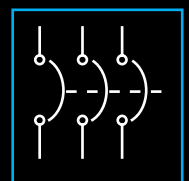


# LOADLINE

## Moulded Case Circuit Breaker



## Moulded Case Circuit Breaker

### CONSTRUCTION

Loadline Moulded Case Circuit Breakers have precision formed moulded case and cover of high performance resin bonded thermoset material. The circuit breakers are designed to allow grouping in distribution panels or switchboards to present their operating handles and label escutcheons uniformly aligned in a single panel cut out.

The **switching mechanism** is Quick make-Quick break type and is tripfree, i.e. the breaker trips internally even if the operating knob is held in ON position.

The **contact mechanism** comprises of fixed and moving contacts made of sintered silver alloy for reliability, long life and anti-welding properties. Arcing contacts are provided in higher frames, further increasing the contact life.

The **arc extinguishing** device comprises of arc chutes having grid plates mounted in parallel between supports of insulating material. The arc is divided between these grid plates which helps in its fast quenching. The arc is thus confined, divided and extinguished in the arc chute. The excellent insulation between the conducting parts and better energy dissipation after short circuit makes it possible to make the load and line connections on either side.

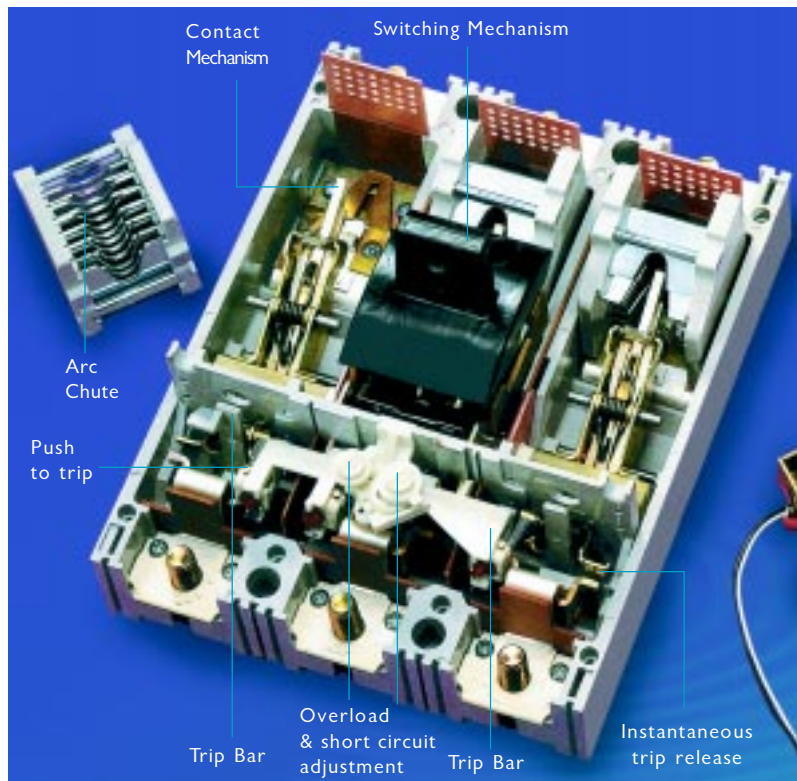
The **tripping mechanism** comprises of a bimetal and heater element for overload protection and fixed & moving core for magnetic protection in each pole coupled to a single trip bar unit to avoid single phasing. The overload and magnetic setting are front adjustable on site.

#### Thermal Magnetic Type

The overload protection is provided by a combination of the heater element and the bimetal strip in each phase which activates the trip mechanism.

Short Circuit protection is provided by the magnetic circuit comprising of the fixed and moving core. In the event of short circuit, the moving core is attracted towards the fixed core due to the high electromagnetic forces developed which actuates the trip mechanism.

The fixed and moving contacts of Loadline MCCBs are so designed that an electromagnetic repulsive force is developed under high currents which is sufficient to overcome the spring tension holding the moving contacts, thereby initiating the contact opening resulting into faster opening of the contacts limiting the prospective short circuit current.



## Moulded Case Circuit Breaker

### TECHNICAL INFORMATION

### G-FRAME

Standard conformity	: IEC 947-2/IS:13947-2
Rated operational voltage	: 415V AC
Rated Insulation Voltage	: 660V AC
Type of release	: Thermomagnetic
Utilisation Category	: A
Rated frequency	: 50/60 Hz
Ambient temp	: 40°C (50°C on request)
Operating altitude	: 2000 meters
Humidity	: 0 - 90%
Rated impulse voltage	: 8 KV



Frame		GS	GN	GH
No. of Poles		3P/4PwSN	1P / 3P / 4PwSN	3P / 4PwSN
Standard current range / rating (I <sub>n</sub> )	A	<b>25-125*</b>	<b>25-125*</b>	<b>25-100*</b>
Thermal release setting		Fixed	Fixed	Fixed
Magnetic release setting for current rating :				
25A - 50A	A	500	500	500
63A - 80A	A	800	800	800
100A - 125A	A	1000	1000	1000
Rated short circuit making capacity (Peak) I <sub>cm</sub>	KA	21	32	52.5
Rated ultimate short circuit breaking capacity(I <sub>cu</sub> ), KA	240V	25	25	30
(at different voltages)	380V	10	16	25
	415V	10	16	25
	500V	7.5	12	14
	600V	6	10	10
	660V	5	9	9
Weight SP	Kg	0.35	0.35	0.35
TP	Kg	0.93	0.93	0.93
4PwSN	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	7.5	7.5	7.5
<b>Internal Accessories</b>				
Auxiliary Switch (1 C/O or 2C/O)		☐	☐	☐
Shunt Trip		☐	☐	☐
Under Voltage Release		☐	☐	☐
<b>External Accessories</b>				
Earth Fault Relay		☐	☐	☐
Rotary Handle		☐	☐	☐
Back Studs		-	-	-
Extended Terminals (above 63A)		+	+	+
Dolly Extension		-	-	-
Phase Barriers		+	+	+
Terminal Shrouds		☐	☐	☐
Dolly pad locking Device		☐	☐	☐

\* Current Ratings - 25A, 32A, 40A, 50A, 63A, 80A, 100A, 125A

☐ Available, - Not Available, + Supplied alongwith the MCCB as standard.

