STANDARD
ELECTRICALS

Range
25A to 1600A in different frame sizes

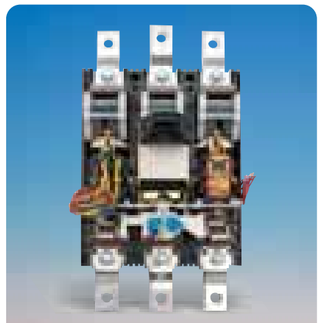
Execution
SP, TP & FP with switched neutral

Specification
IS : 13947-1 & 2 IEC : 60947-1 & 2

MOULDED CASE CIRCUIT BREAKER (MCCB)

Introduction

The STANDARD range of Moulded Case Circuit Breakers (MCCBs) are designed for circuit protection of low voltage distribution system.They are suitable for application as main breakers and for protection of branch and feeder circuit & connected equipments / load.


Inner view of MCCB

These MCCBs provide overload and short circuit protection for all circuit elements. They are designed for use in Switchboards, Control Panels, Combination Starters, in separate enclosures and meet the requirements of lighting, distribution and power circuits.

Standard Electricals Ltd. (SEL) offers a comprehensive range of MCCBs employing world class technology and fully conforms to the latest IEC-60947-1& 2/IS-13947-1& 2.

The MCCB comprises of switching mechanism, contact system, arc extinguishing device and tripping unit all contained in a compact Moulded Case and Cover.

The insulating case and cover are made of high strength, heat resistant, flame retardant resin bonded thermo setting material which provides:-

- Interphase insulation of a high dielectric strength, making the MCCB considerably compact and light weight.
- The insulated enclosure with high withstand capacity against thermal and mechanical stresses.
- Protection against secondary fire hazards.
- Increased safety of operating personnel.

Features

- Comprehensive range : 25A - 1600A in different frame sizes.
- Compact dimension - space economy.
- Identical front plate cut out - lends uniformity.
- Interchangeable line & load connection -Offers flexibility of mounting.
- Adjustable / front accessible thermal and magnetic setting. (Thermal setting for overload adjustable from 70% - 100% of the rated current & magnetic setting for short circuit adjustable 4-10 times / 5-10 times).
- Available in Single pole, 3 pole and 4 pole with switched neutral version.
- Suitable for use as Switch Disconnectors / Isolators.
- Trip Free Mechanism - The breaker trips internally in case of fault, even if the knob is in the ON position.
- Mounting possible in vertical or horizontal position or $\pm 15^{\circ}$ in vertical plane.
- Complete range of accessories. (Under Voltage Release, Shunt Trip, Auxiliary Switches, Rotary Handles, Extended Terminals, Back Studs, Phase Barriers, Terminal Shrouds, Enclosures and Earth Leakage Relay).

Technical Data

Standard conformity	:	IEC 60947-1& 2/IS:13947-1 & 2
Rated Operational Voltage	:	415V AC
Rated Insulation Voltage	:	690V AC
Type of release	:	Theromagnetic
Utilisation category	:	A
Rated Frequency	:	50/60Hz
Ambient temp.	:	40°C (50°C on request)
Operating altitude	:	2000 meters
Humidity	:	0 - 90%
Rated Impulse Voltage	:	8 KV

Electrical & Mechanical Life

Rated Current (A)	Mechanical Life	Electrical Life
In ≤ 100	8500	1500
100< In ≤ 315	7000	1000
315< In ≤ 630	4000	1000
630< In ≤ 800	2500	500

Technical Specifications

FRAME		SKB-1		SKB-2		SKB-3	SKB-4	SKB-0
No. of Poles		1P/3P/4PwSN		1P/3P/4P wSN		3P/4P wSN	3P/4P wSN	3P/4PwSN
Standard current range/rating(I_n) A		25-200*		25-250*		160-800*	160-800*	800-1600*
Thermal release setting(Adjustable) of I_n		70-100% of I_n		70-100% of I_n		70-100% of I_n	70-100% of I_n	70-100% of I_n
Magnetic release setting		Fixed		Fixed		Adjustable	Adjustable	Adjustable
for current rating(25A-63A)		400A		400A		–	–	–
for current rating(80A-125A)		800A		800A		–	–	–
for current rating(160A-250A)		1600A		1600A		–	–	–
for current rating(160A-320A)				5-10 times I_n		5-10 times I_n	–	
for current rating(400A-800A)		–		–		4-10 times I_n	4-10 times I_n	
for current rating(800A-1600A)		–		–		–	–	4000-10000A
Rated short circuit making capacity (Peak) I_{cm} KA		52.5	32	73.5	52.5	73.5	105	105
Rated ultimate short circuit		(25-125A)	(160-200A)	(25-125A)	(160-250A)			
breaking capacity (Icu), kA	240V	40	25	50	40	50	70	70
(At different voltage)	380V	35	16	35	35	35	50	50
	415V	25	16	35	25	35	50	50
	500V	18	12	25	18	25	35	35
Weight TP (Triple Pole) Kg.		1.8		1.8		9.2	9.2	17#/19**
FPwSN (4 pole switched neutral) Kg.		2.4		2.4		11.6	11.6	22/25
Terminal capacity (Cable) (Sq.mm)		70 (upto 100A)/150 (125A-250A)				–	–	–
(Bus bar width) (mm)		25 (125 to 200Amp.)				40	40	45** upto 800A 45** upto 1000A 60** upto 1250A 65** upto 1600A 35*.5# upto 1600A
Recommended Torque (Nm)		10		10		–	–	–

*Current Ratings for SKB-1 & SKB-2 : 25A, 32A, 50A, 63A, 80A, 100A, 125A, 160A, 200A, 250A
for SKB-3 & SKB-4 : 160A, 200A, 250A, 315A, 400A, 500A, 630A, 800A
for SKB-0 : 1000A, 1250A, 1600A

Terminals at back / rear ** Terminals in front

Technical Specifications

FRAME		SKB-5	SKB-6	SKB-7
No. of Poles		1P/3P/4P wSN	1P/3P/4P wSN	3P/4P wSN
Standard current range/rating(I_n) A		25-125*	25-125*	25-100*
Thermal release setting		Fixed	Fixed	Fixed
Magnetic release setting		Fixed	Fixed	Fixed
for current rating (25A-50A)		500A	500A	500A
for current rating (63A-80A)		800A	800A	800A
for current rating (100A-125A)		1000A	1000A	1000A
Rated short circuit making capacity (Peak) I_{cm} kA		17	32	52.5
Rated ultimate short circuit breaking capacity (Icu), kA (At different voltages)	240V	25	25	30
	380V	10	16	25
	415V	10	16	25
	500V	7.5	12	14
Weight SP (Single Pole) Kg.		0.35	0.35	–
Weight TP (Triple Pole) Kg.		0.93	0.93	0.93
FPWSN (Four Pole Switched Neutral) Kg.		1.2	1.2	1.2
Terminal capacity (Cable) (Sq.mm)		70	70	70
(Bus bar width) (mm)		10	10	10
Recommended Torque (Nm)		2.5	2.5	2.5

