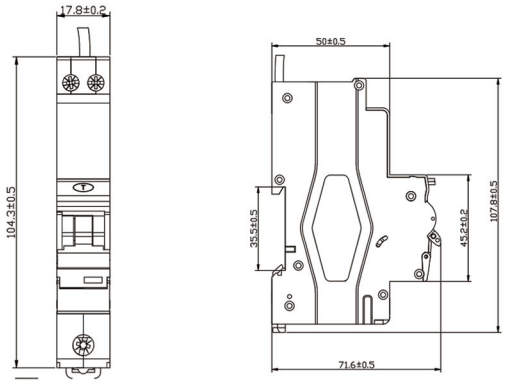
The suitable conductors should be used for connection,see table below for relative parameters.

Rated current In (A)	Cross section area s (mm²)	Tightening torque (N . m)
25	4	2
32	6	2
40	10	2

4. Functions

Switching and isolation function.
Protection against overload and short-circuit currents.
Protection against the effects of sinusoidal alternating earth fault currents.
Protection against indirect contacts and additional protection against direct contacts.
Protection against fire hazard caused by insulation faults.
Used in residential building and distribution boards.

5. Overall and mounting dimensions

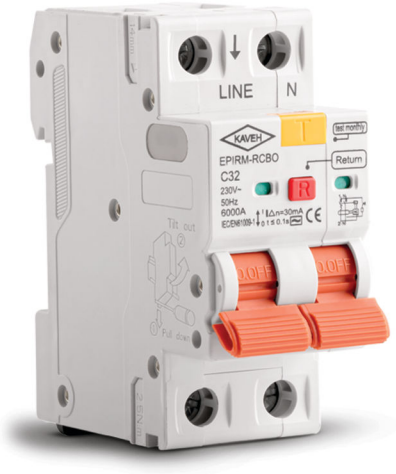


EPBR-i

EPR-M Series (Electro-magnetic)
Residual Current Operated Circuit Breaker(RCBO)

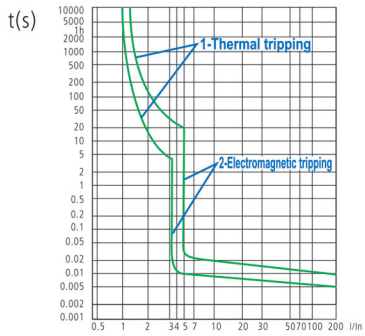
Technical data

Standard	EN / IEC 61009 -1
Breaking capacity	6kA
Protection	Ground fault, overcurrent and short circuit
Rated current,In	16,25,32,40,50,63A
Operating, I△n	30,100, 300mA
Characteristic	B,C Curve
Rated residual current operated making & breaking capacity I△m	500A
Rated residual non-operated current I△n	0.5I△n
Rated impulse withstand voltage Uimp	4000V
Number of poles	1P+N
Rated voltages 2pole	240VAC
Ambient temperature (°C)	-25~+40,Max. 95%humidity
Residual current off-time	≤ 0.1 sec.
Type of trip Ground fault	Electronic/Electro-magnetic
Over current	Thermal-magnetic
Protection degree	IP20
Terminal capacity	10mm² flexible/16mm² rigid
Installation	35mm DIN rail
Width	2 modules
Type of terminal	Lug type and Pin type

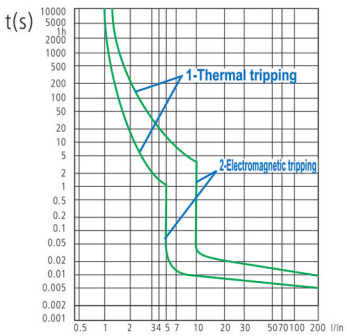


EPR-M Series (Electro-magnetic)
Residual Current Operated Circuit Breaker(RCBO)

1. Curves



B type



C type

2. Wiring

The suitable conductors should be used for connection,see table below for relative parameters.

Rated current In (A)	Cross section area s (mm²)	Tightening torque (N . m)
16~20	2.5	2
25	4	2
32	6	2
40,50,63	10	2

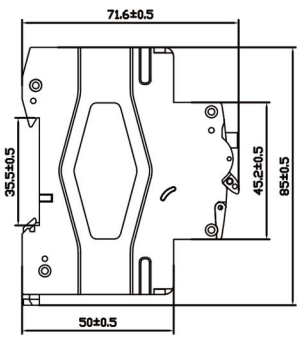
3. Types

Both RCCBs and RCBOs are devided into types depending on the operating function:
Type AC ⊠ : For which tripping is ensured for residual sinusoidal alternating currents, whether suddenly applied or slowly rising.
Type A ⊠ :For which tripping is ensued for residual sinusoidal alternating currents and residual pulsating direct currents, whether suddenly applied or slowly rising.

4. Tripping sensitivity data

RCD with a rated residual current of maximum 30 mA are used for personnel,material and fire protection, as well as for protection against direct contact.
RCD with a rated residual current of maximum 300 mA are used as preventative fire protection in case of insulation faults.
RCD with a rated residual current of 100 mA co-ordinated with the earth system according to the formula $I_{\Delta n} < 50/R$, to provide protection again indirect contacts.

5. Overall and mounting dimensions



EPRM

Molded Case Circuit Breaker

CONTENTS

General :

The circuit breaker is a mechanical opening-closing device, which is used for closing, breaking, separating circuit and transporting current of that circuit under ordinary conditions and for automatically breaking the circuit under extraordinary conditions like short circuit and over current.

Operating Principle of the Circuit Breaker:
The most important function of the circuit breaker, in addition to opening-closing the circuit, is to protect the circuit under extraordinary conditions.
There are some units inside the device to let the breaker fulfill its protection functions. Opening units of LV circuit breakers are described as release mechanism in IEC 60947-2 standard.

Releases :
- Over current releases (Over current opening unit)
- Under voltage releases (Low voltage opening unit)
- Shunt Trip releases (Remote release unit)

All the circuit breakers are equipped with over current releases. However, under voltage and shunt trip-release coil is not a standard accessory and added to the circuit breaker as per requirement.

Over Current Releases:
All the values exceeding rated current value are called over current.

Formation of Over Current:
Over currents in electrical circuits result from increase of power expended the or a short circuit. Both over currents are very dangerous for electrical circuits. Over currents lead to thermal and dynamic forcing in electrical circuit.
- Although over currents, which are a result of increase in power expended, are not usually too high, they can go up to (2-3) time more than the rated current.
- Currents resulting from short circuit depend on characteristic of the electrical circuit. For example, they can go up to 3,2 kA in a transformer of 100 kVA; or 60kA in a transformer of 2500 kVA. Electrical devices such as transformer, generator, motor, cable etc. have a thermal forcing value 12 to resist without damage due to the heat caused by over current. As it can be seen in the formula, both current value and current delay time is very important. In order to keep $I^2.t$ value under a particular value, flow duration of the current should decrease as the current increases. LV circuit breakers open the circuit below $1^2.t$ value of the protected device to provide safe protection (Figure-1).

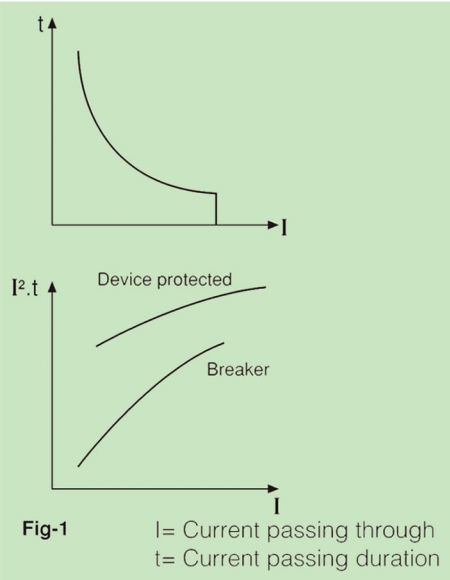
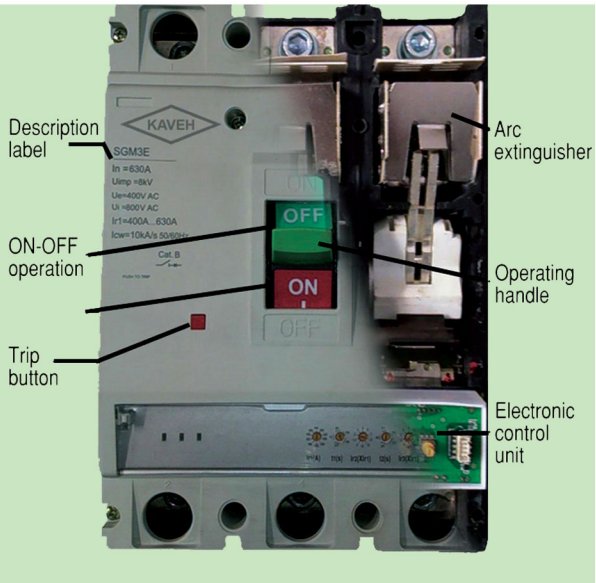


Fig-1 I= Current passing through
t= Current passing duration



Over Current Release are divided into two:

1. Releases opened under over load conditions,
2. Releases opened under short circuit conditions.

Releases opened under over load conditions:

These are the releases that operate when the current expended in the circuit exceeds the rated current value of the breaker. They operate on reverse time delay basis. As current value increases, opening duration decreases.

Releases opened under short circuit conditions:

These are the releases that open the circuit in a very short time when the short circuit current exceeds the adjustment value of the release.

Undervoltage Releases:

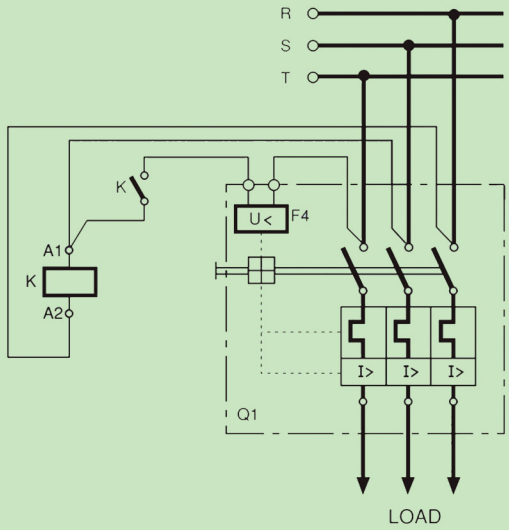
Voltage going below a particular value in electrical circuits or failure of any phase in tri-phase circuits may result in failure of devices. For example, failure of any phase in tri-phase motor shall overload other phases and result in failure of the motor. When required, low voltage coil can be assembled to the breaker to prevent occurrence of such failures. As under voltage coil is usually supplied by two phases, control of other phase is performed by a contactor (Figure-2).

Shunt Trip Releases:

They are used for remote-release of the circuit breaker. When a voltage is applied to a shunt trip release, opening should be made up to 70% and %110 of the supply voltage.

Types of circuit breakers:

LV circuit breakers are manufactured in two different types depending on the release type. These are thermal-magnetic and electronic circuit breakers.



K : Contactor (Coil AC 380 V)
F4: Low voltage release (UVR)
Q1: LV circuit breaker

Fig-2

Moulded Case Circuit Breaker

Thermal - Magnetic Circuit Breakers:
Thermal protection function, (1,1-3) x In (For protection under over load conditions)
Bimetal, which provides thermal protection, consists of combination of two metals with different extension coefficients under heat. When bimetal is heated, it bends towards the metal with less extension. In this way, a notch that assists opening of the breaker mechanism is released to disable the breaker. Bending speed of bimetal is in direct proportion with size of the current passing through the breaker. Because, increase of current means increase of heat. In this way, over current protection function of the breaker is fulfilled by bimetal at load currents higher than the rated current.

Magnetic protection function, >3 x In: (For protection under short circuit conditions)

Another function of the breaker is to protect the connected circuit against short circuits. Short circuit may occur as a result of contact of phases with each other or contact of phase-ground. Since a very high current shall pass through the cables in case of short circuit, system energy should be broken in a shorter time due to thermal protection. Breaker should perform instant opening to protect load it is connected to. The part fulfilling this function is a mechanical opening mechanism that operates with magnetization caused by the magnetic area formed by the short circuit current.

Circuit Breakers with Electronic Over Current Release:
The feature discriminating electronic circuit breakers from thermal-magnetic breakers is to control the over current releases with electronic circuit. Electronic control is performed via microprocessor. During design of the electronic circuit, worst possibilities to encounter in operation have been taken into consideration. In high circuit currents, direct opening has been ensured without operating electronic circuit. In this way, possibility of failure in the electronic circuit has been eliminated. Federal electronic circuit breakers can be connected to computer through RS-232 protocol upon request. In this way;

- Computer memory can be used instead of current recording devices.
- Maximum, minimum, average etc. values of the drawn current at various time intervals (day-night) can be taken.
- Statistical information can be accessed any time.
- Opening period of the breaker can be adjusted in case of over current formation.
- Rated current and instant opening current of the breaker can be changed on computer.
- External opening control can be provided.

Rated and instant opening current adjustment areas of electronic circuit breakers are quite wide. This feature allows wide use opportunity to the breaker. Furthermore, electronic circuit breakers are not affected from ambient temperatures.

Operating principle of limiter circuit breaker:
While breaker is opened and closed with lever, moving contact should be in ON position in pos-1, in OFF position in pos-3 (Figure - 3). The short circuit current that comes into existence when there is a short circuit in a breakingby enabling the breaking mechanism via releases and takes breaking lever to trip position. Opening duration varies between 10-20 ms. In Federal limiter breakers, reverse magnetic area where short circuit occurs takes moving contact from pos-1 to pos-2 and contact remains in this position. That is, contact does not come to ON position again. Opening of the moving contact starts with the first millisecond of the short circuit. The contact arrives pos-2 in the first two milliseconds and complete cut-off of the arc lasts in 3-5 milliseconds maximum. Magnetic releases, which get into operation with start of the short circuit, take the breaking mechanism to OFF position; the mechanism takes the moving contact in pos-2 to pos-3 and the breaking lever remains in trip position. The current, which takes the moving contact from pos-1 to pos-2, is a lower current than the expected short circuit current. Limited current is at one-eighth and even one-tenth of the expected current (Figure- 4), The expected short circuit current would flow in a shorter time than the current if there was no limiter circuit breaker.

Advantages of Kaveh limiter circuit breaker:
- They protect transformers, cables and other devices in circuit by limiting the current up to 90% depending on the breaker type.
- As explosions and arcs remain at a very low level, critical safety is guaranteed in order not to give damage to other devices in the panel.

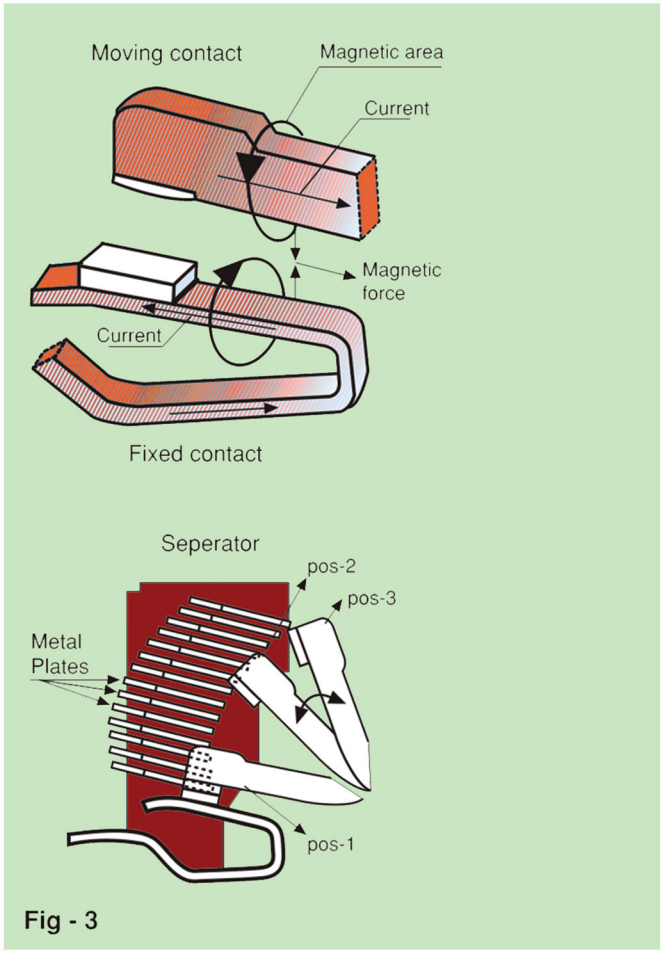


Fig - 3

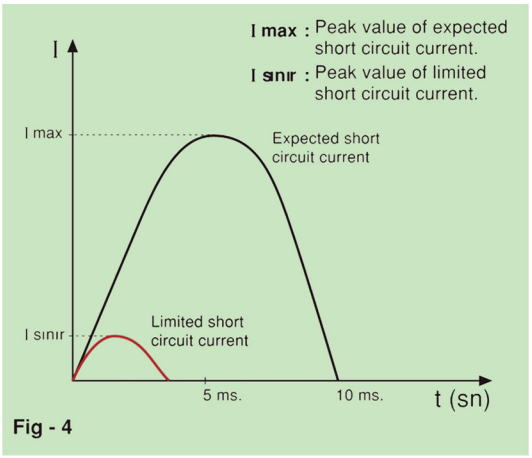
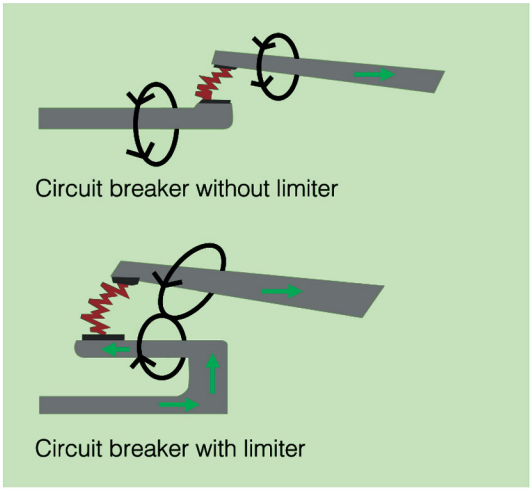


Fig - 4



Parts of circuit breakers:

Body and Cover: Fiber-glass polyester resin has been used as the body and cover material in accordance with IEC 60512-20-2 standard. This material, which is called BMC (Bulk Molding Compound) in the literature, is preferred due to high electrical and mechanical values and can resist to a temperature of 160°C continuously. BMC material does not burn when in contact with wire at a temperature of 960°C in accordance with IEC 60695-2-1.

Bimetal: Bimetal is a material consisting of combination of two plate metals with different extension coefficients against heat. The current passing through the breaker heats up bimetal. Due to effect of this heat, bimetal bends towards the less-extending plate. Since heat increases as the current passing through the breaker increases, bimetal is heated more and bends more. In this way, it controls the opening mechanism to open the breaker.

Contacts: Contact alloy is determined for breakers by considering broken and carried current values and construction. Usually silver, graphite, nickel, wolfram alloy Contacts are used in breakers.
Contacts, which are made of silver-graphite alloys with a smoothers structure, are used in fixed (bottom) contacts, silver - wolfram contacts, which are harder, are used in moving (top) contacts. A swaged structure has been ensured in moving contacts. In this way, swaged and hard alloy contacts have a place on soft fixed contacts in each opening-closing. In this way, the lowest resistance is ensured. Moving contact should touch the fixed contact very well in order to have low contact resistance. However, excessive contact pressure force results in damage of contacts in a shorter period than normal. Contact alloys are very important for a healthy opening-closing.

Extinction of Arc: Separators are used to extinct the arc which is formed during operation of the breaker operating under energy. While moving contact is separated from fixed contact, current continues to flow between contacts for a while and this is called arc. This arc should be extinct in a very short time.
Arc is pushed towards separators due to magnetic field formed around the arc. In this way, arc is extended and becomes slim and broken off between separator plates (Figure-5). Due to characteristic of the material used on side walls of the separators, a gas comes out due to high temperature caused by the arc. This gas has an important effect on extinction of the arc.

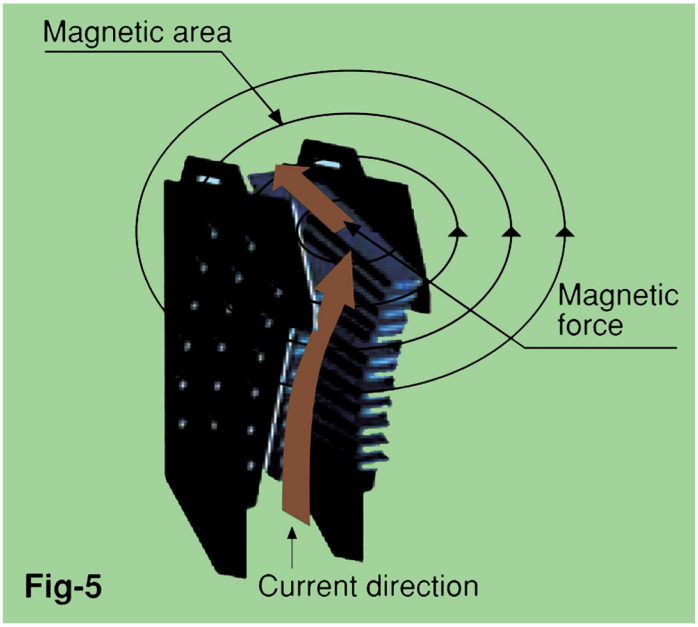


Fig-5

Utilization Type of the Circuit Breaker:
There are 3 positions indicating position of the breaker. These positions are shown in Figure-6.

ON/I Position:
It indicates that contacts of the breaker are closed. In this position, the breaker lever is in the top position.

TRIP Position:
It indicates that the breaker is opened due to any failure (over load or short circuit). In this case, breaker lever is in the middle position between ON and OFF positions. In order to take the breaker, which is in trip position, to ON position; push the breaker lever downwards as shown by the OFF sign. Breaker shall be set with "click" sound. After that, pull the lever as shown by ON sign to close thebreaker.

OFF/0 Position:
It indicates that contacts of the breaker are open. In this way, the breaker lever is in the bottom position.

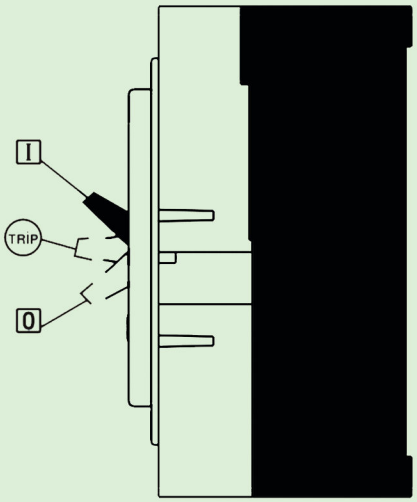
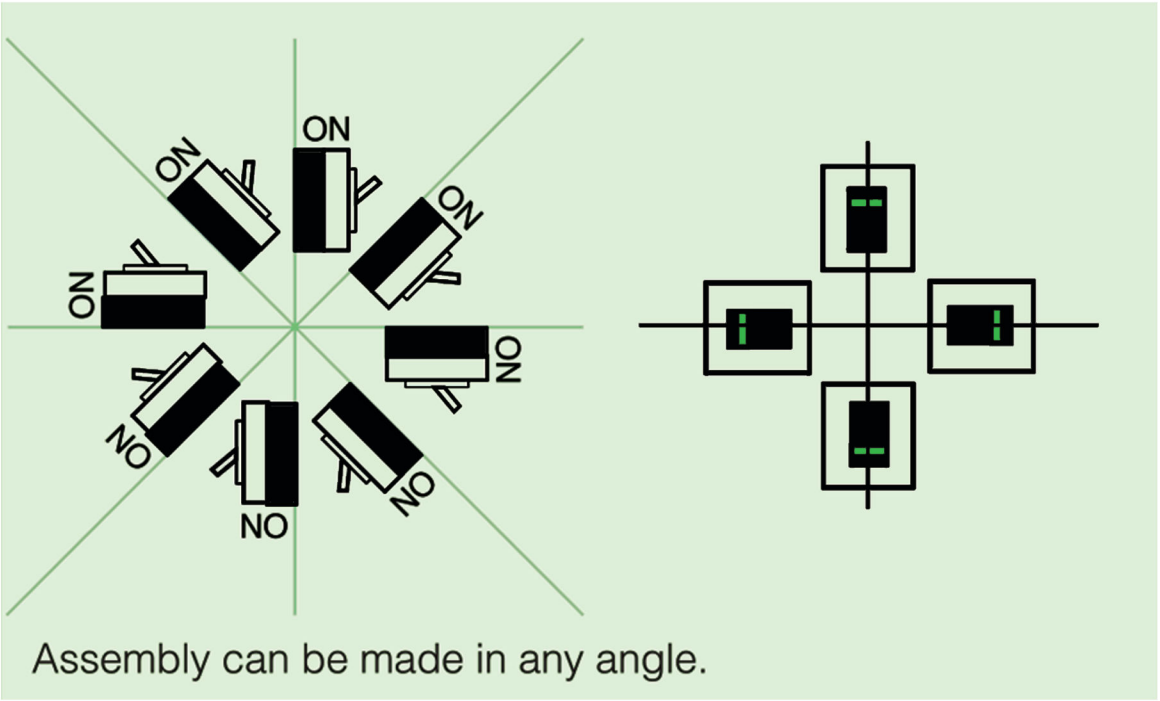


Fig-6



Assembly can be made in any angle.

Assembly:

Important considerations during assembly are listed below.

- The place to assemble the breaker should be free of dust and moisture.
- Breaker should be assembled in a way not to be subject to gas and vapor.
- If the environment is dusty and moist, the breaker must be assembled in a housing with appropriate protection degree.
- While the breaker is in operation, it should not be exposed to vibration and sudden impacts.
- Minimum distances between two breakers assembled one on another should be as shown in Figure-7.
- Minimum distances between grounded or insulated wall and the breaker should be as shown in Figure-8.
- Assembly method of the connectors vary according to connection at the front or at the back. Connector may be demounted, reversed and mounted again if required.
- Cable connections of measurement devices should be made through busbars, no connection should be made through terminals of the breaker (Please request extension busbars from factor for connections to be made with cable shoes.)
- End insert should be used in connections of multi-wire cables to breaker connector and no brazing should be made at cable ends.
- In connection is made to the breaker via copper busbars, busbars should be painted and feather edges should be rounded to minimize the risk of jumping.
- Phase curtains must be placed in the conduit between two busbars in the breaker body.
- Grounding should be made in accordance with the regulations.

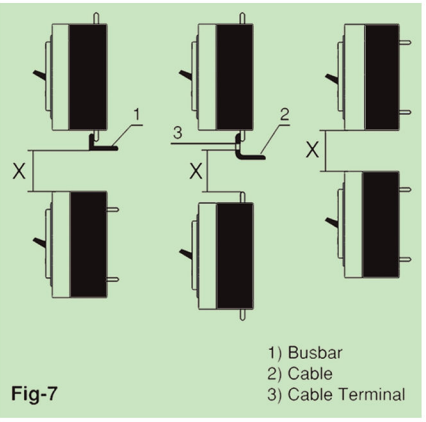
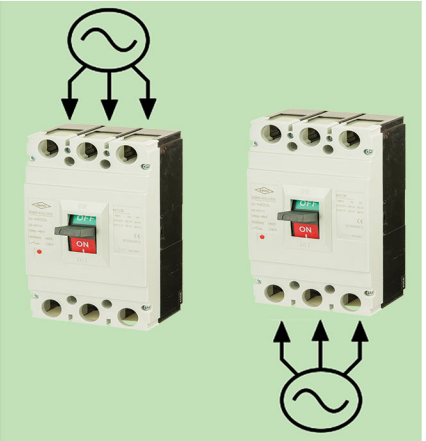


Fig-7



Power connection can be made at top or bottom connectors.

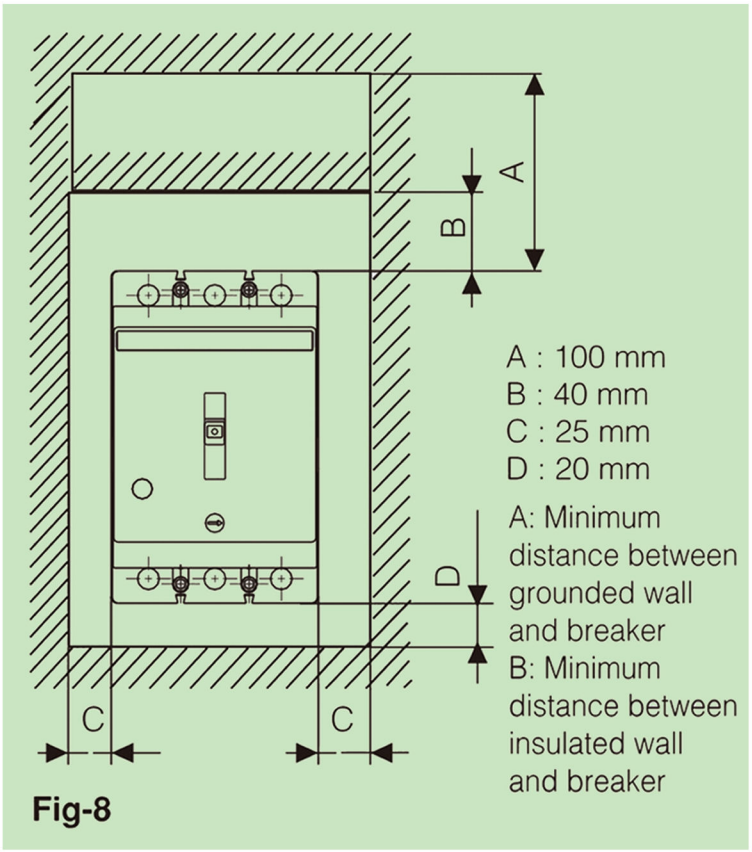


Fig-8

Moulded Case Circuit Breaker

Network Protection Breakers: Big powerful motor, load with starting resistance don at exist in main networks and lines are quite long. LV circuit breaker should open in short circuit currents to occur by the end of these lines. Therefore, magnetic adjustments of the circuit breakers utilized in main lines should be between (5 - 10)xIn.

Three-phase thermal-magnetic circuit breakers / For protection of main networks:

Nominal current In (A)	Rated current adjustment are I_1 (A)	Short circuit opening current I_2 (A)	Type	Order code	Type	Order code	Type	Order code
16-32 40-125	—	320 A 10 In	125 H 36 kA	SGMF0□□□L32	—	—	—	—
25-32 40-160	(0.8-1)In	320 A 10 In	160 L 36 kA	SGMA0□□□L3	160 M 50 kA	SGMA0□□□M3	—	—
125-250	(0.8-1)In	10 In	36 kA	SGMA0□□□L3	50 kA	SGMA0□□□M3	65 kA	SGMA0□□□H3
315-400	(0.8-1)In	10 In	50 kA	SGMA0□□□L3	65 kA	SGMA0□□□M3	85 kA	SGMA0□□□H3
400-630	(0.8-1)In	(5-10)In	50 kA	SGMD0□□□L3	65 kA	SGMD0□□□M3	85 kA	SGMD0□□□H3
400-630	(0.8-1)In	10 In	50 kA	SGMA0□□□L3	65 kA	SGMA0□□□M3	85 kA	SGMA0□□□H3
630-800	(0.8-1)In	10 In	50 kA	SGMA0□□□L3	65 kA	SGMA0□□□M3	85 kA	SGMA0□□□H3

□: Please enter amper value

Short circuit current of a generator

Srg rated power (kVA)
Ur rated voltage (V)
Ikg short circuit current (A)
Irg rated current (A)
Xd% temporary reactance (%)
(Reactance observed around 5-20% of the impedance value for 5-30 ms)

Is calculated with the following formula.

$$I_{KG} = \frac{I_{rg} \cdot 100}{X''_d\%} \qquad I_{rg} = \frac{S_{rg}}{\sqrt{3} \cdot U_r}$$

Circuit breakers should be selected according to the following formula in order to protect the generator circuits.
For single generator Icu > Ikg
For n pieces of identical generator connected parallel, Icu > Ikg x (n-1) For generator connected to network parallel, Icu > Iknet.

Generator			Breaker
kVA	kWA	A	A
9.4	7.5	13.6	16
12.5	10	18.2	20
18.7	15	27.3	32
25	20	36.4	40
31.1	25	45.5	50
37.5	30	54.6	63
50	40	73	80
62.5	50	91	100
75	60	109	125
100	80	146	160
125	100	182	200
156	125	228	250
187	150	273	300
250	200	364	400
312	250	455	500
375	300	546	630
500	400	730	800
625	500	910	1000
750	600	1090	1250

Moulded Case Circuit Breaker

Motor Circuit Protection Breakers: Motors draw very high current for a short time during first start-up. In order to ensure operating continuity and to protect the system, magnetic adjustment area of the breaker to be selected should be (8 - 12)xIn.
Three-phase thermal-magnetic circuit breakers / For protection of motor circuits:

Nominal current In (A)	Rated current adjustment are I_1 (A)	Short circuit opening current I_2 (A)	Type	Order code	Type	Order code
16 - 25 32 - 125 160	(0.8-1)In (0.8-1)In (0.8-1)In	320 A 10 In 10 In	160 L 36 kA	SGMA0□□□L3	160 M 50 kA	SGMA0□□□M3
125 - 250	(0.8-1)In	10 In	250 L 36 kA	SGMA0□□□L3	250 M 50 kA	SGMA0□□□M3

□: Please enter amper value

Motor power (kW)	Motor power (Hp)	Motor rated current (A)	Breaker rated current (A)
5.5	7.5	11.5	16
9	12	18.5	20
11	15	22.5	25
15	20	30	32
18.5	25	36	40
22	30	43	50
30	40	58	63
37	50	72	80
40	54	79	100
54	70	98	100

Motor power (kW)	Motor power (Hp)	Motor rated current (A)	Breaker rated current (A)
59	80	112	125
80	110	147	160
100	136	188	200
132	175	243	250
140	190	260	300
160	220	292	300
200	270	368	400
250	340	465	500
315	430	580	630

Note: These circuit breakers provide short circuit protection. Overload protection should be provided via thermal relays connected to the contactors

Three-phase thermal-magnetic circuit breakers:

Nominal current In (A)	Rated current adjustment are I_1 (A)	Short circuit opening current I_2 (A)	Type	Order code	Type	Order code
32 - 100	(0.8-1)In	(6-10)I1 For 400 - 630	100L 36kA	SGMA0□□□L3	100M 50kA	SGMA0□□□M3
80 - 160			160L 36kA	SGMA0□□□L3	160M 50kA	SGMA0□□□M3
100 - 125			250L 36kA	SGMA0□□□L3	250H 50kA	SGMA0□□□M3
315 - 400			400L 36kA	SGMA0□□□L3	400M 65kA	SGMA0□□□M3
400 - 630			630L 50kA	SGMA0□□□L3	630M 65kA	SGMA0□□□M3
630 - 800			800L 50kA	SGMA0□□□L3	800M 65kA	SGMA0□□□M3
1000 - 1250			1250L 50kA	SGMA1□□□L3	1250M 65kA	SGMA1□□□M3

Delay time of the short circuit opening current (when required) can be adjusted as t2 : 100 150 200 250 300 350 400 ms..
□: Please enter amper value

Reasons for Over Voltages Occurring at L.V. Facilities and the Measures that Must Be Taken:

As known, over voltages may develop at power plants from time to time.These over voltages develop as a sudden impact for a very short time during the engagement and disengagement of equipment such as transformers, condensers, coils, etc., and this is also called lightning stroke or switching. During these temporary incidents that occur from time to time, by a jump between phases or phase-earth, they may turn into short circuits. Dirt, dust and moisture on the insulating material increase the probability of occurrence. During the closing of the circuit when L.V. transformers are taken into operation, very short-period high magnetization currents occur. The initial peak value of these currents may go up to 16-35- fold of the nominal current in transformers between 50kVA and 1500 kVA, and 10-16-fold in power transformers over 1500kVA. Temporary magnetization currents fade away within a very short period of time (several milliseconds). When selecting switching devices for transformers, these magnetization currents have to be taken into consideration. Additionally, some electronic devices, at starting (engines running in idle, transformers running in idler, industrial welding devices, fluorescent lights with electronic ballasts and electronic equipment) from harmonic currents and voltages in multiples of the basic mains frequency.
For the protection of facilities from such harmonic currents and voltages, Harmonic Filter Reactors must be installed at the input of the low voltage panels and thus measures should be taken against damages on equipment by harmonic currents and voltages.

In order to prevent the high voltage, described in the adjacent text and may occur due to many other reasons in addition to these, reaching dangerous levels, primarily suitable (approved quality) surge arrests must be installed at the M.V. and L.V. side of the transformer and the system earthing has to be made very well.
As an example, let us assume that the total resistance of the earthing network surrounding transformer center for protective earthing is represented by RE and the earthing resistance is RE=5. When a phase-earth short circuit occurs on the medium voltage side of the transformer center, the short circuit current that will be developed will run into the ground and form a potential in the ground.
If the short circuit current is 6,000 amperes, a voltage of 5 x 6000 = 30,000 volts will be distributedwithin the transformer center earthing networks. If the L.V. facility earthing has been connected to the M.V. protective earthing by mistake, the low voltage equipment connected to the facility earthing will be affected by the developed 30,000 volt potential and this will cause serious damages in the low voltage equipment. The value of the over voltage developed by the phase-earth short circuit current on the medium voltage side diminishes considerably at 20m distance from the transformer center and becomes affectless. Therefore, the operating earthing at the transformer center must be installed at least 20m way from the protective earthing.

MAX.CURRENT LOAD CAPACITY OF PRODUCTS IN DIFFERENT CONDITIONS:

Current load capacity of device decrease if the operating temperature is exceed to given value on indoor conditions Standart Circuit breakers was calibrated for 40-50°C. Values in the chart show the highest operating currents to be applied as a function of the ambient temperature. Increase in ambient temperature of the breaker shall result in decrease in allowed operating current of the breaker. Therefore, by considering the ambient temperature of the breaker, the rated current should be calibrated according to ambient temperature or the circuit breaker should be selected according to operating currents suitable for the value in the table. If the breaker is operated in an environment with a temperature higher than the calibrated ambient temperature, it opens earlier than the nominal values. If it is operated in a colder environment, it opens later than the nominal values.