1P - Single Pole

3P - Three Pole

4PwSN - Four Pole with Switched Neutral

## Moulded Case Circuit Breaker

### TECHNICAL INFORMATION

### AA-FRAME

Standard conformity	: IEC 947-2/IS:13947-2
Rated operational voltage	: 415V AC
Rated Insulation Voltage	: 660V AC
Type of release	: Thermomagnetic
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



**AAS**



**AAN**



**AAM**

Frame		AAS		AAN		AAM
No. of Poles		1P / 3P / 4PwSN		1P / 3P / 4PwSN		3P/4PwSN
Standard current range / ratings ( $I_n$ )	A	<b>25-200*</b>		<b>25-250*</b>		<b>50-250*</b>
Thermal release setting (Adjustable)		70-100% of $I_n$		70-100% of $I_n$		70-100% of $I_n$
Magnetic release setting for current rating :						
25A - 63A		400A		400A		-
80A - 125A		800A		800A		-
160A - 250A		1600A		1600A		-
50 - 250A AM frame		-		-		1600A
Rated short circuit making capacity (Peak) lcm KA		52.5	32	73.5	52.5	52.5
Rated ultimate short circuit breaking capacity(Icu), KA		(25-125A)	(160-200A)	(25-125A)	(160-250A)	(50-250A)
(at different voltages)		240V	40	25	50	40
		380V	35	16	35	35
		415V	25	16	35	25
		500V	18	12	25	18
		600V	15	10	22	15
		660V	13	9	20	13
Weight						
SP (Single Pole)	Kg	0.7		0.7		0.7
TP (Triple Pole)	Kg	1.8		1.8		1.8
FPwSN(Four Pole Switched Neutral)	Kg	2.4		2.4		2.4
Terminal capacity (Cable)	Sq.mm	70(upto 100A)/150 (125A-250A)				
(Bus bar width)	mm	25 (125A-250A)				
Recommended Torque	Nm	10		10		10
<b>Internal Accessories</b>						
Auxiliary Switch (1 C/O or 2C/O)		□		□		□
Shunt Trip		□		□		□
Under Voltage Release		□		□		□
<b>External Accessories</b>						
Earth Fault Relay		□		□		□
Rotary Handle		□		□		□
Back Studs		□		□		□
Extended Terminals (above 63A)		+		+		+
Dolly Extension		-		-		-
Phase Barriers		+		+		+
Terminal Shrouds		□		□		□
Dolly pad locking Device		□		□		□

\* Current Ratings - 25A, 32A, 40A, 50A, 63A, 80A, 100A, 125A, 160A, 200A, 250A

□ Available, - Not Available, + Supplied alongwith the MCCB above 63A..

1P - Single Pole  
3P - Three Pole  
4PwSN - Four Pole with Switched Neutral



## Moulded Case Circuit Breaker

### TECHNICAL INFORMATION

### F-FRAME

Standard conformity	: IEC 947-2/IS:13947-2
Rated operational voltage	: 415V AC
Rated Insulation Voltage	: 660V AC
Type of release	: Thermomagnetic
Utilisation Category	: A
Rated frequency	: 50/60Hz
Ambient temp	: 40°C (upto 55°C on request)
Operating altitude	: 2000 meters
Humidity	: 0 - 90%
Rated impulse voltage	: 8 kV



**FN**



**FH**

Frame			FN	FH
No. of Poles			3P	3P
Standard Current ratings (In)	A		<b>25-250*</b>	<b>25-250*</b>
Thermal release setting			Fixed	Fixed
Magnetic release setting for current rating			Fixed	Fixed
25A - 32A			500A	500A
40A - 80A			800A	800A
100A - 125A			1250A	1250A
160A - 250A			1600A	1600A
Rated short circuit making capacity (Peak) Icm kA			73.5	105
Rated ultimate short circuit breaking capacity(Icu), kA	240V		--	--
(at different voltages)	380V		40	50
	415V		35	50
	500V		--	--
	600V		--	--
	660V		--	--
Weight	TP (Triple Pole)	Kg	2.9	2.9
	Terminal Type		M8	M8
	Terminal capacity (Cable)	Sq.mm	185	185
	(Bus bar width)	mm	18	18

#### Internal Accessories

Auxiliary Switch (1 C/O or 2C/O)		☐	☐
Shunt Trip		☐	☐
Under Voltage Release		☐	☐
Alarm Switch (1 C/O)		☐	☐

#### External Accessories

Earth Fault Relay		☐	☐
Rotary Handle		☐	☐
Back Studs		☐	☐
Extended Terminals (above 63A)		+	+
Dolly Extension		-	-
Phase Barriers		+	+
Terminal Shrouds		☐	☐
Dolly pad locking Device		☐	☐

\* Current Ratings - 25A, 32A, 40A, 50A, 63A, 80A, 100A, 125A, 160A, 200A, 250A

☐ Available, - Not Available, + Supplied alongwith the MCCB above 63A.

3P - Three Pole



## Moulded Case Circuit Breaker

### TECHNICAL INFORMATION

### CN / CH / DN - FRAME

Standard conformity	: IEC 947-2/IS:13947-2
Rated operational voltage:	415V AC
Rated Insulation Voltage	: 660V AC
Type of release	: Thermomagnetic
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



Frame		CN	CH	DN
No. of Poles		3P/4PwSN	3P/4PwSN	3P
Standard current ratings (In)	A	<b>160-800*</b>	<b>160-800*</b>	<b>800-1600*</b>
Thermal release setting (Adjustable)		70-100% of $I_n$	70-100% of $I_n$	70-100% of $I_n$
Magnetic release setting		Adjustable	Adjustable	Adjustable
160 - 315A	CN/CH Frame	5-10 times $I_n$	5-10 times $I_n$	-
400 - 800A	CN/CH Frame	4-10 times $I_n$	4-10 times $I_n$	-
800 - 1600A	DN frame	-	-	4 -10 times $I_n$
Rated short circuit making capacity (Peak) $I_{cm}$ KA		52.5	73.5	105
Rated ultimate short circuit breaking capacity ( $I_{cu}$ ), KA				
240V		50	70	70
380V		35	50	50
415V		35	50	50
500V		25	35	35
600V		22	30	30
660V		20	27	27
Weight TP (Triple Pole)	Kg	9.2	9.2	17#/19**
FPwSN (Four Pole with Switched Neutral)	Kg	11.6	11.6	-
Terminal capacity (cable)	Sq.mm	-	-	-
(Bus bar width)	mm	40	40	45** upto 800A 45** upto 1000A 60** upto 1250A 65** upto 1600A 35.5# upto 1600A
Recommended Torque	Nm	41	41	65
<b>Internal Accessories</b>				
Auxiliary Switch (1 C/O or 2 C/O)		☐	☐☐☐	☐
Shunt Trip		☐	☐☐☐	☐
Under Voltage Release		☐	☐☐☐	☐
<b>External Accessories</b>				
Earth Fault Relay		☐	☐☐☐	☐
Rotary Handle		☐	☐☐☐	☐
Back Studs		☐	-	☐
Extended Terminals		+	☐☐☐	☐
Dolly Extension		☐	☐☐☐	☐
Phase Barriers		+	-	☐
Terminal Shrouds		-	-	-
Dolly pad locking Device		☐	☐☐☐	☐

\* Current Ratings - 160A, 200A, 250A, 315A, 400A, 500A, 630A, 800A, 1000A, 1250A, 1600A.