*Current Ratings 25A, 32A, 50A, 63A, 80A, 100A, 125A

Technical Specifications

FRAME		SKB-8	SKB-9
No. of Poles		3P/4PwSN	3P/4PwSN
Current Rating (in) A		25-250*	25-250*
Thermal Release Setting		Fixed	Fixed
Magnetic Release Setting		Fixed	Fixed
for current rating (25-32A)		500A	500A
for current rating (50-80A)		800A	800A
for current rating (100-125A)		1250A	1250A
for current rating (160-250A)		1600A	1600A
Rated short circuit making Capacity (Peak) I_{cm} kA		73.5	105
Rated ultimate short circuit breaking capacity (Icu), kA at	240V	50	70
	380V	35	50
	415V	35	50
	500V	25	35
Weight TP Kg./FPwSN		2.9/3.8	2.9/3.8
Terminal Capacity (Cable) Sq. mm		185	185
(Bus Bar width) mm		18	18

*Current Ratings 25A, 32A, 50A, 63A, 80A, 100A, 125A, 160A, 200A, 250A

Internal Accessories

FRAME	SKB-1	SKB-2	SKB-3	SKB-4	SKB-5	SKB-6	SKB-7	SKB-8	SKB-9	SKB-0
Auxiliary Switch(1 C\O or 2C\O)	*	*	*	*	*	*	*	*	*	*
Shunt trip	*	*	*	*	*	*	*	*	*	*
Under Voltage Release	*	*	*	*	*	*	*	*	*	*

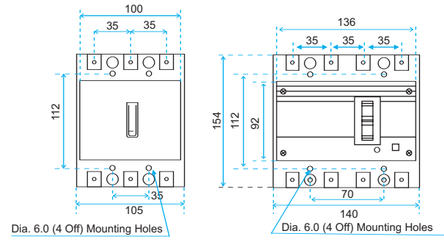
External Accessories

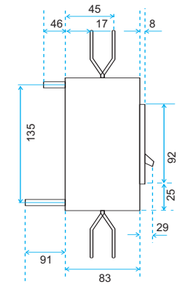
FRAME	SKB-1	SKB-2	SKB-3	SKB-4	SKB-5	SKB-6	SKB-7	SKB-8	SKB-9	SKB-0
Earth Fault Relay	*	*	*	*	*	*	*	*	*	*
Rotary Handle	*	*	*	*	*	*	*	*	*	*
Back Studs	*	*	*	-	-	-	-	*	*	*
Extended Terminals	+	+	+	+	+	+	+	+	+	*
Dolly Extension	-	-	*	*	-	-	-	-	-	*
Phase Barriers	+	+	+	-	+	+	+	+	+	*
Terminal Shrouds	*	*	-	-	*	*	*	*	*	-
Dolly Pad locking Device	*	*	*	*	*	*	*	*	*	*

* Available
– Not Available
\+ Supplied along with MCCB as standard. (Extended terminal supplied above 100A)

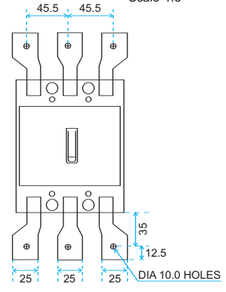
Dimensional Details (in mm)

SKB-1/2



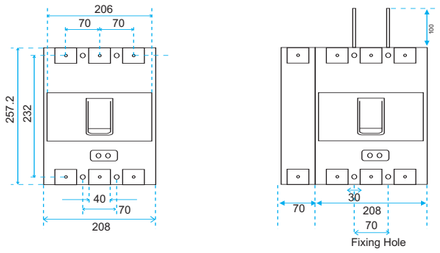


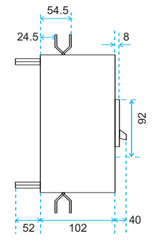
Scale-1.5



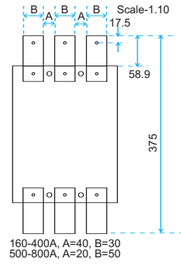
3P With Extended Terminals

SKB-3/4





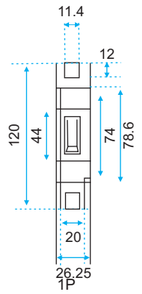
Scale-1.10

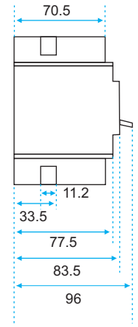


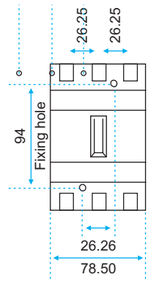
3P With Extended Terminals

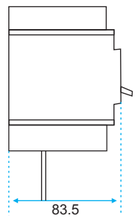
Dimensional Details (in mm)