Thermal-Magnetic Circuit Breaker				
In (A)	20°C	30°C	40-50°C	60°C
16	17.1	16.6	16.0	14.6
20	21.4	20.8	20.0	18.2
25	26.7	26.0	25.0	22.8
32	34.2	33.3	32.0	29.1
40	42.8	41.6	40.0	36.4
50	53.5	52.0	50.0	45.5
63	67.4	65.5	63.0	57.3
80	85.6	83.2	80.0	72.8
100	107.0	104.0	100.0	91.0
125	133.8	130.0	125.0	113.8
160	171.2	166.4	160.0	145.6
200	214.0	208.0	200.0	182.0
225	240.8	234.0	225.0	204.8
250	267.5	260.0	250.0	227.5
315	337.0	327.0	315.0	273.0
400	428.0	416.0	400.0	364.0
500	535.0	520.0	500.0	455.0
630	674.1	655.2	630.0	573.3
800	856.0	832.0	800.0	728.0

Example: Highest operating current of a circuit breaker with 100 A rated current calibrated to 40-50°C would be 104 A in an environment of 30°C.

Utilization of Circuit Breakers in Direct Current Circuits:
Non-electronic thermal-magnetic circuit breakers can be safely used in switching of DC currents.
As it is seen in Figure-9, 2 or 3 poles are connected serially for voltages higher than 250V and voltage per pole is reduced

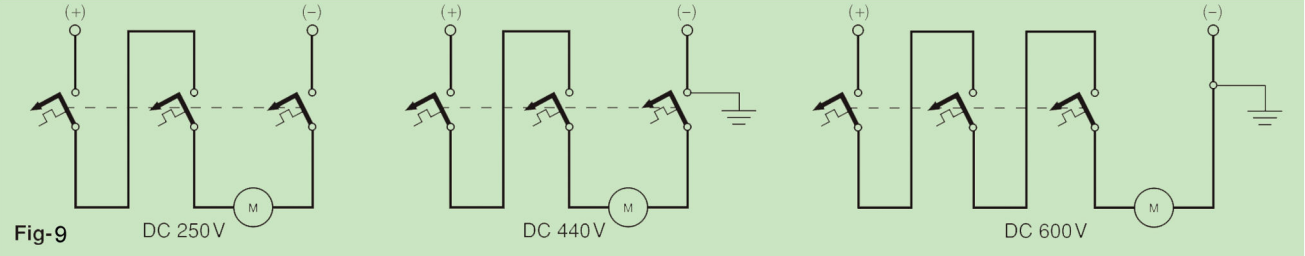


Fig-9

Breaker Selection Table Used for Protection of 3-Phase Capacitor Circuits:Distribution Transformers:
(400 V, for Ambient Temperature 50°C)

Capacitor		Breaker
Power (kVAr)	Rated Current (A)	Rated Current In (A)
5	7.6	16
10	15.2	25
15	22	40
20	29	63
25	36	80
30	43	100
40	58	100
50	72	125
60	87	125
80	115	160
100	144	200
150	216	300
200	288	400
250	361	500
300	433	630
350	505	800
400	577	800
500	722	1000
550	793	1250
600	866	1250

Circuit breakers protecting capacitor circuits :

They should resist temporary currents during enablement and disablement of the capacitors.
They should resist currents at 15% more than capacity value and periodical and permanent over currents arising due to voltage harmonics.
They should have high mechanical and electrical life. They should be selected to protect contactors after them.
They should break short circuit currents to occur in capacitor connectors.
According to IEC 60831-1 standard
Capacitors can operate continuously at currents 1.3 times more than rated currents and capacity value can be 15% more.
Accordingly, the highest current to pass through the circuit can reach 1,5 x Irc.

Icmax = 1.3 x 1.15 x Irc

Icmax : Maximum current to pass through the capacitor
Irc : Capacitor rated current

Therefore

Rated current of the circuit breaker to be selected should be higher than 1.5 x Irc.
Thermal adjustment should be at 1.5 x Irc value.
Magnetic adjustment should not be lower than 15 x Irc.

Breakers Used in LV Main Distribution Panels of Distribution Transformers:
(up to 36kV voltage)

Transformer power Sn (kVA)	Nominal current In (A)	Breaker rated current In (A)	Short circuit current Usc (%)	3-phase short circuit current Isc (rms) (A)
40	58	63	4.5	1283
50	72	80	4.5	1603
63	91	100	4.5	2020
80	115	125	4.5	2566
100	144	160	4.5	3207
125	180	200	4.5	4009
160	231	250	4.5	5132
200	289	300	4.5	6415
250	361	400	4.5	8019
315	455	500	4.5	10103
400	578	630	4.5	12830
500	723	800	4.5	16038
630	910	1000	4.5	20207
800	1156	1250	6	19245
1000	1445	1600	6	24057
1250	1805	2000	6	30071
1600	2312	2500	6	38491
2000	2900	3000	6	48113
2500	3600	4000	6	60142

Example: Rated current of the primary circuit breaker to be connected to the main distribution panel of a 1600 kVA transformer should be 2500A; short circuit breaking capacitor should be at least 50 kA. Short circuit breaking capacities of breakers at secondary outputs should be selected to be at least 50 kA.

Highest short circuit current of a distribution transformer on load side:
Tri-phase short circuit current of a transformer, with 36kV medium voltage side and 0.4kV output side, between low voltage ends is found with the following formula.

Sn : Nominal power of the transformer (kVA)
In : Rated current of the transformer (A)
Un : Output voltage between phases when transformer is unloaded (V)
Usc : Short circuit voltage of the transformer (%)
Isc : 3-phase maximum short circuit current at secondary side of the transformer (rms) (A)

$$Isc(rms) = \frac{S \times 100}{1.73 \times Un \times Usc}$$

What would be the continuous short circuit current when (Un: 400 V, Usc: %4,5) secondary of 630 kVA transformer is subject to short circuit?

$$Isc(rms) = \frac{630 \times 100}{1.73 \times 400 \times 4.5} = 20207\ A$$

alculation of short circuit at any point of the line:

$$I_{sc}=\frac{Un}{\sqrt{3}.\sqrt{Rt^2+Xt^2}}\ (kA)$$

Rt: Total resistance (mΩ)
Xt: Total reactance (mΩ)

Note: Rms value is an expression used in alternative voltage and current measurement and this value is the AC (alternative current) value equivalent to effective or DC (direct current) value. For example, AC voltage giving light amount of a lamp, on which 12V DC voltage is applied, is called 12V AC rms voltage. AC rms value = AC peak value / 1.41

Detailed calculation of short circuit at any point of the facility :

Facility zone	Resistance (mΩ)	Reactance (mΩ)
At network side	$R_1=Z_1 \times \cos\varphi \times 10^{-3}$ $\cos\varphi=0.15$ $Z_1=\frac{U^2}{P_1}$ (Network impedance of the interconnected system)	$X_1=Z_1 \times \sin\varphi \times 10^{-3}$ $\sin\varphi=0.98$
Transformer	$R_2=\frac{Pc \times U^2}{S^2} \times 10^{-3}$ Pc=cupper loss (W) S=apparent power of transformer (kVA)	$X_2=\sqrt{Z_2^2-R_2^2}$ $Z_2=\frac{Usc}{100} \times \frac{U^2}{S}$ Z_2= impedance of transformer
Cables (1)	$R_3=\frac{L}{k.S} \times 10^3$ k=56 (Cu) or 36 (Al) k=self-conductivity $\left(\frac{m}{\Omega mm^2}\right)$	X_3=0.07L (tri-phase cables) X3=0.15L (mono-phase cables) L : cable length (m) S : cable section (mm^2)
Busbars	$R_3=\frac{L}{k.S} \times 10^3$ k=56 (Cu) veya 36 (Al) k=self-conductivity $\left(\frac{m}{\Omega mm^2}\right)$	X_3=0.15 L L : busbar lenght (m) S : busbar section (mm^2)
Circuit breaker	R_4 negligible	X_4 negligible

Calculation of short circuit currents (kA)

	Resistance (mΩ)	Reactance (mΩ)	Short circuit current (kA)
M1	$Rt_1=R_1+R_2+R_3$ $Rt_1=2.61$	$Xt_1=X_1+X_2+X_3$ $Xt_1=12.2$	$\frac{400}{\sqrt{3}\sqrt{(2.61^2+12.2^2)}}=18.52kA$
M2	$Rt_2=Rt_1+R_4+R_5$ $Rt_2=2.71$	$Xt_2=Xt_1+X_4+X_5$ $Xt_2=12.65$	$\frac{400}{\sqrt{3}\sqrt{(2.71^2+12.65^2)}}=17.86kA$
M3	$Rt_3=Rt_2+R_6+R_7$ $Rt_3=9.46$	Xt3=Xt2+X6+X7 $Xt_3=17.55$	$\frac{400}{\sqrt{3}\sqrt{(9.46^2+17.55^2)}}=11.58kA$

(1) If there are more than one parallel cable per phase, divide resistance and reactance of one cable into number of cables.

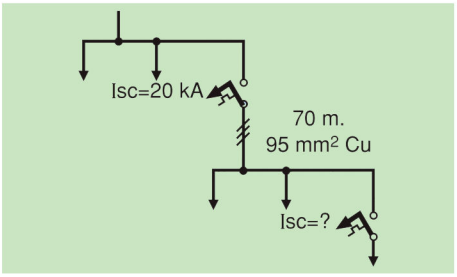
Single line diagram	Facility zone	Resistance (mΩ)	Reactance (mΩ)
	network side P1=500 MVA	$R_1=\frac{400^2}{500} \times 0.15 \times 10^{-3}$ $R_1=0.05\ m\Omega$	$X_1=\frac{400^2}{500} \times 0.98 \times 10^{-3}$ $X_1=0.31\ m\Omega$
	Transformer S=800 kVA Usc=%6 U=400 V Pc=9700 W	$R_2=\frac{9700 \times 400^2 \times 10^{-3}}{800^2}$ $R_2=2.42\ m\Omega$	$X_2=\sqrt{\left(\frac{6}{100} \times \frac{400^2}{800}\right)^2-(2.42)^2}$ $X_2=11.75\ m\Omega$
	Connection cables From transformer to Circuit breaker 2 (3x240) mm2 Copper per phase L=4 m	$R_3=\frac{4 \times 10^3}{56 \times 240 \times 2}$ $R_3=0.14\ m\Omega$	$X_3=0.07 \times \frac{4}{2}$ $X_3=0.14\ m\Omega$
M1	circuit breaker	$R_4=0$	$X_4=0$
main switchboard 1 2 3	output busbar no2 (Al) 10x80 mm2 Per phase L=3 m	$R_5=\frac{3 \times 10^3}{36 \times 800}$ $R_5=0.10\ m\Omega$	$X_5=0.15 \times 3$ $X_5=0.45\ m\Omega$
M2	circuit breaker	$R_6=0$	$X_6=0$
secondary switchboard M3	Connection between secondary panel and primary low voltage panel (cables)(3x185 mm copper per phase L= 70 m	$R_7=\frac{70 \times 10^3}{56 \times 185}$ $R_7=6.75\ m\Omega$	$X_7=0.07 \times 70$ $X_7=4.9\ m\Omega$

Calculation of short circuit at any point of the network:

The following tables allow fast calculation of the short circuit current at any point in the network, if short circuit current at network side, cable section, type and length are known.

380 V										
Cable (mm^2) Cu	Al	Cable length (m)								
1.5	2.5	—	—	—	1	—	—	2	—	3
2.5	4	—	—	1	—	—	2	3	4	5
4	6	—	1	—	—	2	3	4	6	8
6	10	1	—	—	2	3	4	6	9	12
10	16	1	2	—	3	5	7	10	15	20
16	25	2	—	3	5	8	11	16	24	32
25	35	3	4	5	8	13	18	25	38	50
35	50	4	5	7	11	18	25	35	53	70
50	70	5	8	10	15	25	35	50	75	100
70	120	7	11	14	21	35	49	70	105	140
95	150	10	14	19	29	48	67	95	143	190
120	185	12	18	24	36	60	84	120	180	240
150	140	13	20	26	39	65	91	130	195	260
185	300	15	23	30	46	77	108	154	231	308
240		19	28	38	57	96	136	192	283	284
300		24	36	48	72	120	168	240	360	480
Isc network (kA)		Isc Short circuit current at Isc lead side (kA)								
100		65	51	42	30	19	14	10	7	5
90		62	49	41	29	19	14	10	7	5
80		58	47	39	29	18	13	10	7	5
70		52	44	37	28	18	13	10	6	5
60		47	40	35	27	18	13	9	6	5
50		41	36	32	25	17	13	9	6	5
45		38	34	30	24	17	13	9	6	5
40		35	32	28	23	16	13	9	6	5
35		31	28	26	21	16	12	9	6	5
30		27	25	23	20	15	12	9	6	5
25		23	22	20	18	14	11	9	6	5
22		21	20	19	18	13	11	9	6	5
15		14	14	13	12	11	9	7	6	4
10		10	10	9	9	8	7	6	5	4
7		7	7	7	6	6	5	5	4	3
5		5	5	5	5	5	4	4	3	3
4		4	4	4	4	4	3	3	3	2

Example:
A value (67m) lower than 70 m cable length is selected on the row corresponding to 95 mm2 cable (Cu) section in 380V panel. Short circuit current to occur is found as 11 kA by intersection this column with the row giving a higher value (Isc: 22 kA) of the 20 kA short circuit current at network direction. Short circuit breaking capacity of the circuit breaker to be used at this point should be higher than (Icu) 11 kA.



Reading of diagram:

Cable section and short circuit current on network side is marked in the table. Cable length is found on the cable section row. Cable length and short circuit current at network side are intersected and marked. This value gives the short circuit current to occur at the end of the cable.

415 V										
Cable (mm^2) Cu	Al	Cable length (m)								
1.5	2.5	—	—	—	—	1	—	2	3	5
2.5	4	—	—	—	1	2	3	4	5	8
4	6	—	—	1	2	3	4	6	8	12
6	10	—	1	2	3	4	6	9	13	19
10	16	—	2	3	5	7	10	15	20	30
16	25	2	3	5	8	11	16	24	32	48
25	35	4	5	8	13	17	25	38	50	75
35	50	5	7	11	18	24	35	53	70	105
50	70	9	12	18	30	42	60	89	120	179
70	120	11	15	23	38	53	75	113	151	226
95	150	14	19	29	48	66	95	143	190	385
120	185	18	24	36	60	84	120	180	240	360
150	240	19	26	39	65	91	130	195	260	391
185	300	23	30	46	77	107	154	231	308	462
240		28	38	57	96	134	192	288	384	576
300		36	48	72	120	168	240	360	480	720
Isc network (kA)		Isc Short circuit current at Isc lead side (kA)								
100		45	40	25	20	12	8	5	4	3
90		45	35	25	20	12	8	5	4	3
80		45	35	25	15	12	8	5	4	3
70		40	35	25	15	12	8	5	4	3
60		40	35	25	15	12	8	5	4	3
50		35	30	25	15	12	8	5	4	3
45		35	30	25	15	12	8	5	4	3
40		30	30	25	15	12	8	5	4	3
35		30	25	20	15	10	8	5	4	3
30		25	25	20	15	10	7	5	4	3
25		25	20	20	12	10	7	5	4	3
22		22	20	17	12	10	7	5	4	3
15		15	15	12	10	8	6	5	4	3
10		10	10	10	8	7	6	4	3	2
7		7	6	6	6	5	4	4	3	2
5		5	5	4	4	4	3	3	2	2
4		4	4	4	3	3	3	2	2	2

Selectivity:

When there is a fault at any point within the network, coordination of the automatic protection elements, which eliminates the fault only via the protection device located on the top or near the fault, is called selectivity. For example, when there is a fault in the load side controlled by A2 circuit breaker due to any reason such as over load or short circuit, if A2 is opened first and Al remains closed, there is full selectivity for this system (Figure-10). If the above-mentioned condition cannot be met to the nominal short circuit current, there is partial selectivity. Selectivity ensures operating continuity, which is mandatory at many industrial, commercial or similar facilities. Selectivity is ensured with opening current (I1) and opening time (t) parameters of the circuit breaker.
These are;

Current Selectivity:

Let suppose that IB1 rated current of B1 circuit breaker is higher than IB2 rated current of B2 circuit breaker in Figure-11. B2 circuit breaker opens the circuit in fault currents lower than IB1 current to provide current selectivity. This selectivity may be upgraded to full selectivity by using a circuit breaker with current limiter in B2. Because, limiter breakers limit the short circuit current and open the circuit in a very short time (less than 10 ms). That is, selectivity should be provided both in over loads and in short circuits.

Time Selectivity:

Thanks to short-time delay adjustment of the circuit breaker, selectivity is provided by comparing opening times with other breakers in the system. As it is seen in Figure-12, operating curves of Cl and C2 breakers are intersected and delay time adjustment of Cl breaker is increased according to C2 breaker to provide selectivity. Here, Cl circuit breaker should have an electrodynamic resistance in compliance with the resistance current during short-time delay. It should be like delay (at transformer side) > delay (load side).

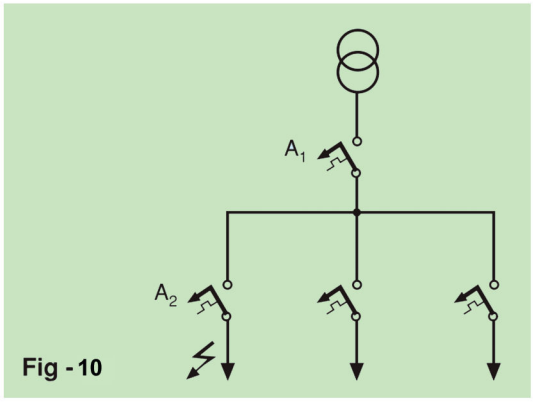


Fig - 10

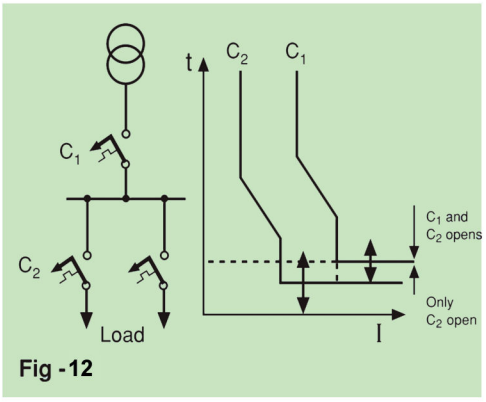


Fig - 12

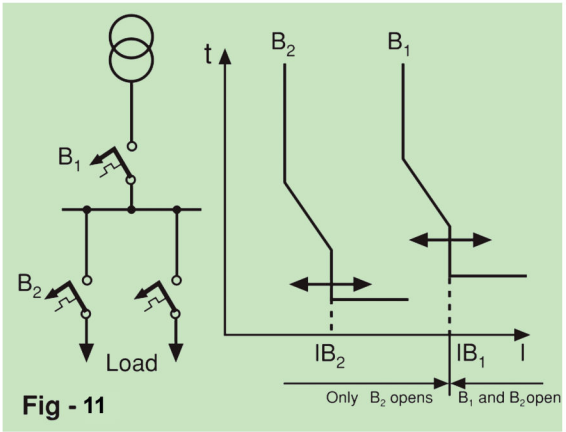


Fig - 11

Selectivity Chart:

Selectivity chart shows the current values at which the circuit breaker closest to the load shall open. Combinations providing selectivity are shown in dark areas. Within these areas, thermal and magnetic opening curves of the circuit breakers at transformer and load sides have been designed to avoid intersections. That is, selectivity tables have been arranged to have the maximum instant opening current of the or more than the instant opening current of the breaker at the load side.

I_2 = Short circuit tripping current of circuit breaker (A)

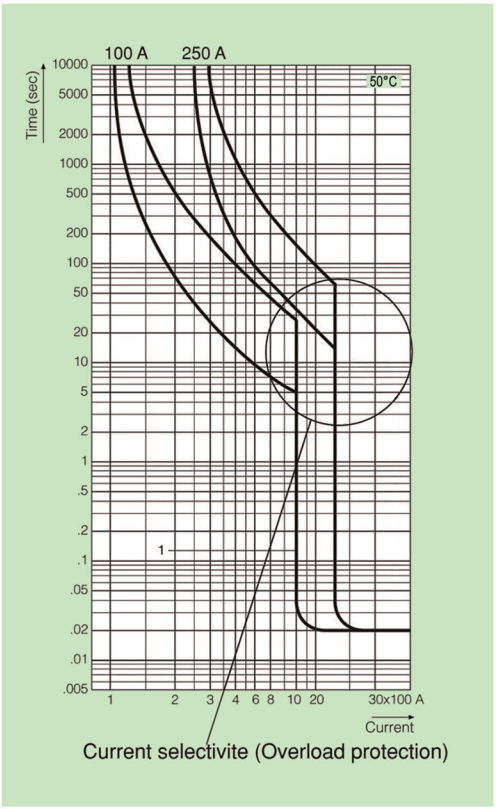
$$\frac{I_2 \text{ (On transformer side)}}{I_2 \text{ (On load side)}} \geq 1{,}5$$

Selectivity Limit:

This is the current value at which both protection elements shall open at the same time when selectivity limit is exceeded. Selectivity limit currents in the tables have been given as the top limit of the short circuit opening

Current Time Curve of 400A NH Fuse with 400A Circuit Breaker:

A circuit breaker, in accordance with IEC 60947-2 standard:
Should operate without opening for 2 hours at 1,05x1n,
Should open within 2 hours at 1,3x1n. In practice, this time is adjusted as, 5-10 minutes.
However a NH fuse, in accordance with IEC 60269-1 standard:
Should operate without opening for 3 hours at 1,25x1n.
Should open within 3 hours at 1,6x1n. Accordingly, a circuit breaker opens earlier than NH Fuses in over currents and provides better protection especially in over currents. (Figure -13)
NH fuses are protection devices which mainly provide protection against short circuit.



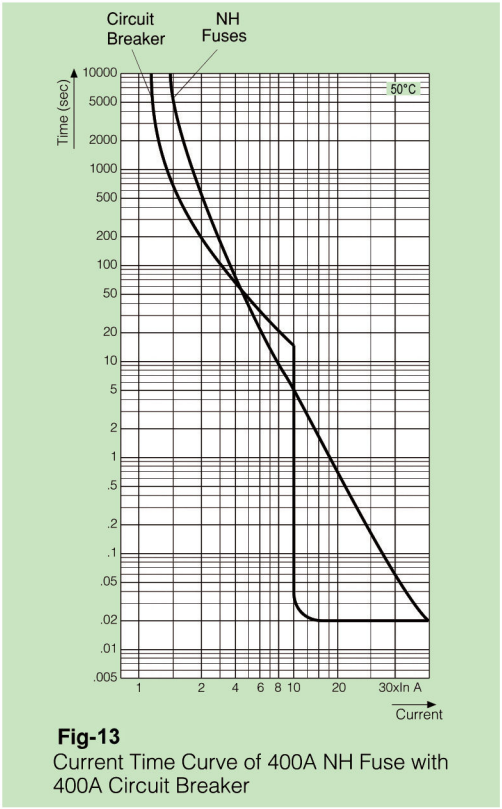
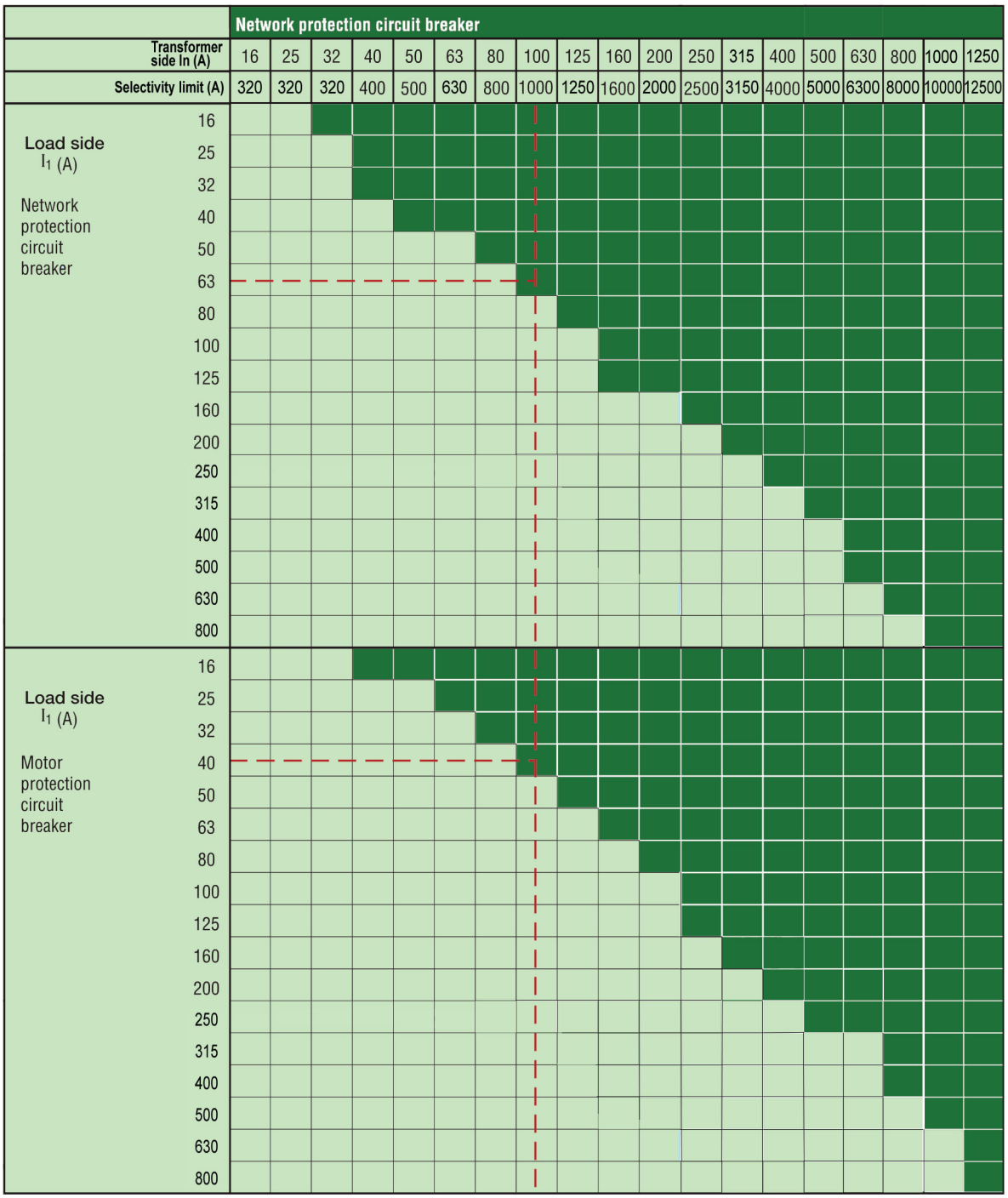


Fig-13
Current Time Curve of 400A NH Fuse with 400A Circuit Breaker



Example:

If there is a network protection circuit breaker with 100 A nominal current at the transformer side, the following circuit breakers should be utilized at the secondary outputs (load side) right below the breaker to provide full selectivity;

Network protection : maximum 63 A
Motor protection : maximum 40 A
Generator protection: maximum 80 A

Moulded Case Circuit Breaker

	Network protection circuit breaker																		
Transformer side In (A)	16	25	32	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250
Selectivity limit (A)	320	320	320	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500
Load side I_1 (A) / Generator protection circuit breaker: 16																			
25																			
32																			
40																			
50																			
63																			
80																			
100																			
125																			
160																			
200																			
250																			
315																			
400																			
500																			
630																			
800																			

	Motor protection circuit breaker									
Transformer side In (A)	160	200	250	315	400	500	630	800	1000	1250
Selectivity limit (A)	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500
Load side I_1 (A) / Network protection circuit breaker: 200										
250										
315										
400										
500										
630										
800										
Load side I_1 (A) / Motor protection circuit breaker: 200										
250										
315										
400										
500										
630										
800										
Load side I_1 (A) / Generator protection circuit breaker: 200										
250										
315										
400										
500										
630										
800										

Sequential Connection:

Sequential connection is a utilization type which allows use of power-cost circuit breakers at the load side by using the current limiting feature of circuit breakers.
Compact circuit breakers at the network side provide protection against over load and short circuit currents. These elements allow circuit breakers with a breaking capability lower than the short circuit current to operate within rated breaking capability limit. As the current is kept under control of the limiter circuit breaker in the whole circuit, sequential connection is useful for all the switching devices at load side of the circuit breaker.

Utilization of Sequential Connection:

In sequential connections, circuit breaker elements can be placed in different panels. In this way, sequential connection makes it possible to use circuit breakers with lower capacity than the possible Ics operating short circuit current to occur in the area of the device. Important point is that a circuit breaker at the capacity to break this short circuit current should be connected at the network side.

Coordination Among Circuit Breakers:

Utilization of a circuit breaker, which has a breaking capacity lower than the short circuit current, is allowed only when another circuit breaker with the required breaking capacity is placed at the network side. In this case, characteristics of both elements should be coordinated with each other in a way not to give any damage to the element at the load side and cables protected by these elements.

3-Step Sequential Connection:

Criteria about sequential connection of serially connected A, B and C circuit breakers are fulfilled in two conditions. A breaker placed at the network side is used for both B and C breakers for sequential connection. Here, it should be checked whether (A+B and A+C) and (A+B and B+C) combinations have the required breaking capacity or not. (Figure - 14)

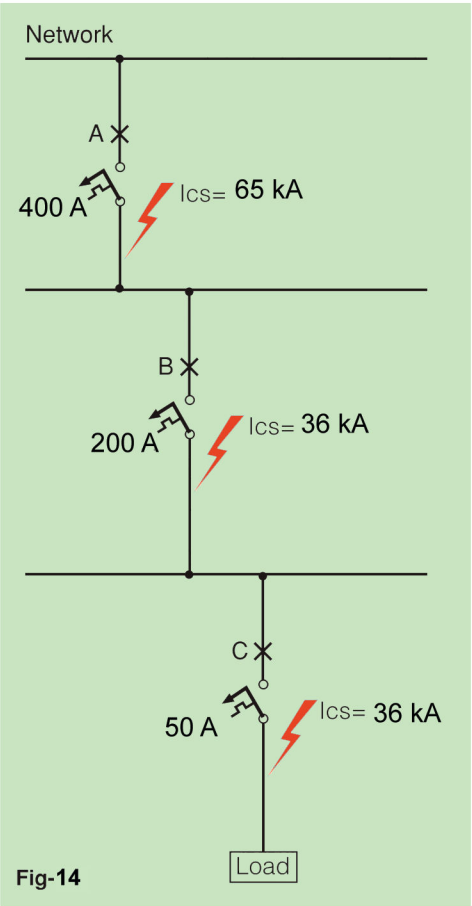


Fig-14

Moulded Case Circuit Breaker

Specification:

Fixed Type	SGM6-125	SGM3S-160	SGM3S-250
Rated current - In (50°C) - (A)	16,25,32, 40,50,63, 80,100,125	16,25,32, 40,50,63,80, 100,125,160	100,125,160, 200,225,250
Number of poles - (Quantity)	3	3	3
Rated operating voltage - Ue (a.c.) 50-60 Hz - (V)	415	415	415
Rated insulation voltage - Ui (a.c.) 50-60 Hz - (V)	690	690	690
Rated impulse withstand voltage - Uimp - (kV)	8	8	8
Test voltage (1 min) (a.c.) 50-60 Hz - (V)	3,000	3,000	3,000
Rated current adjustment area - I_1 - (A)	Fixed	Fixed	Fixed
Instant opening current adjustment area - I_2 - ① (A)	10xIn (320A for 16-25A)	10xIn	10xIn
Highest nominal short circuit breaking capacity - Icu ②	H	L M	L M H
(a.c.) 50-60 Hz 220/240 V (kA rms)	—	50 50	50 65 85
(a.c.) 50-60 Hz 380/415 V (kA rms)	36	36 50	36 50 65
(a.c.) 50-60 Hz 440 V (kA rms)	25	27 36	27 36 50
(a.c.) 50-60 Hz 500 V (kA rms)	16	16 25	16 25 36
(a.c.) 50-60 Hz 690 V (kA rms)	10	10 16	10 16 25
(d.c.) 250 V ③ (kA rms)	15	15 25	16 25 36
Nominal operating short circuit breaking capacity-Ics 415v~ ④ (kA rms)	%75	%75	%75
Rated short circuit making capacity-Icm 415V~kA peak	36	50 50	50 65 85
Breaking duration (in short circuit) - (ms)	<20	<20	<20
Category (EN/IEC 60947-2 , ISIRI4835-2)	A	A	A
Thermal fixed - magnetic fixed	■	■	■
Thermal adjusted - magnetic fixed	□	□	□
Thermal fixed - magnetic adjusted	□	□	□
Thermal adjust - magnetic adjust	—	—	—
Microprocessor unit (Electronic)	□	—	□
Current limiting	■	■	■
Mechanical life - (Operation)	>15000	>15000	>15000
Electrical life - (Operation)	3000	3000	3000
Minimum connection sections ⑤ - (mm^2)	2.5,2.5,4, 6,10,10,16, 25,35,50	2.5,2.5,4, 6,10,10,16, 25,35,50,70	2.5,2.5,4,6,10, 10,16,25,35,50, 70,95,95,120
Weight - (kg)	0.9	1.3	2.1
Maximum - minimum tightening torque - (Nm)	6	6	10
Undervoltage release	□	□	□
Shunt trip release	□	□	□
Auxiliary contact block	□	□	□
Motor control mechanism	□	□	□
Extended rotary handle	□	□	□
Lock Mechanism with key	—	—	—
Extension bar	□	□	□
Terminal cover	—	—	—
Inverser (mechanical) lock	—	—	—
Phase seperator	■	■	■
Extension handle	—	—	—

- ■ marked sections are standard, □ sections are manufactured upon order.
- ① see technical characteristic tables for products with value.
- ② Icu: O-t-CO test (O : Breaking maneuver, CO : Closing maneuver, t : Waiting duration)
- ③ For serial connected two poles of the breaker.
- ④ Ics : O-t-CO-t-CO test (O : Breaking maneuver, CO : Closing maneuver, t : Waiting duration)
- ⑤ Connection sections are given in accordance with EN/IEC 60947-1 standard.