☐ Available, - Not Available, + Supplied alongwith the MCCB as standard.

\*\* Terminals at Front

# Terminals at back / rear

3P - Triple Pole  
4PwSN - Four Pole with Switched Neutral

# Moulded Case Circuit Breaker

## TECHNICAL INFORMATION

## GN / AN / CH / DN - FRAME

### DC MCCBs

Standard conformity	:IEC 947-2/IS:13947-2
Rated operational voltage	:250V DC
Rated Insulation Voltage	:660V AC
Type of release	:Thermomagnetic
Utilisation Category	:A
Ambient temp	:40°C
Operating altitude	:2000 meters
Humidity	:0-90%



Frame		GN	AAN	CH	DN
No. of Poles		3P	3P	3P	3P
Standard current ratings In	A	<b>25-125*</b>	<b>160-250*</b>	<b>160-800*</b>	<b>800-1600*</b>
Thermal release setting		Fixed	Adjustable (70-100% of I <sub>n</sub> )	Adjustable (70-100% of I <sub>n</sub> )	Adjustable (70-100% of I <sub>n</sub> )

### Magnetic release setting for current rating :

25-50A	GN Frame	500A	-	-	-
63-80A	GN Frame	800A	-	-	-
100-125A	GN Frame	1000A	-	-	-
160-200A	AN Frame	-	1600A	-	-
160-315A	CH Frame	-	-	5 - 10 times I <sub>n</sub>	-
400-800A	CH Frame	-	-	4 - 10 times I <sub>n</sub>	-
800-1600A	DN frame	-	-	-	4 - 10 times I <sub>n</sub>
Rated ultimate short circuit breaking capacity (I <sub>cu</sub> ), at 250V DC	KA	10	10	40	40
Weight	Kg	0.93	1.8	9.2	17#/19**
Terminal capacity	(cable) Sq.mm (bus bar width) mm	70 10	150 25	- 40	- 45** upto 800A 45** upto 1000A 60** upto 1250A 65** upto 1600A 35.5# upto 1600A
Recommended Torque	Nm	7.5	10	41	65

### Internal Accessories

Auxiliary Switch		□	□	□	□
Shunt Trip		□	□	□	□

### External Accessories

Earth Fault Relay		□	□	□	□
Rotary Handle		□	□	□	□
Back Studs			□	□	□
Extended Terminals		+	+	+	□
Dolly Extension		-	-	□	□
Phase Barriers		+	+	+	□
Terminal Shrouds		□	□	-	-
Dolly pad locking Device		□	□	□	□

\* Current Ratings - 25A, 32A, 40A, 50A, 63A, 80A, 100A, 125A, 160A, 200A, 250A, 315A, 400A, 500A, 630A, 800A, 1000A, 1250A, 1600A.

□ Available, - Not Available, + Supplied alongwith the MCCB as standard. \*\* Terminals at Front, # Terminals at Rear.

### Loadline DC MCCBs

DC MCCBs are available in three pole version from 25A-1600A with breaking capacity of 10KA & 40KA.

The selection of the circuit breaker for DC applications depends on these criteria :-

- Rated current of the equipment.
- Rated voltage, which determines the number of poles in

series for breaking. For voltages beyond 250V DC, two poles of the breaker are connected in series to form the positive pole and the third pole to be used as a negative pole or three poles can be used in series.

- The maximum short-circuit current at the point of installation, which determines the breaking capacity.
- The (L/R) ratio for the application should be ≤ 15 ms.



# LOADLINE

## Moulded Case Circuit Breaker

### G FRAME SINGLE POLE MCCB



Current Rating (A)	Icu 16kA Cat. No.
25	LGNS0025
32	LGNS0032
40	LGNS0040
50	LGNS0050
63	LGNS0063
80	LGNS0080
100	LGNS0100
125	LGNS0125

### G FRAME THREE POLE MCCB



Current Rating (A)	Icu 10kA Cat. No.	Icu 16kA Cat. No.	Icu 25kA Cat. No.
25	LGST0025	LGNT0025	LGHT0025
32	LGST0032	LGNT0032	LGHT0032
40	LGST0040	LGNT0040	LGHT0040
50	LGST0050	LGNT0050	LGHT0050
63	LGST0063	LGNT0063	LGHT0063
80	LGST0080	LGNT0080	LGHT0080
100	LGST0100	LGNT0100	LGHT0100
125	LGST0125	LGNT0125	-
160	LGST0160	LGNT0160	-

### G FRAME FOUR POLE wSN MCCB



Current Rating (A)	Icu 10kA Cat. No.	Icu 16kA Cat. No.	Icu 25kA Cat. No.
25	LGSF0025	LGNF0025	LGHF0025
32	LGSF0032	LGNF0032	LGHF0032
40	LGSF0040	LGNF0040	LGHF0040
50	LGSF0050	LGNF0050	LGHF0050
63	LGSF0063	LGNF0063	LGHF0063
80	LGSF0080	LGNF0080	LGHF0080
100	LGSF0100	LGNF0100	LGHF0100
125	-	-	-



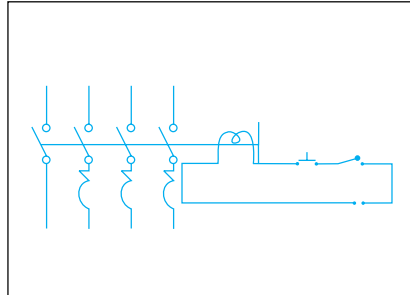


# Moulded Case Circuit Breaker

## G FRAME ACCESSORIES

(Accessories are for 3P / 4P wSN)

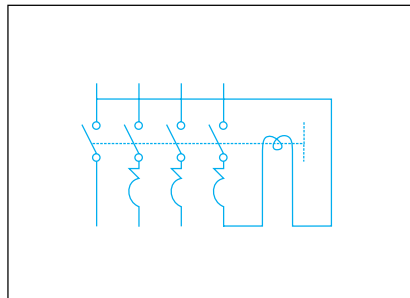
### SHUNT TRIP



Voltage	Cat No.
18-30Vdc/12-36Vdc	LLSTG030
110-110Vac	LLSTG110
220-240Vac	LLSTG240

For Operating the Shunt Trip, one Changeover contact of the auxiliary switch would be used leaving one free.

### UNDER VOLTAGE RELEASE



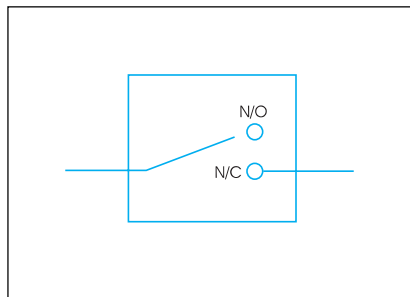
Voltage	Cat No.
110-120 Vac	LUVRG110
220-240 Vac	LUVRG240
380-440 Vac	LUVRG440

The breaker trips if the supply voltage dips below 85% of the rated voltage.