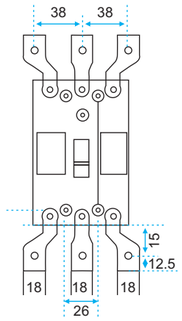
SKB-5/6/7



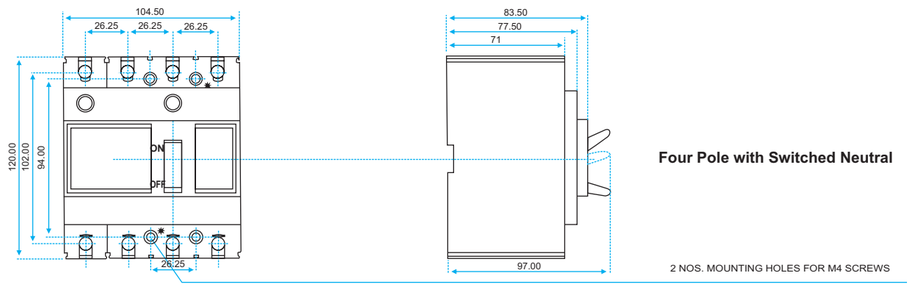




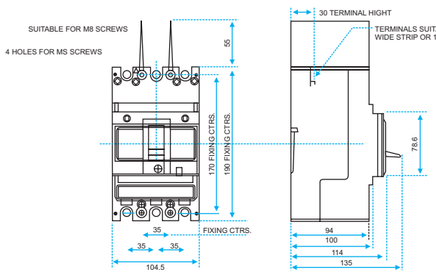


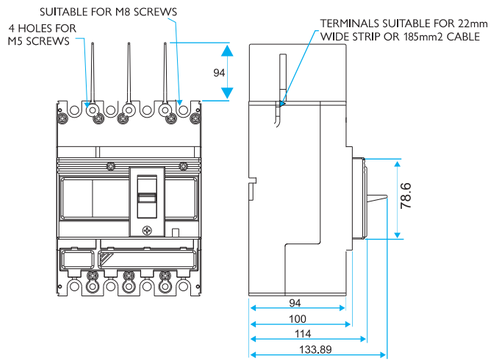


SKB-5/6/7



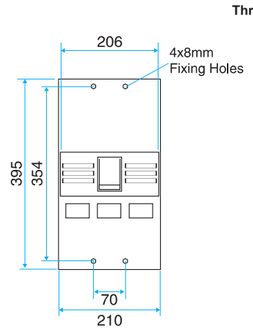
SKB 8 & 9

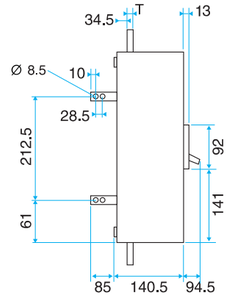


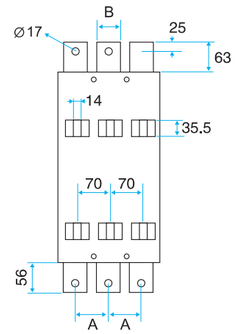


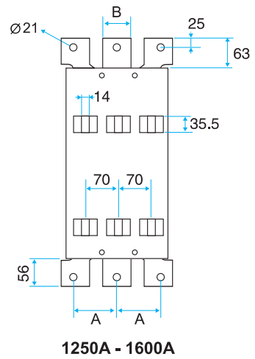
Dimensional Details (in mm)

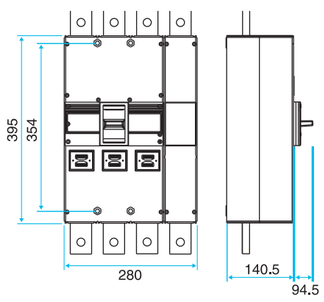
SKB 0











S. No.	Rating	A	B	T
1.	800A	70	45	6x2
2.	1000A	70	45	15
3.	1250A	82	60	15
4.	1600A	87	65	18

MCCB Adjustable Type - Three Pole

Rating (Amps.)	Cat No.	
	SKB-1	SKB-2
25	ISLAST0025	ISLANT0025
32	ISLAST0032	ISLANT0032
50	ISLAST0050	ISLANT0050
63	ISLAST0063	ISLANT0063
80	ISLAST0080	ISLANT0080
100	ISLAST0100	ISLANT0100
125	ISLAST0125	ISLANT0125
160	ISLAST0160	ISLANT0160
200	ISLAST0200	ISLANT0200
250	-	ISLANT0250

Rating (Amps.)	Cat No.		
	SKB-3	SKB-4	SKB-0
160	ISLCNT0160	ISLCHT0160	–
200	ISLCNT0200	ISLCHT0200	–
250	ISLCNT0250	ISLCHT0250	–
315	ISLCNT0315	ISLCHT0315	–
400	ISLCNT0400	ISLCHT0400	–
500	ISLCNT0500	ISLCHT0500	–
630	ISLCNT0630	ISLCHT0630	–
800	ISLCNT0800	ISLCHT0800	–
1000	–	–	ISLDNT1000
1250	–	–	ISLDNT1250
1600	–	–	ISLDNT1600

MCCB Adjustable Type - Four Pole (wSN)

Rating (Amps.)	Cat No.		
	SKB-1	SKB-2	
25	ISLASF0025	ISLANF0025	
32	ISLASF0032	ISLANF0032	
50	ISLASF0050	ISLANF0050	
63	ISLASF0063	ISLANF0063	
80	ISLASF0080	ISLANF0080	
100	ISLASF0100	ISLANF0100	
125	ISLASF0125	ISLANF0125	
160	ISLASF0160	ISLANF0160	
200	ISLASF0200	ISLANF0200	
250	-	ISLANF0250	

Rating (Amps.)	Cat No.		
	SKB-3	SKB-4	SKB-0
160	ISLCNF0160	ISLCHF0160	–
200	ISLCNF0200	ISLCHF0200	–
250	ISLCNF0250	ISLCHF0250	–
315	ISLCNF0315	ISLCHF0315	–
400	ISLCNF0400	ISLCHF0400	–
500	ISLCNF0500	ISLCHF0500	–
630	ISLCNF0630	ISLCHF0630	–
800	ISLCNF0800	ISLCHF0800	–
1000	–	–	ISLDNF1000
1250	–	–	ISLDNF1250

MCCB Fixed Type - Single Pole

Rating (Amps.)	Cat No.	
	SKB-6	
25	ISLGNS0025	
32	ISLGNS0032	
50	ISLGNS0050	
63	ISLGNS0063	
80	ISLGNS0080	
100	ISLGNS0100	
125	ISLGNS0125	

MCCB Fixed Type - Three Pole

Rating (Amps.)	Cat No.		
	SKB-5	SKB-6	SKB-7
25	ISLGST0025	ISLGNT0025	ISLGHT0025
32	ISLGST0032	ISLGNT0032	ISLGHT0032
50	ISLGST0050	ISLGNT0050	ISLGHT0050
63	ISLGST0063	ISLGNT0063	ISLGHT0063
80	ISLGST0080	ISLGNT0080	ISLGHT0080
100	ISLGST0100	ISLGNT0100	ISLGHT0100
125	ISLGST0125	ISLGNT0125	-

Rating (Amps.)	Cat No.		
	SKB-8	SKB-9	
25	ISLFNT0025	ISLFHT0025	
32	ISLFNT0032	ISLFHT0032	
50	ISLFNT0050	ISLFHT0050	
63	ISLFNT0063	ISLFHT0063	
80	ISLFNT0080	ISLFHT0080	
100	ISLFNT0100	ISLFHT0100	
125	ISLFNT0125	ISLFHT0125	
160	ISLFNT0160	ISLFHT0160	
200	ISLFNT0200	ISLFHT0200	
250	ISLFNT0250	ISLFHT0250	

MCCB Fixed Type - Four Pole (wSN)

Rating (Amps.)	Cat No.		
	SKB-5	SKB-6	SKB-7
25	ISLGSF0025	ISLGNF0025	ISLGHF0025
32	ISLGSF0032	ISLGNF0032	ISLGHF0032
50	ISLGSF0050	ISLGNF0050	ISLGHF0050
63	ISLGSF0063	ISLGNF0063	ISLGHF0063
80	ISLGSF0080	ISLGNF0080	ISLGHF0080
100	ISLGSF0100	ISLGNF0100	ISLGHF0100