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Moulded Case Circuit Breaker

Fixed Type	SGM3S-400			SGM3S-630			SGM3S-800			SGM3S-1250		
Rated current - In (50°C) - (A)	315,400			400,630			630,800			800,1000,1250		
Number of poles - (Quantity)	3			3			3			3		
Rated operating voltage - Ue (a.c.) 50-60 Hz - (V)	415			415			415			415		
Rated insulation voltage - Ui (a.c.) 50-60 Hz - (V)	800			800			800			800		
Rated impulse withstand voltage - Uimp - (kV)	8			8			8			8		
Test voltage (1 min) (a.c.) 50-60 Hz - (V)	3,000			3,000			3,000			3,000		
Rated current adjustment area - I_1 - (A)	Fixed			Fixed			Fixed			Fixed		
Instant opening current adjustment area - I_2 - (A)	10xIn			10xIn			10xIn			10xIn		
Highest nominal short circuit breaking capacity - Icu	L	M	H	L	M	H	L	M	H	L	M	H
(a.c.) 50-60 Hz 220/240 V (kA rms)	65	85	100	65	85	100	65	85	100	65	85	100
(a.c.) 50-60 Hz 380/415 V (kA rms)	50	65	85	50	65	85	50	65	85	50	65	85
(a.c.) 50-60 Hz 440 V (kA rms)	35	50	65	35	50	65	35	50	65	35	50	65
(a.c.) 50-60 Hz 500 V (kA rms)	25	40	50	25	40	50	25	40	50	25	40	50
(a.c.) 50-60 Hz 690 V (kA rms)	16	18	25	16	18	25	16	18	25	16	18	25
(d.c.) 250 V (kA rms)	25	36	40	25	36	40	25	36	40	25	36	40
Nominal operating short circuit breaking capacity-Ics 415v~ (kA rms)	%75			%75			%75			%75		
Rated short circuit making capacity-Icm 415V~kA peak	65	85	100	65	85	100	65	85	100	65	85	100
Breaking duration (in short circuit) - (ms)	<20			<20			<20			<20		
Category (EN/IEC 60947-2 , ISIRI4835-2)	A			A			A			A		
Thermal fixed - magnetic fixed	■			■			■			■		
Thermal adjusted - magnetic fixed	□			□			□			□		
Thermal fixed - magnetic adjusted	□			□			□			□		
Thermal adjust - magnetic adjust	□			□			□			□		
Microprocessor unit (Electronic)	□			□			□			□		
Current limiting	■			■			■			■		
Mechanical life - (Operation)	>15000			>15000			>15000			>15000		
Electrical life - (Operation)	3000			3000			3000			3000		
Minimum connection sections - (mm^2)	50,70,95,95, 120,185			50,70,95,95, 120,185,240			2(30x5),2(40x5), 40x12			40x15, 2(40x12)		
Weight - (kg)	4.5			5			7			26		
Maximum - minimum tightening torque - (Nm)	25			25			40			40		
Undervoltage release	□			□			□			□		
Shunt trip release	□			□			□			□		
Auxiliary contact block	□			□			□			□		
Motor control mechanism	□			□			□			□		
Extended rotary handle	□			□			□			□		
Lock Mechanism with key	—			—			—			—		
Extension bar	□			□			□			□		
Terminal cover	—			—			—			—		
Inverser (mechanical) lock	—			—			—			—		
Phase seperator	■			■			■			■		
Extension handle	—			—			—			—		

Moulded Case Circuit Breaker

Adjustable Type	SGM6S-125	SGM3S-160	SGM3S-250
Rated current - In (50°C) - (A)	16,25,32, 40,50,63, 80,100,125	16,25,32, 40,50,63,80, 100,125,160	100,125,160, 200,225,250
Number of poles - (Quantity)	3	3	3
Rated operating voltage - Ue (a.c.) 50-60 Hz - (V)	415	415	415
Rated insulation voltage - Ui (a.c.) 50-60 Hz - (V)	690	690	690
Rated impulse withstand voltage - Uimp - (kV)	8	8	8
Test voltage (1 min) (a.c.) 50-60 Hz - (V)	3,000	3,000	3,000
Rated current adjustment area - I_1 - (A)	(0.8-1)In	(0.8-1)In	(0.8-1)In
Instant opening current adjustment area - I_2 - (A)	10xIn (320A for 16-25A)	10xIn	10xIn
Highest nominal short circuit breaking capacity - Icu	H	L M	L M H
(a.c.) 50-60 Hz 220/240 V (kA rms)	—	50 50	50 65 85
(a.c.) 50-60 Hz 380/415 V (kA rms)	36	36 50	36 50 65
(a.c.) 50-60 Hz 440 V (kA rms)	25	27 36	27 36 50
(a.c.) 50-60 Hz 500 V (kA rms)	16	16 25	16 25 36
(a.c.) 50-60 Hz 690 V (kA rms)	10	10 16	10 16 25
(d.c.) 250 V (kA rms)	15	15 25	16 25 36
Nominal operating short circuit breaking capacity-Ics 415v~ (kA rms)	%75	%75	%75
Rated short circuit making capacity-Icm 415V~kA peak	36	50 50	50 65 85
Breaking duration (in short circuit) - (ms)	<20	<20	<20
Category (EN/IEC 60947-2 , ISIRI4835-2)	A	A	A
Thermal fixed - magnetic fixed	□	□	□
Thermal adjusted - magnetic fixed	■	■	■
Thermal fixed - magnetic adjusted	—	—	—
Thermal adjust - magnetic adjust	□	□	□
Microprocessor unit (Electronic)	□	□	□
Current limiting	■	■	■
Mechanical life - (Operation)	>15000	>15000	>15000
Electrical life - (Operation)	3000	3000	3000
Minimum connection sections - (mm^2)	2.5,2.5,4, 6,10,10,16, 25,35,50	2.5,2.5,4, 6,10,10,16, 25,35,50,70	2.5,2.5,4,6,10, 10,16,25,35,50, 70,95,95,120
Weight - (kg)	0.9	1.3	2.1
Maximum - minimum tightening torque - (Nm)	6	6	10
Undervoltage release	□	□	□
Shunt trip release	□	□	□
Auxiliary contact block	□	□	□
Motor control mechanism	□	□	□
Extended rotary handle	□	□	□
Lock Mechanism with key	—	—	—
Extension bar	□	□	□
Terminal cover	—	—	—
Inverser (mechanical) lock	—	—	—
Phase seperator	■	■	■
Extension handle	—	—	—

Moulded Case Circuit Breaker

SGM3S-400	SGM3S-630	SGM3S-400	SGM3S-630	SGM3S-800	SGM3S-1250
315,400	400,630	315,400	400,630	630,800	800,1000,1250
3	3	3	3	3	3
415	415	415	415	415	415
800	800	800	800	800	800
8	8	8	8	8	8
3,000	3,000	3,000	3,000	3,000	3,000
(0.8-1)In	(0.8-1)In	(0.8-1)In	(0.8-1)In	(0.8-1)In	(0.8-1)In
10xIn	10xIn	(6-10)In	(6-10)In	10xIn	10xIn
L M H	L M H	L M H	L M H	L M H	L M H
65 85 100	65 85 100	65 85 100	65 85 100	65 85 100	65 85 100
50 65 85	50 65 85	50 65 85	50 65 85	50 65 85	50 65 85
35 50 65	35 50 65	35 50 65	35 50 65	35 50 65	35 50 65
25 40 50	25 40 50	25 40 50	25 40 50	25 40 50	25 40 50
16 18 25	16 18 25	16 18 25	16 18 25	16 18 25	16 18 25
25 36 40	25 36 40	25 36 40	25 36 40	25 36 40	25 36 40
%75	%75	%75	%75	%75	%75
65 85 100	65 85 100	65 85 100	65 85 100	65 85 100	65 85 100
<20	<20	<20	<20	<20	<20
A	A	A	A	A	A
□	□	□	□	□	□
■	■	□	□	■	■
—	—	—	—	—	—
□	□	■	■	□	□
□	□	□	□	□	□
■	■	■	■	■	■
>15000	>15000	>15000	>15000	>15000	>15000
3000	3000	3000	3000	3000	3000
50,70,95,95, 120,185	50,70,95,95, 120,185,240	50,70,95,95, 120,185	50,70,95,95, 120,185,240	2(30x5),2(40x5), 40x12	40x15, 2(40x12)
4.5	5	4.5	5	7	26
25	25	25	25	40	40
□	□	□	□	□	□
□	□	□	□	□	□
□	□	□	□	□	□
□	□	□	□	□	□
□	□	□	□	□	□
—	—	—	—	—	—
□	□	□	□	□	□
—	—	—	—	—	—
—	—	—	—	—	—
■	■	■	■	■	■
—	—	—	—	—	—

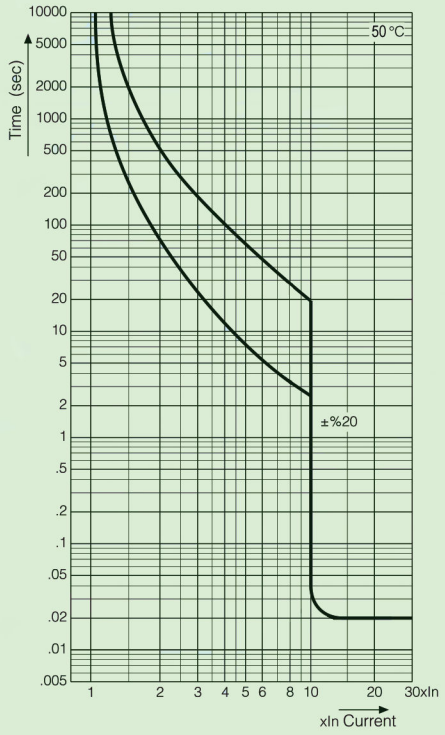
Moulded Case Circuit Breaker

Electronic Type	SGM3S-0250	SGM3S-400	SGM3S-800	SGM3S-1250
Rated current - In (50°C) - (A)	100,125,160, 200,225,250	315,400	630,800	1000,1250
Number of poles - (Quantity)	3	3	3	3
Rated operating voltage - Ue (a.c.) 50-60 Hz - (V)	415	415	415	415
Rated insulation voltage - Ui (a.c.) 50-60 Hz - (V)	800	800	800	1000
Rated impulse withstand voltage - Uimp - (kV)	8	8	8	8
Test voltage (1 min) (a.c.) 50-60 Hz - (V)	3,000	3,000	3,000	3,000
Rated current adjustment area - I_1 - (A)	(0.5-1)In	(0.5-1)In	(0.5-1)In	(0.5-1)In
Instant opening current adjustment area - I_2 - (A)	(2-12)In	(2-12)In	(2-12)In	(2-12)In
Highest nominal short circuit breaking capacity - Icu	L M	L M	L M	L M
(a.c.) 50-60 Hz 220/240 V (kA rms)	50 65	65 100	65 100	85 100
(a.c.) 50-60 Hz 380/415 V (kA rms)	35 50	65 100	65 100	85 100
(a.c.) 50-60 Hz 440 V (kA rms)	25 35	50 75	50 75	60 75
(a.c.) 50-60 Hz 500 V (kA rms)	16 20	35 50	35 50	35 50
(a.c.) 50-60 Hz 690 V (kA rms)	8 10	20 25	20 25	20 25
(d.c.) 250 V (kA rms)	16 20	35 50	35 50	— —
Nominal operating short circuit breaking capacity-Ics 415v~ (kA rms)	%70	%65	%65	%60
Rated short circuit making capacity-Icm 415V~kA peak	50 65	65 100	65 100	85 100
Breaking duration (in short circuit) - (ms)	<20	<20	<20	<20
Category (EN/IEC 60947-2 , ISIRI4835-2)	B	B	B	B
Rated Short-time Withstand Current - Icw (kA/S)	2.7	5	10	15
Thermal fixed - magnetic fixed	□	□	□	□
Thermal adjusted - magnetic fixed	□	□	□	□
Thermal fixed - magnetic adjusted	—	□	□	□
Thermal adjust - magnetic adjust	□	—	—	—
Microprocessor unit (Electronic)	■	■	■	■
Current limiting	■	■	■	■
Electrical life - (Operation)	8000	7500	7500	7500
Minimum connection sections - (mm^2)	2.5,2.5,4,6,10, 10,16,25,35,50, 70,95,95,120	185,240	240,2(30x5), 2(40x5),40x12	40x15, 2(40x12)
Weight - (kg)	2.1	5	9	26
Mechanical life - (Operation)	>20000	>10000	>10000	>10000
Maximum - minimum tightening torque - (Nm)	10	25	40	50
Undervoltage release	□	□	□	□
Shunt trip release	□	□	□	□
Auxiliary contact block	□	□	□	□
Motor control mechanism	□	□	□	□
Extended rotary handle	□	□	□	□
Lock Mechanism with key	—	—	—	—
Extension bar	□	□	□	□
Terminal cover	—	—	—	—
Inverser (mechanical) lock	—	—	—	—
Phase seperator	■	■	■	■
Extension handle	—	—	—	—

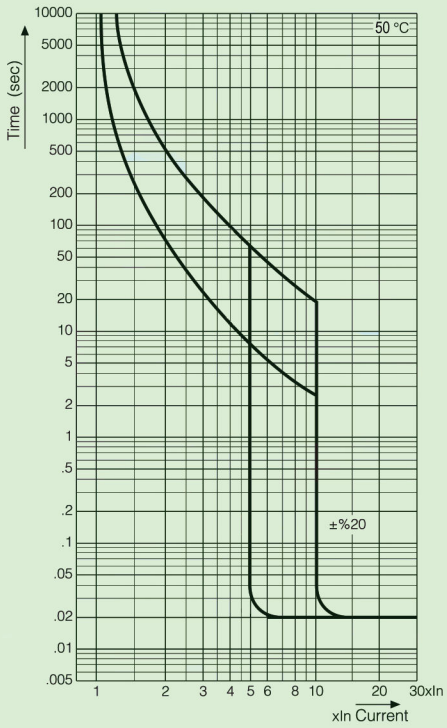
KAVEH

Time-Current triping curve

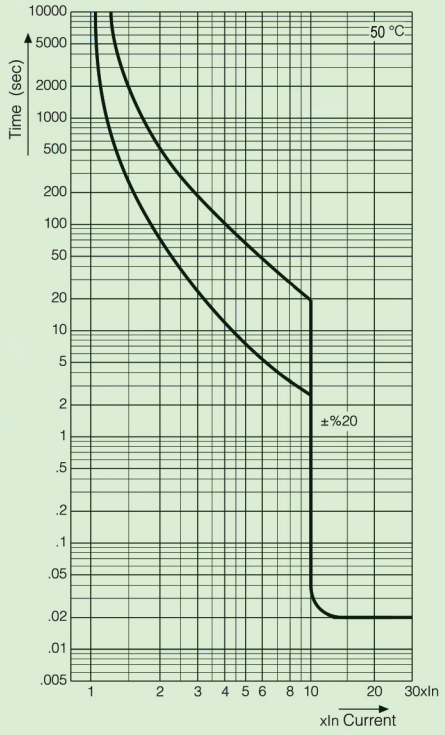
Thermal magnetic fixed type circuit breaker



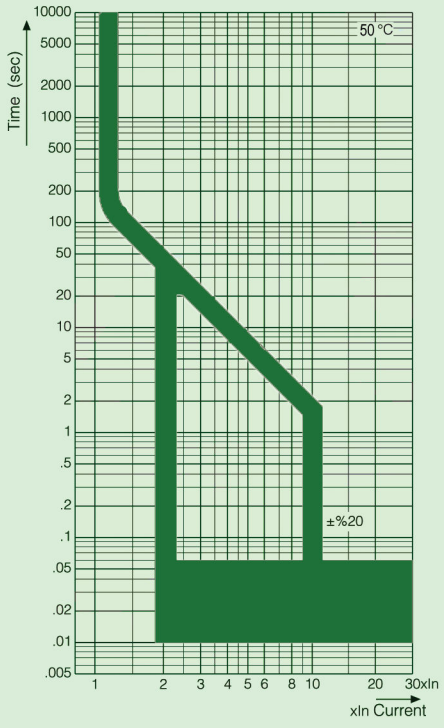
Thermal magnetic adjustable type circuit breaker



Thermal adjustable magnetic fixed type circuit breaker



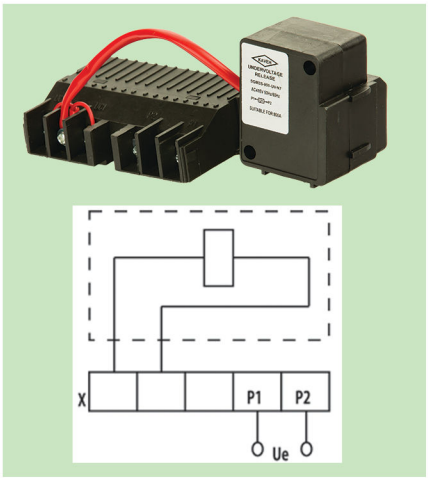
Electronic type circuit breaker



Accessories:

Undervoltage Release :

It is used for opening the circuit breaker when energy is cut off or voltage goes below 70% of the operating voltage. In order to close the breaker, the voltage should be equal to or higher than 85% of the operating voltage. When no energy is supplied to the low voltage coil, the circui+t breaker does not open.
Operation voltage(V):
When the voltage is 35%-70% of rated operational voltagesmake the circuit breaker tripped stably;
When 85%-110%,guarantee the circuit breaker switched on,when lower than 35% should prevent switch on.
Remark: X-terminal blocks, in the dotted box is the circuit breaker inner wiring diagram.



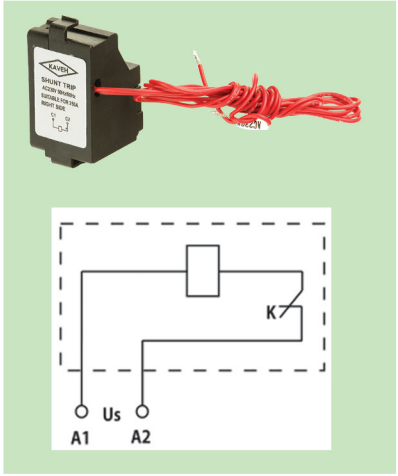
Extended Rotary Handle:

It is used for opening - closing the circuit breaker. It is used for rotating the circuit breaker, not pushing-pulling it upwards-downwards

Model	Installation size H (mm)
SGM3S-100	49
SGM3S-225	55
SGM3S-400	74
SGM3S-630	66
SGM3S-800	66

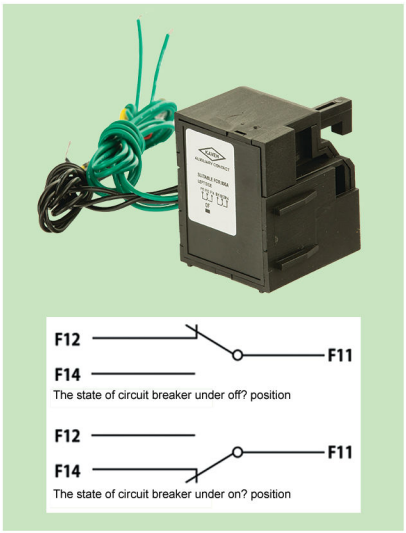
Shunt Trip Release:

It is used for opening the circuit breaker remotely. When the breaker is in closed (ON) position, when voltage is supplied to the opening relay the breaker is opened and gets Trip position. Opening relay may be manufactured at different voltages set out in the table in order to operate in AC and DC voltages. Operation of opening coil is guaranteed between 70% and 110% of the nominal voltage according to standards.
Rated supply voltageUs (V):
AC230V, AC400V, DC24V,DC110V,DC220V
Operation voltage (V): (0.7~1.1)Us
Remark: K-the microswitch in series with col in the shunt release is the normally dosed contact, when circuit breaker opening, the contact disconnect automatically, switch on when closing, in the box is the circuit breaker inner wiring diagram.



Auxiliary Contact Block:

It is used for supplying electrical signaling of the circuit breaker according to the operating position. Auxiliary contacts are opened and closed with primary contacts to fulfill warning and locking functions.
NO : Normally open contact
NC : Normally closed contact
Coventional thermal current Ith (A): 3A
Rated operational current Ie (A):
In ≤ 225A:0.26A; In ≤ 400A:0.3A

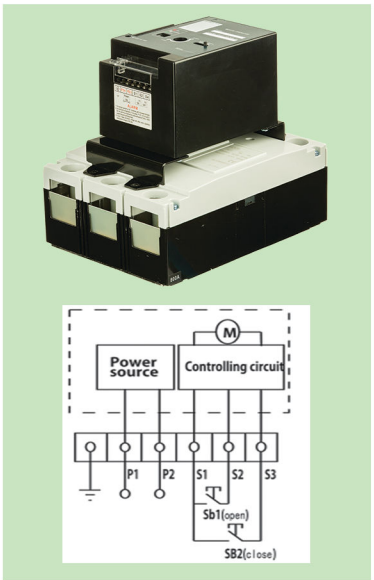


Extension Bars:

Extension busbars allow easy and healthy cable or busbar connections to the terminals of the breaker. Busbars are manufactured of electrolytic copper material with silver coating.

Motor Control Mechanisms:

They are used for opening - closing the circuit breaker remotely. Moreover, thanks to the notch on it, manual opening-closing can be made. Motor control mechanism is assembled on top cover of the circuit breaker. It has mechanical locking feature.



INTERNAL MOUNTED ACCESSORIES

Item	Accessories	125A 3P	160A 3P	250A 3P	400A 3P	630A 3P	800A 3P
SGM3S	SD						
	MX						
	OF						
	MN						
	SD+OF						
	TWO SETS OF						
	MX,OF						
	MX,SD						
	MX,SD+OF						
	MX,TWO SETS OF						
	MN,MX						
	MN,OF						
	MN,SD						
	MN,SD+OF						
	MN,TWO SETS OF						
	OF, SD						
	OF, MX						
	OF, SD+OF						
	OF,TWO SETS OF						
	SD,OF						
	SD,MX						
	SD,SD+OF						
	SD,TWO SETS OF						
	SD+OF,OF						
	SD+OF,SD						
	SD+OF,MX						
	SD+OF,TWO SETS OF						
	TWO SETS OF,OF						
	TWO SETS OF,SD						
	TWO SETS OF,MX						
	TWO SETS OF,SD+OF						

Item	Accessories	250 3P	400 - 630 3P	800 3P	1250 3P
SMG3S Electronic Type	SD				
	MX				
	MN				
	OF				
	SD+OF				
	TWO SETS OF				
	MX,OF				
	MX,SD				
	MX,SD+OF				
	MX,TWO SETS OF				
	MN,MX				
	MN,OF				
	MN,SD				
	MN,SD+OF				
	MN,TWO SETS OF				
	NOTE:OF/SD/SD+OF/TWO SETS OF can be matched each together.				

Electronic type :

Range of application:
SGM3E series MCCB is supplied with rated insulation voltage 800V and 1000V and used for circuit of AC 50Hz ,rated operating voltage AC 400V ,rated Ampere 160A-1250A,rated operating voltage AC 400V . Equipped with the protection devices for over-current,short circuit and under voltage,the product is capable of preventing damage of circuits and supplying units the product according to IEC 60947-2.

Temperature:
Average temperature less than +35°C within 24 hours for -5°C ~ +40°C.

Altitude of installation:
Altitude of installation shall be less than 2000m, and the capacity reduction is adopted for being used at 2000+ m.

Condition of the atmosphere:
The relative temperature of the atmosphere is not more than 50% when the highest temperature is +40°C,and the relative remperture is higher under lower temperature (e.g. 90% at +20°C) ,and the condensation formed on the surface of the products for temperature change shall be considered.

Pollution level: III

Installation category: III

Installation conditions:
Any installation place of the external magnetic field direction should not exceed 5 times of the geomagnetic field, Vertical installation, handle up to position, turning on the power supply installation area should be no significant impact and vibration.

Mode of Connection:
Using screw terminals, fasten the screw to fix the wire.

Utilization category:
A TYPE: In the case of short circuit, circuit breaker without specifying a series connection in circuit used as the load side another short circuit device of selective protection (in the case of short circuit, Selective protection without person is short time delay).

B TYPE: In the case of short circuit, circuit breaker specifying a series connection in circuit used as the load side another short circuit device of selective protection (in the case of short circuit, Selective protect person is short time delay).

Performance and parameter

MCCB rated current:

Frame size	Breaking capacity Class	kA Icu/Ics	Rated current In(A)
		400V	
250	M	35/22	160A-250A
	H	50/35	
400	M	65/42	315A-400A
	H	100/65	
800	M	65/42	500A-630A
	H	100/65	700A-800A
1250	M	65/42	1000A-1250A
	H	100/65	

Endurance (operations):

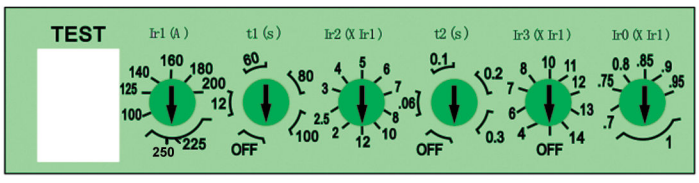
Frame size	250	400, 800, 1250
Mechanical endurance	20000	10000
Electrical endurance	8000	7500

Setting currentand Electronic tripping characteristics

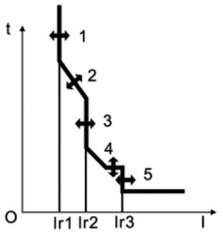
250

1. Adjustable long time protection tripping current Ir1, according to different rated current, can be adjusted 7positions.
2. Adjustable long time delay tripping time t1, can be adjusted 4positions.
3. Adjustable short time delay tripping time of short current Ir2, can be adjusted 10 positions.
4. Adjustable short time delay tripping time t2,can be adjusted 4 positions.
5. Adjustable instantaneous tripping current Ir3,can be adjusted 10 positions.
6. Adjustable pre-alarmming tripping current Ir0,can be adjusted 7 positions.

250,In=250AElectronic tripping device



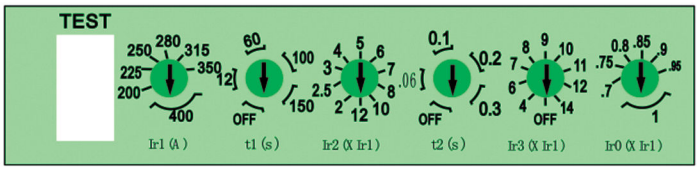
Electronic tripping characteristics curve



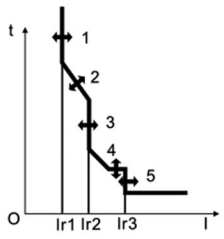
400

1. Adjustable long time prote ction tripping current Ir1, according to different rated current, can be adjusted 7positions.
2. Adjustable long time delay tripping time t1, can be adjusted 4positions.
3. Adjustable short time delay tripping time of short current Ir2, can be adjusted 10 positions.
4. Adjustable short time delay tripping time t2, can be adjusted 4 positions.
5. Adjustable instantaneous tripping current Ir3, can be adjusted 10 positions.
6. Adjustable pre-alarmming tripping current Ir0, can be adjusted 7 positions.

400,In=400AElectronic tripping device



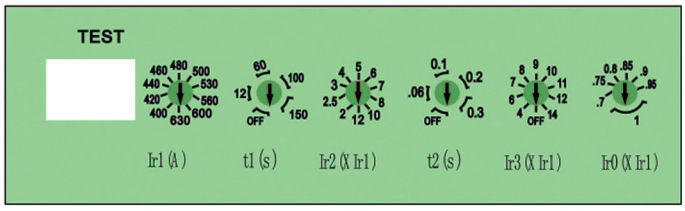
Electronic tripping characteristics curve



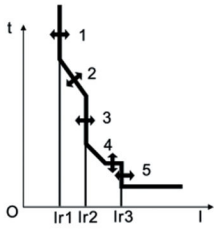
630

1. Adjustable long time prote ction tripping current Irtaccording to different rated current, can be adjused 10positions.
2. Adjustable long time delay tripping time t1, can be adjusted 4positions.
3. Adjustable short time delay tripping time of short current Ir2, can be adjusted 10 positions.
4. Adjustable short time delay tripping time t2, can be adjusted 5 positions.
5. Adjustable instantaneous tripping current Ir3, can be adjusted 10 positions.
6. Adjustable pre-alarmming tripping current Ir0, can be adjusted 7 positions.

630,In=630AElectronic tripping device



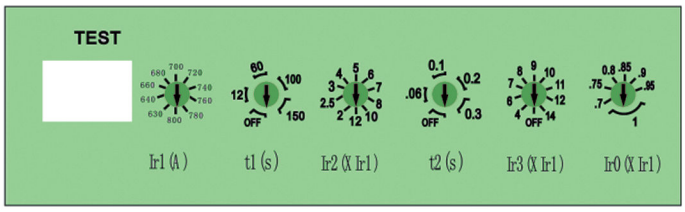
Electronic tripping characteristics curve



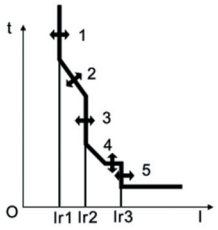
800

1. Adjustable long time prote ction tripping current Irtaccording to different rated current, can be adjused 10positions.
2. Adjustable long time delay tripping time t1, can be adjusted 4positions.
3. Adjustable short time delay tripping time of short current Ir2, can be adjusted 10 positions.
4. Adjustable short time delay tripping time t2, can be adjusted 5 positions.
5. Adjustable instantaneous tripping current Ir3, can be adjusted 10 positions.
6. Adjustable pre-alarmming tripping current Ir0, can be adjusted 7 positions.

800,In=800AElectronic tripping device



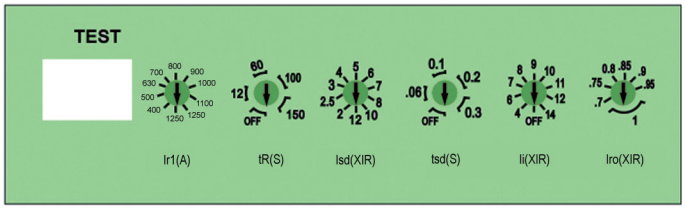
Electronic tripping characteristics curve



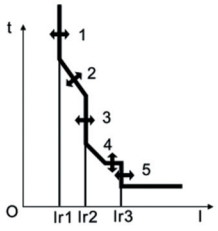
1250

1. Adjustable long time prote ction tripping current Irtaccording to different rated current, can be adjused 10positions.
2. Adjustable long time delay tripping time t1, can be adjusted 4positions.
3. Adjustable short time delay tripping time of short current Ir2, can be adjusted 10 positions.
4. Adjustable short time delay tripping time t2, can be adjusted 5 positions.
5. Adjustable instantaneous tripping current Ir3, can be adjusted 10 positions.
6. Adjustable pre-alarmming tripping current Ir0, can be adjusted 7 positions.

1250,In=1250 AElectronic tripping device

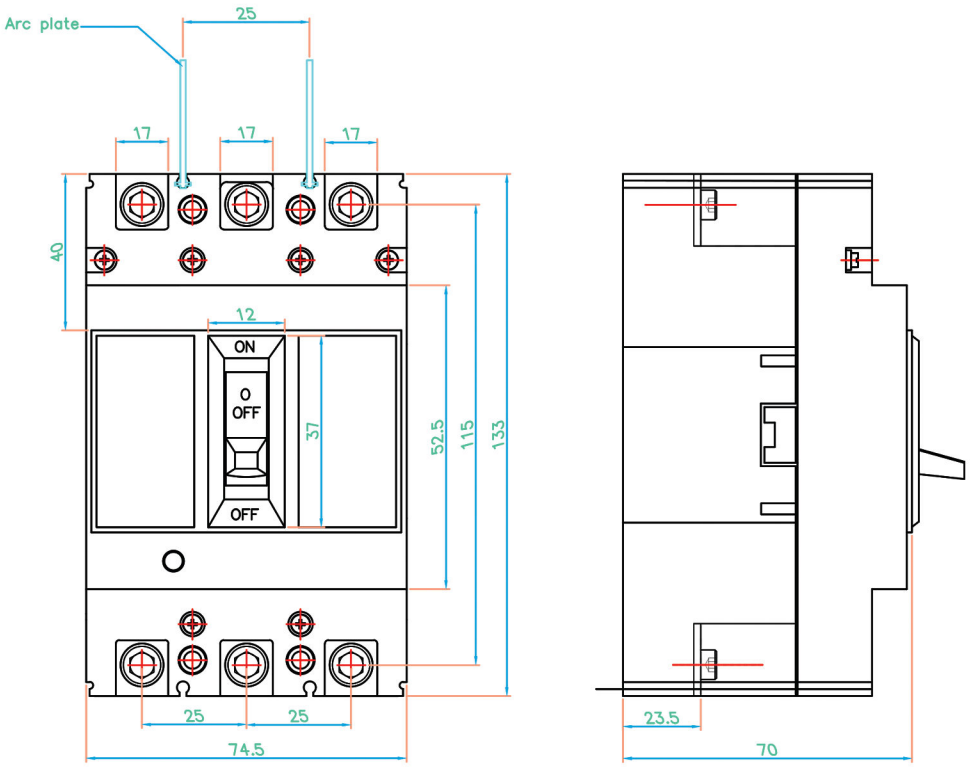


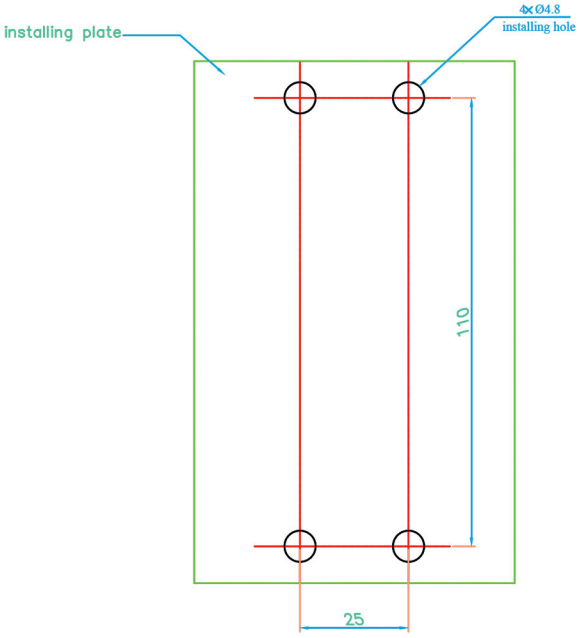
Electronic tripping characteristics curve



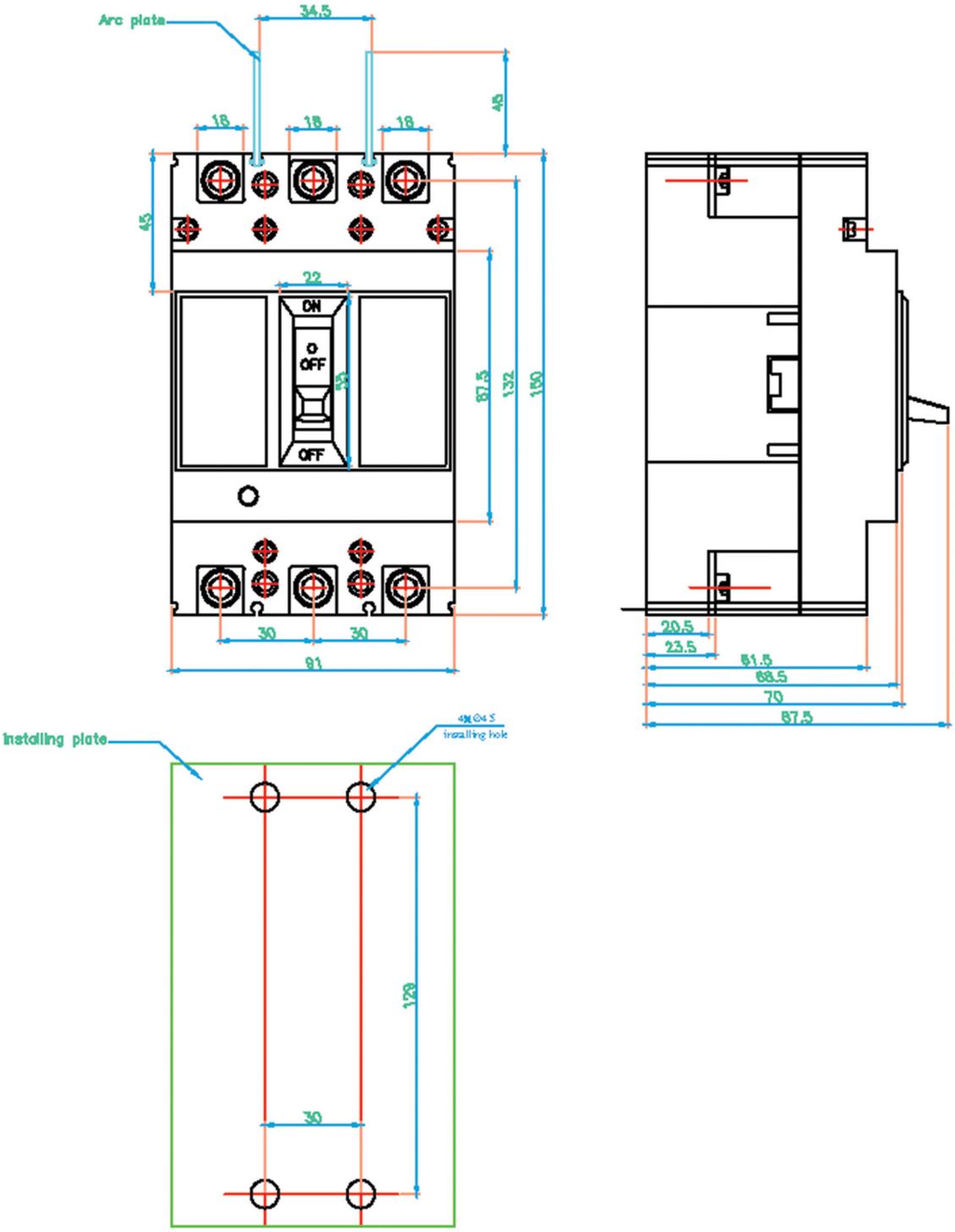
Dimensions

Thermal & Magnetic MCCB 125H
16A upto 125A Thermal & Magnetic Fixed

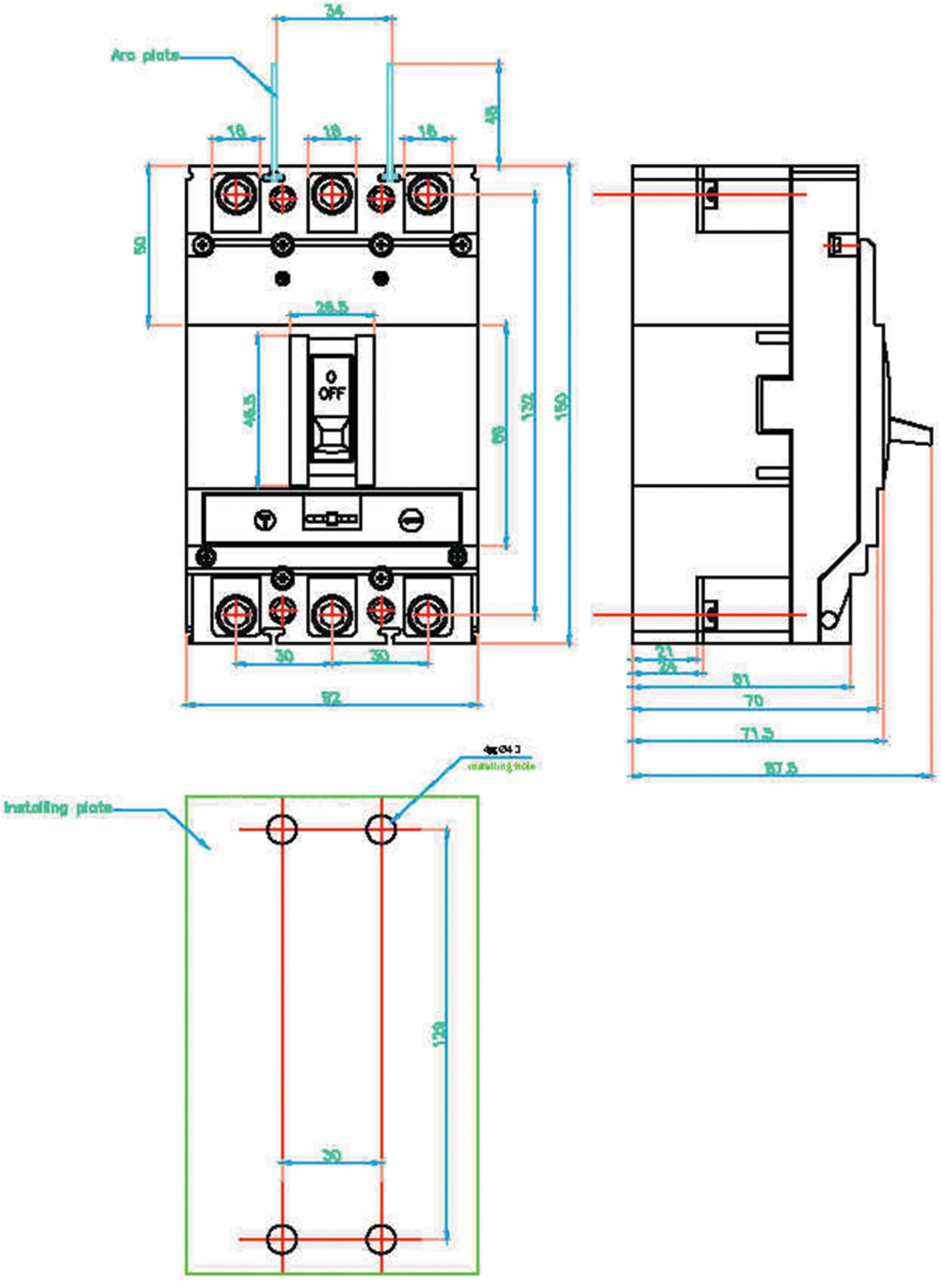




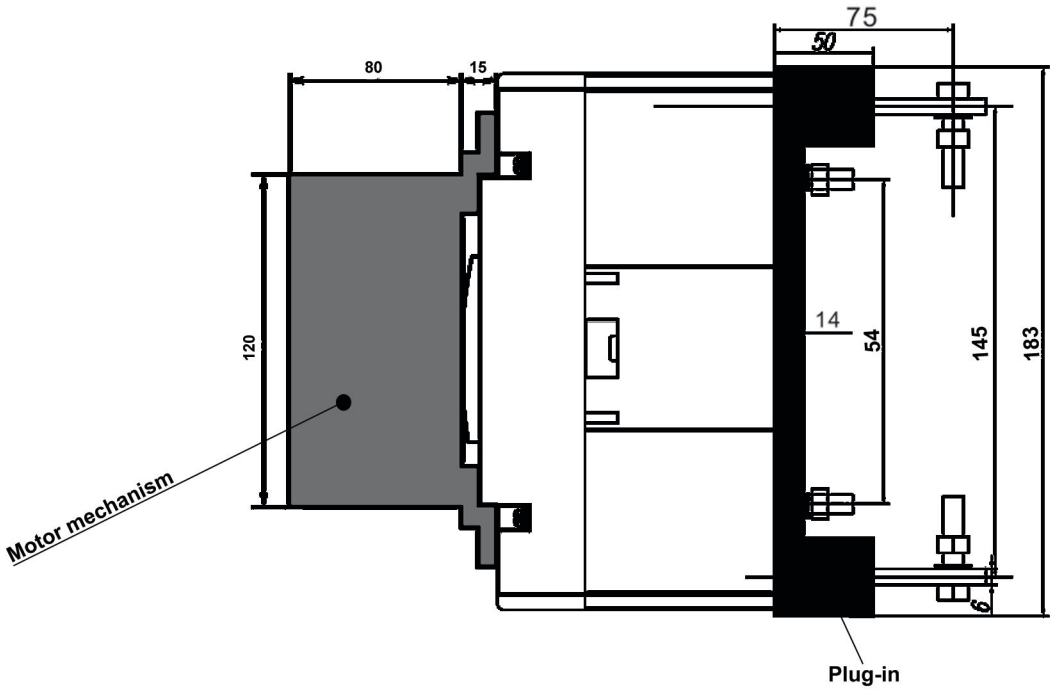
Thermal & Magnetic MCCB 160L
Thermal & Magnetic Fixed