The breaker cannot be switched ON unless there is a supply to the UVR. (NVNC feature).

Supplied with external mounting Power pack to operate on AC supplies. Additional transformer is supplied with LUVRG440 & LUVRG110.

### AUXILIARY SWITCH



Voltage	Current Rating (AC15)	Cat No.	Config.
250Vac/250Vdc	3 Amps	LLASG1CO	(1NO+1NC)
250Vac/250Vdc	3 Amps	LLASG2CO	2(1NO+1NC)
450Vac/250Vdc	3 Amps	LLASG1CO	(1NO+1NC)
450Vac/250Vdc	3 Amps	LLASG2CO	2(1NO+1NC)

### ROTARY HANDLE



	Cat No.
Direct Padlockable	LLDRHG00
With Door interlock and 300mm remote shaft	LLRRHG30

# LOADLINE

## Moulded Case Circuit Breaker

### G FRAME ACCESSORIES

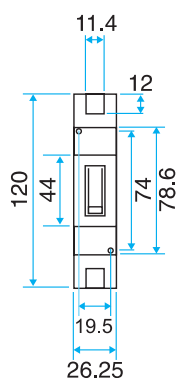
(Accessories are for 3P / 4P wSN)

### OTHER ACCESSORIES

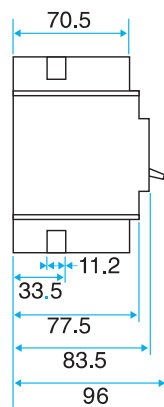


	Cat. No.
Dolly Pad locking device	LLDPG125
Extended terminals	LLETG125
Phase Barriers	LLPBG125
Terminal Shrouds Single Pole	LLTSPG125
Three Pole	LLTPG125

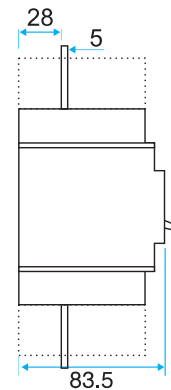
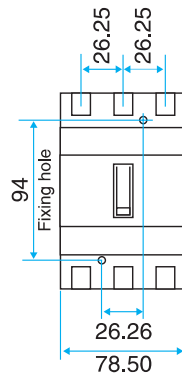
### DIMENSIONS (IN MM)



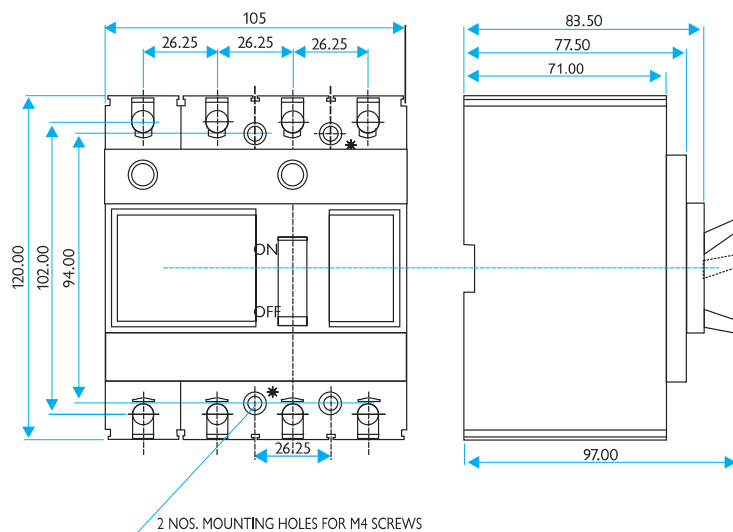
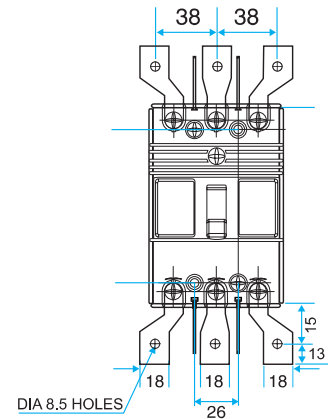
Single Pole