Rating (Amps.)	Cat No.		
	SKB-8	SKB-9	
25	ISLFNF0025	ISLFHF0025	
32	ISLFNF0032	ISLFHF0032	
50	ISLFNF0050	ISLFHF0050	
63	ISLFNF0063	ISLFHF0063	
80	ISLFNF0080	ISLFHF0080	
100	ISLFNF0100	ISLFHF0100	
125	ISLFNF0125	ISLFHF0125	
200	ISLFNF0200	ISLFHF0200	
250	ISLFNF0250	ISLFHF0250	

Auxiliary Switch

Frame 1 / 2, 3 / 4, 5/6/7*, 8/9

Frame Size	Configuration	Cat No.
SKB 1/2	1NO + 1NC	ISLLAS1CO
SKB 1/2	2 (1NO + 1NC)	ISLLAS2CO
SKB 3/4	1NO + 1NC	ISLLASC1CO
SKB 3/4	2 (1NO + 1NC)	ISLLASC2CO
SKB 5/6/7	1NO + 1NC	ISLLASG1CO
SKB 5/6/7	2 (1NO + 1NC)	ISLLASG2CO
SKB 8/9	1NO + 1NC	ISLLASF1CO
SKB 8/9	2 (1NO + 1NC)	ISLLASF2CO
SKB 0	1NO + 1NC	ISLLASD1CO
SKB 0	2 (1NO + 1NC)	ISLLASD2CO

*Voltage rating 450Vac/250Vac/250Vdc *In frame 5/6/7 current rating is 3 Amp.
*In frame 1/2,3/4,8/9 current rating is 4 Amp.


Auxiliary Switch

Shunt Trip

Shunt trip is used to trip the breaker electrically from a remote point. Since shunt trip coil does not have a continuous rating, the coil must be connected to the load end of the breaker and must not be energised for more than 2 secs.

Coil Voltage	Frame Size (Cat No.)				
	SKB 1/2	SKB 3/4	*SKB 5/6/7	SKB 8/9	SKB 0
12-36 Vdc	ISLLSTA030	ISLLSTC030	ISLLSTG030	ISLLSTF030	ISLLSTD030
100-110 Vac	ISLLSTA110	ISLLSTC110	ISLLSTG110	ISLLSTF110	ISLLSTD110
220-240 Vac	ISLLSTA240	ISLLSTC240	ISLLSTG240	ISLLSTF240	ISLLSTD240
280-415 Vac	ISLLSTA415	ISLLSTC415	ISLLSTG415	ISLLSTF415	ISLLSTD415


Shunt Trip

* For operating the Shunt Trip, one changeover contact of the Aux. switch should be used leaving one free.

Under Voltage Release

Coil Voltage	Frame Size (Cat No.)				
	SKB 1/2	SKB 3/4	*SKB 5/6/7	SKB 8/9	SKB 0
110-120 Vdc	ISLUVRA110	ISLUVRC110	ISLUVRG110	ISLUVRF110	ISLUVRD110
220-240 Vac	ISLUVRA240	ISLUVRC240	ISLUVRG240	ISLUVRF240	ISLUVRD240
380-440 Vac	ISLUVRA440	ISLUVRC440	ISLUVRG240	ISLUVRF440	ISLUVRD440

The breaker trips if the supply voltage dips below 85% of the rated voltage.
The breaker can not be switched ON unless there is a supply to the UVR (NVNC feature).
Supplied with external mounting Power pack to operate on AC supplies in all the frame sizes
Additional transformer is also supplied for 380-440V AC & 110-120V AC.


Under Voltage Release

Rotary Handle

- Direct Padlockable
- With Door interlock and 300mm remote shaft

Frame Size	Cat No.
SKB 1/2	ISLLRRHA30
SKB 3/4	ISLLRRHC30
SKB 5/6/7	ISLLRRHG30
SKB 8/9	ISLLRRHF30
SKB 0	ISLLRRHD30


Rotary Handle & Spares

Other External Accessories

- Dolly Pad locking device
- Extended terminals
- Phase Barriers
- Dolly Extension
- Back Studs

Earth Fault Relay

The earth fault detection system for use with STANDARD MCCBs comprises of a core balance transformer (CT) coupled to an advanced RCD relay. The relay may be used to trip a circuit breaker via a shunt trip or an under voltage release in the event of an Earth Fault.

The relay and one of the four available CT's is all that is required for a complete earth fault sensing system suitable for the control of a circuit breaker in a circuit upto 800A fitted with either a shunt trip or an under voltage release. The simple arrangement and a small number of inter-connection necessary ensure that EFR is easily selected and installed.

The relay is suitable for 220-240V AC supply with the flexibility of choosing the sensitivity between 300mA to 2A and time delay should be selected by the DIP switches provided on the facia of the relay.

Features

- No nuisance tripping
- DIN rail mounting
- Adjustable time delay
- Choice of sensitivity from 300mA upto 2A
- Trip indication LED(Red)
- ON indication LED(Green)
- Test push button
- Reset push button

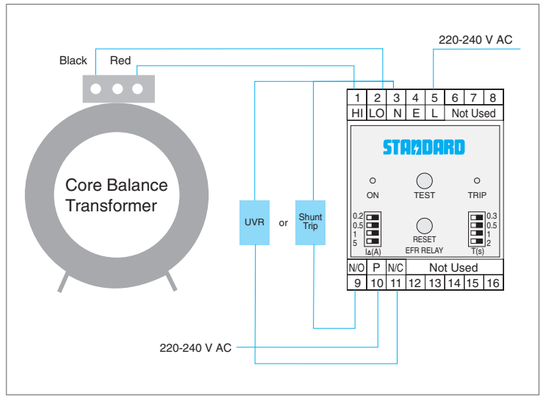

Earth Fault Relay

Technical Data

Supply Voltage : 220V / 240V AC, 50 / 60Hz
Changeover contact : 5A-15A 240V AC
Sensitivity : 300mA, 500mA, 1A, 2A
Time delay (m.sec.) : 200, 500, 1000, 5000

The earth fault relay is supplied with the CT based on the current rating. To operate the EFR a shunt trip or an under voltage release is necessary which has to be ordered separately.