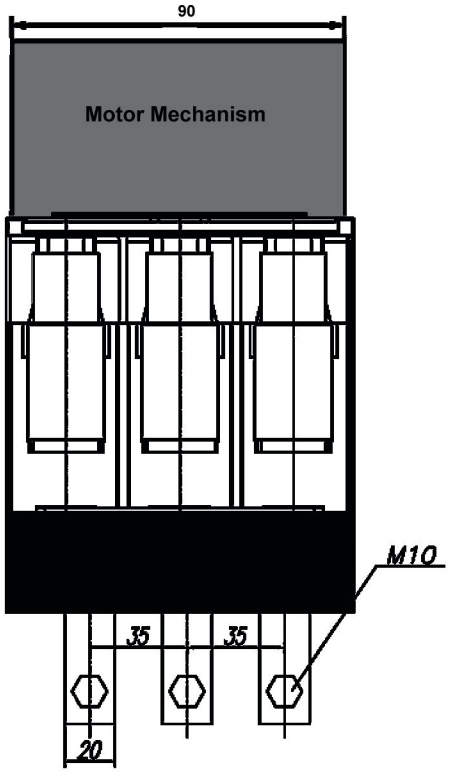


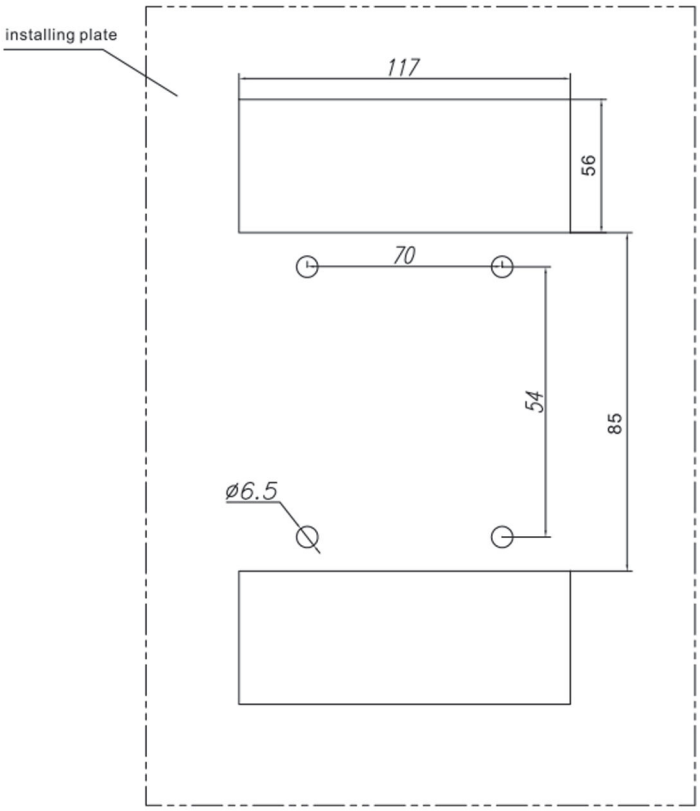
Thermal & Magnetic MCCB 160L
Thermal Adjustable, Magnetic Fixed



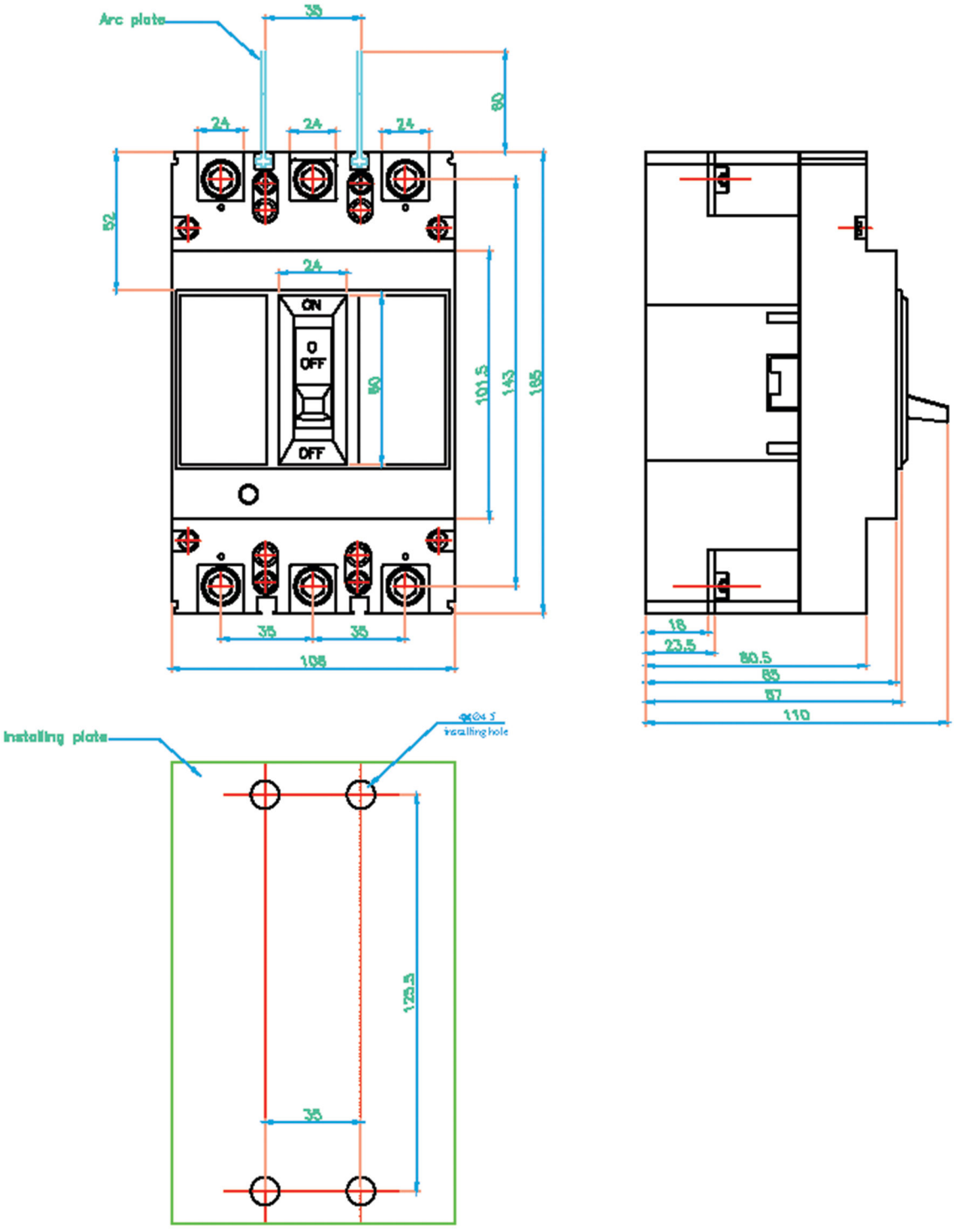
3P, 160L, Plug-in With Motor Mechanism Dimension



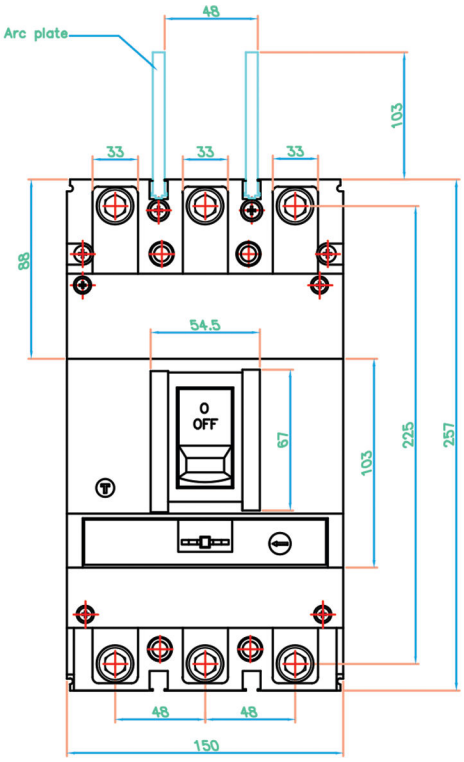


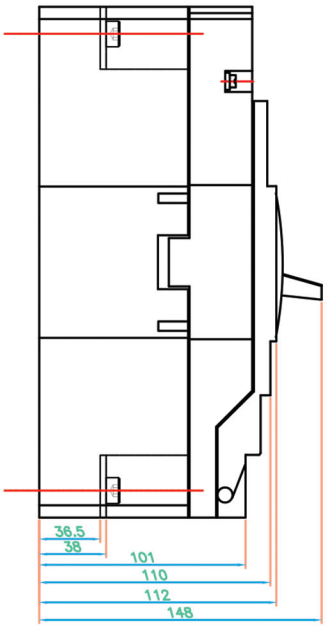


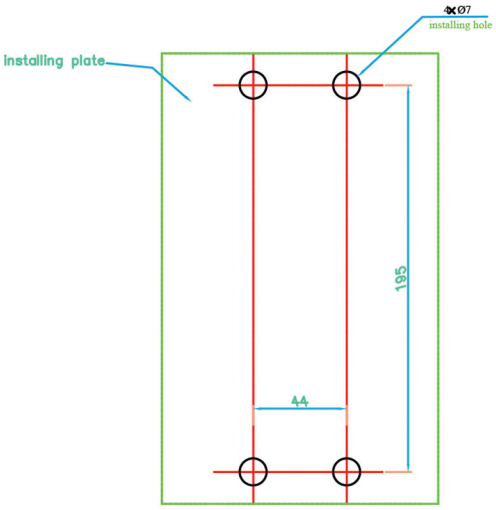
Thermal & Magnetic MCCB 250L
Thermal & Magnetic Fixed



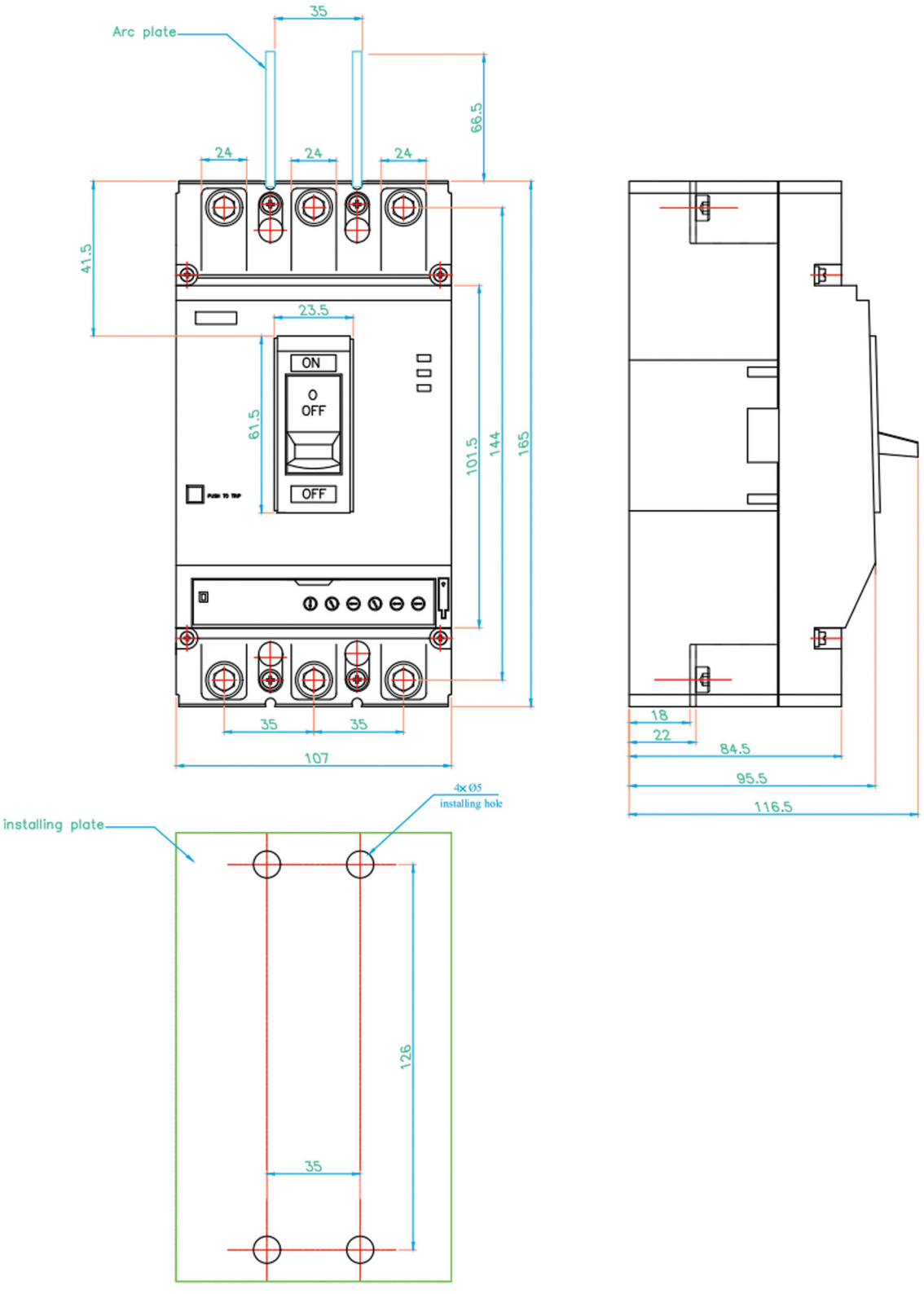
Thermal & Magnetic MCCB 250L
Thermal Adjustable, Magnetic Fixed



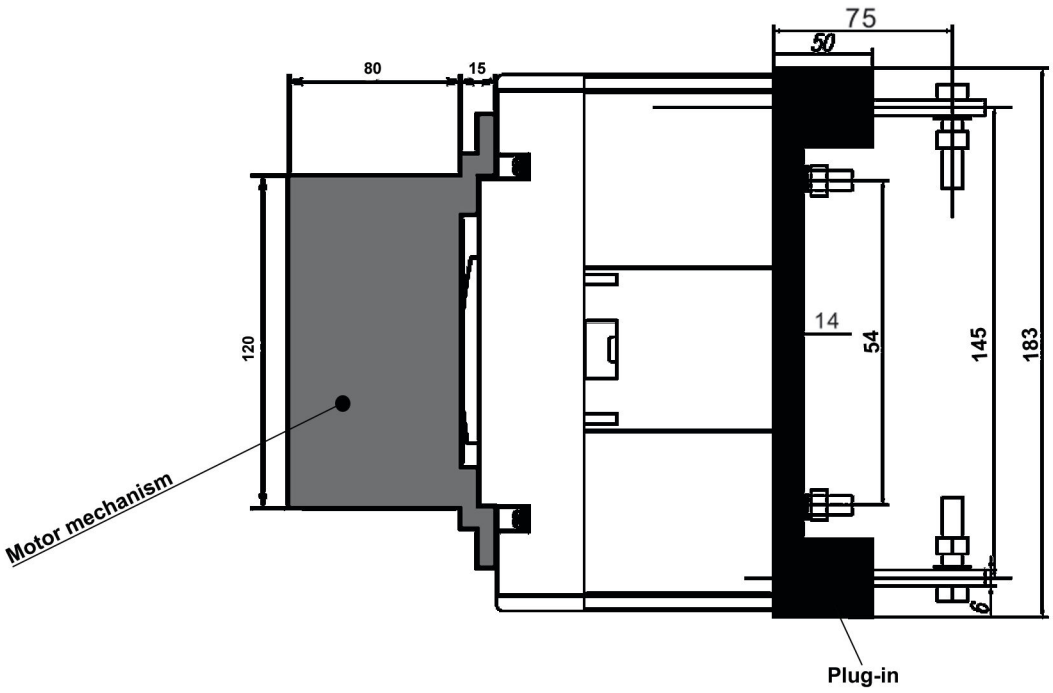


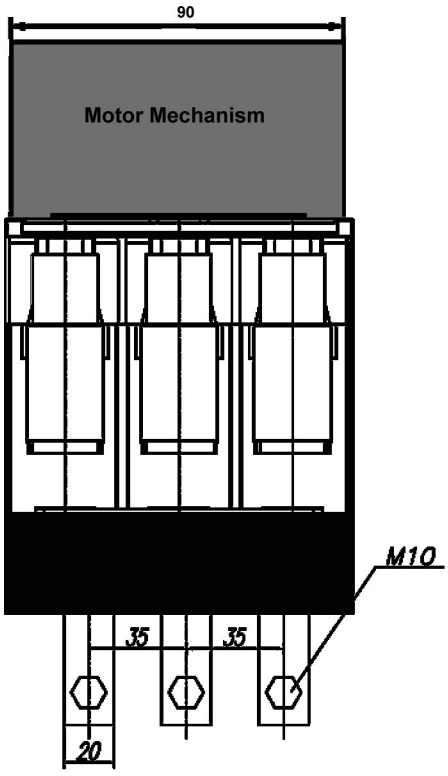


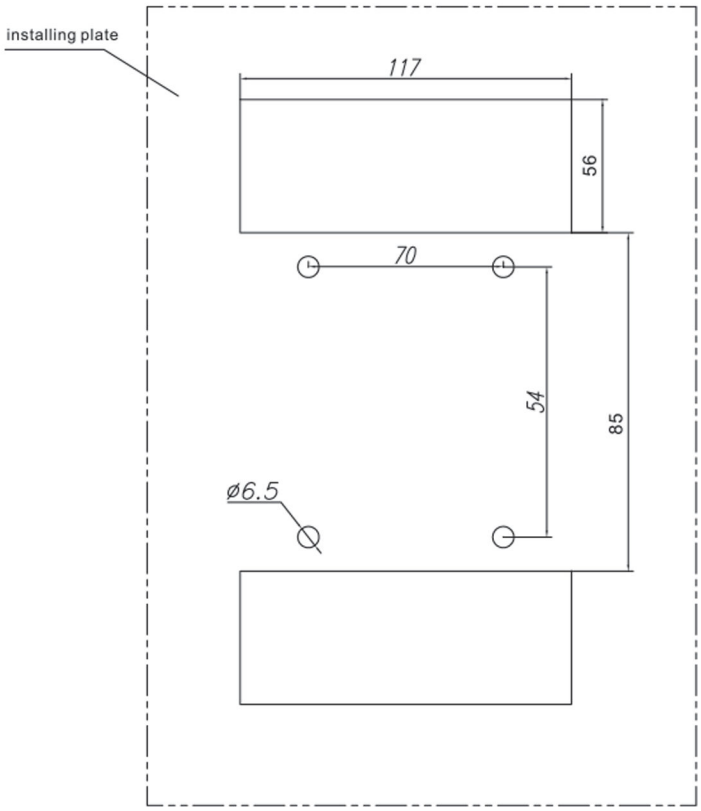
Electronic MCCB 250L



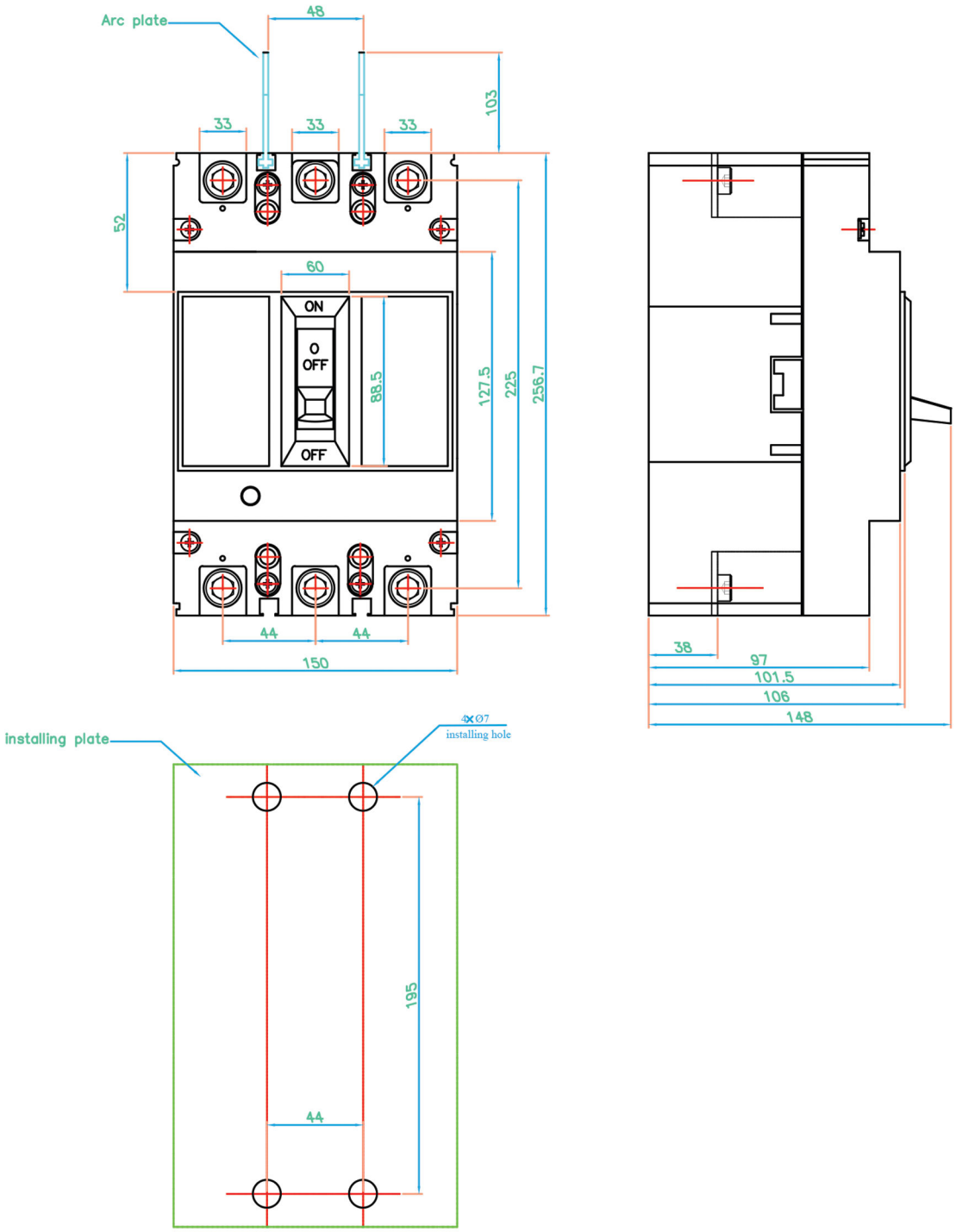
3P, 250L, Plug-in With Motor Mechanism Dimension



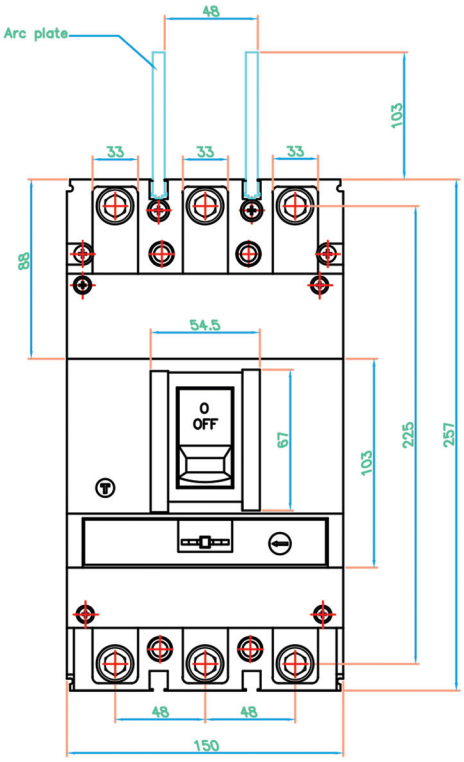


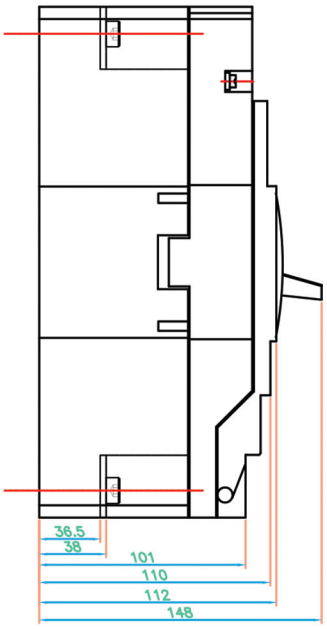


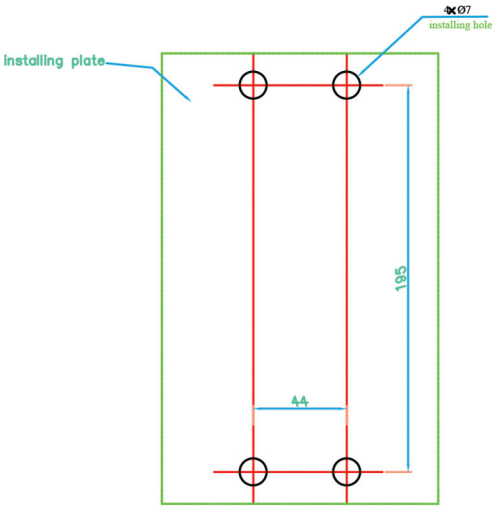
Thermal & Magnetic MCCB 400M
Thermal & Magnetic Fixed



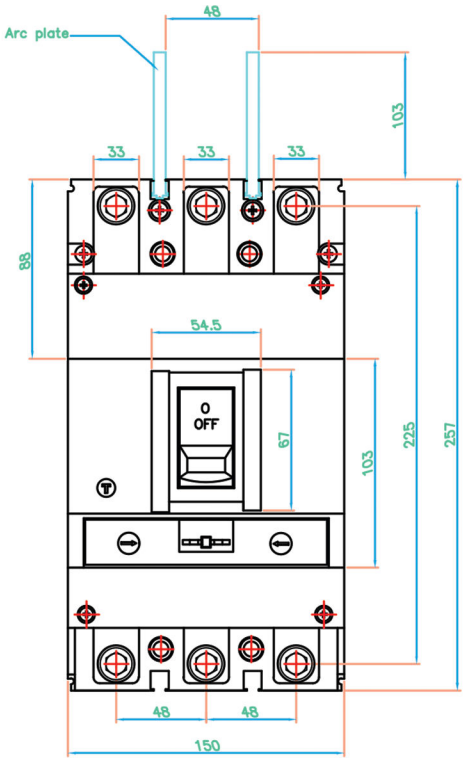
Thermal & Magnetic MCCB 400M
Thermal Adjustable, Magnetic Fixed

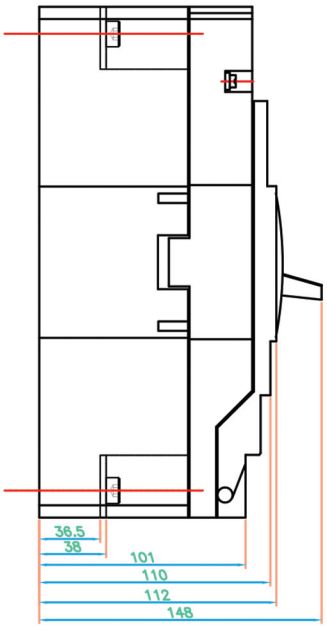


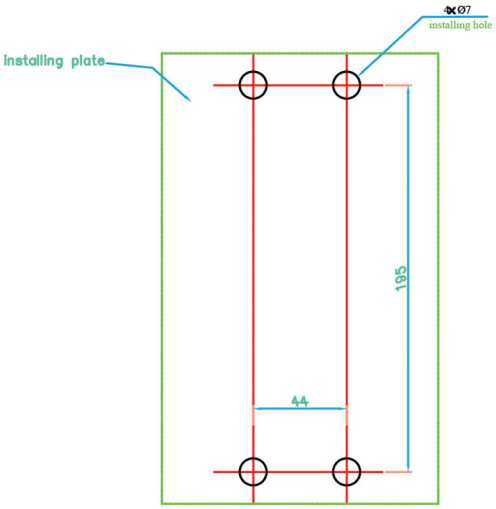




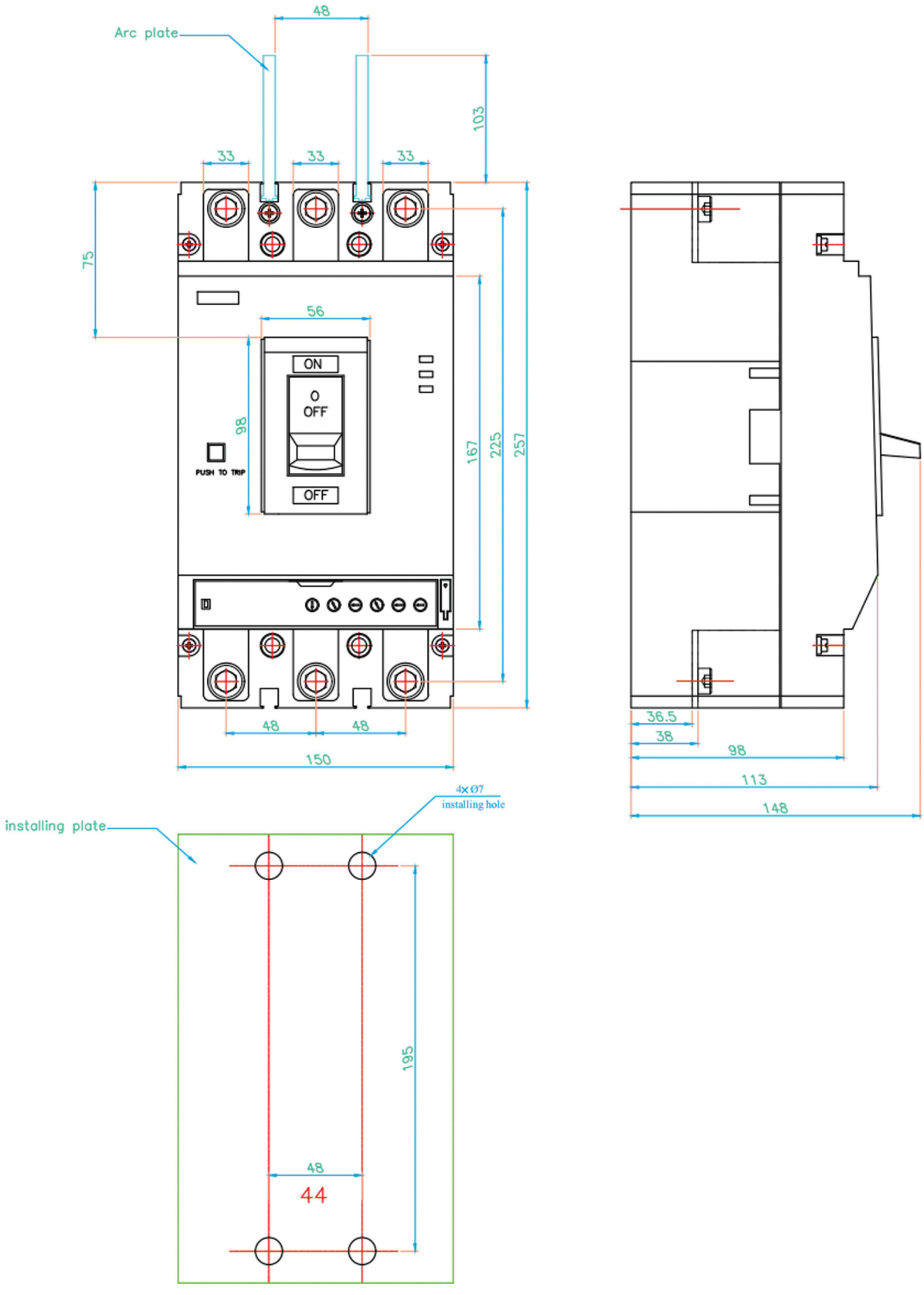
Thermal & Magnetic MCCB 400M
Thermal & Magnetic Adjustable



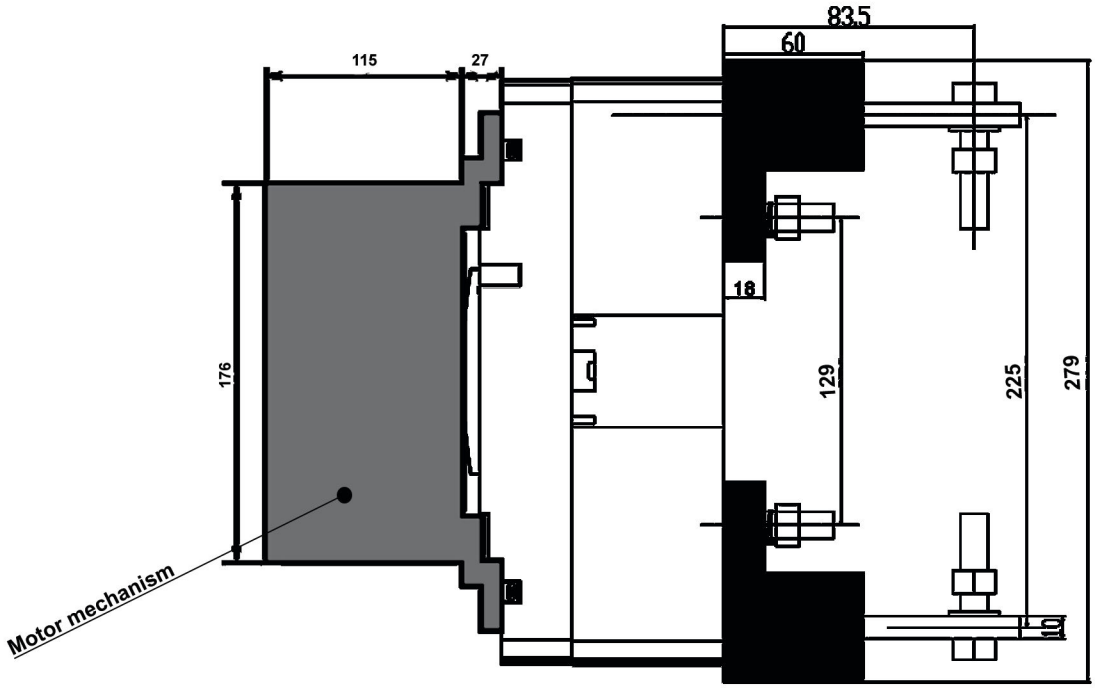


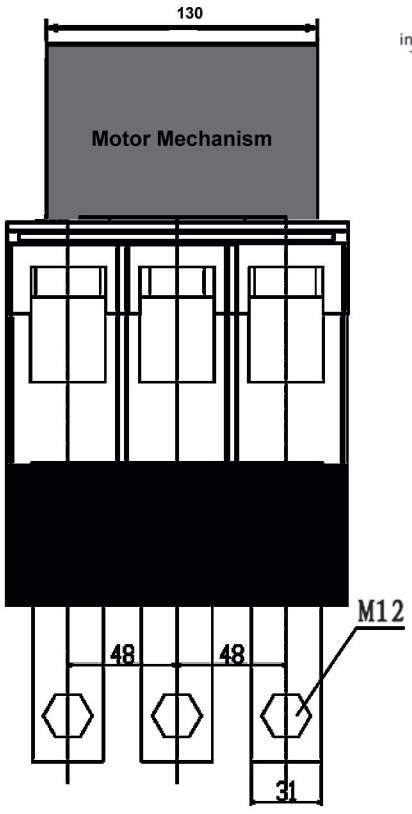


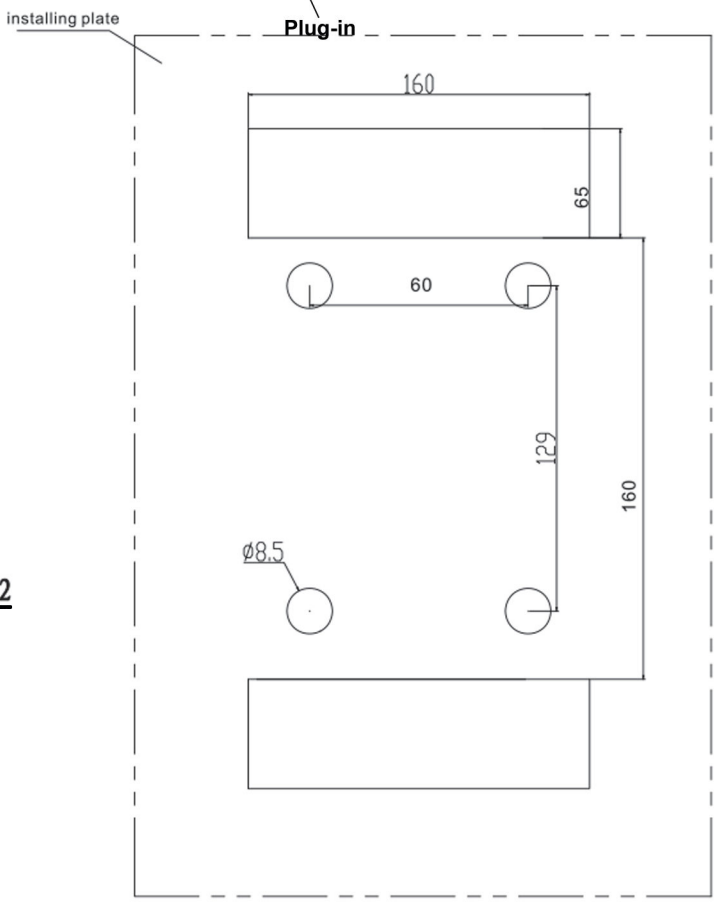
Electronic MCCB 400M



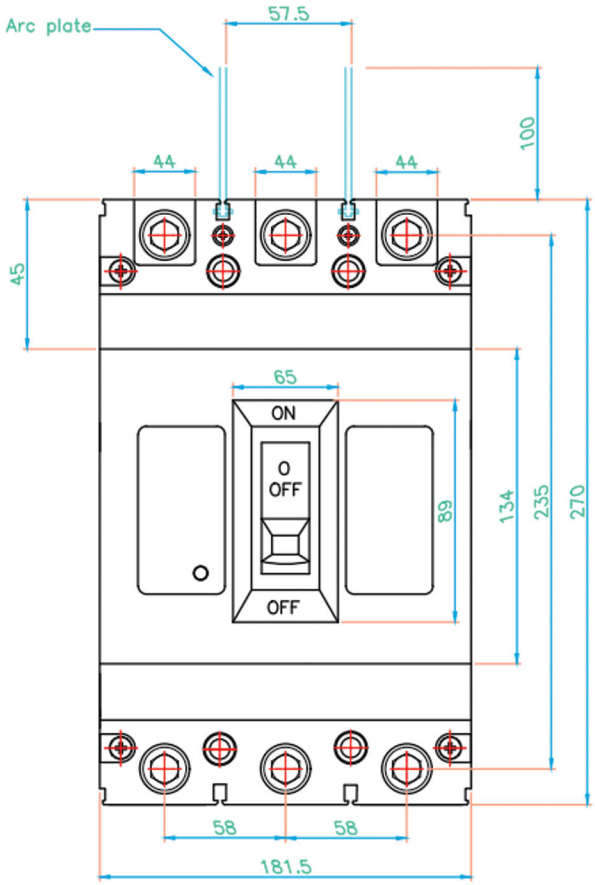
3P, 400M, Plug-in With Motor Mechanism Dimension