Three Pole



Three Pole with Extended Terminals

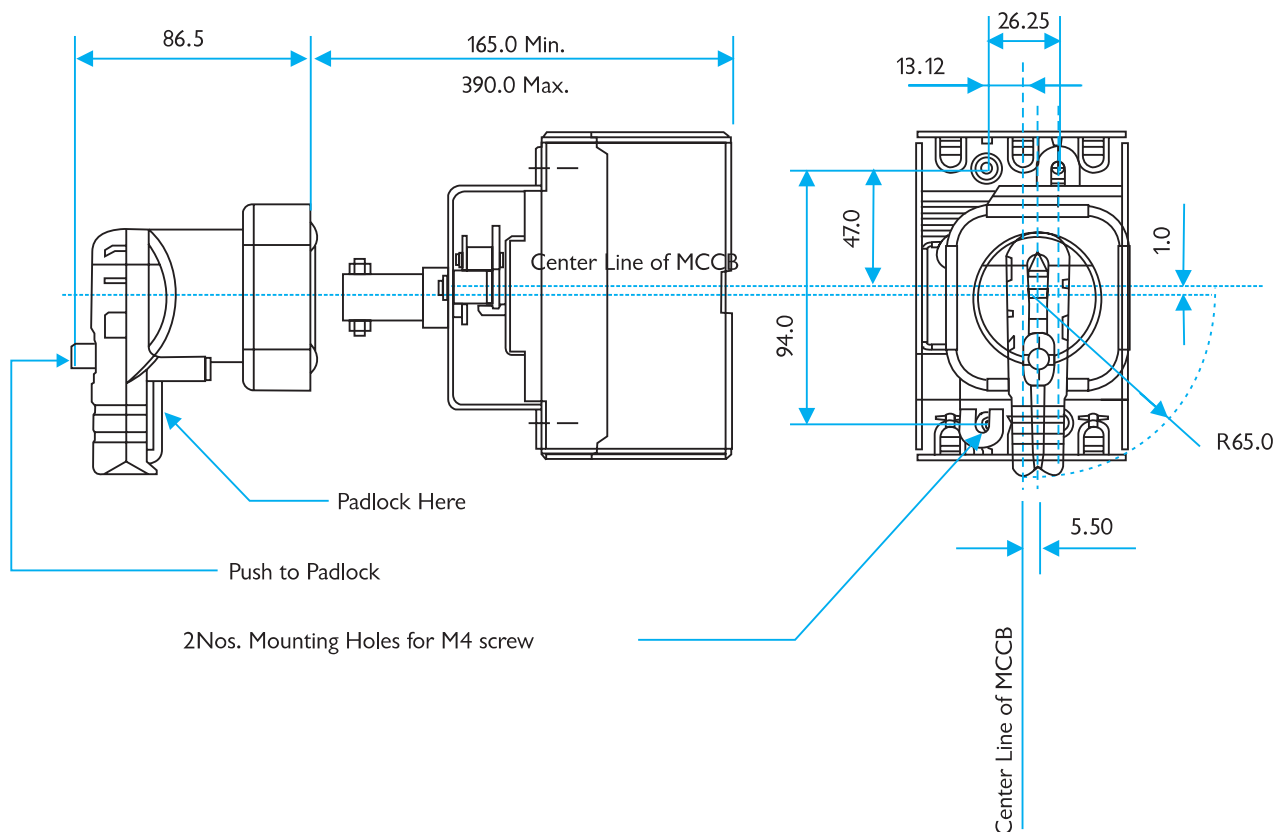


Four Pole with Switched Neutral

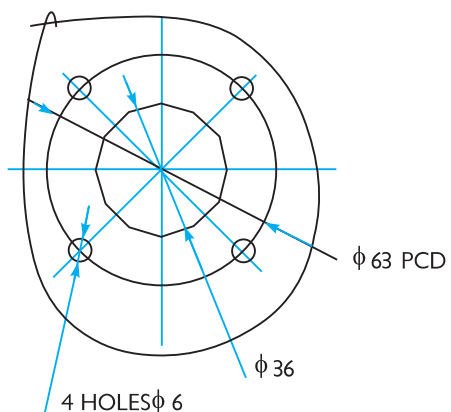


**DIMENSIONS (IN MM) - ROTARY HANDLE**

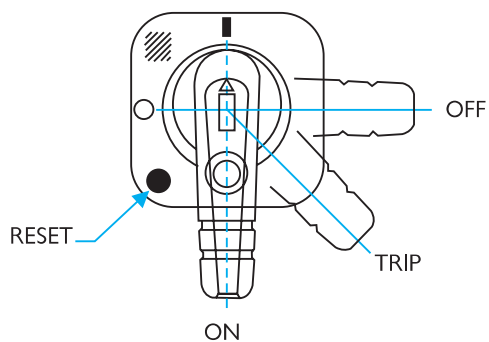
**HANDLE FIXING DETAILS - 'G' FRAME**



**DOOR CUT-OUT**



**ROTARY HANDLE POSITION**



- I - MCCB ON
- O - MCCB OFF
- TRIP - (In between I and O positions)  
MCCB tripped by release or push to trip
- To re-close the MCCB move the handle towards position 'RESET' first till MCCB resets and then switch to position - 'I'.

# LOADLINE

## Moulded Case Circuit Breaker

### AA FRAME SINGLE POLE MCCB



Current Rating (A)	Icu 25kA Cat. No.
25	LASS0025
32	LASS0032
40	LASS0040
50	LASS0050
63	LASS0063
80	LASS0080
100	LASS0100
125	LASS0125
160	LANS0160
200	LANS0200
250	LANS0250

### AA FRAME THREE POLE MCCB



Current Rating (A)	Icu 16kA Cat. No.	Icu 25kA Cat. No.	Icu 35kA Cat. No.
25	–	LAST0025	LANT0025
32	–	LAST0032	LANT0032
40	–	LAST0040	LANT0040
50	–	LAST0050	LANT0050
63	–	LAST0063	LANT0063
80	–	LAST0080	LANT0080
100	–	LAST0100	LANT0100
125	–	LAST0125	LANT0125
160	LAST0160	LANT0160	–
200	LAST0200	LANT0200	–
250	–	LANT0250	–

### AA FRAME FOUR POLE wSN MCCB



Current Rating (A)	Icu 16kA Cat. No.	Icu 25kA Cat. No.	Icu 35kA Cat. No.
25	–	LASF0025	LANF0025
32	–	LASF0032	LANF0032
40	–	LASF0040	LANF0040
50	–	LASF0050	LANF0050
63	–	LASF0063	LANF0063
80	–	LASF0080	LANF0080
100	–	LASF0100	LANF0100
125	–	LASF0125	LANF0125
160	LASF0160	LANF0160	–
200	LASF0200	LANF0200	–
250	–	LANF0250	–



## Moulded Case Circuit Breaker

### AM FRAME THREE POLE MCCB ( MOTOR DUTY)



Current Rating (A)	Icu 25kA Cat. No.
50	LAMT0050
63	LAMT0063
80	LAMT0080
100	LAMT0100
125	LAMT0125
160	LAMT0160
200	LAMT0200
250	LAMT0250

### AM FRAME FOUR POLE wSN MCCB (MOTOR DUTY)



Current Rating (A)	Icu 25kA Cat. No.
50	LAMF0050
63	LAMF0063
80	LAMF0080
100	LAMF0100
125	LAMF0125
160	LAMF0160
200	LAMF0200
250	LAMF0250



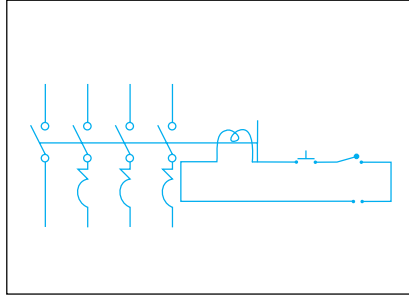
# LOADLINE

## Moulded Case Circuit Breaker

### AA/AM FRAME ACCESSORIES

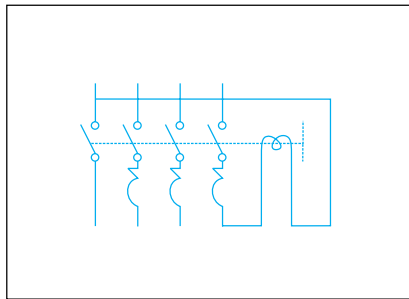
(Accessories are for 3P / 4P wSN)

#### SHUNT TRIP



Voltage	Cat. No.
18-30Vdc/12-36Vdc	LLSTA030
100-110Vac	LLSTA110
220-240Vac	LLSTA240
380-415 Vac	LLSTA415

#### UNDER VOLTAGE RELEASE



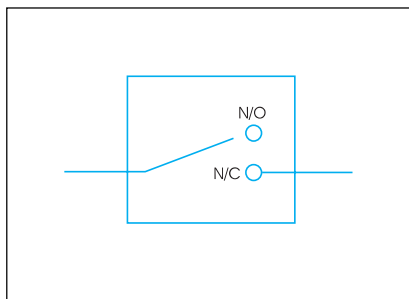
Voltage	Cat. No.
110-120 Vac	LUVRA110
220-240 Vac	LUVRA240
380-440 Vac	LUVRA440

The breaker trips if the supply voltage dips below 85% of the rated voltage.

The breaker cannot be switched ON unless there is a supply to the UVR. (NVNC feature).

Supplied with external mounting Power pack to operate on AC supplies. Additional transformer is supplied with LUVRA440 & LUVRA110.