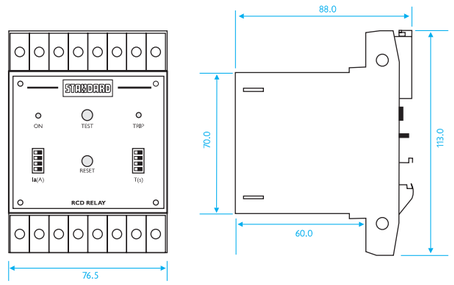
Coil Voltage	Cat No.
25-100	ISEF1100
125-200	ISEF2200
250-400	ISEF3400
500-800	ISEF4800



Core Balance Current Transformer

Size	MCCB Current Rating	Internal Dimension	Shape
1.	25-100A	60mm	Circular
2.	125-200A	95mm	Circular
3.	250-400A	145mm	Circular
4.	500-800A	300 x 80 mm	Rectangular
5.	1000-1600A	On Request	Rectangular

Dimensional Details (in mm)

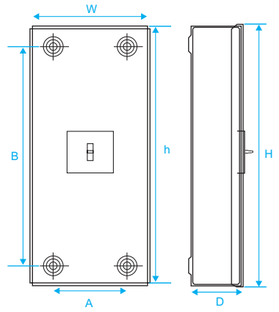


General Purpose Enclosure

Enclosures made of special grade CRCA steel are available for housing SKB-1 to SKB-9 Frame MCCBs upto 800A. They are manufactured with latest technology using CNC Punch and Brake presses to attain highest degree of perfection. The enclosures are painted with latest techniques in powder coating using epoxy polyester and polyester resin based powder paints to ensure smooth, scratch resistant surface coatings. They are suitable for wall mounting & adequate knockouts are provided for cable entry.

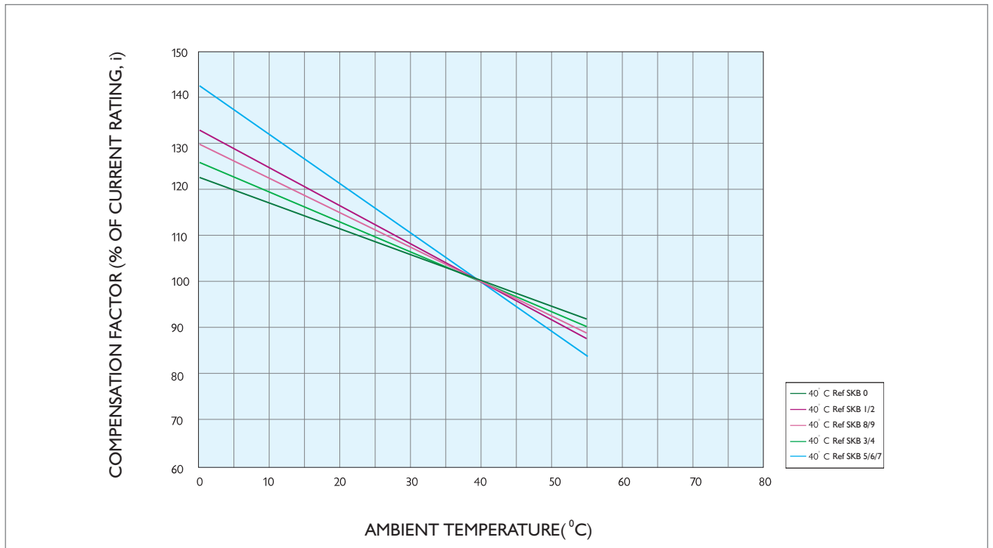
Description	Cat. No.
SKB-5/6/7 Frame SP	ISEGSP
SKB-5/6/7 Frame TP	ISEGTP
SKB-5/6/7 Frame FP	ISEGFP
SKB-1/2 Frame SP	ISEASP
SKB-1/2 Frame TP	ISEATP
SKB-1/2 Frame FP	ISEAFP
SKB-8/9 Frame TP	ISEFTP
SKB-8/9 Frame FP	ISEFFP
SKB-3/4 Frame TP (400A)	ISECTP
SKB-3/4 Frame FP (400A)	ISECFP
SKB-3/4 Frame TP (800A)	ISECTP
SKB-3/4 Frame FP (800A)	ISECFP

Dimensional Details (in mm)



Description	W	D	h	H	AxB
SKB-5/6/7 Frame	260	108	360	370	160x360
SKB-1/2 Frame	260	108	560	570	160x480
SKB-8/9 Frame	260	122	560	570	160x480
SKB-3/4 Frame upto 400 A	440	122	960	975	280x802
SKB-3/4 Frame upto 800 A	540	122	960	975	380x802

Ambient Temperature Compensation Chart (SKB 1/2, SKB 3/4, SKB 5/6)



Discrimination Data

IS:13703 HBC Fuse - Upstream Device

STANDARD MCCB DO WNSTREAM DEVICE (LOW SET)

Product	Rating (A)	KA @ 415V	Current Rating of HBC Fuses										
			80	100	125	160	200	250	315	400	500	630	800
SKB 1/2	25	25	1200	1400	1800	2400	3200	4500	5500	8000	12000	14000	23000
	32	25	1200	1400	1800	2400	3200	4500	5500	8000	12000	14000	23000
	40	25	350	1400	1800	2400	3200	4500	5500	8000	12000	14000	23000
	50	25	300	1400	1800	2400	3200	4500	5500	8000	12000	14000	23000
	63	25	250	1400	1800	2400	3200	4500	5500	8000	12000	14000	23000
	80	25		300	450	2400	3200	4500	5500	8000	12000	14000	23000
	100	25			400	650	3200	4500	5500	8000	12000	14000	23000
	125	25				550	3200	4500	5500	8000	12000	14000	23000
	160	25					650	1300	5500	8000	12000	14000	23000
	200	25						1200	1300	8000	12000	14000	23000
SKB 3/4	250	50							1000	8000	12000	14000	23000
	315	50								2000	12000	14000	23000
	400	50									2500	14000	23000
	500	50										3500	23000
	630	50											5500
SKB 0	800	50											6000

The above table gives fault currents in amperes till which level the downstream breakers shall act prior to the upstream fuse.

DISCRIMINATION DATA
STANDARD MCCB UPSTREAM DEVICE INSTANTANEOUS TRIP SET AT HIGH

Product	Rating	kA@	SKB 1/2										SKB 3/4						SKB 0				
	(A)	415V	25	23	40	50	63	80	100	125	160	ALL	250	315	400	500	630	800	600	800	1000	1250	1600
SKB 1/2	63	25						800	800	800	1600	1600	2500	3000	4000	5000	6300	8000	7400	8300	9200	9200	9200
	80	25									1600	1600	2500	3000	4000	5000	6300	8000	7400	8300	9200	9200	9200
	100	25									1600	1600	2500	3000	4000	5000	6300	8000	7400	8300	9200	9200	9200
SKB 3/4	125	25									1600	1600	2500	3000	4000	5000	6300	8000	7400	8300	9200	9200	9200
	160	25											2500	3000	4000	5000	6300	8000	7400	8300	9200	9200	9200
	200	25											2500	3000	4000	5000	6300	8000	7400	8300	9200	9200	9200
	315	50													4000	5000	6300	8000	7400	8300	9200	9200	9200
	400	50														5000	6300	8000	7400	8300	9200	9200	9200
	500	50															6300	8000	7400	8300	9200	9200	9200
	630	50																8000	7400	8300	9200	9200	9200
	800	50																	7400	8300	9200	9200	9200
SKB 0	1000	50																			9200	9200	9200
	1250	50																				9200	9200
	1600	50																					9200

The above table gives fault current in amperes till which level the downstream breakers shall act prior to the upstream breaker

STANDARD ELECTRICALS

Selection & Application

TRANSFORMER PROTECTION

Primary side

For the protection of transformer with a circuit breaker connected to the primary side (LT primary) the no load inrush current of the transformer must be considered. The peak value of the first current wave often reaches 10-15 times the rated current and may sometimes reach as high as 20-25 times. However, the transient decays very quickly (in a few m.sec.). Thus the MCCB selected should have a magnetic setting which will not be actuated by the momentary inrush current.