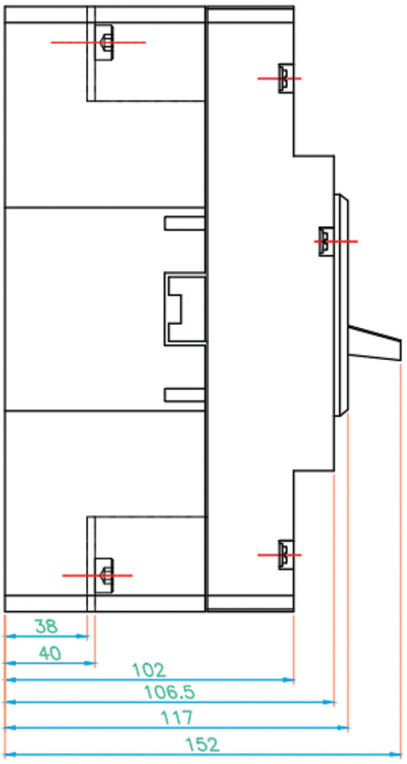


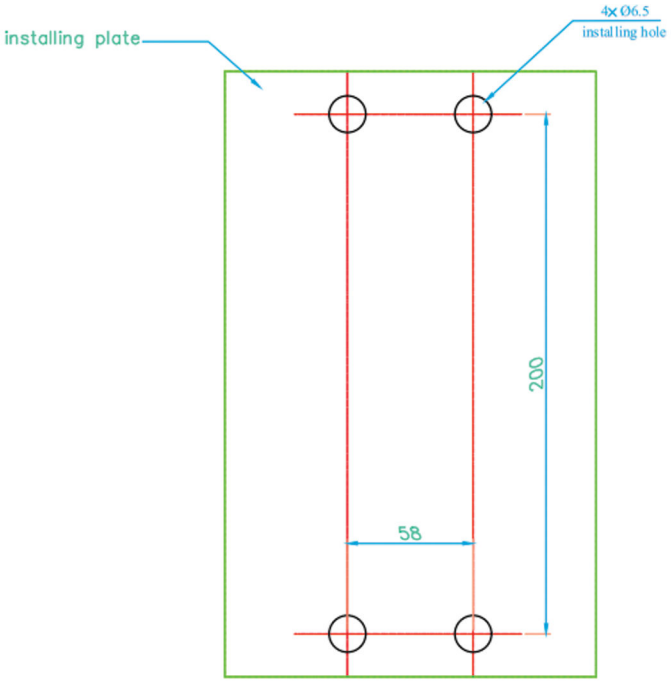




Thermal & Magnetic MCCB 630L
Thermal & Magnetic Fixed







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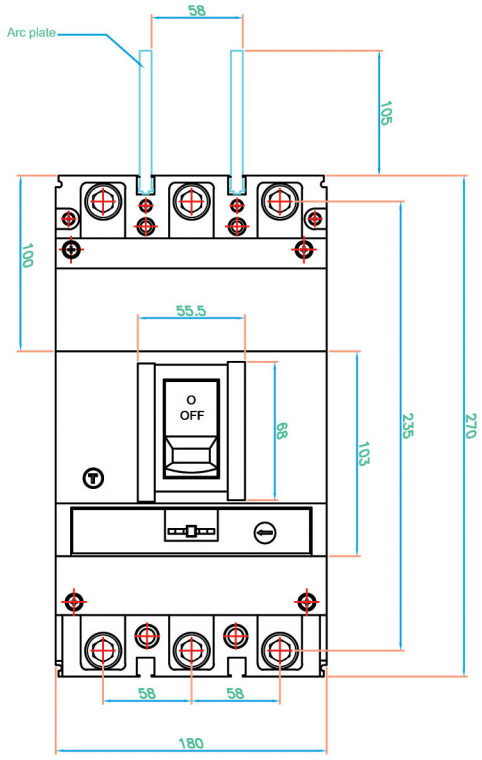

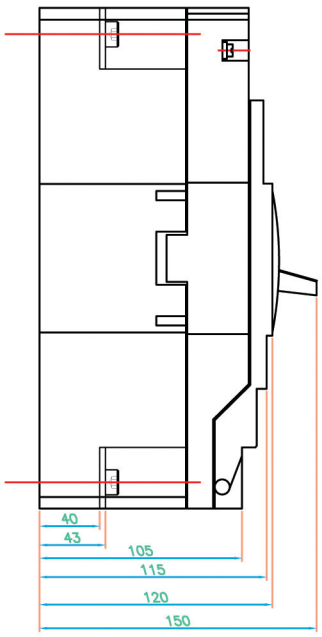

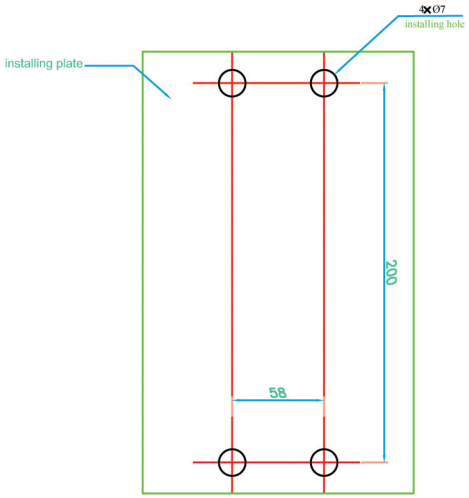

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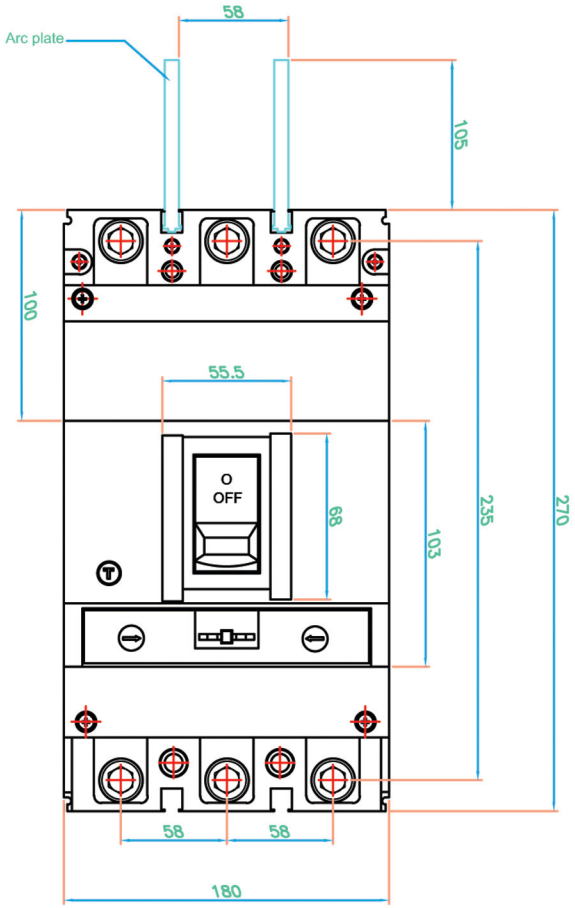
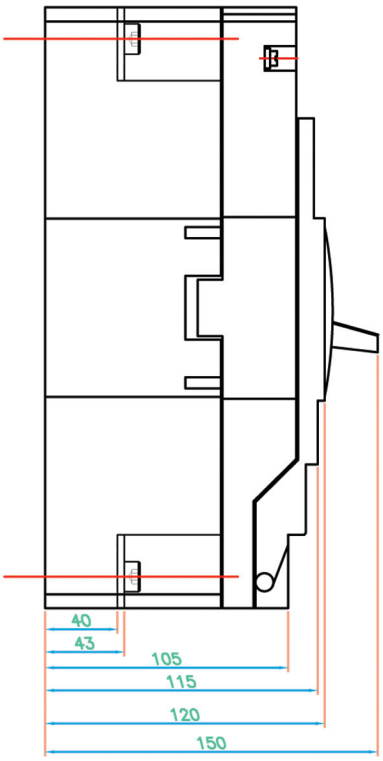
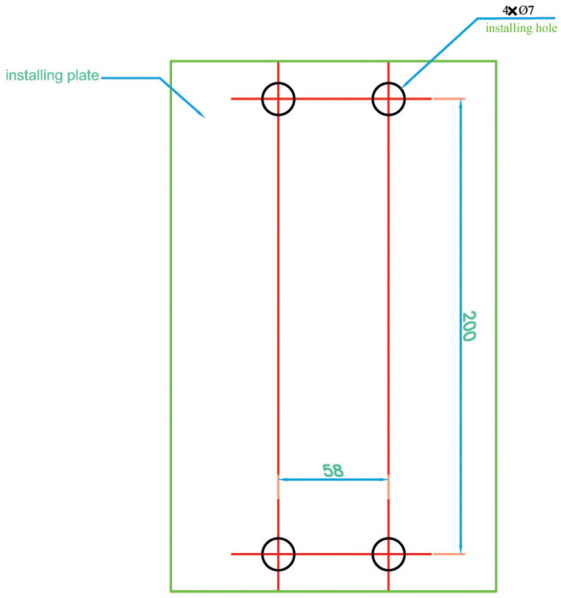
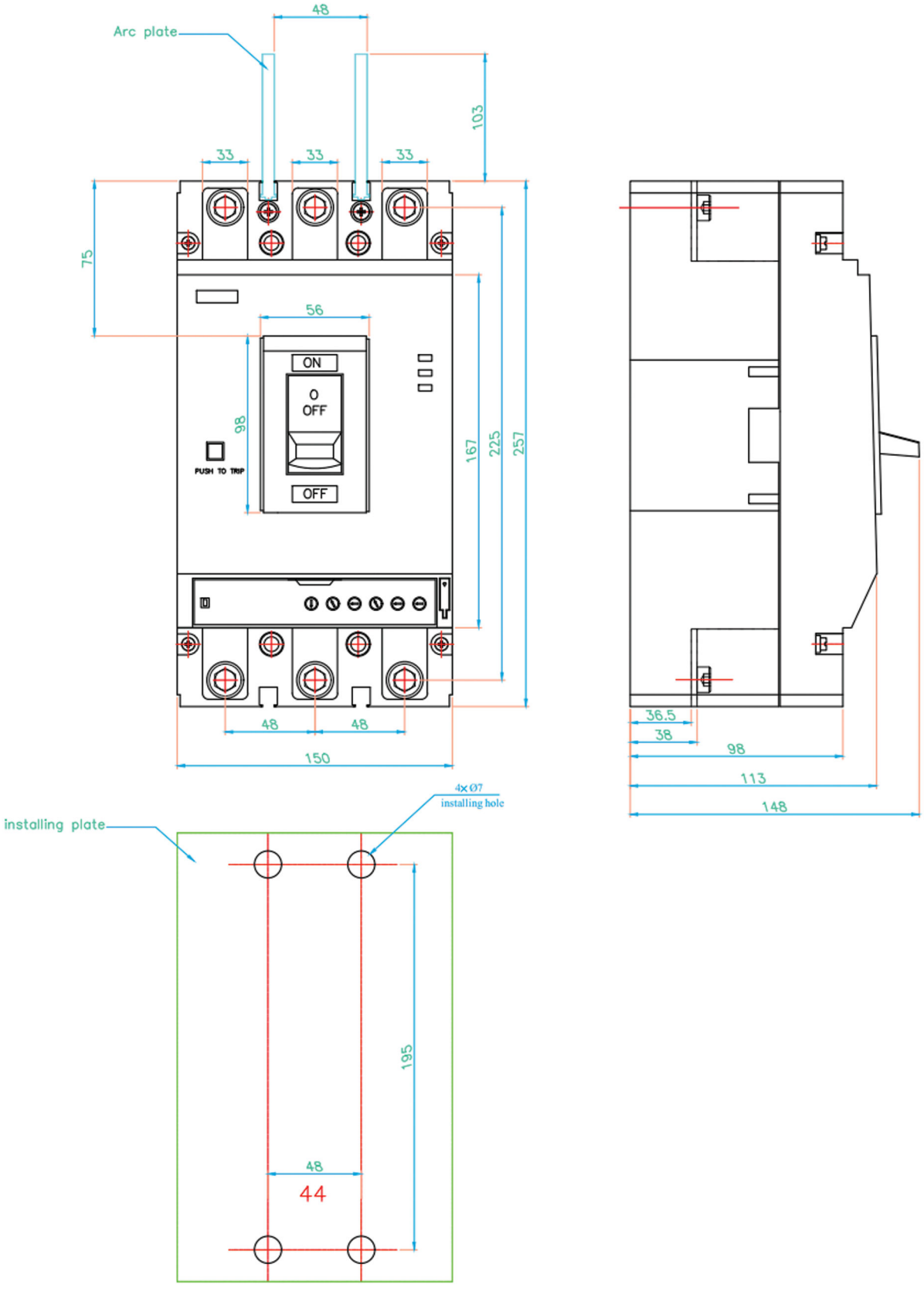


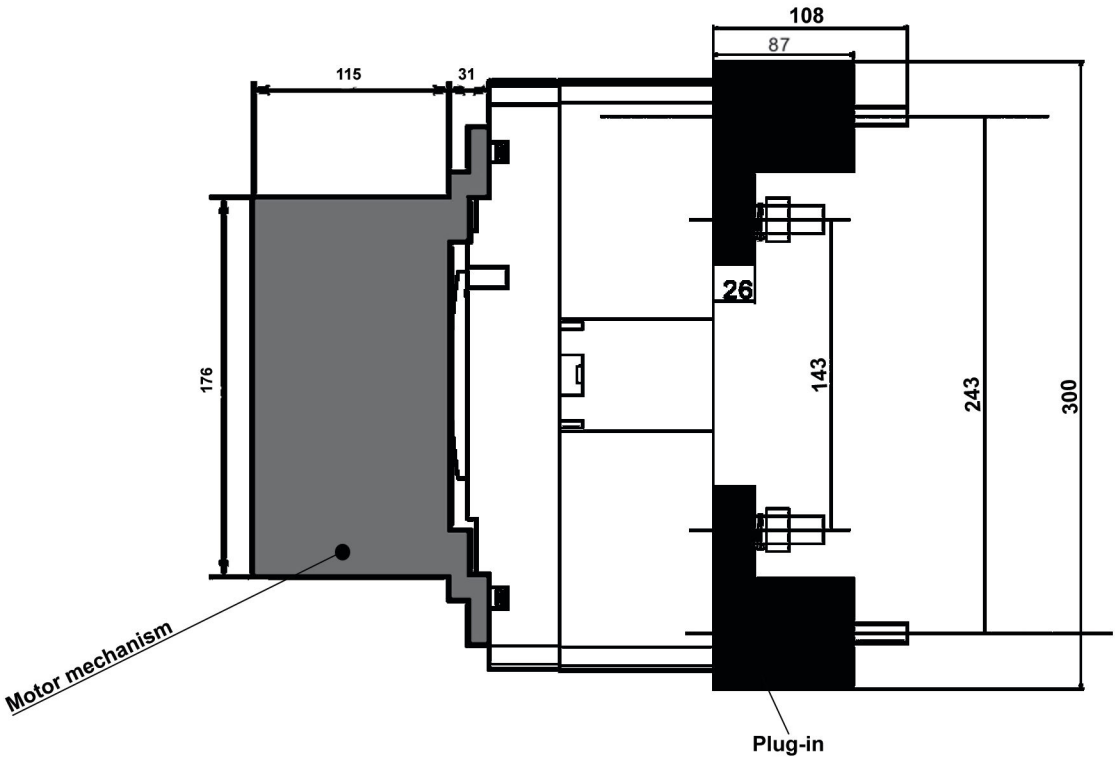


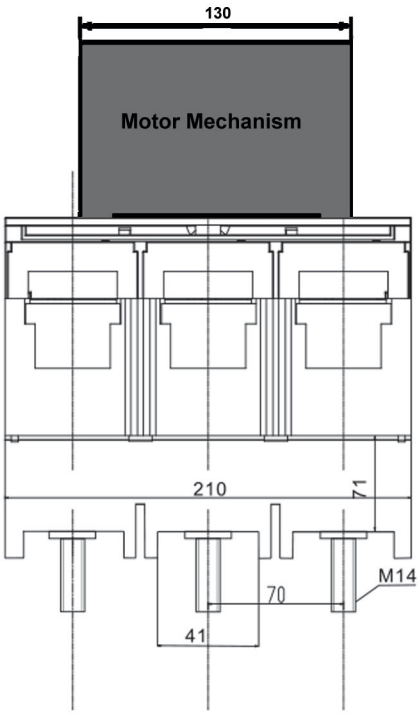


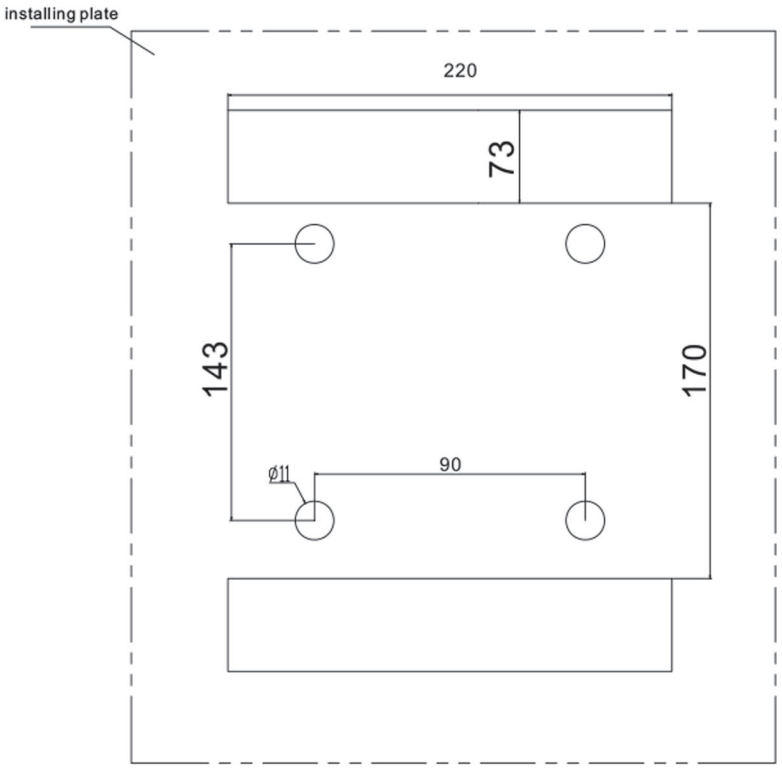
Electronic MCCB 630M



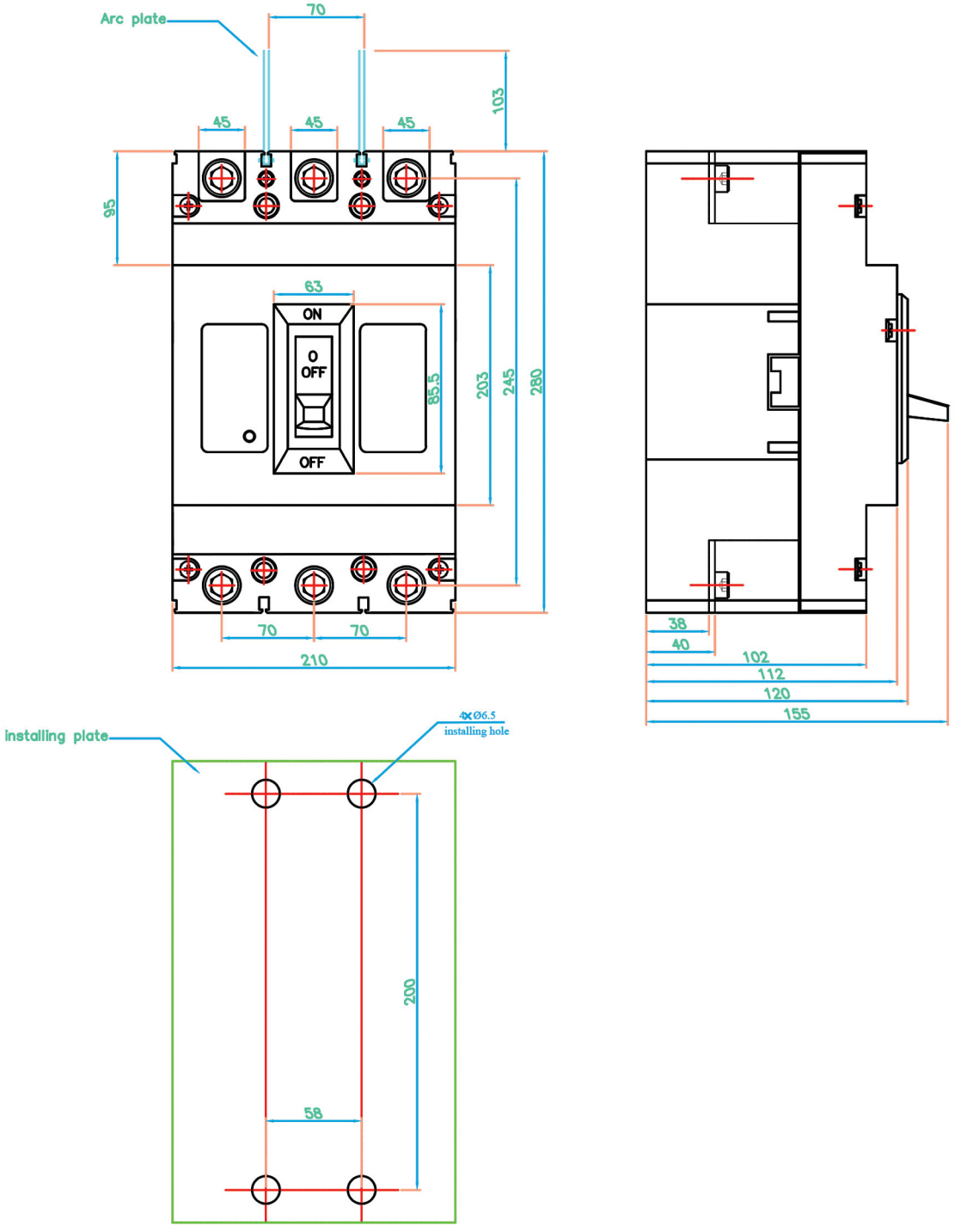
3P, 630M, Plug-in With Motor Mechanism Dimension



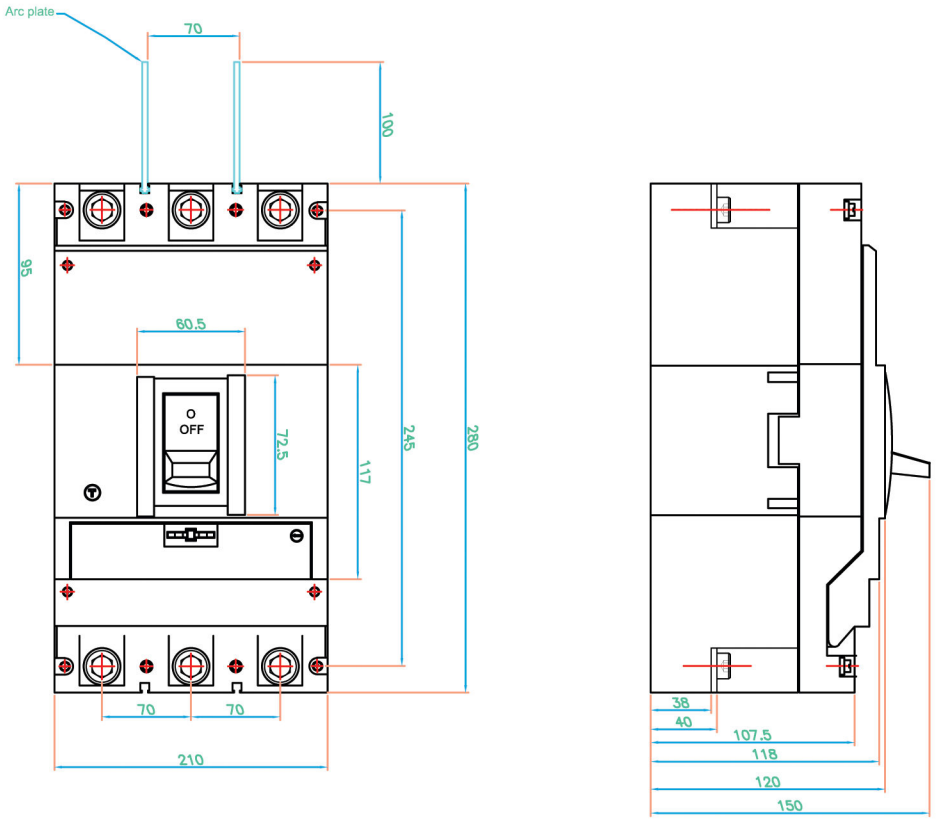


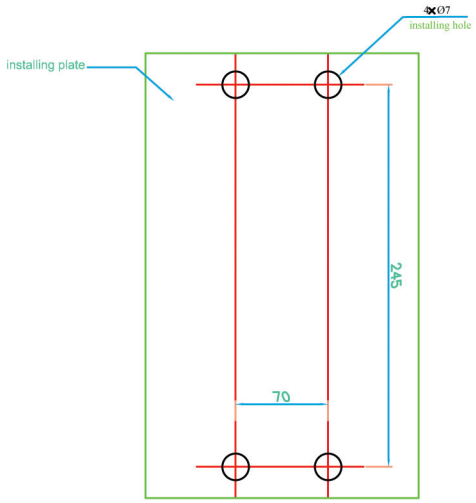


Thermal & Magnetic MCCB 800M
Thermal & Magnetic Fixed



Thermal & Magnetic MCCB 800M
Thermal Adjustable, Magnetic Fixed





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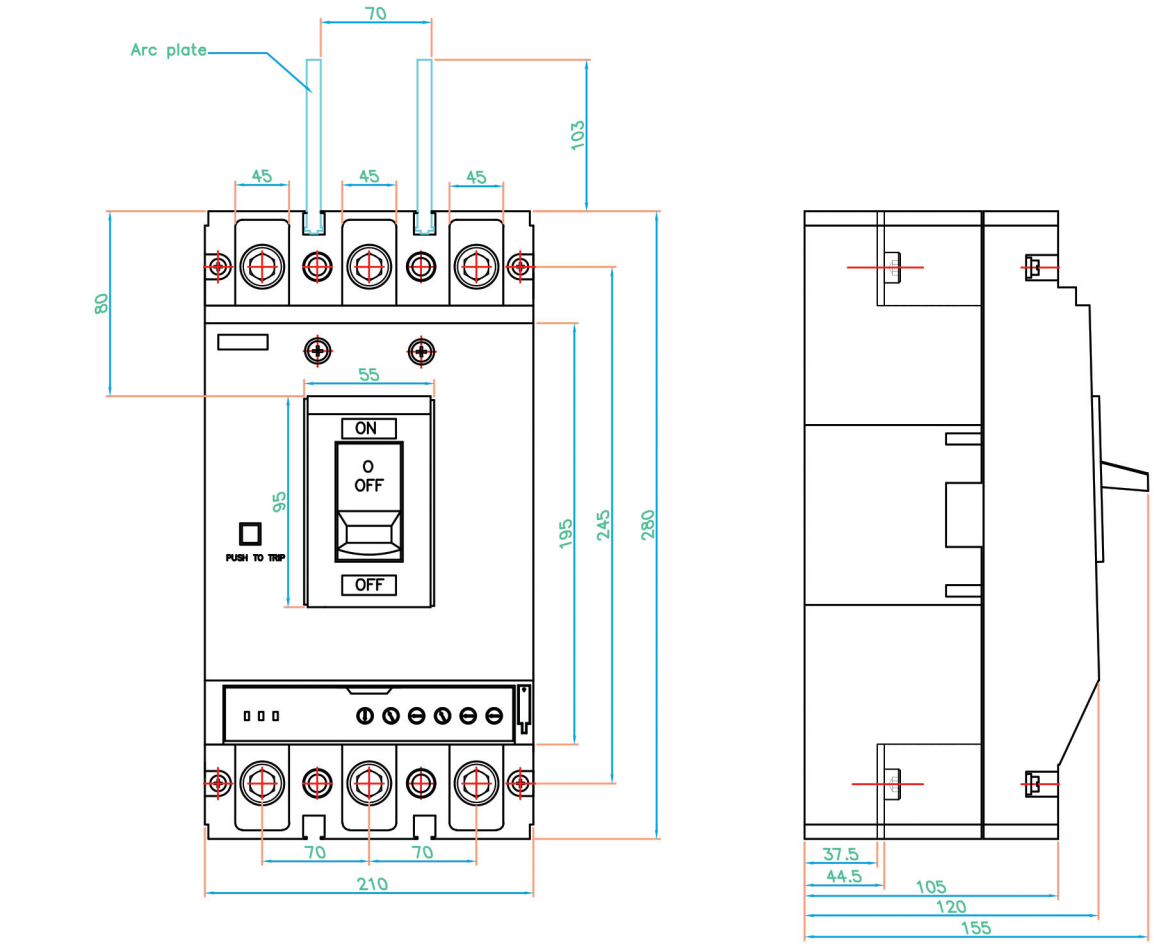
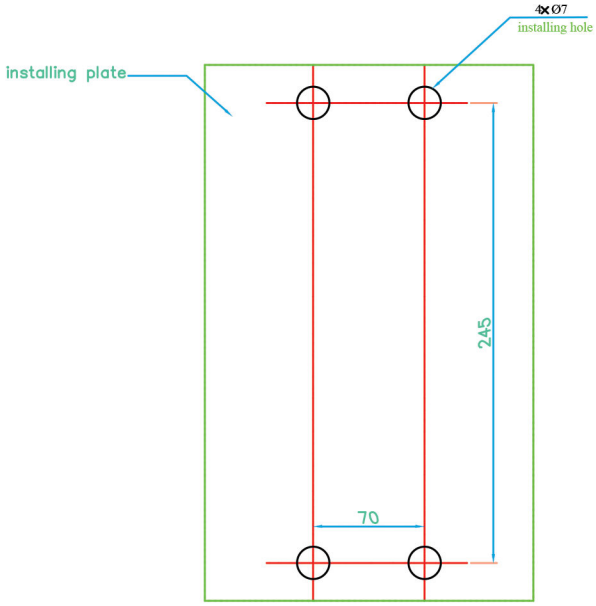
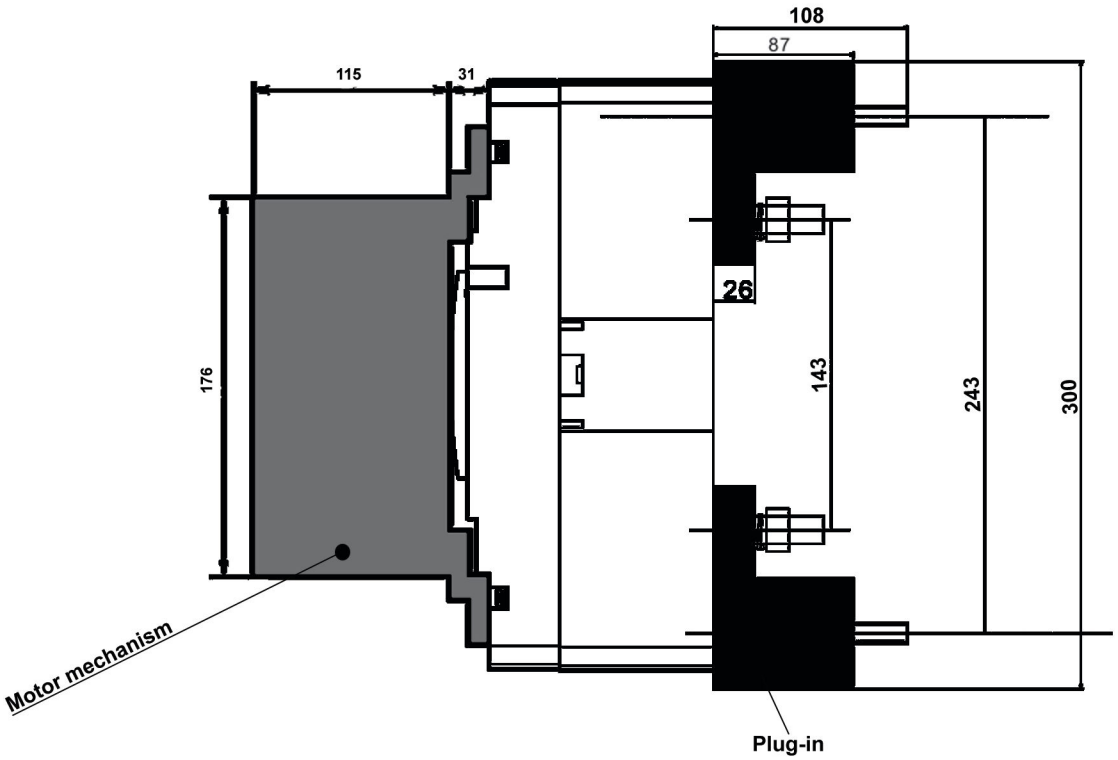
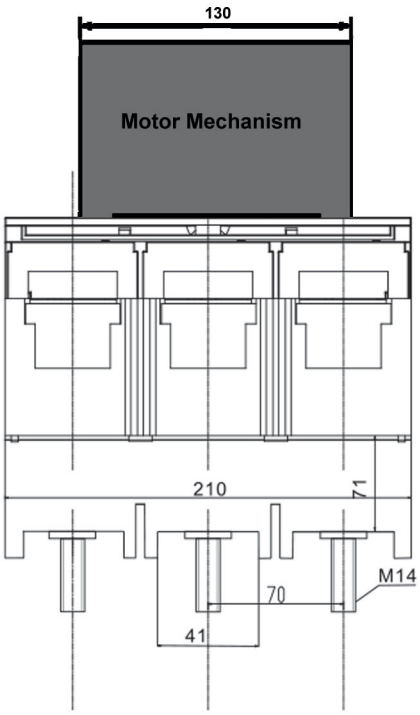
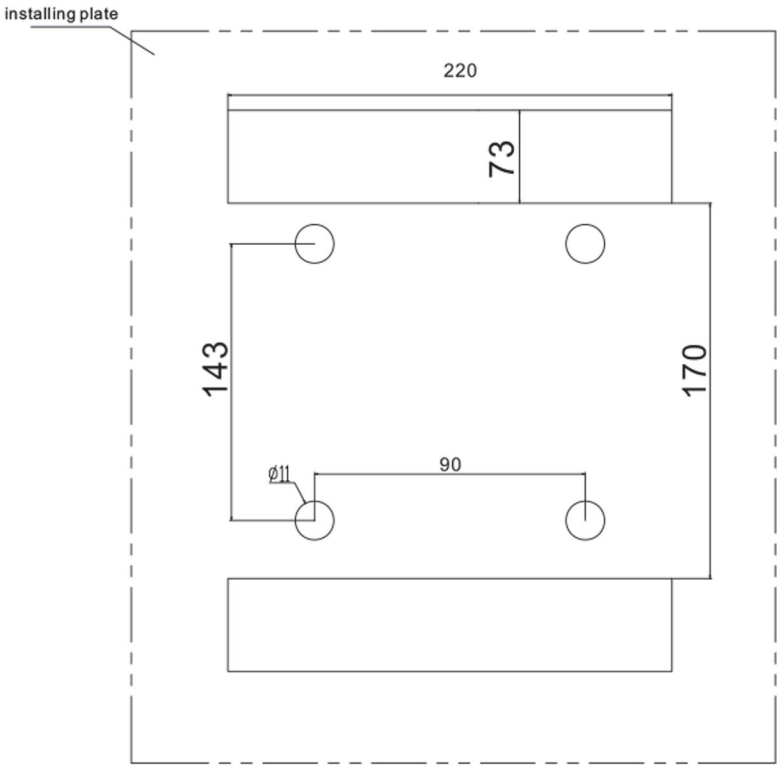




3P, 800M, Plug-in with Motor mechanism Dimension







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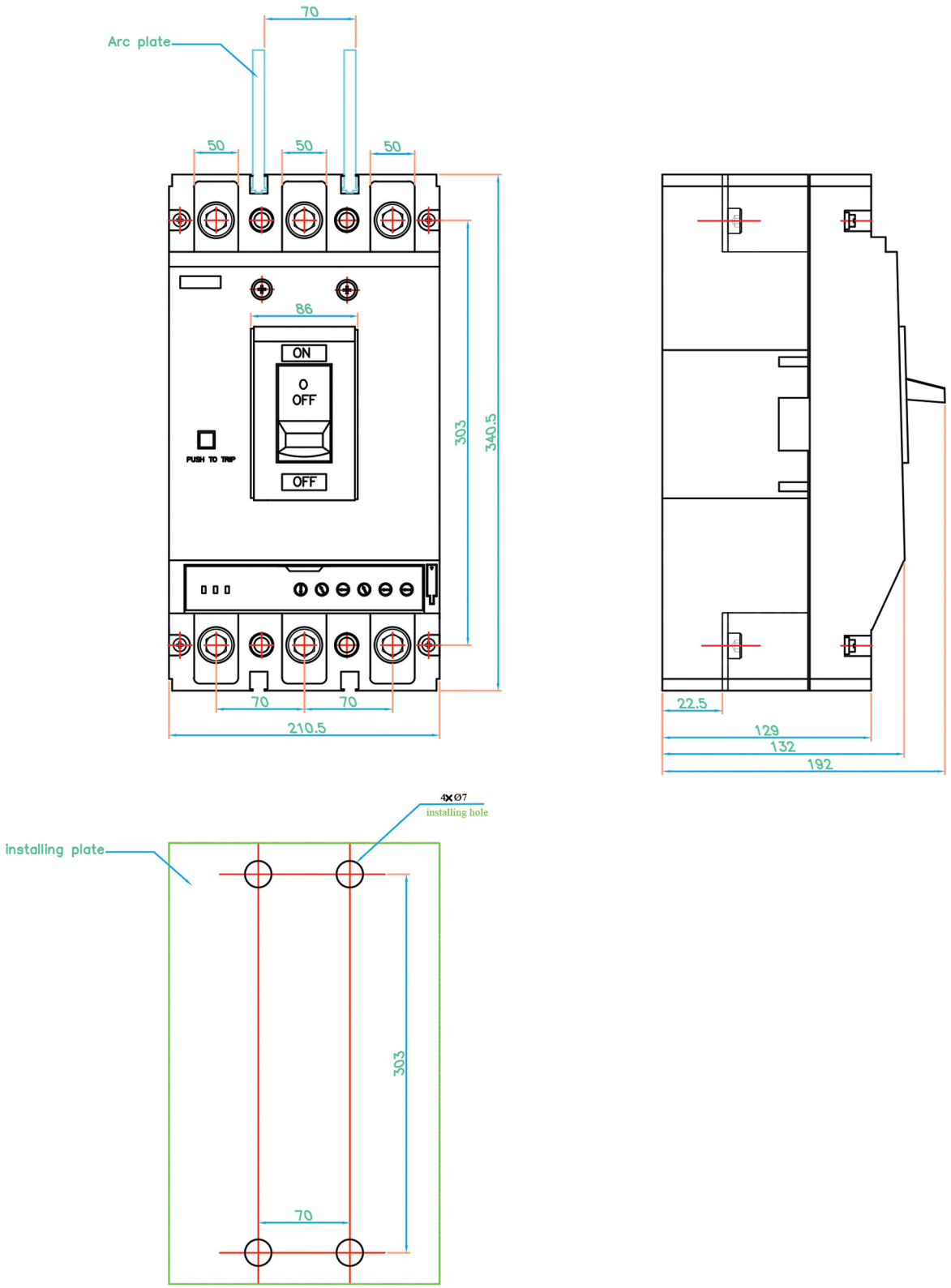
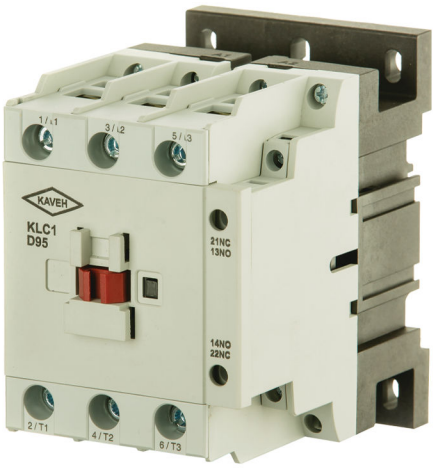


Contactor and Thermal Relay



CONTENTS

General :

Contactors allow remote-control of electrical facilities such as compensation, heating and etc. And in particular, electrical motors via a cable. When they are used with thermal relays, they protect devices and facilities against overload currents. Electrokaveh contactors are manufactured in accordance with IEC 60947-4-1 and ISIRI 4835-4-1 standards. Coil and auxiliary contact blocks can be easily mounted and demounted with primary and auxiliary contacts. Electrokaveh type contactors have three-end coil. In this way, connection flexibility is provided. Coils of the contactors can be controlled safety between 0.8 -1.1 times more of rated coil voltage.They operate with full efficiency between ambient temp. of -5°C ~ +55°C. Contactors capability of being assembled on rail provides great ease during installation. They can resist 1000V voltage in terms of their material composition.