#### AUXILIARY SWITCH



Voltage	Current Rating (AC15)	Cat. No.	Config.
250Vac/250Vdc	4 Amps	LLASA1CO	(1NO+1NC)
250Vac/250Vdc	4 Amps	LLASA2CO	2(1NO+1NC)
450Vac/250Vdc	4 Amps	LLASA1CO	(1NO+1NC)
450Vac/250Vdc	4 Amps	LLASA2CO	2(1NO+1NC)

#### ROTARY HANDLE



	Cat. No.
Direct Padlockable	LLDRHA00
With Door interlock and 300mm remote shaft	LLRRHA30



# Moulded Case Circuit Breaker

**AA/AM FRAME ACCESSORIES**

(Accessories are for 3P / 4P wSN)

**BACK STUDS**



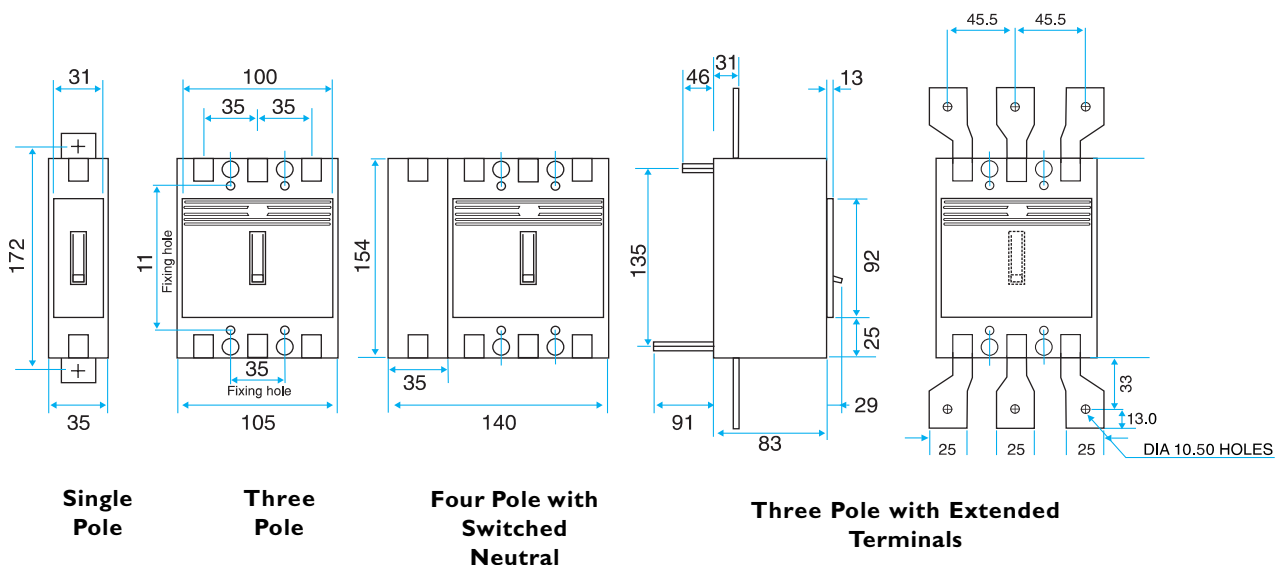
	<b>Cat. No.</b>
Upto 250A	LLBSA250

**OTHER ACCESSORIES**



	<b>Cat. No.</b>
Dolly Pad locking device	LLDPA250
Extended terminals	LLETA250
Phase Barriers	LLPBA250
Terminal Shrouds Three Pole	LLTTPA250