Secondary side

STANDARD MCCBs can be used for protection of transformer on the LT side (secondary side) as an outgoing protective device.

The rated current of the transformer is calculated as follows :

$$I_e = \frac{kVA \times 1000}{\sqrt{3} \times U_e} \text{ Amps}$$

'U_e' is the Rated Voltage at the LT side

The Breaking capacity of the breaker for protection can be calculated as :

$$I_b = \frac{I_e}{Z\%} \times 10^{-3} \text{ Kiloamperes}$$

Where 'I_b' is the rated breaking capacity,
'I_e' the rated current
'Z%' is the percentage impedance of transformer (specified by the manufacturer)

Selection table For Transformer Protection

MCCB Rating in Amperes

Transformer Rating (KVA)	SKB-5 10kA	SKB-6 16kA	SKB-7 25kA	SKB-1 25kA	SKB-2 25kA	SKB-2 35kA	SKB-3 35kA	SKB-4 50kA	SKB-0 50kA
16	25	25	25	25	25	25			
25	40	40	40	40	40	40			
63	100	100	100	100	100	100			
100				160	160	160	160	160	
160				250	250	250	250	250	
200							315	315	
250							400	400	
315							500	500	
400							630	630	
500							800	800	
630									1000
750									1200

GENERATOR Set Protection

STANDARD MCCBs can be used for the effective protection and control of Diesel Generating set against overload and short circuits.

The Current rating of MCCB to be selected is calculated as follows :

$$kVA = \sqrt{3}\, U_e \times I_e$$

or

$$I_e = \frac{kVA}{\sqrt{3} \times U_e}$$

Where,

kVA = Rating of the DG Set

U_e = Rated Voltage

I_e = Rated Current

The MCCB rating selected is greater than or equal to the rated current value

Selection Table for DG Set Protection

DG Set Rating (KVA)	MCCB Rating (Amperes)
16	25
25	40
63	100
10	160
16	250
20	315
25	400
31	500
40	630
63	1000
750	1200

Selection & Application

FEEDER / CABLE PROTECTION

An estimation of the prospective short-circuit current (psc) in an installation is an important consideration in the selection of the appropriate protective device.

The magnitude of the short-circuit current (rms value of the AC component) at a point in the installation will depend upon;

(A) Prospective short-circuit current at the origin of the installation.

(B) The amount of resistance in the circuit between the origin of the installation and the point at which the short circuit occurs.

(C) The type of short-circuit, phase to phase or phase to earth or phase to neutral.

It is possible to arrive at a maximum prospective short circuit value at the origin by taking the transformer kVA rating and its impedance and calculating from the expression :

$$\text{SC kA} = \frac{\text{Transformer rating (kVA) x 100}}{\sqrt{3} \text{ x Secondary voltage x \% impedance of transformer}}$$

To calculate the resistance in the LV circuit, obtain details of lengths and sizes of cables between the source of supply and the point under calculation. Using the table provided, determine the sum of cable resistances and then simply read off the estimated fault current from the relevant transformer curve on the graph.

The values assume a symmetrical fault across the three phases. In a single circuit, for line to neutral faults, take the cable resistance value from the table and double it.

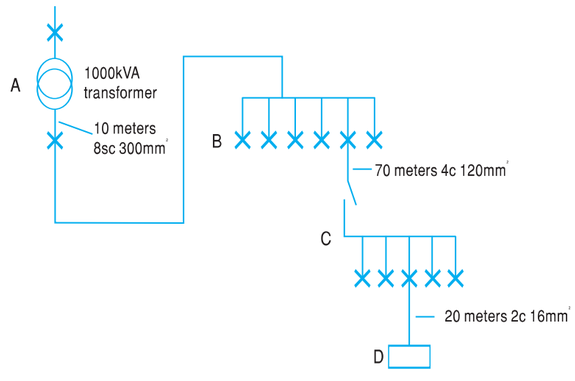
The selection of STANDARD MCCB for feeder /cable protection depends on the total load to be protected and the prospective short-circuit current (psc) at the point of installation.

PSC at	Aapproximately 27kA
PSC at B resistance A to B (a)	0.30mΩ = 25kA
PSC at C +resistance A to B +resistance B to C1	0.30mΩ 10.70mΩ 11.00mΩ = 12kA
PSC at D +resistance A to B +resistance B to C +resistance C to D	0.30mΩ 10.70mΩ 46.00mΩ (b) 57.00mΩ = 3kA

(a) 2 cables per phase divided by 2
(b) 2 core cable, multiplied by 2

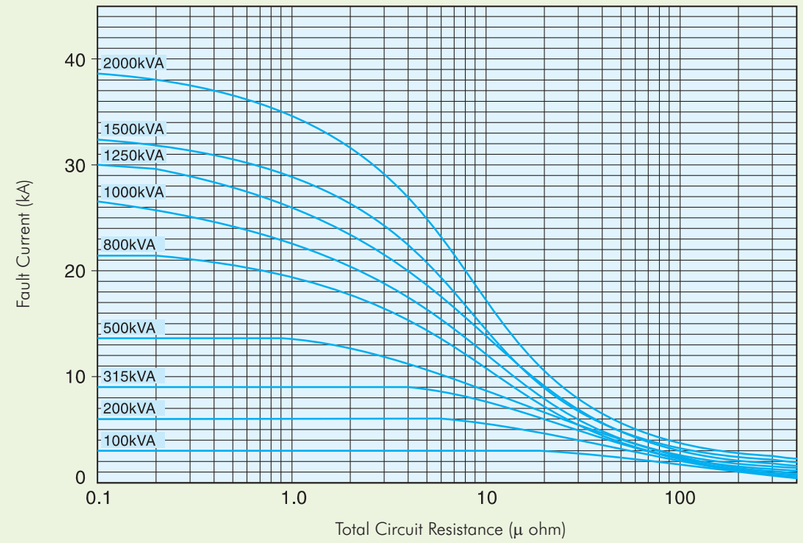
The above calculations have an inbuilt safety margin as they assume a no impedance fault condition which would not be the case in practice.