Major features of the contactor:
1-The contactor should bear high current values without being subject to any corruption or boiling. This depends on quality of contactors (contact surface and resource technology). Contactor selection is very important especially in AC-3 class and capacitor control.

2- While the contractor is closed, the current flowing over the contacts causes heating. This heating is limited in standards. According to IEC 60947-4-1, when continuous thermal current (Ith) passes through primary contacts for 8 hours, maximum heat increase in contactor terminals should not exceed 65K.

3- When the contactor breaks the current, it forms an electrical arc between separating contacts. The arc is the electron and ion current detaching from the contact material as a result of thermal impact. Arc temperature reaches thousands of degrees and this is higher than the temperature born by metals and conductors used in manufacture of breaking cells and contacts.
Therefore arc should be terminated as soon as possible. For this purpose , separators are used in contactors.

Acceptable continuous thermal current Ith:
Acceptable thermal current is the highest value of the test current to be used in heat increase test to be carried out in accordance with IEC 60947-4-1 . This test is based on applying current to contact terminals through PVC-insulated copper conductors for 8 hours. In this case, heat change in contactor terminals should not exceed (ΔQ) 65 K.

Closing capacity:
The closing capacity is the current value, which the contactor can successfully close without any damage in contacts. Power factor and frequency of closing are factors affecting the closing capacity. In IEC60947-4-1, for AC3 utilization class; if Ie is the maximum motor operating current; the closing capacity should be 10 x Ie.

Breaking capacity:
The breaking capacity is the current value, which the contactor can successfully break without any damage in contacts and arc extinction cells. As the voltage value increases , the breaking capacity decreases. In IE060947-4-1, for AC3 utilization class; if Ie is the maximum motor operating current; the closing capacity should be 8 x Ie.

Mechanical life:
Maximum number of openings + closings, which can be performed without any maintenance operation by supplying the coil only without passing any current through main poles of the contactor, determines mechanical resistance of the contactor.

Electrical life:
Electrical resistance is the max. number of openings + closings without any maintenance operation while load current passes through poles of the contactor. Electrical resistance is determined as a result of tests carried out on typical currents specified for various utilization classes.
AC1: Resistive load, Closing current = breaking current = Ie
AC3: Squirrel cage asynchronous motors. Closing current = 6Ie (drive), Breaking current = Ie (Ie=In)
AC4: Discrete operation of squirrel cage or ring asynchronous motor and current breaking applications. Closing current = breaking current = 6Ie.

Contactor Selection According to Utilization Classes:
One of the most important points in contactor selection is to understand the load well and to determine instant load characteristic sizes well.

Important selection parameters:
Operating voltage (Ue), operating current (Ie), Coil voltage, current to be broken (Ic), utilization class, operating type and contact life.

Contactor selection for motors:
Important selection parameters in contactor selection for motors;
- Operating voltage (Ue),
- Breaking current while motor is operating = Operating current (Ie),
- Motor start-up current (Ic=m x Ie),
- Start-up frequency (K),
- Operation number.

a. Cage asynchronous motors:
Motor rated power (kW), operating voltage and motor operating type (continuous, discrete, short-term etc.) are taken into consideration. While contactor is selected for motors operated at low power due to reasons such as high environmental temperature or increased safety, danger zone etc.
Motor operating current should be taken into consideration.

b. Ring asynchronous motors:
Separate selections are made for stator and rotor circuits. Selection of stator contactor is made according to Ith thermal current. Important criteria for selection in rotor circuit are operating status (start-up, adjustment), insulation (there is grounding or not), application type (intermediate contactor or final contactor).

c. Contactor selection in driving AC motors:
In direct driving; selection is made in AC3 utilization category according to motor nominal power. In unloaded star-triangle drives, since 1/3 of the motor nominal current shall pass through star contactor, the star contactor is selected at 1/3 of the nominal motor power according to AC3 utilization category. Since energy and triangle contactor is serially connected to motor coils, motor coil current passes through these contactors during operation. Therefore, these contactors are selected at 0.58 times more that is $\sqrt{3}$ of the motor nominal power according to AC3 category.
All the contactors are selected at 0.58 times more that is $\sqrt{3}$ of the motor nominal power according to AC3 category in star-triangle drive of motors under load.

d. Contactor selection for DC current:
Extinction of arc in direct current is more difficult than alternative current. In this selection, time constant L/R of the load is a size as important as load voltage and current.
Load constant (L/R) is approximately 1 ms in non-inductive loads, 7.5 ms in shunt motors, 10 ms in serial motors and 300 ms in electromagnets. Important parameters in inductive DC load switching are voltage, load type (Ohmic or inductive) and switching frequency.

Contactor selection in driving cage asynchronous motors	
Direct drive	Primary contactor current = Ie
Normal star-delta drive	Primary contactor : 0,58 Ie Delta contactor : 0,58 Ie Star contactor : 0,58 Ie Transition contactor : 0,30 Ie
Impedance drive	Primary contactor : Ie Start-up contactor : 0,7 Ie
Auto transformer drive	Primary contactor : Ie Transformer contactor : Ie Star contactor : 0,5 Ie

Contactor selection in direct driving squirrel cage asynchronous motors:

Threephase 380/400V		Thermal relay adjustment area (A)	Suitable KAVEH Contactor
kW	In (A)		
0,37	1,03	1 - 1,6	D0911
0,55	1,6	1,25 - 2	D0911
0,75	2	1,6 - 2,5	D0911
1,1	2,6	2,5 - 4	D0911
1,5	3,5	2,8 - 4	D0911
2,2	5	4,5 - 6,3	D0911
3	6,6	5,5 - 8	D0911
4	8,5	7 - 10	D0911
5,5	11,5	9 - 12,5	D1211
7,5	15,5	14 - 20	D1811
9	18,5	17 - 22	D2511
11	22	20 - 25	D2511
15	30	23 - 32	D3211
18,5	37	30 - 40	D4011
22	44	37 - 50	D5011
30	60	55 - 70	D6511
37	72	63 - 80	D8011
45	85	75 - 105	D9511
55	105	95 - 125	F11510
75	138	100 - 160	F15010
90	170	125 - 200	F22510
110	205	200 - 315	F26510
132	245	200 - 315	F26510
160	300	250 - 400	F33010

Contactor selection in star-triangle driving squirrel cage asynchronous motors:

380/400V		Thermal relay adjustment area (A)	Suitable KAVEH Contactor		
kW	In (A)		Line	Star	Delta
7,5	15,5	7-10	D1211	D1211	D0911
9	18,5	9-12,5	D1211	D1211	D0911
11	22	11-16	D1211	D1211	D0911
15	30	14-20	D1811	D1811	D0911
18,5	37	20-25	D1811	D1811	D0911
22	44	23-32	D3211	D3211	D1811
30	60	30-40	D5011	D4011	D2511
37	72	38-50	D5011	D5011	D3211
45	85	48-57	D5011	D5011	D3211
55	105	57-66	D6511	D6511	D5011
75	138	63-80	D8011	D8011	D5011
90	170	75-105	F15010	F15010	D8011
110	205	100-160	F15010	F15010	D8011
132	245	100-160	F22510	F22510	F15010
160	300	125-200	F22510	F22510	F15010
200	370	200-315	F26510	F26510	F22510
220	408	200-315	F26510	F26510	F22510

e. Ohmic loads:

Ohmic loads are the most problem-free loads for enablement and disablement; because only rated current passes through the contactor. Closing current is equal to breaking current. It should be considered that the heat to be produced shall be higher as the switching frequency increases and calculation should be made by assuming lower rated current of the contactors selected according to AC 1. 2 or 3 poles of 3-phase contactors, which are used for supplying heating circuits that are usually mono-phased, are connected serially. If two poles are serial, rated operating current should be calculated as 1,6 x Ie; if three poles are serial, it should be calculated as 2 x Ie.

f. Compensation applications:

Capacitors cause high frequency (1...5kHz) and high value temporary currents in the circuits they are connected to during start up. Switching of a single capacitor or a capacitor within a group of capacitors has different characteristics.Gradual start-up in group of capacitors is more difficult for the contactor. Because, while the capacitors In group of capacitors start up gradually, a circulating current is formed between parallel capacitor, in addition to drawing current of the battery and it forces the contactor. Therefore, special contactors and combinations have been developed for compensation applications. Where required, shock coil is used to limit the current. Contactors developed for controlling tri-phase capacitors have been developed with limit resistant transition contact blocks limiting the current value at start-up.

g. Illumination facility applications:

Impact voltages and currents,which occur in illumination applications from time to time.may force the contactor It has been classified in terms of type behavior and closing-breaking operation for selection.While contactor is selected for illumination circuits,important factors are bulb type,connection,whether there is compensation or not start-up and operating current and power factor. While the contactor is loaded up to 15 times of the lamp rated current during closing in filament lamps, breaking current is equal to rated current. Compensation is very important in discharge and flo-rescent lamps.In high pressure mercury vapor lamps,a current occurs at two times of the operating current during pre-heating period (approximately 5 minutes).This regime period is about 10 minutes in halogen lamps and sodium vapor lamps.

Contactor failures and impacts:
If the contactors are not used in accordance with the technical data present in the catalogues or if there are failures in the supply network, failures may occur.

Possible disablement reasons of contactors:
In general, contactors are actually devices which are not subject to failures quite easily. If selection has been made correct and if operating conditions are accurate, a contactor may perform millions of safe openings - closings.Below are the failures frequently encountered in contactors and reasons and solutions of these failures.
-Too long control (coil) circuit cables may cause some problems. Whereas significant voltage decrease throughout long cables makes closing difficult, too big section cable capacitance hinders opening.

Connection sections:

Min. and max. connection sections (mm^2)	Primary contact / Auxiliary contact	mm^2	mm^2	mm^2	mm^2	mm
D0911		1...4	1...4 + 1...4	1...6	1...6 + 1...6	8
D1211		1...4	1...4 + 1...4	1...6	1...6 + 1...6	8
D1811		1...2,5	1...2,5 + 1...2,5	1...2,5	1...2,5 + 1...2,5	8
		2...6	1,5...6 + 1,5...6	1,5...6	1,5...6 + 1,5...6	10
D2511		2...10	1,5...6 + 1,5...6	1,5...6	1,5...6 + 1,5...6	10
D3211		1...2,5	1...2,5 + 1...2,5	1...2,5	1...2,5 + 1...2,5	8
		2...10	4...10 + 4...10	1,5...10	2,5...10 + 2,5...10	12
D4011 D5011 D6511		1...2,5	1...2,5 + 1...2,5	1...2,5	1...2,5 + 1...2,5	8
		2,5...25	2,5...16 + 2,5...16	2,5...25	4...16 + 4...16	—
D8011		1...2,5	1...2,5 + 1...2,5	1...2,5	1...2,5 + 1...2,5	8
D9511		4...50	4...35 + 4...35	4...50	16...35 + 16...35	—
F11510 F15010	—	4...95	4...50 + 4...50	4...95	16...50 + 16...50	—
F22510 F26510 F33010	—	4...185	4...95 + 4...95	4...185	4...95 + 4...95	32
F40010	—	—	—	—		38
F50010 F63010	—	—	—	—	—	44

If control cable is longer than the recommended value, it is recommended to utilizea lower coil voltage or to connect a parallel resistance or inductive impedance to the coil.Existence of dust or foreign objects in the contactor, sever atmosphere conditions and corrosion may hinder closing of the contactor especially with remote-control.When such a fault is encountered, the contactor should be cleaned with a strong clean air flow against dust and dirt, housing should be made more closed and protected, the circuit should be checked and any factor corrupting conductivity should be eliminated.
-The contactor coil may burn due to low or high voltage. Voltage regulator should be used in cases where network voltage fluctuates too much. Moreover,dust and foreign objects in air gap facilitate it. When coil is burnt, first voltage and frequency should be checked and a stable control voltage should be ensured.
-Another incident hindering opening other than the capacitive impact is adherence of the contacts. Reason of this adherence might be switching in high current, short circuit or fault in star- delta transition. If there is a short circuit, first of all reason of the short circuit should be found out.

-Incidents causing noisy operation of the contactor are presence of foreign objects such as dust etc. in the air gap, failure of nucleus surface due to long- time operation and inappropriate voltage and frequency. In order to avoid them, nucleus surface should be kept clean and coil should be replaced according to voltage and frequency if required.

Coil replacement:
Screws on both sides of the contactor are removed, top parts are separated, coil in the bottom is pulled out of its slot and new coil is mounted. Top part is placed and contactor is closed. However, attention should be paid to secure the spring during assembly.

Contact life depending on opening current:
Contact melting loss at a particular switch device generally depends on opening current and contact lives are given in diagrams.
The most common area of utilization of the contactors is operation of motors. Different operating types of the motors are classified in IEC 60947-4-1.

Utilization classes of contactor:
Accurate determination of the utilization class and selection in accordance with this class is the most important point for healthy operation of the contactor.
The reason of many failures encountered in application is the failure to make the right selection according to utilization class of contactors.

AC1 class:
It covers the alternative current loads with a power factor at least 0,95.
The most common example of this is heating applications.

a.Contactor utilization classes according to IEC 60947-4-1:

Current type	Utilization category	Area of utilization
Alternative current	AC - 1	Non-inductive or low-inductive loads, resistance furnaces
	AC - 3	Squirrel cage motors, driving, motor stop in operation
	AC - 4	Squirrel cage motors, driving, reversing operation, stepping operation
	AC - 5a	Electrical discharge lamp control mechanism switching
	AC - 6b	Switching of capacitor groups

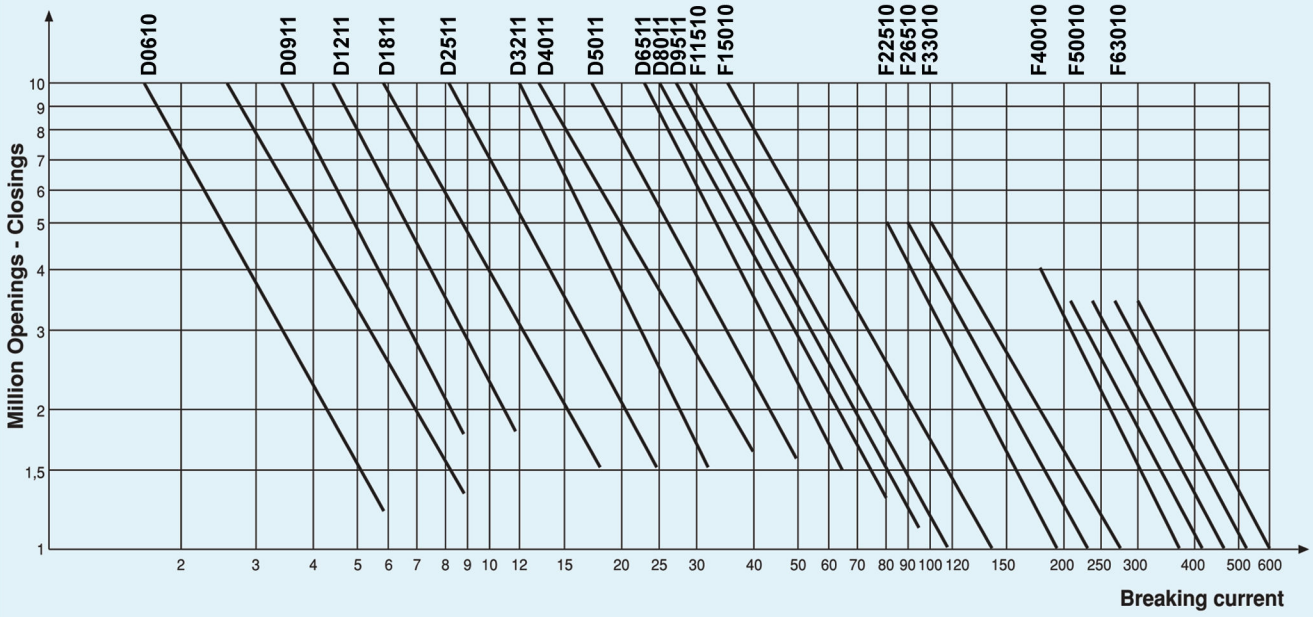


Fig-1 Electrical life values of contactors according to breaking current (Ue£440V, 50Hz for AC-3 class)

AC3 class:
This is the most common application class. It covers cage asynchronous motors disabled while in operation after driving.At closing, motor start-up current which is 5...7 times more than rated current of the motor, passes through the contactor contacts.
At start-up, thecontactor shall break the rated current drawn by the motor.

AC4 class:
This is related to discrete operation and reverse-current braking applications of cage or ring motors. Contactor opens and closes at driving current, which is 5...7 times more than rated current of the motor. Breaking is difficult at low speeds. Sample applications are pressing machines, wire and cabl machines, discrete operating machine tools,metallurgy, lifting, electro valves, couplers etc.

Specifications

	KLC1		D06
Main	Product or component type		AC Contactor
	Product name		KLC1-D
	Contactor application		Motor control
Complementary	Utilisation category		AC-3, AC-5a, AC-4
	Poles description		3P (3 NO)
	[Ue] rated operational voltage	Power circuit: (50/60 Hz)	690V AC
	[Ie] rated operational current	at <= 440V AC AC-3 for power circuit	6 A
	Control circuit type	at 50/60 Hz	AC
	[Uc] control circuit voltage	50/60 Hz	230V AC
	Motor power kW	at 220...230V AC 50/60 Hz AC-3 at 380...440V AC 50/60 Hz AC-3 at 660...690V AC 50/60 Hz AC-3 at 400V AC 50/60 Hz AC-4	1.5 kW 2.2 kW 3 kW 1.5 kW
	Auxiliary contact composition		1 NO or 1 NC
	[Uimp] rated impulse withstand voltage		8 kV
	Overvoltage category		III
	[Ith] conventional free air thermal current (at 50° C)	for power circuit for signalling circuit	10 A 10 A
	Irms rated making capacity conforming to IEC60947	for power circuit for signalling circuit	110 A AC 110 A AC
	Rated breaking capacity conforming to IEC60947	at 415 V at 220...230 V at 660...690 V	110 A 110 A 70 A
	[Icw] rated short-time withstand current	50 °C - 1 s for power circuit	90 A
	Associated fuse rating	at a 440 V for power circuit for signalling circuit conforming to IEC 60947	15 A gG 10 A gG
	Average impedance	Ith 10 A 50 Hz for power circuit	2 mOhm
	[Ui] rated insulation voltage	Power circuit: conforming to IEC 60947-4-1 Signalling circuit: conforming to IEC 60947-4-1 Signalling circuit: conforming to IEC 60947-5-1	690 V 690 V 690 V
	Insulation resistance	for signalling circuit	> 10 MOhm
	Inrush power in VA		30 VA (at 20 °C)
	Hold-in power consumption in VA		4.5 VA (at 20 °C)
	Control circuit voltage limits (at <50 °C)	Operational: Drop-out:	0.8...1.15 Uc 0.2...0.75 Uc
	Connections - terminals Screw clamp terminals	1 cable(s) solid 1 cable(s) flexible without cable end 1 cable(s) flexible with cable end 2 cable(s) solid 2 cable(s) flexible without cable end 2 cable(s) flexible with cable end	1.5...4 mm² 0.75...4 mm² 0.34...2.5 mm² 1.5...4 mm² 0.75...4 mm² 0.34...1.5 mm²
	Maximum operating rate		3600 Mcycles
	Electrical durability	at 660...690 V comforming to IEC 60947 at Ue <= 440 V	70 A 1.3 Mcycles 6 A AC-3
	Dimensions (mm)		58 x 45 x 57
	Heat dissipation		1.3 W
Environment	IP degree of protection	conforming to VDE 0106 / ISIRI 3134 / IEC60695	IP2x
	Ambient air temperature for storage		-50...80 °C
	Operating altitude (without derating)		2000 m
	Flame retardance (conforming to UL 94)		V1

Contactor and Thermal Relay





D911	D1211	D1811	D2511	D3211
AC Contactor	AC Contactor	AC Contactor	AC Contactor	AC Contactor
KLC1-D	KLC1-D	KLC1-D	KLC1-D	KLC1-D
	Motor control & Resistive load			
	AC-3,AC-5a,AC-4,AC-1,AC-5b			
3P (3 NO)	3P (3 NO)	3P (3 NO)	3P (3 NO)	3P (3 NO)
690V AC / 300 DC	690V AC / 300 DC	690V AC / 300 DC	690V AC / 300 DC	690V AC / 300 DC
9A AC-3 / 20A AC-1	12A AC-3 / 25A AC-1	18A AC-3 / 32A AC-1	25A AC-3 / 40A AC-1	32A AC-3 / 50A AC-1
AC	AC	AC	AC	AC
230V AC	230V AC	230V AC	230V AC	230V AC
2.2 kW 4 kW 5.5 kW 2.2 kW	3 kW 5.5 kW 7.5 kW 3 kW	4 kW 9 kW 10 kW 4 kW	5.5 kW 11 kW 15 kW 5.5 kW	7.5 kW 15 kW 18.5 kW 7.5 kW
1 NO + 1 NC	1 NO + 1 NC	1 NO + 1 NC	1 NO + 1 NC	1 NO + 1 NC
6 kV	6 kV	6 kV	6 kV	6 kV
III	III	III	III	III
20 A 10 A	25 A 10 A	32 A 10 A	40 A 10 A	50 A 10 A
200 A AC 140 A AC / 200 A DC	250 A AC 140 A AC / 250 A DC	300A AC 140A AC / 250A DC	450A AC 140A AC / 250A DC	550A AC 140A AC / 250A DC
200 A 200 A 140A	250 A 250 A 140A	300A 300A 140A	450A	550A
210 A	210 A	240 A	380 A	430 A
10 A gG 20 A gG	10 A gG 25 A gG	10A gG 35A gG	10A gG 40A gG	10A gG 63A gG
2.0 mOhm	2.5 mOhm	2.5 mOhm	2.0 mOhm	2.0 mOhm
690 V 690 V	690 V 690 V	690 V 690 V	690 V 690 V	690 V 690 V
> 10 MOhm	> 10 MOhm	> 10 MOhm	> 10 MOhm	> 10 MOhm
70VA	70 VA	70 VA	70 VA	70 VA
7.5VA 60Hz / 7VA 50Hz	7.5VA 60Hz / 7VA 50Hz	7.5VA 60Hz / 7VA 50Hz	7.5VA 60Hz / 7VA 50Hz	7.5VA 60Hz / 7VA 50Hz
0.8...1.1 Uc 0.3...0.6 Uc	0.8...1.1 Uc 0.3...0.6 Uc	0.8...1.1 Uc 0.3...0.6 Uc	0.8...1.1 Uc 0.3...0.6 Uc	0.8...1.1 Uc 0.3...0.6 Uc
1...4 mm^2 1...4 mm^2 1...4 mm^2 1...4 mm^2 1...4 mm^2 1...2.5 mm^2	1...4 mm^2 1...4 mm^2 1...4 mm^2 1...4 mm^2 1...4 mm^2 1...2.5 mm^2	1.5...6 mm^2 1.5...6 mm^2 1...6 mm^2 1...6 mm^2 1.5...6 mm^2 1...4 mm^2	1.5...10 mm^2 2.5...10 mm^2 1...10 mm^2 2.5...10 mm^2 2.5...10 mm^2 1.5...6 mm^2	1.5...10 mm^2 2.5...10 mm^2 1...10 mm^2 2.5...10 mm^2 2.5...10 mm^2 1.5...6 mm^2
3600 cyc/h	3600 cyc/h	3600 cyc/h	3600 cyc/h	3600 cyc/h
0.6 Mcycles 20A AC-1 2 Mcycles 9A AC-3	0.8 Mcycles 25A AC-1 2 Mcycles 12A AC-3	1.0 Mcycles 25A AC-1 1.6 Mcycles 18A AC-3	1.4 Mcycles 40A AC-1 1.65 Mcycles 25A AC-3	1.65 Mcycles 32A AC-1 1.4 Mcycles 50A AC-3
77 x 45 x 86	77 x 45 x 86	77 x 45 x 86	78 x 45 x 92	78 x 45 x 92
2...3 W	2...3 W	2...3 W	2...3 W	2...3 W
IP20	IP20	IP20	IP20	IP20
-60...80 °C	-60...80 °C	-60...80 °C	-60...80 °C	-60...80 °C
0...3000 m	0...3000 m	0...3000 m	0...3000 m	0...3000 m
850 °C	850 °C	850 °C	850 °C	850 °C

Specifications

	KLC1		D4011
Main	Product or component type		AC Contactor
	Product name		KLC1-D
	Contactor application		Motor control & Resistive load
Complementary	Utilisation category		AC-3, AC-5a, AC-4, Ac-1,Ac-5b
	Poles description		3P (3 NO)
	[Ue] rated operational voltage	Power circuit: (50/60 Hz)	690V AC/ 300V DC
	[Ie] rated operational current	at <= 440V AC AC-3 for power circuit	40A AC-3 / 65A AC-1
	Control circuit type	at 50/60 Hz	AC
	[Uc] control circuit voltage	50/60 Hz	220V AC
	Motor power kW	at 220...230V AC 50/60 Hz (AC-3) (AC-3e) at 380...440V AC 50/60 Hz (AC-3) (AC-3e) at 660...690V AC 50/60 Hz (AC-3) (AC-3e)	11 kW 22 kW 30 kW
	Auxiliary contact composition		1 NO + 1 NC
	[Uimp] rated impulse withstand voltage		8 kV
	Overvoltage category		III
	[Ith] conventional free air thermal current	for power circuit for signalling circuit	65 A (at 50 °C) 10 A (at 50 °C)
	Irms rated making capacity conforming to IEC60947	for power circuit for signalling circuit	800 A AC 140 A AC / 250 A DC
	Rated breaking capacity conforming to IEC60947	at 415 V at 220...230 V at 660...690 V	650 A 800 A 140 A
	[Icw] rated short-time withstand current	50 °C - 1 s for power circuit	480 A
	Associated fuse rating	at <=690 V coordination type 2 for power circuit for signalling circuit conforming to IEC 60947	80 A gG 10 A gG
	Average impedance	Ith 40 A 50 Hz for power circuit	2 mOhm
	[Ui] rated insulation voltage	Power circuit: conforming to IEC 60947-4-1 Signalling circuit: conforming to IEC 60947-4-1 Signalling circuit: conforming to IEC 60947-5-1	690 V 690 V 690 V
	Insulation resistance	for signalling circuit	> 10 MOhm
	Inrush power in VA (at 20 °C)		70 VA (at 20 °C)
	Hold-in power consumption in VA(at 20 °C)		7.5 VA 60Hz / 7 VA 50Hz
	Control circuit voltage limits (at <50 °C)	Operational: Drop-out:	0.8...1.1 Uc 0.3...0.6 Uc
	Connections - terminals Screw damp terminals	1 cable(s) solid 1 cable(s) flexible without cable end 1 cable(s) flexible with cable end 2 cable(s) solid 2 cable(s) flexible without cable end 2 cable(s) flexible with cable end	2.5...25 mm² 2.5...25 mm² 2.5...25 mm² 2.5...16 mm² 2.5...16 mm² 2.5...10 mm²
	Maximum operating rate		3600 cyc/h 60 °C
	Electrical durability	at Ue <= 440 V at Ue <= 440 V	1.4 Mcycles 40 A AC-3 1.65 Mcycles 65 A AC-1
	Dimensions (mm)		75 x 126 x 120
	Heat dissipation		4...5 W
Environment	IP degree of protection	conforming to VDE 0106 / ISIRI 3134 / IEC60695	IP20
	Ambient air temperature for storage		-60...80 °C
	Operating altitude (without derating)		0...3000 m
	Flame retardance (conforming to UL 94)		850 °C

Contactor and Thermal Relay




D5011	D6511	D8011	D9511
AC Contactor	AC Contactor	AC Contactor	AC Contactor
KLC1-D	KLC1-D	KLC1-D	KLC1-D
	Motor control & Resistive load		
	AC-3,AC-5a,AC-4,AC-1,AC-5b		
3P (3 NO)	3P (3 NO)	3P (3 NO)	3P (3 NO)
690V AC / 300 DC	690V AC / 300 DC	690V AC / 300 DC	1000V AC 25...400 Hz
50 A AC-3e / 80A AC-1	65A AC-3e /80A AC-1	80A AC-3e / 125A AC-1	95A AC-3e / 125A AC-1
AC	AC	AC	AC
220V AC	220V AC	220V AC	220V AC
15 kW 25 kW 33 kW	18.5 kW 30 kW 37 kW	22 kW 45 kW 45 kW	25 kW 45 kW 45 kW
1 NO + 1 NC	1 NO + 1 NC	1 NO + 1 NC	1 NO + 1 NC
8 kV	8 kV	8 kV	8 kV
III	III	III	III
80 A (at 60 °C) 10 A (at 60 °C)	80 A (at 60 °C) 10 A (at 60 °C)	125 A (at 60 °C) 10 A (at 60 °C)	125 A (at 60 °C) 10 A (at 60 °C)
900 A AC 140 A AC / 250 A DC	1000 A 140 A AC	1100 A (at 440 V) 140A AC / 250A DC	1100A AC 140A AC / 250A DC
900 A - -	1000 A at 440 V	1100 A (at 440 V)	1100A (at 440 V)
600 A	780 A (at 40 °C)	990 A (at 40 °C)	1100 A
100 A gG 10 A gG	100 A gG 10 A gG	160A gG 10A gG	160A gG 10A gG
2.0 mOhm	2 mOhm	0.8 mOhm - Ith125 A	0.8 mOhm
690 V 690 V	690 V 690 V	1000 V 690 V	1000 V 690 V
> 10 MOhm	> 10 MOhm	> 10 MOhm	> 10 MOhm
140VA 60Hz/160VA 50Hz	140VA 60Hz/160VA 50Hz	245 VA 60Hz/245 VA 50Hz	245 VA 60Hz/245 VA 50Hz
13VA 60Hz / 15VA 50Hz	13VA 60Hz / 15VA 50Hz	26 VA 60Hz / 26 VA 50Hz	26 VA 60Hz / 26 VA 50Hz
0.8...1.1 Uc 0.3...0.6 Uc	0.8...1.1 Uc 0.3...0.6 Uc	0.8...1.1 Uc 0.3...0.6 Uc	0.8...1.1 Uc 0.3...0.6 Uc
2.5...25 mm^2 2.5...25 mm^2 2.5...25 mm^2 2.5...16 mm^2 2.5...16 mm^2 2.5...10 mm^2	2.5...25 mm^2 2.5...25 mm^2 2.5...25 mm^2 2.5...16 mm^2 2.5...16 mm^2 2.5...10 mm^2	- 4...50 mm^2 4...50 mm^2 - 4...25 mm^2 4...16 mm^2	- 4...50 mm^2 4...50 mm^2 - 4...25 mm^2 4...16 mm^2
3600 cyc/h 60°C	3600 cyc/h 60°C	3600 cyc/h 60°C	3600 cyc/h 60°C
1.65 Mcycles 80A AC-1 1.4 Mcycles 50A AC-3 &AC-3e	1.0 Mcycles 80A AC-1 0.8 Mcycles 65A AC-3 &AC-3e	0.8 Mcycles 125A AC-1 1.5 Mcycles 80A AC-3	1.3 Mcycles 125A AC-1 1.2 Mcycles 95A AC-3
75x 126 x 120	75 x 126 x 120	75 x 126 x 130	75 x 126 x 130
4...5 W	2...3 W	6...10 W	6...10 W
IP20	IP20	IP20	IP20
-60...80 °C	-60...80 °C	-60...80 °C	-60...80 °C
0...3000 m	0...3000 m	0...3000 m	0...3000 m
850 °C	850 °C	850 °C	850 °C

Specifications

	KLC1		F11510
Main	Product or component type		AC Contactor
	Product name		KLC1-F
	Contactor application		Motor control Resistive load
Complementary	Utilisation category		AC-3, AC-5a, AC-4,AC-1, AC-5b
	Poles description		3P (3 NO)
	[Ue] rated operational voltage	Power circuit: (50/60 Hz)	<= 1000 V AC, <= 250 V DC
	[Ie] rated operational current	at <= 440V for power circuit	200 A(at 40 °C) AC-1 /115 A 55°C AC-3
	Control circuit type	at 50/60 Hz	AC
	[Uc] control circuit voltage	50/60 Hz	220V AC
	Motor power kW	at 220...230V AC 50/60 Hz (AC-3) (AC-3e) at 380...440V AC 50/60 Hz (AC-3) (AC-3e) at 660...690V AC 50/60 Hz (AC-3) (AC-3e)	30 kW 59 kW 80 kW
	Auxiliary contact composition		1 NO
	[Uimp] rated impulse withstand voltage		8 kV
	Overvoltage category		III
	[Ith] conventional free air thermal current (at 40° C)	for power circuit	200 A
	Irms rated making capacity conforming to IEC60947	for power circuit	1150 V at 440 V
	Rated breaking capacity conforming to IEC60947	at 440 V	920 A
	[Icw] rated short-time withstand current	40 °C - 10 s for power circuit	1100 A
	Associated fuse rating	CB (65 KA <= 480 V AC, 50KA <=600 V AC) gG/J V AC 600=<	200A 200A
	Average impedance	50 Hz for power circuit	0.37 mOhm (Ith 200 A)
	[Ui] rated insulation voltage		1000V IEC 60947-4-1
	Power dissipation per pole	AC-1 / AC-3	15 W / 5W
	Inrush power in VA	40...400Hz cos phi 0.9(at 20 °C) with LX1 coil	590...855 VA
	Hold-in power consumption in VA		4.5 VA (at 20 °C)
	Control circuit voltage limits (at <50 °C)	Operational: Drop-out:	0.85...1.1 Uc 0.2...0.55 Uc
	Connections - terminals Screw clamp terminals	power ciruit lugs-ring terminal power ciruit bar	1 x 95mm² 2 x 20 x 3mm
	Maximum operating rate		2400 cyc/h 60 °C
	Mechanical durability		10 Mcycles
	Dimensions (mm)		162 x 163.5 x 171
	Heat dissipation		5.9...7.2 W / 2.2...5.5 W
Environment	IP degree of protection	front face with shrouds IEC 60529	IP2x
	Ambient air temperature for storage		-60...80 °C
	Operating altitude (without derating)		3000 m
	Flame retardance (conforming to UL 94)		850 °C