**DIMENSIONS (IN MM)**

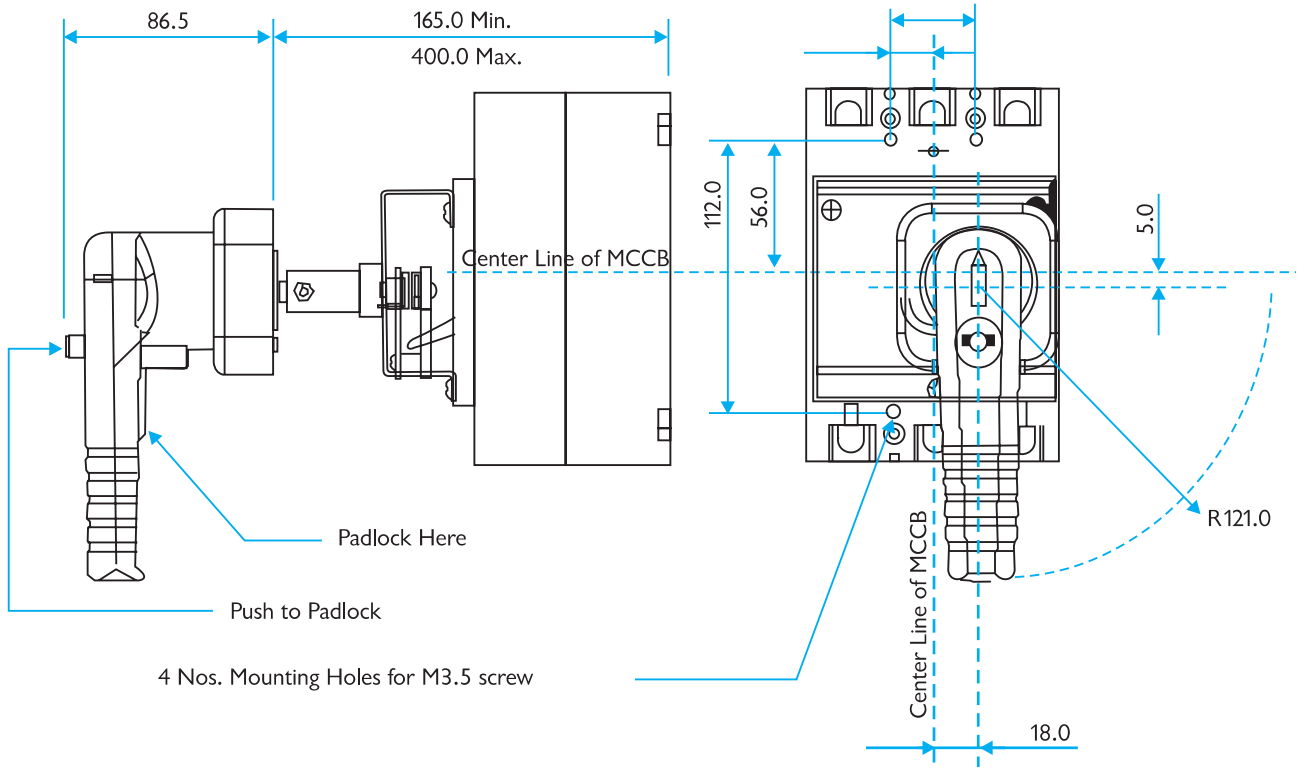


# LOADLINE

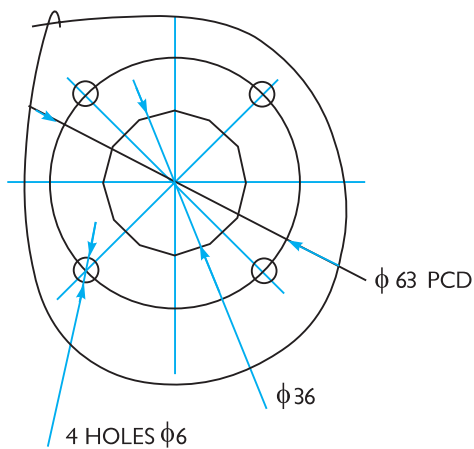
## Moulded Case Circuit Breaker

### DIMENSIONS (IN MM) - ROTARY HANDLE

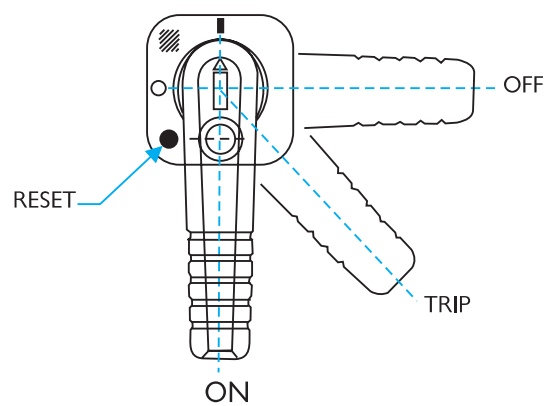
#### HANDLE FIXING DETAILS - 'A' FRAME



#### DOOR CUT-OUT



#### ROTARY HANDLE POSITION



- I - MCCB ON
- O - MCCB OFF
- TRIP - (In between I and O positions)  
MCCB tripped by release or push to trip
- To re-close the MCCB move the handle towards position 'RESET' first till MCCB resets and then switch to position - 'I'.

# Moulded Case Circuit Breaker

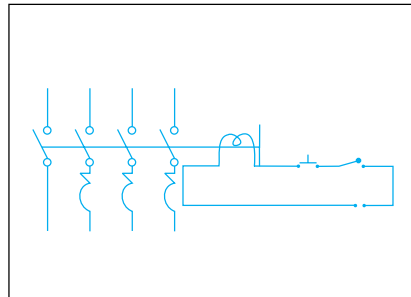
## FN/FH FRAME THREE POLE MCCB



Current Rating (A)	Icu 35kA Cat. No.	Icu 50kA Cat. No.
25	LFNT0025	LFHT0025
32	LFNT0032	LFHT0032
40	LFNT0040	LFHT0040
50	LFNT0050	LFHT0050
63	LFNT0063	LFHT0063
80	LFNT0080	LFHT0080
100	LFNT0100	LFHT0100
125	LFNT0125	LFHT0125
160	LFNT0160	LFHT0160
200	LFNT0200	LFHT0200
250	LFNT0250	LFHT0250

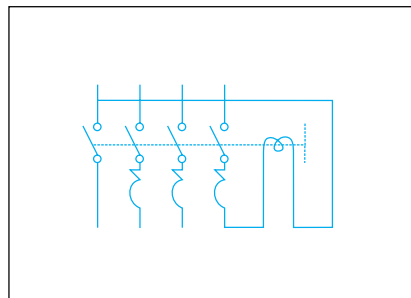
## FN/FH FRAME ACCESSORIES (Accessories are for 3P / 4P wSN)

### SHUNT TRIP



Voltage	Cat No.
18-30Vdc / 12-36Vdc	LLSTF030
100-110Vac	LLSTF110
220-240Vac	LLSTF240
380-415 Vac	LLSTF415

### UNDER VOLTAGE RELEASE



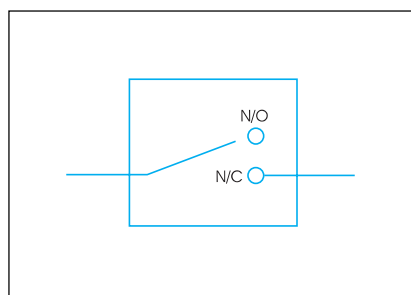
Voltage	Cat No.
110-120 Vac	LUVRF110
220-240 Vac	LUVRF240
380-440 Vac	LUVRF440

The breaker trips if the supply voltage dips below 85% of the rated voltage.

The breaker cannot be switched ON unless there is a supply to the UVR. (NVNC feature).

Supplied with external mounting Power pack to operate on AC supplies. Additional transformer is supplied with LUVRF440 & LUVRF110.

### AUXILIARY SWITCH



Voltage	Current Rating (AC15)	Cat No	Config.
250Vac/250Vdc	4 Amps	LLASF1CO	(1NO+1NC)
250Vac/250Vdc	4 Amps	LLASF2CO	2(1NO+1NC)
450Vac/250Vdc	4 Amps	LLASF1CO	(1NO+1NC)
450Vac/250Vdc	4 Amps	LLASF2CO	2(1NO+1NC)



# LOADLINE

## Moulded Case Circuit Breaker

### FN/FH FRAME ACCESSORIES

(Accessories are for 3P / 4P wSN)

#### ROTARY HANDLE



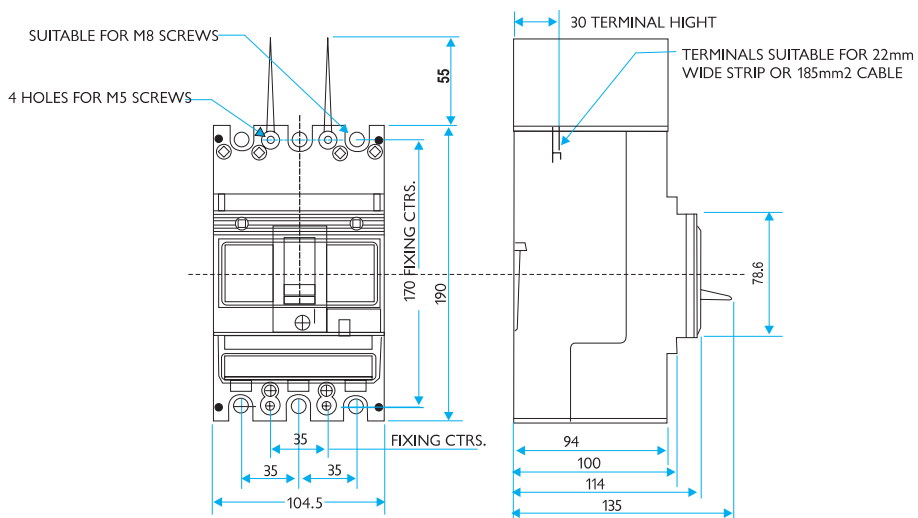
	Cat. No.
Direct Padlockable	LLDRHF00
With Door interlock and 300mm remote shaft	LLRRHF30