Typical Installation



Selection & Application

Estimating the Prospective Short Circuit Current



Maximum Resistance of Copper Conductors at 20°C (μ ohm)

Nominal Cross-sectional Area (mm²)	Cable Length											
	5m	10m	15m	20m	30m	40m	50m	60m	70m	80m	90m	100m
1	90.50	181.00										
1.5	60.50	121.00	182.00									
2.5	37.10	37.10	74.10	111.00	148.00							
4	23.10	46.10	69.20	92.20	138.00							
6	15.40	30.80	46.20	61.60	92.40	123.00						
10	9.15	18.30	27.50	36.60	54.90	73.20	91.50	110.00				
16	5.75	11.50	17.30	23.00	34.50	46.00	57.20	69.00	80.50	103.50		
25	3.64	7.27	10.90	14.50	21.80	29.10	36.40	43.60	50.90	58.20	65.40	72.70
35	2.62	5.24	7.86	10.48	15.70	21.00	26.20	31.40	36.70	41.90	47.20	52.40
50	1.94	3.87	5.81	7.74	11.60	15.50	19.40	23.20	27.10	31.00	34.80	38.70
70	1.34	2.68	4.02	5.36	8.04	10.70	13.40	16.10	18.80	21.40	24.10	26.80
95	0.96	1.93	2.10	3.86	5.79	7.72	9.65	11.60	13.60	15.40	17.40	19.30
120	0.77	1.53	2.30	3.06	4.59	6.12	7.65	9.18	10.70	12.20	13.80	15.30
150	0.62	1.24	1.86	2.48	3.72	4.96	6.20	7.44	8.68	9.92	11.20	12.40
185	0.49	1.00	1.49	1.98	2.97	3.96	4.96	5.96	6.94	7.93	8.92	9.91
240	0.34	0.75	1.13	1.51	2.26	3.02	3.77	4.52	5.28	6.03	6.79	7.54
300	0.30	0.63	0.90	1.20	1.80	2.80	3.00	3.61	4.21	4.81	5.41	6.01
400	0.23	0.47	0.70	0.94	1.41	1.88	2.35	2.85	3.29	3.76	4.23	4.70
500	0.18	0.37	0.55	0.73	1.10	1.46	1.83	2.20	2.56	2.93	3.29	3.66
630	0.14	0.28	0.42	0.57	0.85	1.13	1.42	1.78	2.15	2.51	2.88	3.25

Selection & Application

Motor Control

STANDARD MCCBs can be used for motor protection. Selection of MCCBs has to be done taking into consideration the starting inrush current, and the system fault levels. Further the selection is also based on type of starting, i.e. DOL or Star Delta.

DOL Starting

Care is to be taken to avoid nuisance tripping during starting of Squirrel Cage Motors since the inrush current will be in the order of 600 to 800% of the full load current of the motor. The overload setting is chosen such that it does not trip during starting.

Star-Delta Starting

In Star Delta starting of motors, since there is a reduction in the starting current due to reduced voltage, the MCCBs do not have a problem in the overload setting. But the transient currents can go upto 12 times the rated current during change over from star to delta which will cause the instantaneous magnetic release to trip the breaker. So proper selection of magnetic pickup level is important for prevention of nuisance tripping during change over from Star to Delta.

It is always recommended to select an MCCB in co-ordination with Contactor and Over Load Relay so as to have the best and optimum benefit of all the devices.

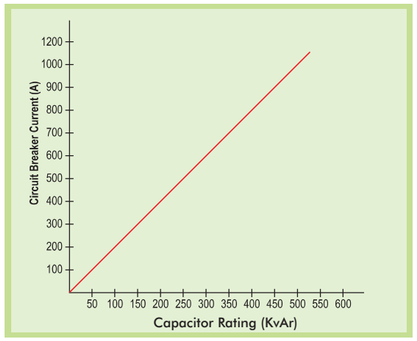
Selection table for Motor Protection

Motor Rating		Apprx. Full Load Current	Direct On Line MCCB Rating/Type		Star/Delta MCCB Rating/Type		
HP	KW	(A) at 415V	SKB-1	SKB-3/4	SKB-1	SKB-3/4	SKB-0
10	7.5	14	25	-	25	-	-
12.5	9	17	25	-	25	-	-
15	11	21	25	-	25	-	-
20	15	28	32	-	32	-	-
25	19	35	40	-	40	-	-
30	22	41	50	-	50	-	-
40	30	52	80	-	63	-	-
50	37	69	100	-	80	-	-
60	45	80	-	-	100	-	-
75	55	97	-	-	125	-	-
100	75	125	-	-	160	-	-
125	90	156	-	250	-	-	-
150	112	190	-	315	-	250	-
175	130	225	-	315	-	315	-
200	149	255	-	315	-	315	-
220	160	275	-	400	-	400	-
250	186	320	-	400	-	500	600
300	224	375	-	500	-	500	600
350	261	449	-	630	-	630	600
400	298	505	-	630	-	630	600

The figures shown are based on following motor starting conditions : -
Direct online 7 X full load current for 5 seconds.
Star/Delta 4 X full load current for 12 seconds.

Selection & Application

Capcitor Control



When a capacitor circuit is opened, it exhibits characteristics distinctly differently from inductor loads due to the effects of residual electric charge in the capacitor. The recovery voltage appears across the contacts immediately after the circuit is opened is equal to the difference between the capacitor residual voltage and supply voltage. Therefore half a cycle after the circuit opens, the voltage between the contacts of the switch rises to twice the supply voltage or higher.

In a three phase circuit the recovery voltage appearing between the contacts in the first interrupted phase could rise to as high as 2.5 times the supply voltage. Unless the breaker contacts are fully open for at least ½ cycle after the capacitor current is interrupted, restrike of arc is likely to occur. If the restrike arc is repeated, the voltage could continue to rise to the dielectric breakdown point of the capacitor. Hence, fast interrupting, quick make, quick-break circuit breakers should be used for this type of circuit.

When a capacitor circuit is closed a condenser charge q = CU which corresponds to the instantaneous value 'U' of the supply voltage at closing time, must be instantaneously supplied, causing a large inrush current to flow through it. If the capacitor circuit is closed in the voltage phase at which the inrush current is maximum, the maximum value of the inrush current is approximately,

$$I_p = \frac{C}{L} \times U$$

The maximum time duration during which the maximum current flows is about 0.5 ms. Selection of a MCCB for capacitor circuit duty must therefore consider the effects of higher short circuit and inrush currents. This will affect the choice of instantaneous trip current rating. In practice, an MCCB which satisfies the following equations should be chosen.

$$I_r > 1.5 \times I_c$$

$$I_{inst} > \frac{I_p}{2}$$

Where :
I_r = Rated current of MCCBs
I_c = Rated current of capacitor
I_{inst} = Short circuit pick up setting of the MCCB
I_p = Maximum capacitor inrush current

It is therefore necessary to select a circuit breaker with current rating not less than 1.5 - 2.0 times the rated current of the capacitor.