Contactor and Thermal Relay




F15010	F18510	F22510	F26510
AC Contactor	AC Contactor	AC Contactor	AC Contactor
KLC1-F	KLC1-F	KLC1-F	KLC1-F
	Motor control & Resistive load		
	AC-3,AC-5a,AC-4,AC-1,AC-5b		AC-3,AC-4,AC-1
3P (3 NO)	3P (3 NO)	3P (3 NO)	3P (3 NO)
	<= 1000 V AC ,<= 250 V		<= 1000 V AC ,<= 460 V
150A AC-3 / 250A AC-1	185A AC-3 / 275A AC-1	225A AC-3 / 315A AC-1	265A AC-3 / 350A AC-1
AC	AC	AC	AC
220V AC	220V AC	220V AC	220V AC
40 kW 80 kW 100 kW	55 kW 100 kW 110 kW	63 kW 110 kW 129 kW	75 kW 140 kW 160 kW
1 NO	1 NO	1 NO	1 NO
8 kV	8 kV	8 kV	8 kV
III	III	III	III
250 A	275 A	315 A	350 A
1500 A (at 440 V)	1850 A (at 440 V)	2250 A (at 440 V)	2650 A (at 440 V)
1200 A	1480 A	1800 A	2120 A
1200 A	1500 A	1800 A	2200 A
250 A CB 250 A gG/J	275 A CB 315 A gG/J	315 A CB 315 A gG/J	315 A aM 400 A gG
0.35 mOhm (Ith 250 A)	0.33 mOhm (Ith 275 A)	0.32 mOhm (Ith 315 A)	0.3 mOhm (Ith 350 A)
1000 V	1000 V	1000 V	1000 V
22W / 8W	25W / 12W	32W / 16W	37W / 21W
690...855 VA	950...1180 VA	950...1180 VA	600...700 VA
6.6...8.1 VA	8.9...10.9 VA	8.9...10.9 VA	8...10 VA
0.85...1.1 Uc AC 0.2...0.55 Uc AC	0.85...1.1 Uc AC 0.2...0.55 Uc AC	0.85...1.1 Uc AC 0.2...0.55 Uc AC	0.85...1.1 Uc AC 0.35...0.55 Uc AC
1 x 95 mm^2 2 x 20 x 3 mm	150 mm^2 25 x 3 mm	185 mm^2 30 x 4 mm	240 mm^2 32 x 4 mm
2400 cyc/h	2400 cyc/h	2400 cyc/h	2400 cyc/h
10 Mcycles	10 Mcycles	10 Mcycles	10 Mcycles
162 x 163.5 x 171	174 x 168.5 x 181	197x 168.5 x 181	203 x 201.5 x 213
5.9...7.2W /2.2...5.5W	8...9.8W /2.2...5.5W	8...9.8 W / 2.2...5.5 W	8 W /2.2...2.5 W
IP2x	IP2x	IP2x	IP20
-60...80 °C	-60...80 °C	-60...80 °C	-60...80 °C
3000 m	3000 m	3000 m	3000 m
850 °C	850 °C	850 °C	850 °C

Specifications

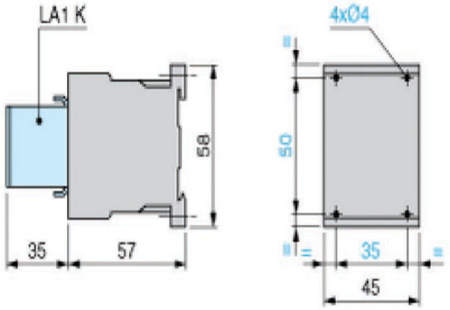
	KLC1		F33010
Main	Product or component type		AC Contactor
	Product name		KLC1-F
	Contactor application		Motor control & Resistive load
Complementary	Utilisation category		AC-3,AC-1, AC-4
	Poles description		3P (3 NO)
	[Ue] rated operational voltage	Power circuit: (50/60 Hz)	<= 1000 V AC, <= 460 V DC
	[Ie] rated operational current	at <= 440V for power circuit/(at <40 °C)	330A AC-3 / 400A
	Control circuit type	at 50/60 Hz	AC
	[Uc] control circuit voltage	50/60 Hz	220V AC
	Motor power kW	at 220...230V AC 50/60 Hz (AC-3) at 380...400V AC 50/60 Hz (AC-3) at 660...690V AC 50/60 Hz (AC-3)	100 kW 160 kW 220 kW
	Auxiliary contact composition		1 NO
			8 kV
	Overvoltage category		III
	[Ith] conventional free air thermal current (at 40° C)	for power circuit (at 40 °C)	400 A
	Irms rated making capacity conforming to IEC60947	for power circuit (at 440 V)	3300 A AC
	Rated breaking capacity conforming to IEC60947		2640 A
	[Icw] rated short-time withstand current	40 °C - 10 s for power circuit	2650 A
	Associated fuse rating	at <=440 V	400 A aM 500 A gG
	Average impedance	50 Hz for power circuit	0.28 mOhm (Ith 400 A)
	[Ui] rated insulation voltage		1000V
	Power dissipation per pole	AC-1 / AC-3	44W / 31W
	Inrush power in VA	40...400Hz cos phi 0.9(at 20 °C) with LX1 coil	600...700 VA
	Hold-in power consumption in VA		8...10 VA
	Control circuit voltage limits (at <50 °C)	Operational: Drop-out:	0.85...1.1 Uc 0.35...0.55 Uc
	Connections - terminals Screw clamp terminals	power ciruit lugs-ring terminal power ciruit bar	240 mm² 2 x 30 x 5 mm
	Maximum operating rate	at 55 °C	2400 cyc/h 55 °C
	Mechanical durability		10 Mcycles
	Dimensions (mm)		206 x 213 x 219
	Heat dissipation		8 W / 2.2...5.5W
Environment	IP degree of protection	front face with shrouds IEC 60529	IP20
	Ambient air temperature for storage		-60...80 °C
	Operating altitude (without derating)		3000 m
	Flame retardance (conforming to UL 94)		850 °C

Contactor and Thermal Relay

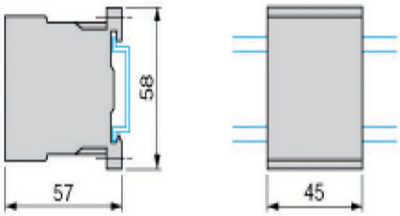
F40010	F50010	F63010
AC Contactor	AC Contactor	AC Contactor
KLC1-F	KLC1-F	KLC1-F
		Motor control & Resistive load
		AC-4,AC-1,AC-3
3P (3 NO)	3P (3 NO)	3P (3 NO)
<= 1000 V AC ,<= 460 V DC	<= 1000 V AC ,<= 460 V DC	<= 1000 V AC ,<= 460 V
500 A AC-1 /400 A	150A AC-3 / 250A AC-1	630A AC-3 / 1000A AC-1
AC	AC	AC
220V AC	220V AC	220V AC
110 kW 200 kW 280 kW	147kW 250 kW 335 kW	200 kW 335 kW 450 kW
1 NO	1 NO	1 NO
8 kV	8 kV	8 kV
III	III	III
500 A	700 A	1000 A
4000 A AC	5000 A AC	6300 A AC
3200 A	4000 A	5040 A
3600 A	4200 A	5050 A
400 A aM 500 A gG	500 A aM 800 A gG	630 A aM 1000 A gG
0.26 mOhm (Ith 500 A)	0.18 mOhm (Ith 700 A)	0.12 mOhm (Ith 1000 A)
1000V	1000 V	1000 V
65W / 42W	88W / 45W	120W / 48W
1000...1150 VA	1050...1150 VA	1500...1730 VA
12...18 VA	16...20 VA	20...25 VA
0.85...1.1 Uc 0.2...0.55 Uc	0.85...1.1 Uc AC 0.3...0.5 Uc AC	0.85...1.1 Uc AC 0.25...0.5 Uc AC
1 x 95mm² 2 x 20 x 3mm	240 mm² 40 x 5 mm	- 2 x 60 x 5 mm
2400 cyc/h	2400 cyc/h	1200 cyc/h
10 Mcycles	10 Mcycles	5 Mcycles
206 x 213 x 219	238 x 233 x 232	304 x 309 x 255
14W / 2.2...5.5W	18W	20W
IP20	IP20	IP20
-60...80 °C	-60...80 °C	-60...80 °C
3000 m	3000 m	3000 m
850 °C	850 °C	850 °C

Dimensions

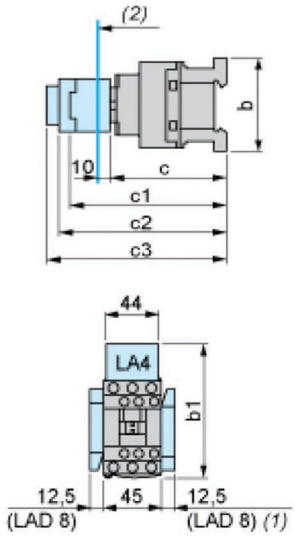
Mounting on Panel



Mounting on Rail (35 mm)



KLC1-D006 contactor - 3poles - AC3
<= 440V AC / 6A - 1NO or 1NC aux
220 / 230V AC coil
Height : 58mm
Width : 45mm
Depth : 57mm

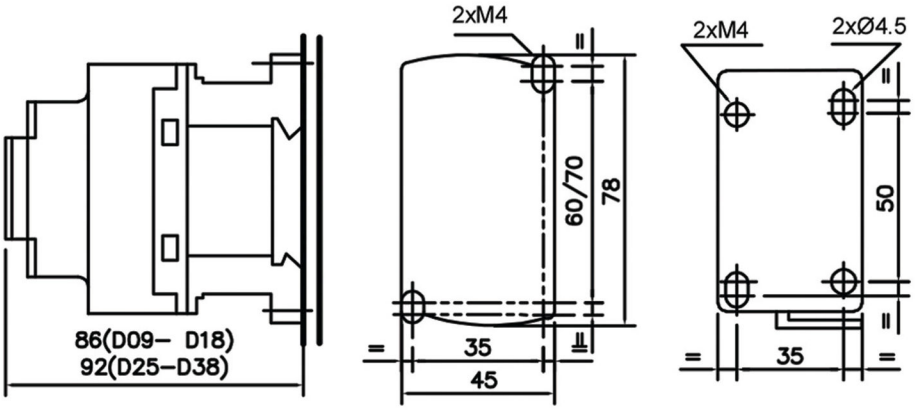


(1) Including LAD 4BB
(2) Minimum electrical clearance

LC1		D09…D18
b	without add-on blocks	77
b1	with LAD 4BB	94
	with LA4 D•2	110(1)
	with LA4 DF, DT	119(1)
	with LA4 DW, DL	126(1)
c	without cover or add-on blocks	84
	with cover, without add-on blocks	86
c1	with LAD N or C (2 or 4 contacts)	117
c2	with LA6 DK10, LAD 6K10	129
c3	with LAD T, R, S	137
	with LAD T, R, S and sealing cover	141
(1)	Including LAD 4BB.	

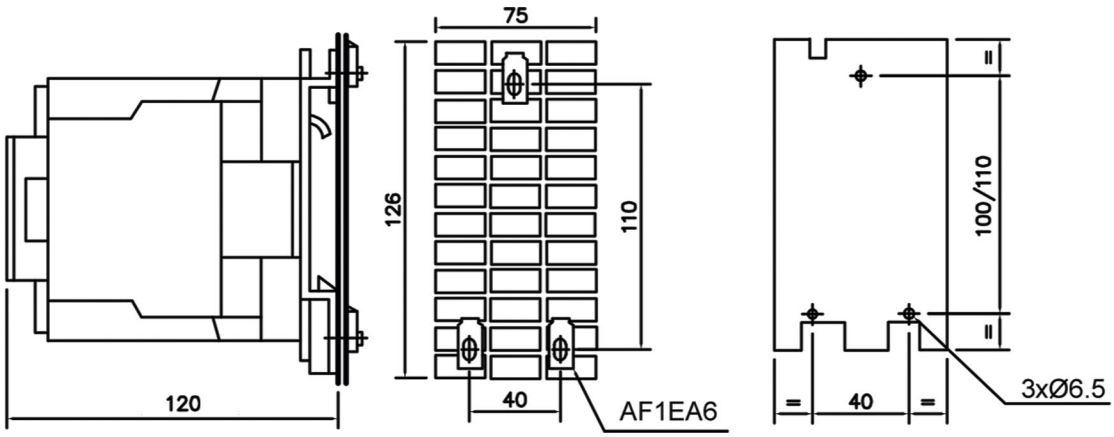
KLC1-D09...D18 contactor - 3poles - AC3
<= 440V AC / 9A...18A - 1NO + 1NC aux
220 / 230V AC coil
Height : 77mm
Width : 45mm
Depth : 86mm

Contactor and Thermal Relay



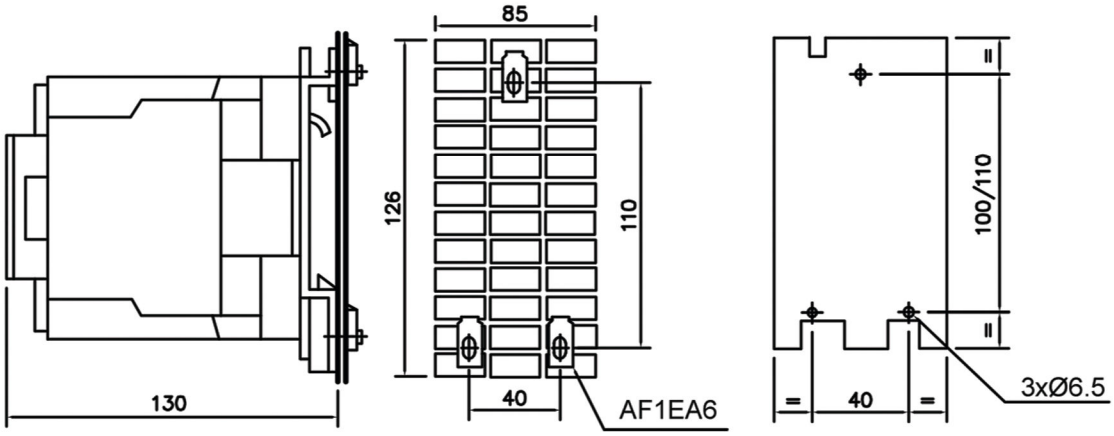
KLC1-D25
KLC1-D32

KLC1-D25,D32 contactor - 3poles - AC3
<= 440V AC / 25A , 32A - 1NO + 1NC aux
220 / 230V AC coil
Height : 77mm
Width : 45mm
Depth : 86mm



KLC1-D40
KLC1-D50
KLC1-D65

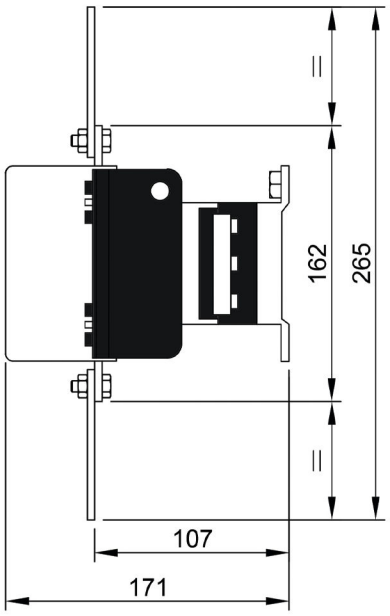
KLC1-D40,D50,D65 contactor - 3poles - AC3
<= 440V AC /40A , 50A , 65A - 1NO + 1NC aux
220 / 230V AC coil
Height : 77mm
Width : 45mm
Depth : 86mm

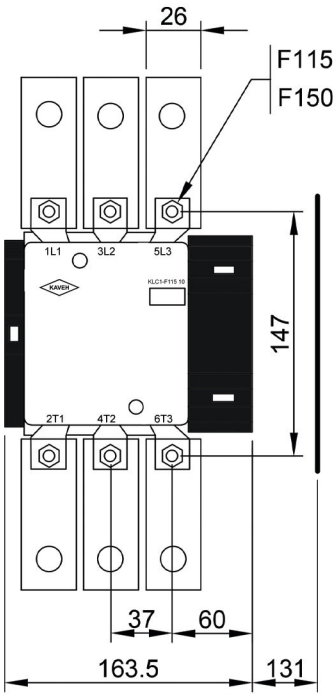


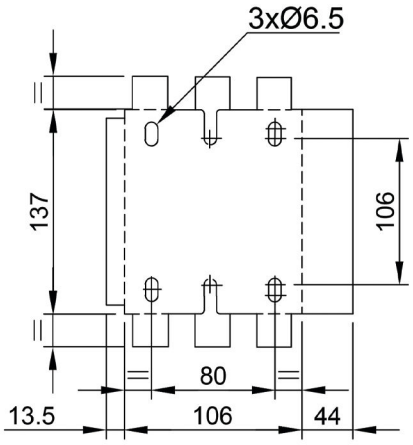
KLC1-D80
KLC1-D95

KLC1-D80,D95 contactor - 3poles - AC3
<= 440V AC /80A , 95A - 1NO + 1NC aux
220 / 230V AC coil
Height : 75mm
Width : 126mm
Depth : 130mm

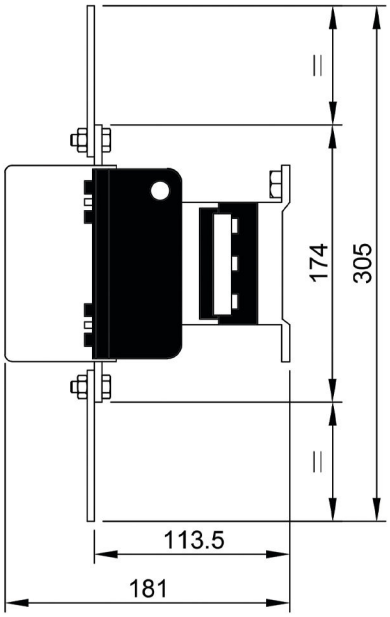
Contactor and Thermal Relay

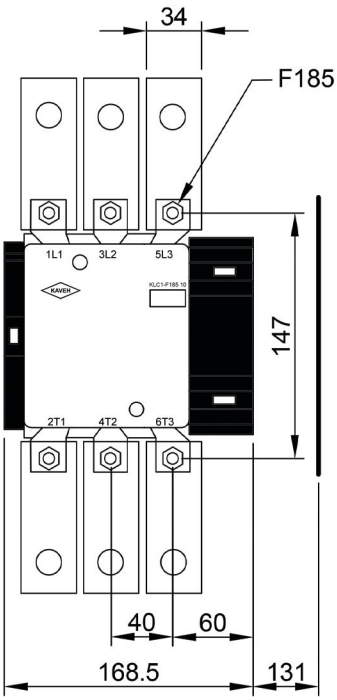


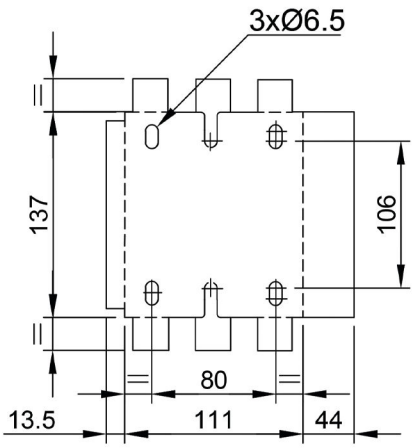




KLC1-F115 / 150 contactor - 3poles - AC3
<=440V AC / 115A , 150A - 1NO auxiliary
220 / 230V AC coil
Height : 162mm
Width : 163.5mm
Depth :171mm

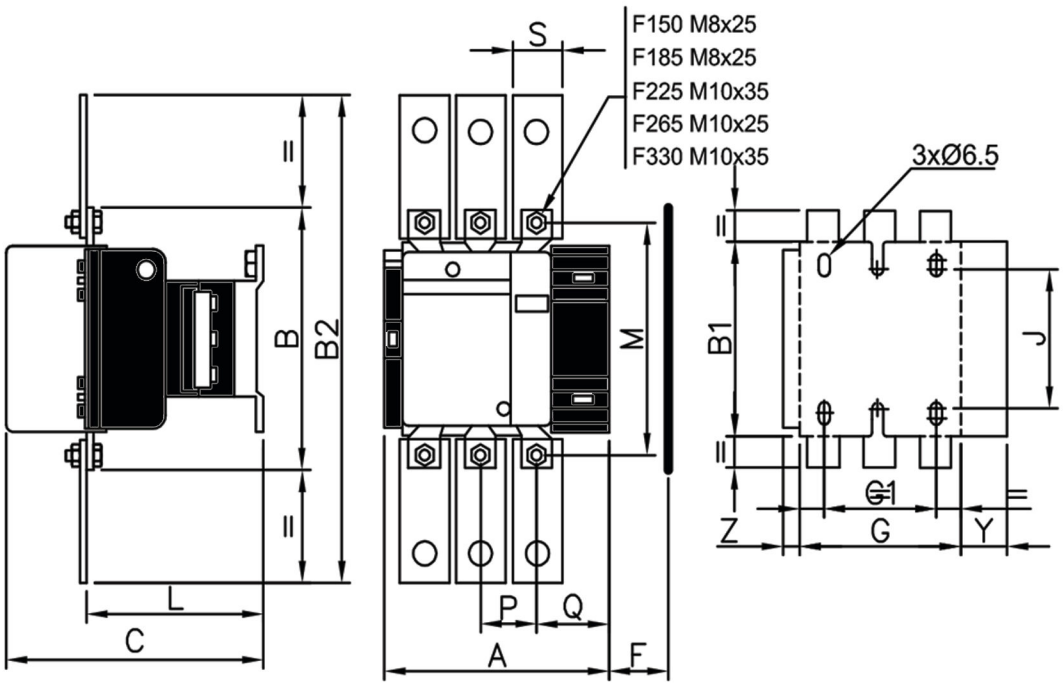




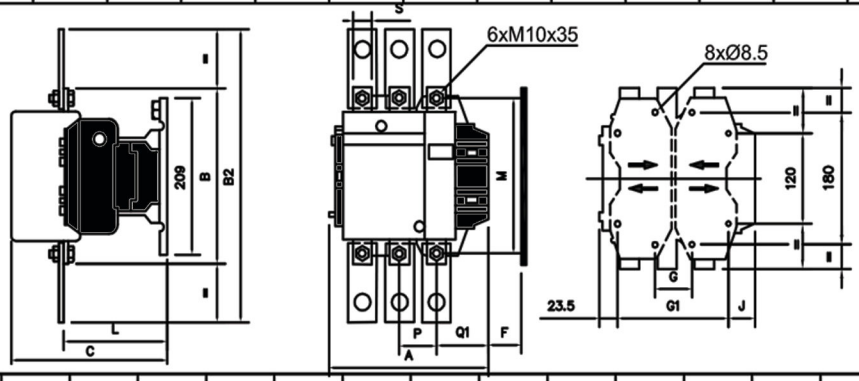


KLC1-F185 contactor - 3poles - AC3
<=440V AC / 185A - 1NO auxiliary
220 / 230V AC coil
Height : 174mm
Width : 168.5mm
Depth :181mm

Contactor and Thermal Relay

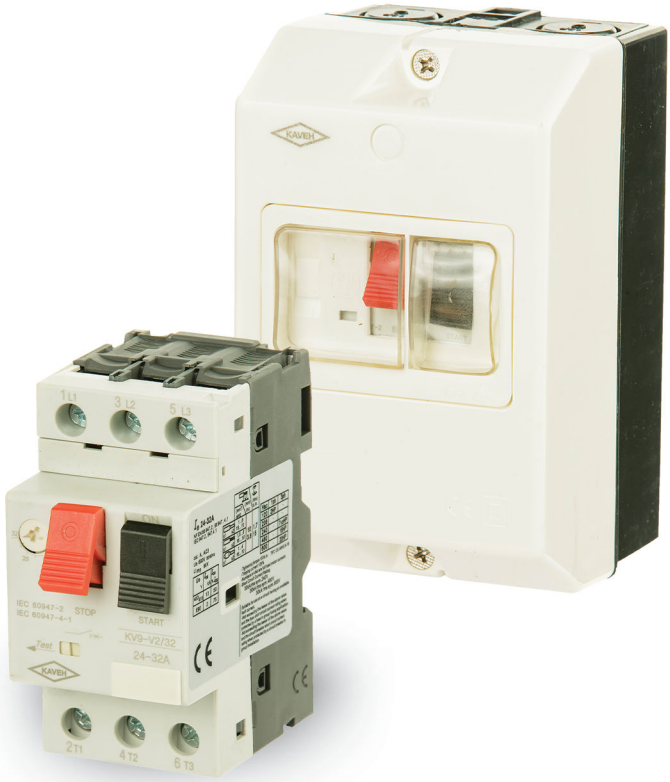


		A	B	B1	B2	C	F	G	G1	J	L	M	P	Q	S	Y	Z
F115	3P	163.5	162	137	265	171	131	106	80	106	107	147	37	60	26	44	13.50
F150	3P	163.5	170	137	301	171	131	106	80	106	107	150	40	57.5	34	44	13.50
F185	3P	168.5	174	137	305	181	130	111	80	106	113.5	154	40	59.5	34	44	13.50
F225	3P	168.5	197	137	364	181	131	111	80	106	113.5	172	48	51.50	44.50	44	13.50
F265	3P	201.5	203	145	375	213	147	142	96	106	141	178	48	66.50	44.50	3844	21.50
F330	3P	213	206	145	375	219	147	154.5	96	106	145	181	48	74	44.50	38	20.50



		A	B	B2	C	F	G	G	G	G1	G1	G1	J	L	M	P	Q	G1	S
F400	3P	213	206	375	219	146	80	66	102	170	156	192	19	145	181	48	43	74	60

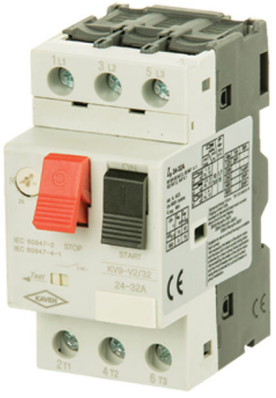
Motor Protection Circuit Breaker



CONTENTS

Technical data

Standard		IEC60947-2, IEC60947-4-1
Approvals		CE
Utilization Category	According to IEC60947-2	A
	According to IEC60947-4-1	AC-3
Rated insulation voltage Ui(V)		690
Rated operational voltage Ue(V)		230/240,400/415,440,500,660/690
Rated impulse withstand voltage Uimp(kA)		8
Electrical life in AC-3(times)		10000
Mechanical life(times)		20000
Tightening torque(N.m)		1.7
Degree of Protection		IP 20; IP65 with enclosure
Ambient air temperature(℃)		- 5 to +40, max. 95% humidity
Storage temperature(℃)		-40~+70
Maximum operating altitude(meters)		≤2000



Motor Protection Circuit Breaker

Technical specifications

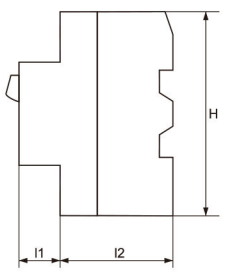
Current setting range (A)	Instantaneous short-circuit release(A)	Thermal current Ithe(A)	Standard rated power of three-phase (kW)			
			230/240V	400V	415V	440V
0.1-0.16	1.5	0.16	-	-	-	-
0.16-0.25	2.4	0.25	-	-	-	-
0.25-0.4	5.0	0.4	-	-	-	-
0.4-0.63	8.0	0.63	-	-	-	-
0.63-1	13.0	1	-	-	-	0.37
1-1.6	22.5	1.6	-	0.37	-	0.55
1.6-2.5	33.5	2.5	0.37	0.75	0.75	1.10
2.5-4	51.0	4	0.75	1.50	1.50	1.50
4-6.3	78.0	6.3	1.10	2.20	2.20	3.00
6-10	138	9	2.20	4.00	4.00	4.00
9-14	170	13	3.00	5.50	5.50	7.50
13-18	223	17	4.00	7.50	9.00	9.00
17-23	327	21	5.50	11.00	11.00	11.00
20-25	327	23	5.50	11.00	11.00	11.00
24-32	416	24	7.50	15.00	15.00	15.50
25-40	480	32	11.00	18.50	22.00	22.00
40-63	550	50	15.00	30.00	33.00	33.00
56-80	665.5	64	22.00	40.00	45.00	45.00

Breaking Capacity

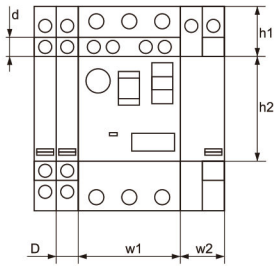
Type				01-06	07	08	10	14	16	20	21 & 22	32
Rated Current(A)			**A**	0.1-1.6	2.5	4	6.3	10	14	18	23 & 25	32
Breaking Capacity Comply to IEC60947-2	230/ 240 V	Icu	**kA**	★	★	★	★	★	★	★	50	50
		Ics %(1)		★	★	★	★	★	★	★	100	100
	400/ 415 V	Icu	**kA**	★	★	★	★	★	15	15	15	10
		Ics %(1)		★	★	★	★	★	50	50	40	50
	440 V	Icu	**kA**	★	★	★	50	15	8	8	6	6
		Ics %(1)		★	★	★	100	100	50	50	50	50
	500 V	Icu	**kA**	★	★	★	50	10	6	6	4	4
		Ics %(1)		★	★	★	100	100	75	75	75	75
	690 V	Icu	**kA**	★	3	3	3	3	3	3	3	3
		Ics %(1)		★	75	75	75	75	75	75	75	75

Overall and mounting dimensions

Dimensions



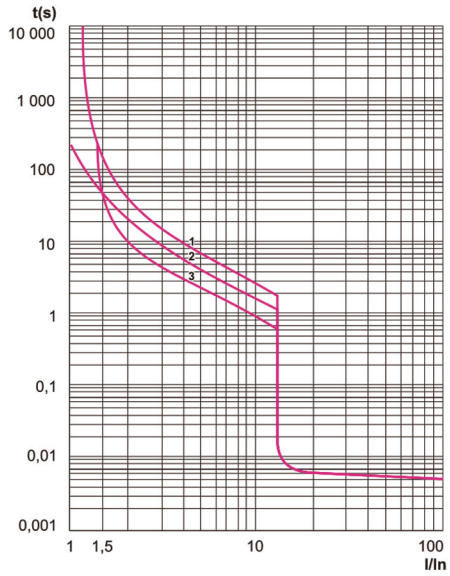
Auxiliary contact UVR

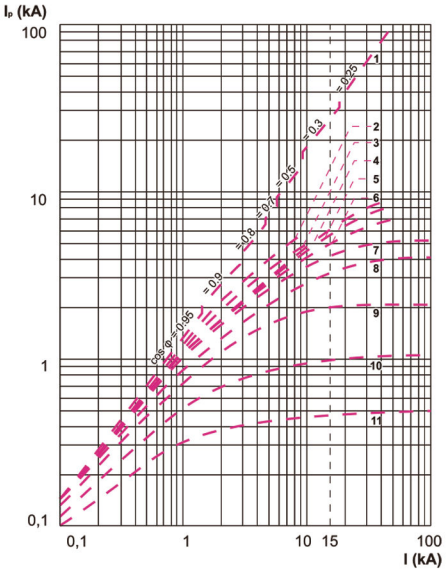


Dimension(mm)				
H	l1	l2	d	D
89	16	50	10	9,2
w1	w2	h1	h2	
44,5	18	22	45	

Motor Protection Circuit Breaker

Curve characteristics





Motor Protection Circuit Breaker

Auxiliary Devices of Motor Protection Circuit Breaker

Voltage-release

Type	Rated operational voltage Ue(V)	Voltage range of operation	Rated insulation voltage Ui(V)	Frequency (Hz)
SGV2-ME AU115	110-127	35%-70% Ue	690	50/60
SGV2-ME AU225	220-240	35%-70% Ue	690	50/60
SGV2-ME AU385	380-415	35%-70% Ue	690	50/60

Auxiliary contact

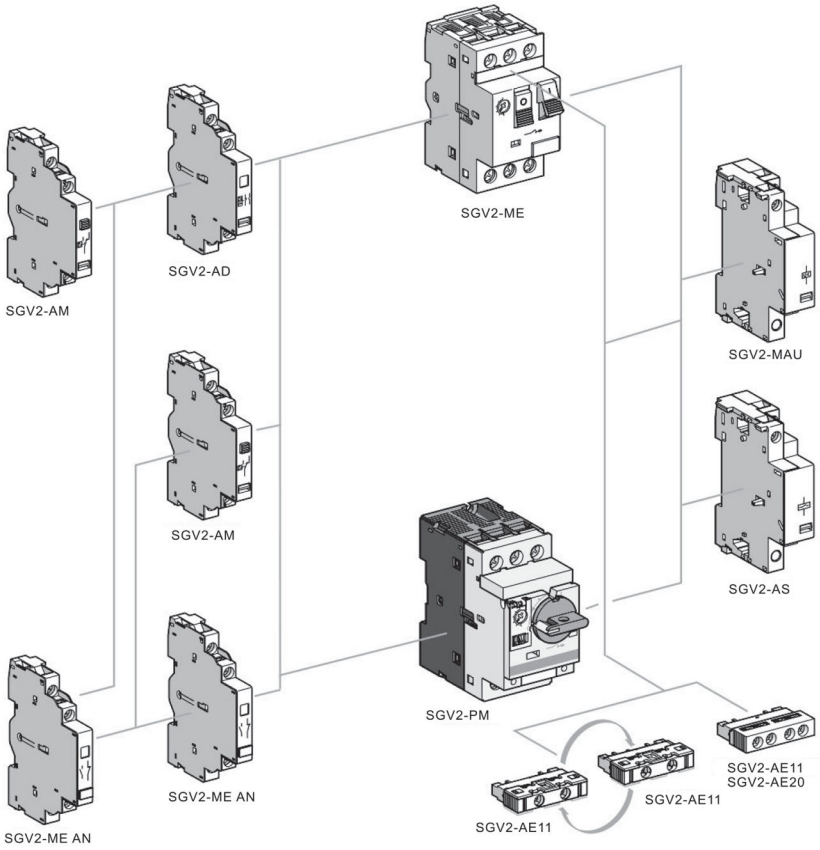
Type	Mounting Type	Auxiliary Contacts		Conventional thermal current Ith(A)
SGV2-AE11	Top	1	1	2.5
SGV2-AE20	Top	2	0	2.5

Auxiliary contact

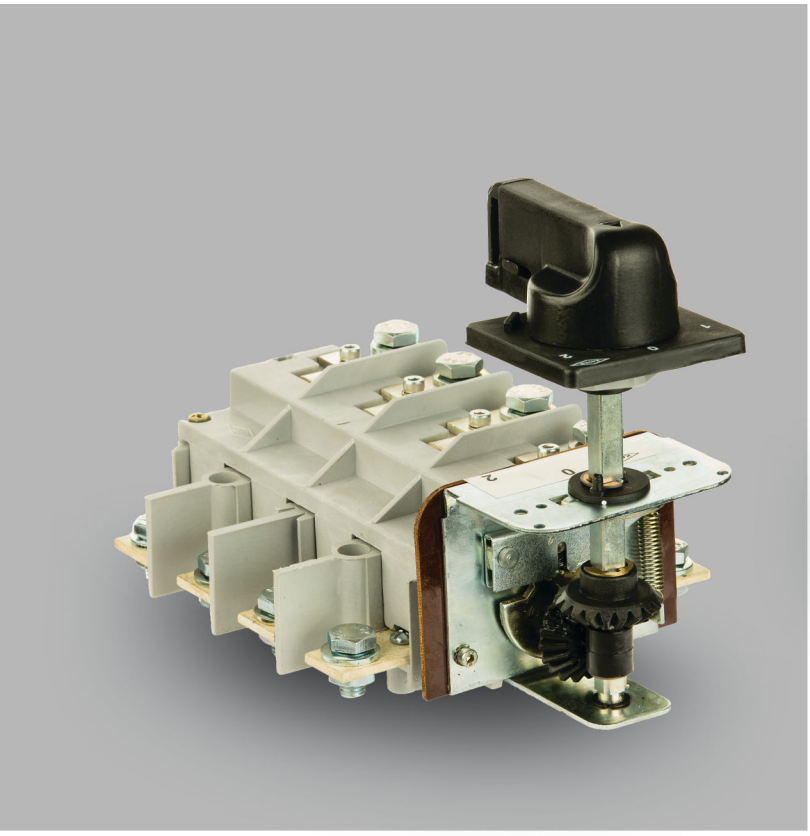
SGV2-ME AN11	Side	1	1	6
SGV2-ME AN20	Side	2	0	6

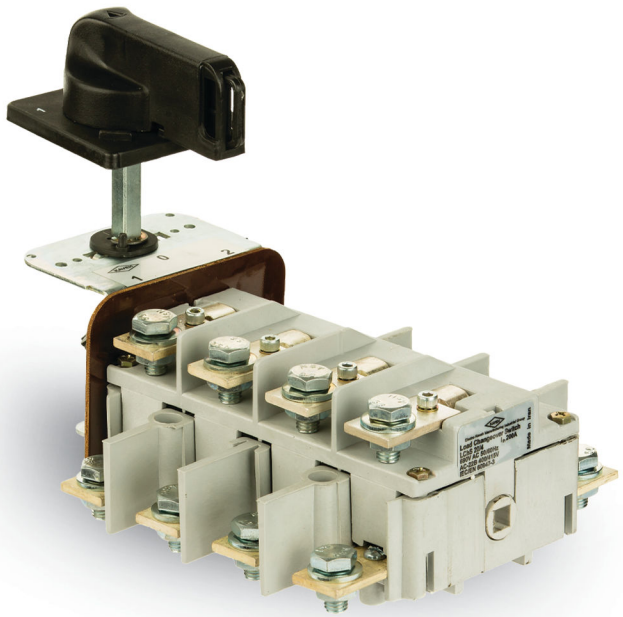
Enclosure

Type	Protection of degree	Material		Suitable SGV2-M
		Plastic box	Screen	
SGV2-ME E	IP 65	wear resistance of UV rays and non-flammable	silicon	Up to 32A



Ghange Over Switch





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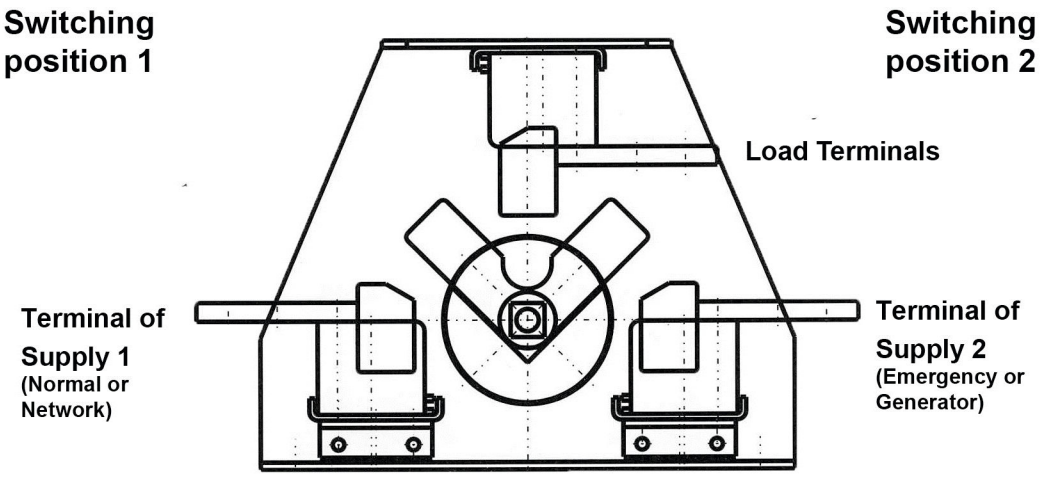
Ghange Over Switch

General :

According to the unique combined contacts, in the KAVEH Changeover Switches ,the changeover switching function is able to take place within a single switch space.