DC CONTROL

MCCBs though not separately designed for DC applications are suitably modified to be able to operate on DC systems also upto 500V DC / 250V DC. This is achieved by modifying for:

i) Current carrying capacity

ii) Over current and short circuit protection

iii) Short circuit breaking capacity (with L/R time constant limitations)

Current Carrying Capacity

The continuous current carrying capacity is generally a function limited by the temperature rise of various internal components of MCCBs.

The AC rating of MCCBs is expressed as "RMS" value. The DC rating is "Average" value. The RMS and average value can be related by a "Form Factor" which is 1.1.

Hence, an AC MCCB can be assigned a 10% higher DC current rating. But in practice the use of DC MCCB ratings are equal to AC ratings and thereby, temperature rise is restricted within limits.

Overload Release & Overload Protection

The overload release are generally thermal type with a Bimetal-Heater system. The heating effect which can be expressed by the factor integral I·t varies for AC and DC. The integral (I·t) for AC will be 1.21 times integral (I·avt) for DC, thus an AC MCCB when used in DC circuit will trip slower. For example a 100A AC MCCB when used in DC circuit for 100A will sense a 20% overload only from 133A onwards.

To retain the same Overload characteristics as AC, it is important to separately calibrate the MCCBs for DC ratings and overload tripping characteristics need to be suitably modified.

Short Circuit Release & Short Circuit Protection

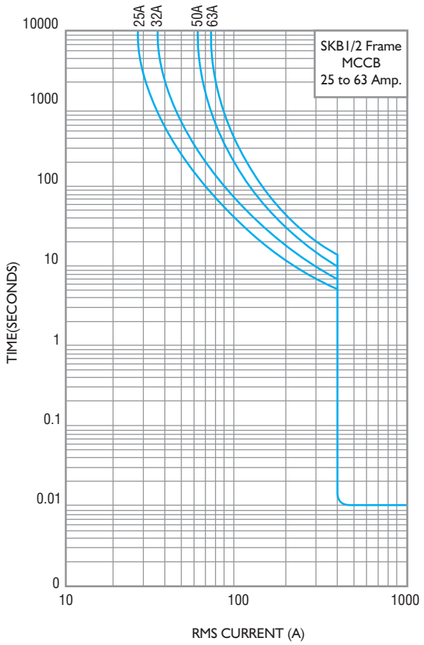
The short circuit release is actuated by the peak value of the AC sine wave. Since no such peak exists in DC, DC tripping will be slower. Hence to achieve the same short circuit pick up level in DC, the short circuit release will be calibrated specially.

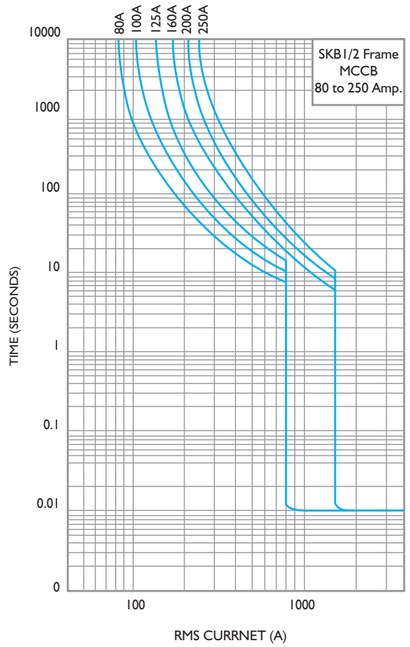
Short Circuit Breaking Capacity

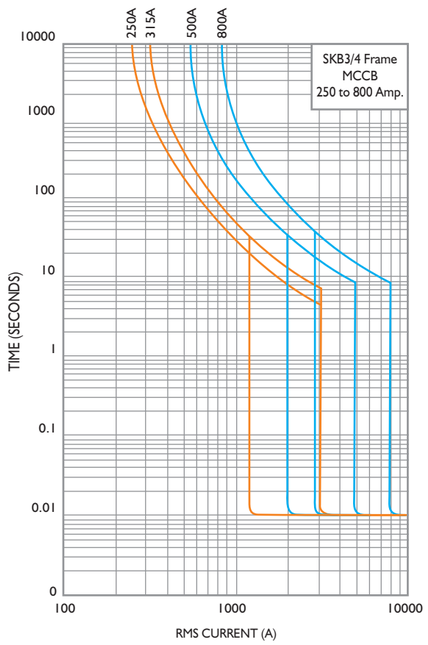
In AC the breaking of the short circuit current usually occurs within the first current zero, by the current limiting effect. No such current zero exists in DC. Arc breaking and ultimate quenching of arc depends on the rapid dissipation of the inductive Energy $\frac{1}{2}Li^2$

This energy dissipation is dependent on L/R or time constant of the circuit. The L/R values should be limited to 10-15 milli seconds to achieve satisfactory performance. This is achieved usually by splitting the DC arc voltage over 2 or 3 poles by connecting them in series, depending upon on the DC voltage.

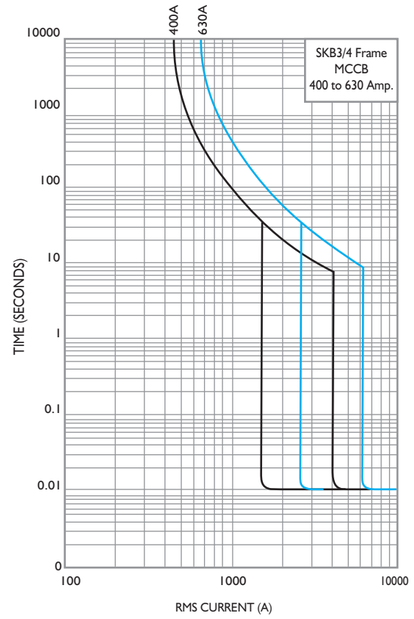
Time Current Characteristics

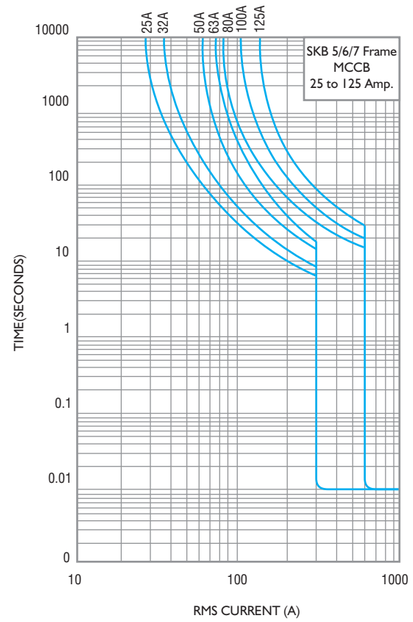






Time Current Characteristics





Time Current Characteristics