The switch can be supplied with a Centre OFF position , preparing the user a compact , safe and user friendly installed unit ,without any complex linkages or difficult wiring connections.

ON - Load changeover switch in “OFF” - position



Application:

Stand-by power supplies, Bypass systems, Drive systems and Generator set switchboards for :

- Water Industries
- Telecom
- Railways
- Communications & Broadcasting
- Manufacturing Companies
- Airports
- Hospitals

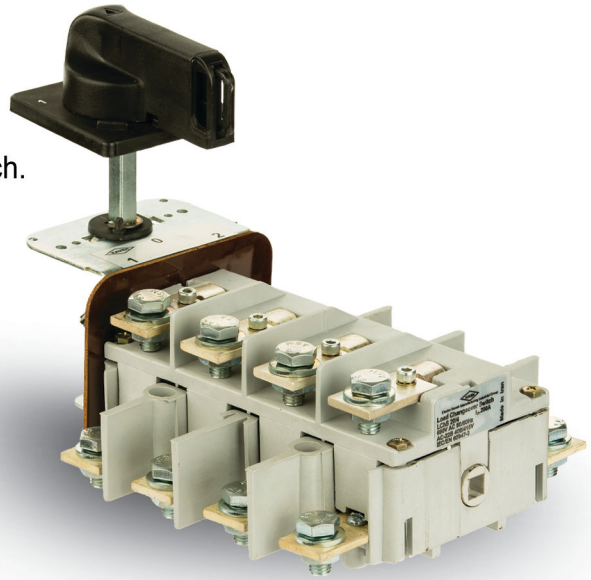
Chang over switch

Technical information:

Type LCHS / 3 - poles	20/3	25/3
Type LCHS / 4 - poles	20/4	25/4
Rated Current (A)		
I_{th} Open (45°C to 55°C)	200	250
I_{th} in enclosure (45°C to 55°C)	200	250
Standards	IEC/EN 60947 - 1&3 VDE 660 – 107 ISIRI 4835 – 1&3	
Rated Frequency (Hz)	40 - 60	40 - 60
Cross section (Min. / Max.) (mm^2)	70-150	95-150
Rated Operational Voltage (V)	690	690
Rated Insulation Voltage (V)	1000	1000
Test Voltage (V)	3500	3500
Rated Operational Current (A)		
AC 21B , Cosφ = 0.95 , 400 Vac	200	250
Rated Operational Current (A)		
AC 22B , Cosφ = 0.65 , 400 Vac	200	250
Rated Breaking Capacity (A)		
AC 22B , Cosφ = 0.65 , 400 Vac	600	750
Rated Operational Power (KW)		
AC 22B , Cosφ = 0.85 , 400 Vac	68	85
AC 22B , Cosφ = 0.65 , 400 Vac	52	65
Short Circuit Making Capacity (I_{cm}) (KA)	2	2.5
Short Time Withstand Capacity (KA) (1sec. eff.) (I_{cw})	1.2	1.2
Rated Fused short circuit current (KA)	50	50
RMS Max. HRC - Fuse	250 Agl	300 Agl
Mechanical Endurance	$2x10^4$	$2x10^4$
Electrical Endurance		
AC 22B , Cosφ = 0.85 , 400 Vac	800	750
AC 22B , Cosφ = 0.65 , 400 Vac	600	500

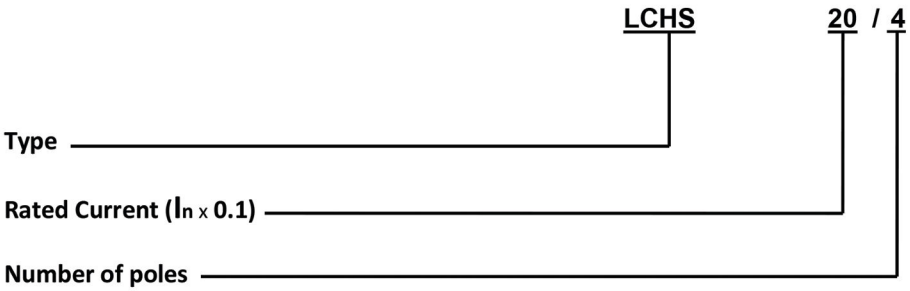
Design features :

- Complete changeover switching system in one switch.
- Compact design saves up to 60% panel space .
- No excess wiring or bus bar connections required .
- Excellent electrical performance .
- Especial L- shaped knife contact .
- Contacts visible for inspection .
- Reduces enclosure size .
- Full load breaking capacity .
- Quick ON – OFF action .
- Double break contacts .
- Forced operation in case of light welding .



Ghange Over Switch

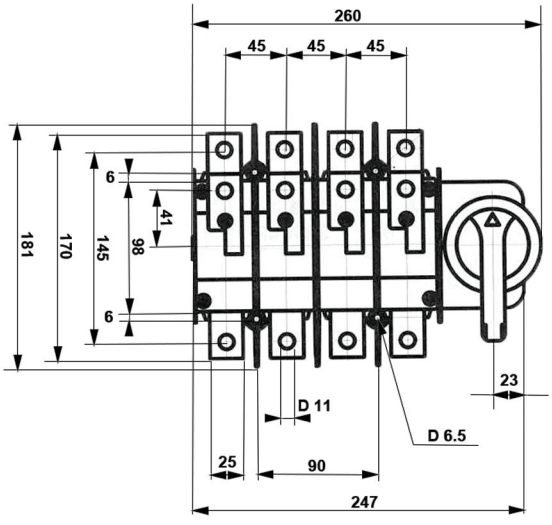
Ordering details :

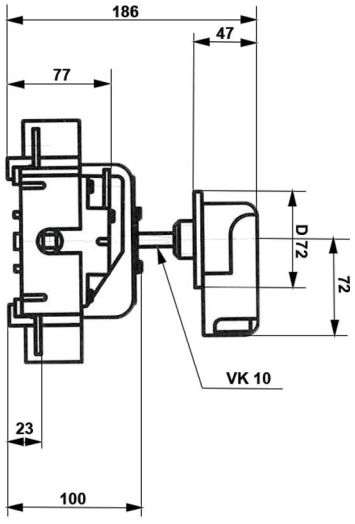


No.	Type	No. of Poles	In (AC23B/ 400V)	Weight (Kg)	Terminal Screw	Fixing Torque (Nm)	Dimension W(Wide) x H(Height) x D(Depth) (mm)
1	LCHS 20/3	3	200 A	2.2	M10	10	260 x 181 x 186
2	LCHS 20/4	4	200 A	2.4	M10	10	260 x 181 x 186
3	LCHS 25/3	3	250 A	2.2	M10	10	260 x 181 x 186
4	LCHS 25/4	4	250 A	2.4	M10	10	260 x 181 x 186

Dimension :

3-poles switches are same dimensions , 4th pole is without contacts





LCHS20/3
LCHS20/4
LCHS25/3
LCHS25/4

KAVEH

Floating Switch

CONTENTS

Floating Switch

General :

Electro Kaveh Floating switches are electromechanical switches and they are used to control the liquid level electrically.

They are 2 types :

1- F2001 : Plastic ball for being used into water tanks and wells.
2- F1002 : Metal ball for being used into chemical materials and fuel tanks.

Floating switches have got changeover contacts which can be used to turn on & turn off Electromotor or Electro pump to control liquid level and also to alarm when Electro pump will be turn on and turn off.

Special feature :

Useable in tanks and deep wells with a diameter of at least 20 cm.

Installation conditions :

Please note the following before installing the Electro kaveh Floating switch

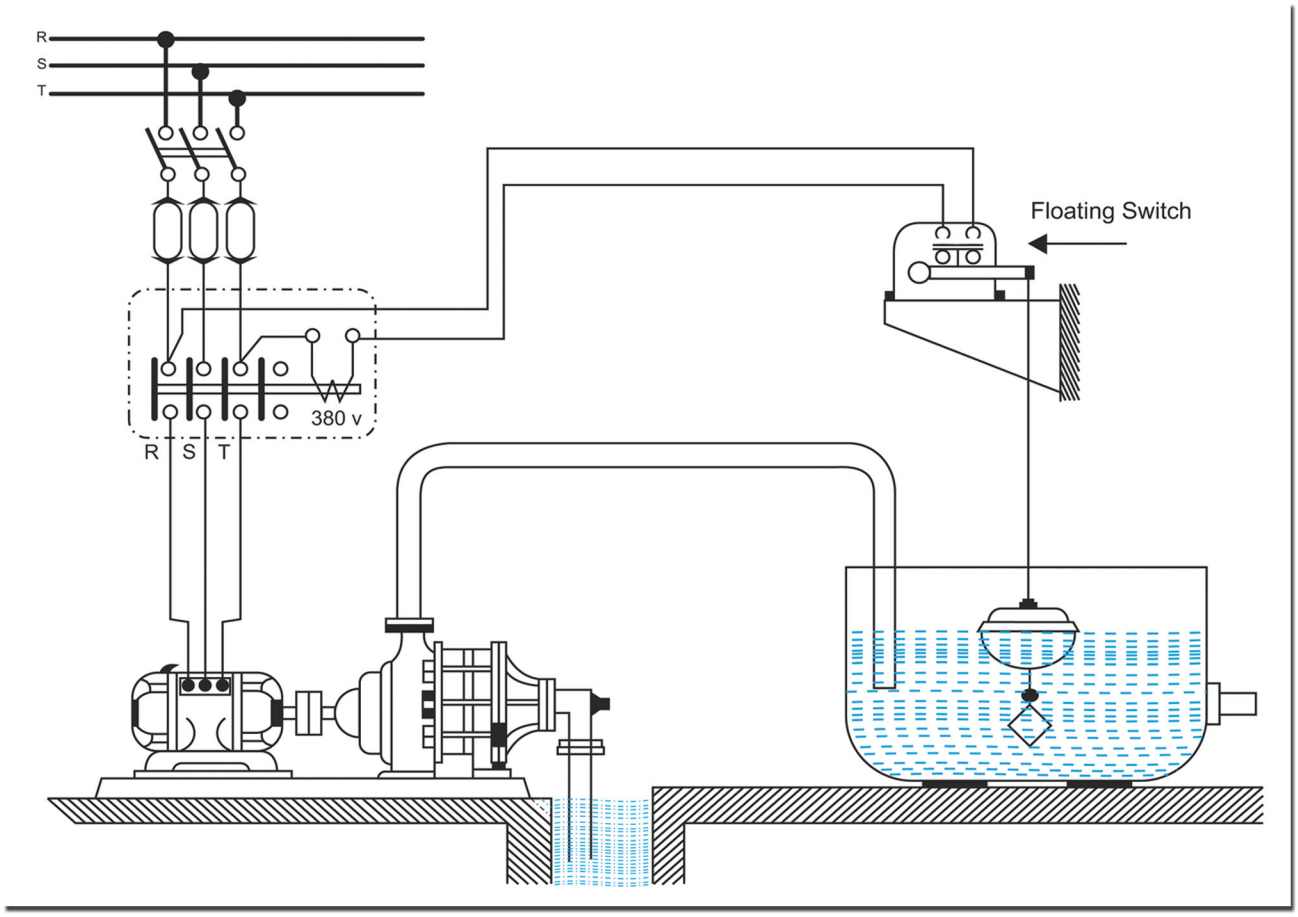
1 - For proper operation (Just for F2001 type), the amount of sand or water in the floating ball (from the place where it is located above of plastic ball) is poured.
2 - For the longer life of contacts, consider the contents of the operation table.
3 - Use this flutter in the control circuit to turn on and off the electro-motor and pumps more than 1hp.

F2001

F1002

Floating switch

Diagram :

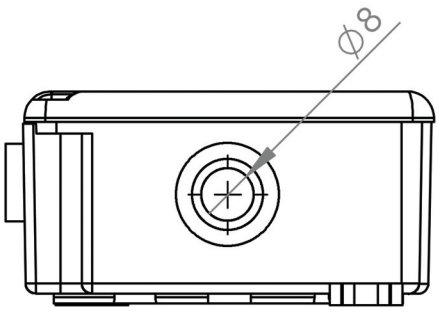


Utilization table :

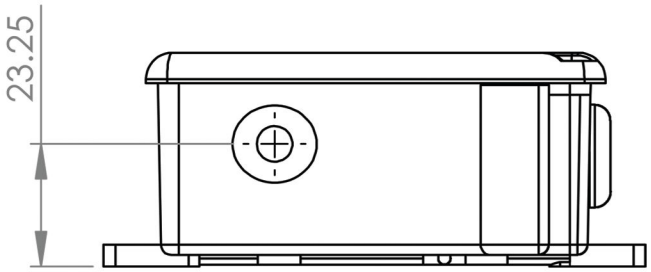
IEC60947-1&3		Rated Voltage (V)					
Rated Current (A) / Utilization category		50	120	240	380	415	500
	AC - 21B	9	7	5	3	2.5	2
	DC - 21B	1.2	1.2	....	....	....	....

Floating Switch

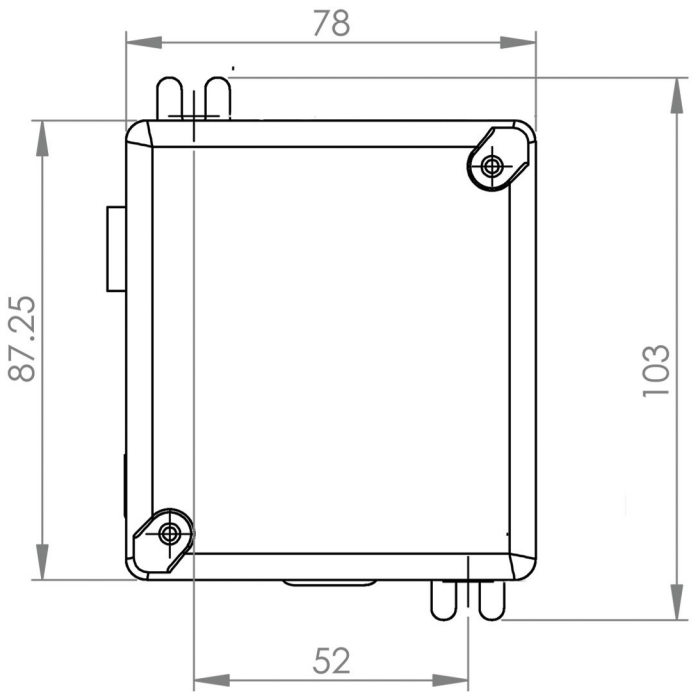
Dimension:



Input & Output Cable



Place of Shaft



Dimension of install

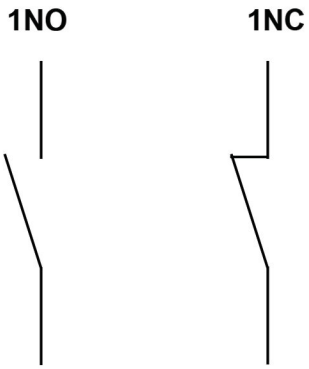


Diagram of Contacts

Surge Protective Device

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Surge Protective Device

SP2 Surge arrestor AC (Type 2):

KV4 - SPD (T2) has reliable voltage protection level and safe characteristic of overload,strong discharge current capability, applied to lighting protection of AC low voltage distribution system.

KAVEH surge protection device with high energy MOV* chip , fast response speed, safe protection function.

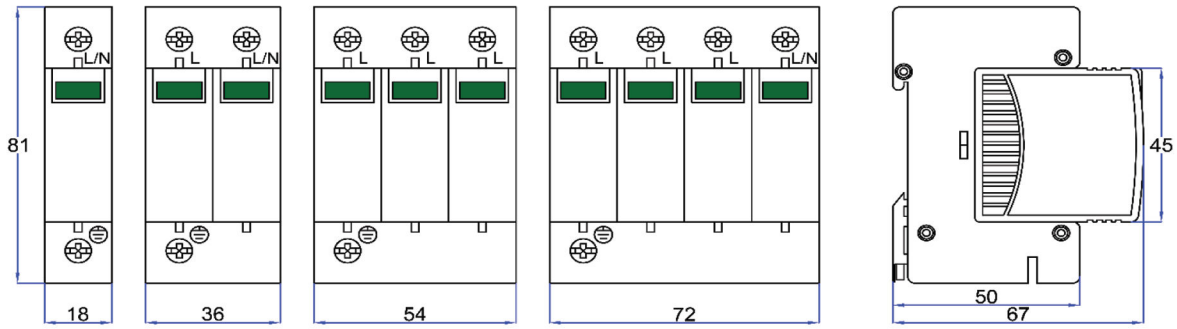
Products comply with IEC61643-11.

* MOV : **M**etal-**O**xide **V**aristor

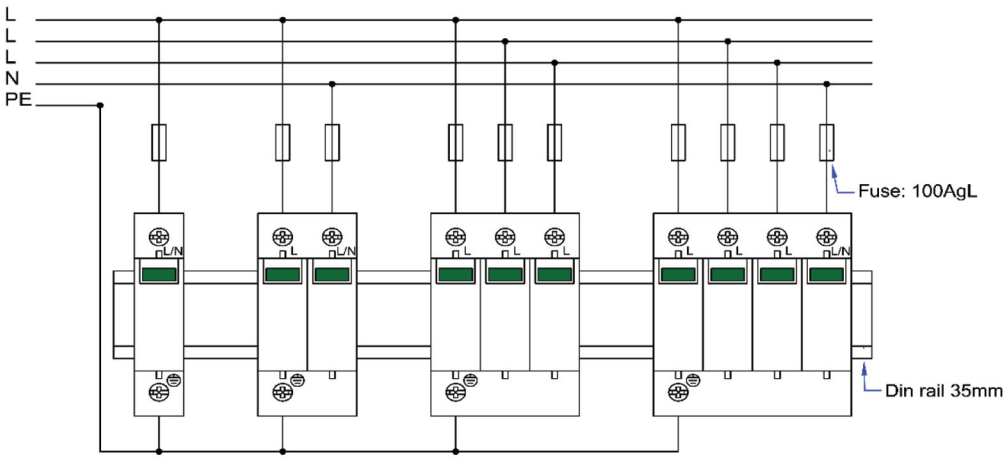
Functions:

* Built-in overheated, over-current protection device.
* Local fault indicator, facilitate the timely replacement.
* Alarm contact, realize remote communication function.
* Modular structure design, easy to maintain.
* Standard 35mm guideway design, convenient installation.
* T2 type pressure limiting surge protector, modular structure design.
* Can be combined many pieces, to realize all kind of protected mode.

Dimensions:



Connection mode:



Surge Protective Device

Technical parameters (KV4SP2-20/40)

Model		KV4SP2 - 20	KV4SP2 - 40
Product picture			
Type	IEC61643-11 (2011)	Type 2 : T2	Type 2 : T2
	IEC61643-1	Class II test	Class II test
	EN61643-11	Type 2	Type 2
	VDE 0675v	C	C
	Test wave	8/20µS	8/20µS
Nominal AC voltage (L-N) Uo		230 VAC (50/60Hz)	230 VAC (50/60Hz)
Nominal AC voltage (L-L) Uo		400 VAC (50/60Hz)	400 VAC (50/60Hz)
Insulation voltage Ui		690 VAC (50/60Hz)	690 VAC (50/60Hz)
Max. continuous operating voltage Uc		275 VAC	275 VAC
Max. continuous operating voltage (L-N)		275 VAC	275 VAC
Nominal discharge current In 8/20µS		10 kA	20 kA
Nominal discharge current In 8/20µS (L-N)		10 kA	20 kA
Max. discharge current Imax 8/20µS		20 kA	40 kA
Max. discharge current Imax 8/20µS (L-N)		20 kA	40 kA
Voltage protection level Up		1.2 kV	1.5 kV
Voltage protection level Up (L-N)		1.2 kV	1.5 kV
Residual Voltage (L-N) @ 1kA		0.8 kV	0.8 kV
Residual Voltage (L-N) @ 5kA		1.0 kV	1.0 kV
Response time		25 nS	25 nS
Response time (L-N)		25 nS	25 nS
Max. mains-side overcurrent protection		Fuse; 100AgL	Fuse; 100AgL
Short-circuit withstand for Fuse		25 kA eff	50 kA eff
Short-circuit resistant		Yes	
Temporary Overvoltage(L-N), fail safe mode		415 V - 120 min	
Temporary Overvoltage(L-N),withstand mode		330 V - 5 S	
Operating temperature range		from -40°C up to +80°C	
Storage temperature range		from -40°C up to +80°C	
Humidity		95%	
Ports		One/Two/Three/Four port SPD	
Combination Poles		1 , 2 , 3 , 4	
Connection cross-section (Min.)		1.50 mm^2 (16.00 AWG)	
Connection cross-section (Max.)		25.00 mm^2 (4.00AWG)	
Torque		4.00N.m (35.00Lbs)	
Terminal connection type		Cable / U-type busbar / Pin-type busbar	
Signaling on device (Indicator)		Visual (Green indicates Normal and Red indicates Failure)	
Mounting type		Din Rail 35mm	
Housing material		Poly Amid 66 (PA66)	
The outer flame retardant grade		Comply with UL94V-0	
Installation location		Indoor (Interior)	
Protection rating		IP20	

Surge Protective Device

SP2 Surge arrestor AC (Type 2):

KV4 - SPD (T2) has reliable voltage protection level and safe characteristic of overload,strong discharge current capability, applied to lighting protection of AC low voltage distribution system.

KAVEH surge protection device with high energy MOV* chip , fast response speed, safe protection function.

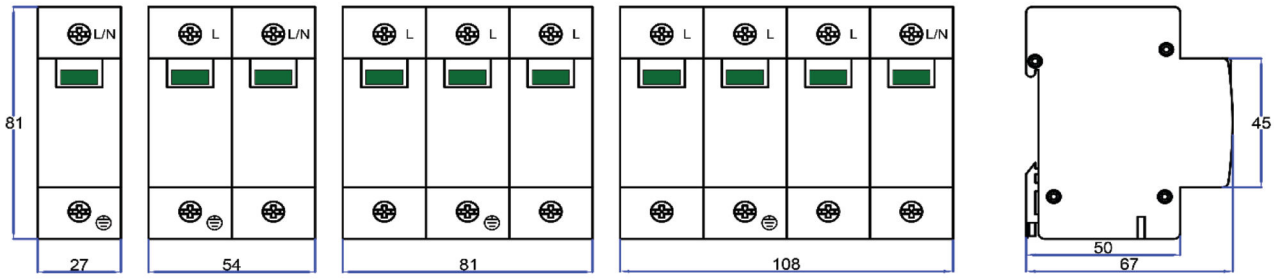
Products comply with IEC61643-11.

* MOV: **M**etal-**O**xide **V**aristor

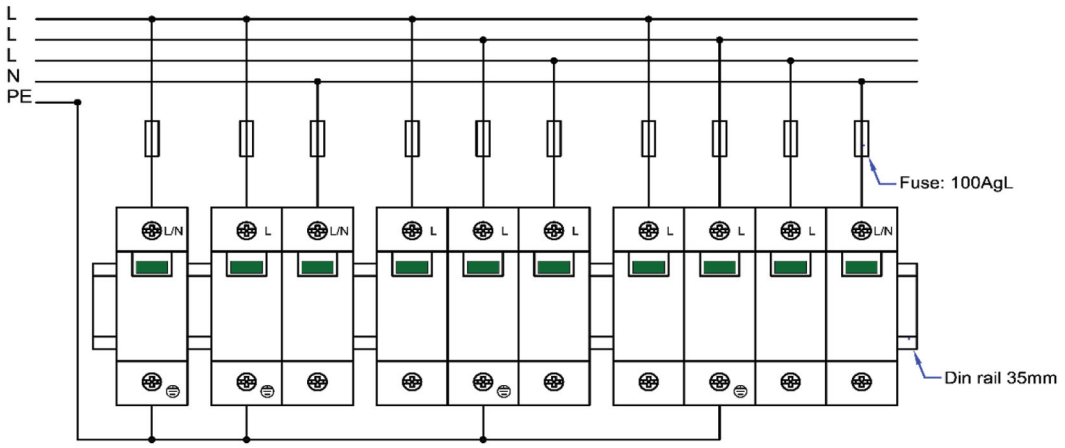
Functions:

* Built-in overheated, over-current protection device.
* Local fault indicator, facilitate the timely replacement.
* Alarm contact, realize remote communication function.
* Modular structure design, easy to maintain.
* Standard 35mm guideway design, convenient installation.
* T2 type pressure limiting surge protector, modular structure design.
* Can be combined many pieces, to realize all kind of protected mode.

Dimensions:



Connection mode:



KAVEH

Surge Protective Device

Technical parameters (KV4SP2-60)

Model		KV4SP2 - 60
Product picture		
Type	IEC61643-11 (2011)	Type 2 : T2
	IEC61643-1	Class II test
	EN61643-11	Type 2
	VDE 0675v	C
	Test wave	8/20µS
Nominal AC voltage (L-N) Uo		230 VAC (50/60Hz)
Nominal AC voltage (L-L) Uo		400 VAC (50/60Hz)
Insulation voltage Ui		690 VAC (50/60Hz)
Max. continuous operating voltage Uc		275 VAC
Max. continuous operating voltage (L-N)		275 VAC
Nominal discharge current In 8/20µS		30 kA
Nominal discharge current In 8/20µS (L-N)		30 kA
Max. discharge current Imax 8/20µS		60 kA
Max. discharge current Imax 8/20µS (L-N)		60 kA
Voltage protection level Up		1.8 kV
Voltage protection level Up (L-N)		1.8 kV
Residual Voltage (L-N) @ 1kA		0.8 kV
Residual Voltage (L-N) @ 5kA		1.0 kV
Response time		25 nS
Response time (L-N)		25 nS
Max. mains-side overcurrent protection		Fuse; 100AgL
Short-circuit withstand for Fuse		80 kA eff
Short-circuit resistant		Yes
Temporary Overvoltage(L-N), fail safe mode		415 V - 120 min
Temporary Overvoltage(L-N),withstand mode		330 V - 5 S
Operating temperature range		from -40°C up to +80°C
Storage temperature range		from -40°C up to +80°C
Humidity		95%
Ports		One/Two/Three/Four port SPD
Combination Poles		1 , 2 , 3 , 4
Connection cross-section (Min.)		1.50 mm² (16.00 AWG)
Connection cross-section (Max.)		35.00 mm² (2.00AWG)
Torque		4.00N.m (35.00Lbs)
Terminal connection type		Cable / U-type busbar / Pin-type busbar
Signaling on device (Indicator)		Visual (Green indicates Normal and Red indicates Failure)
Mounting type		Din Rail 35mm
Housing material		Poly Amid 66 (PA66)
The outer flame retardant grade		Comply with UL94V-0
Installation location		Indoor (Interior)
Protection rating		IP20

Surge Protective Device

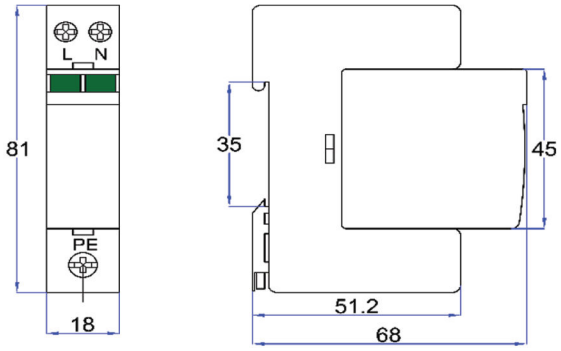
SP3 Surge arrestor AC (T2+T3):

KV4-SPD (SP3 : T2+T3) has reliable voltage protection level and safe characteristic of overload,strong discharge current capability, applied to lighting protection of AC low voltage distribution system.
"Type 3 SPD" have a low discharge capacity. Therefore they install as a supplement to "Type 2 SPD" and in the vicinity of sensitive loads.
KAVEH surge protection devices with High energy " MOV " Chip , fast response speed, safe protection function.
Products comply with IEC61643-11.

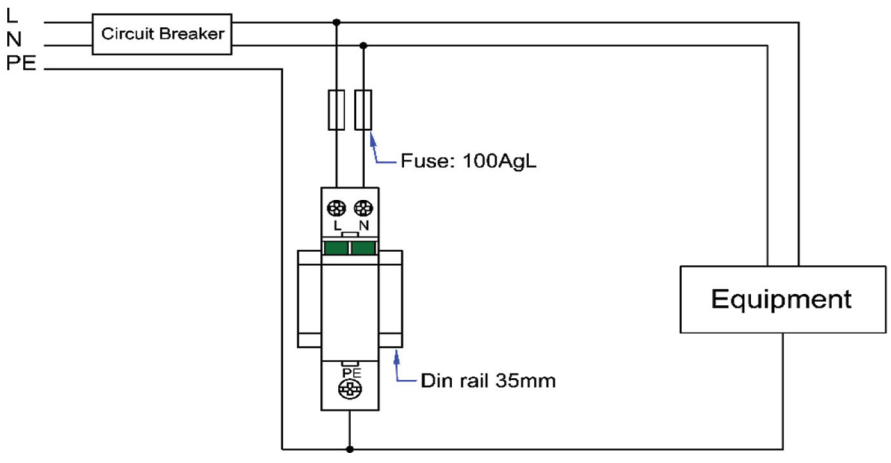
Functions:

* Built-in overheated, over-current protection device.
* Local fault indicator, facilitate the timely replacement.
* Alarm contact, realize remote communication function.
* Modular structure design, easy to maintain.
* Standard 35mm guideway design, convenient installation.
* Integration of structure, 18mm wide, compact design.
* T2 type pressure limiting surge protector, open circuit voltage of 6kV.
* Can be combined many pieces, to realize all kind of protected mode.
* T3 type is characterized by a combination of voltage waves (1.2/50 μs) and current waves (8/20 μs).

Dimensions:



Connection mode:



Surge Protective Device

SP3 Technical parameters

Model		KV4SP3 - 20	KV4SP3 - 40
Product picture			
Type	IEC61643-11 (2011)	Type 2 + Type 3 : T2+T3	Type 2 + Type 3 : T2+T3
	IEC61643-1	Class II + Class III test	Class II + Class III test
	EN61643-11	Type 2 + Type 3	Type 2 + Type 3
	VDE 0675v	C + D	C + D
	Test wave	8/20µS + 1.2/50µS	8/20µS + 1.2/50µS
Nominal AC voltage (L-N) Uo		230 VAC (50/60Hz)	230 VAC (50/60Hz)
Nominal AC voltage (L-L) Uo		400 VAC (50/60Hz)	400 VAC (50/60Hz)
Insulation voltage Ui		690 VAC (50/60Hz)	690 VAC (50/60Hz)
Open-Circuit voltage in Class III tests Uoc		20kV	20kV
Max. continuous operating voltage Uc		275 VAC	275 VAC
Max. continuous operating voltage (L-N)		275 VAC	275 VAC
Nominal discharge current In 8/20µS		10 kA	20 kA
Nominal discharge current In 8/20µS (L-N)		10 kA	20 kA
Max. discharge current Imax 8/20µS		20 kA	40 kA
Max. discharge current Imax 8/20µS (L-N)		20 kA	40 kA
Voltage protection level Up		1.2 kV	1.5 kV
Voltage protection level Up (L-N)		1.2 kV	1.5 kV
Residual Voltage (L-N) @ 1kA		0.8 kV	0.8 kV
Residual Voltage (L-N) @ 5kA		1.0 kV	1.0 kV
Response time		25 nS	25 nS
Response time (L-N)		25 nS	25 nS
Max. mains-side overcurrent protection		Fuse; 100AgL	Fuse; 100AgL
Short-circuit withstand for Fuse		25 kA eff	50 kA eff
Short-circuit resistant		Yes	
Temporary Overvoltage(L-N), fail safe mode		415 V - 120 min	
Temporary Overvoltage(L-N),withstand mode		330 V - 5 S	
Operating temperature range		from -40°C up to +80°C	
Storage temperature range		from -40°C up to +80°C	
Humidity		95%	
Ports		Two port SPD	
Combination Poles		2	
Connection cross-section (Min.)		L/N: 0.50 mm² (20.00AWG) - PE: 1.50 mm² (16.00 AWG)	
Connection cross-section (Max.)		L/N: 16.00 mm² (6.00AWG) - PE: 25.00 mm² (4.00AWG)	
Torque		L/N: 2.50N.m (22.00Lbs) - PE: 4.00N.m (35.00Lbs)	
Terminal connection type		Cable / Pin-type busbar	
Signaling on device (Indicator)		Visual (Green indicates Normal and Red indicates Failure)	
Mounting type		Din Rail 35mm	
Housing material		Poly Amid 66 (PA66)	
The outer flame retardant grade		Comply with UL94V-0	
Installation location		Indoor (Interior)	
Protection rating		IP20	

Cylindrical Fuse - Switch

CONTENTS

EPF-32 Series
Fuse Holder and Links

Technical data

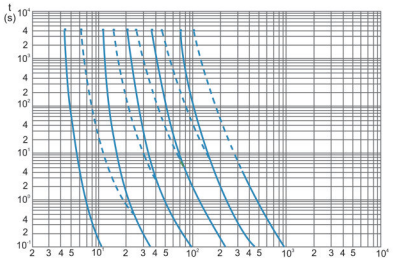
Standard	IEC60269-2 GB/T 13539.2
Description	Fuse switch disconnector with LED indicator
Number of Poles	1P,2P,3P,4P
Fuse size	10X38
Rated operational current Ie	2-32A
Rated operational voltage Ue	250VAC(1P)/500VAC(2P-4P)
Rated insulation voltage	500VAC
Rated impulse withstand voltage	4kV
Conditional short-circuit current	20kA
Utilization category with fuse	g G
Protection degree	IP20
Mounting method	Din rail installation

Cylindrical Fuse - Switch

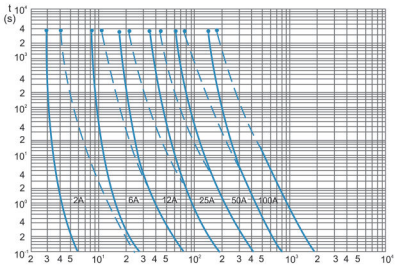
EPF-32 Fuse Holder and Links	Code No.	Fuse link size	Link current	Packing unit (holder)
 EPF-32-1P	EPF-32-1 EPF-32X-1	10 X 38mm	2A	12
			4A	12
			6A	12
			10A	12
			16A	12
			20A	12
			25A	12
			32A	12
 EPF-32-2P	EPF-32-2 EPF-32X-2	10 X 38mm	2A	6
			4A	6
			6A	6
			10A	6
			16A	6
			20A	6
			25A	6
			32A	6
 EPF-32-3P	EPF-32-3 EPF-32X-3	10 X 38mm	2A	4
			4A	4
			6A	4
			10A	4
			16A	4
			20A	4
			25A	4
			32A	4
 EPF-32-4P	EPF-32-4 EPF-32X-4	10 X 38mm	2A	3
			4A	3
			6A	3
			10A	3
			16A	3
			20A	3
			25A	3
			32A	3

Cylindrical Fuse - Switch

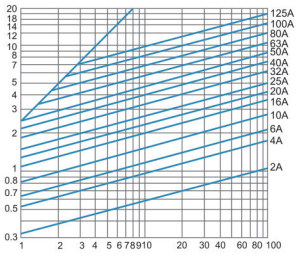
Curves



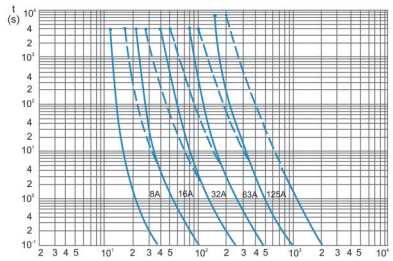
Prospective current(effective value)IP(A) ⟶
Time-current band of "gG" fuse link



Prospective current(effective value)IP(A) ⟶
Time-current band of "gG" fuse link



Prospective current Ip(KA)
(symmetrical effective value)
Characteristic of cut-off current of "gG" fuse link

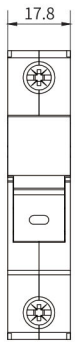


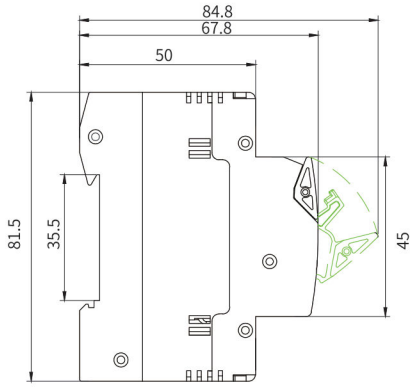
Prospective current Ip(KA) ⟶
(effective value)
Time-current band of "gG" fuse link

Wiring The suitable conductors should be used for connection.

In	$I^2t(A^2S)$	$I^2t(A^2S)$	Watts loss
(A)	(V) Prearcing	(kA) Clearing at 600V	(W) In
3	-	-	-
6	4	30	1.5
8	6	50	2.0
10	9	70	2.5
12	15	120	3.0
16	25	150	3.5
20	34	260	4.8
25	60	390	6.0
32	95	600	7.5

Overall and mounting dimensions





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Head Office : No 7&9 -5th floor Bldg .250 - North SAADI Ave
Tehran - Iran P.C. :1147614165
Tel: +98 21 77686085 +98 21 77613656 Fax : +98 21 77614612
www.electrokaveh.com
E-mail : kaveh@electrokaveh.com