#### OTHER ACCESSORIES



	Cat. No.
Dolly Pad locking device	LLDPF250
Extended terminals	LLETF250
Phase Barriers	LLPBF250
Terminal Shrouds Three Pole	LLTTPF250

### DIMENSIONS (IN MM)



Three Pole





Moulded Case Circuit Breaker

**CN FRAME THREE POLE MCCB**



Current Rating (A)	Icu 35kA Cat. No.
160	LCNT0160
200	LCNT0200
250	LCNT0250
315	LCNT0315
400	LCNT0400
500	LCNT0500
630	LCNT0630
800	LCNT0800

**CN FRAME FOUR POLE wSN MCCB**



Current Rating (A)	Icu 35kA Cat. No.
160	LCNF0160
200	LCNF0200
250	LCNF0250
315	LCNF0315
400	LCNF0400
500	LCNF0500
630	LCNF0630
800	LCNF0800

**CH FRAME THREE POLE MCCB**



Current Rating (A)	Icu 50kA Cat. No.
160	LCHT0160
200	LCHT0200
250	LCHT0250
315	LCHT0315
400	LCHT0400
500	LCHT0500
630	LCHT0630
800	LCHT0800

**CH FRAME FOUR POLE wSN MCCB**



Current Rating (A)	Icu 50kA Cat. No.
160	LCHF0160
200	LCHF0200
250	LCHF0250
315	LCHF0315
400	LCHF0400
500	LCHF0500
630	LCHF0630
800	LCHF0800



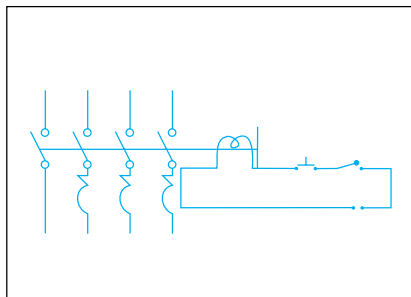
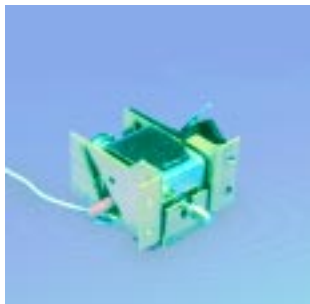
# LOADLINE

## Moulded Case Circuit Breaker

### CN/CH FRAME ACCESSORIES

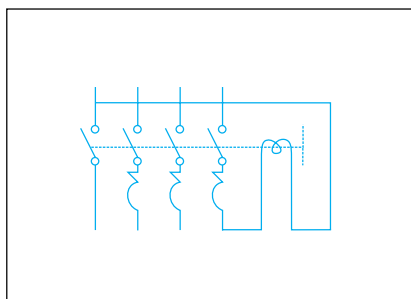
(Accessories are for 3P / 4P wSN)

#### SHUNT TRIP



Voltage	Cat. No.
18-30Vdc/12-36Vdc	LLSTC030
100-110Vac	LLSTC110
220-240Vac	LLSTC240
380-415 Vac	LLSTC415

#### UNDER VOLTAGE RELEASE



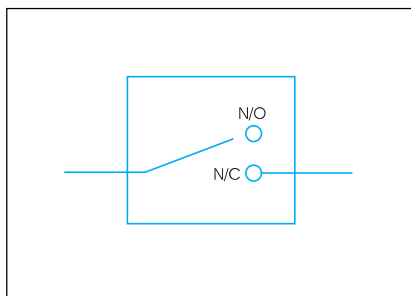
Voltage	Cat. No.
110-120 Vac	LUVRC110
220-240 Vac	LUVRC240
380-440 Vac	LUVRC440

The breaker trips if the supply voltage dips below 85% of the rated voltage.

The breaker cannot be switched ON unless there is a supply to the UVR. (NVNC feature).

Supplied with external Power pack to operate on AC supplies. Additional transformer is supplied with LUVRC440 & LUVRC110.

#### AUXILIARY SWITCH



Voltage	Current Rating (AC15)	Cat. No.	Config.
250Vac/250Vdc	4 Amps	LLASC1CO	(1NO+1NC)
250Vac/250Vdc	4 Amps	LLASC2CO	2(1NO+1NC)
450Vac/250Vdc	4 Amps	LLASC1CO	(1NO+1NC)
450Vac/250Vdc	4 Amps	LLASC2CO	2(1NO+1NC)

#### ROTARY HANDLE



	Cat. No.
Direct Padlockable	LLDRHC00
With Door interlock and 300mm remote shaft	LLRRHC30



# Moulded Case Circuit Breaker

## CN/CH FRAME ACCESSORIES



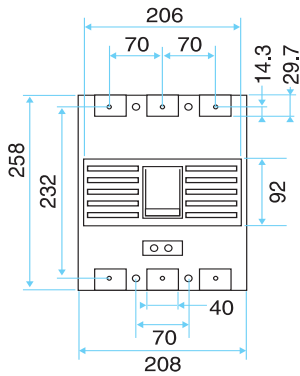
### BACK STUDS

	Cat. No.
Upto 400A	LLBSC400

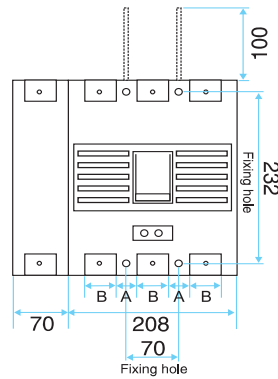
### OTHER ACCESSORIES

	Cat. No.
Dolly Pad locking device	LLDPC800
Phase Barriers	LLPBC800
Dolly Extension	LLDEC800

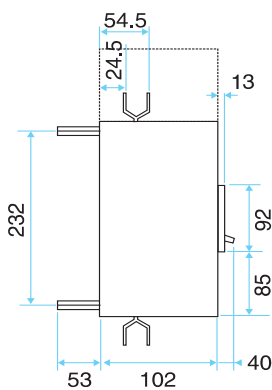
## DIMENSIONS (IN MM)



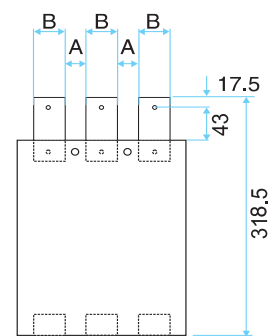
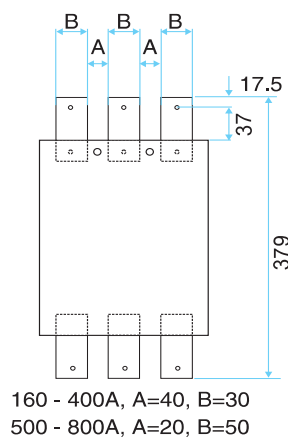
**Three Pole**



**Four Pole with Switched Neutral**



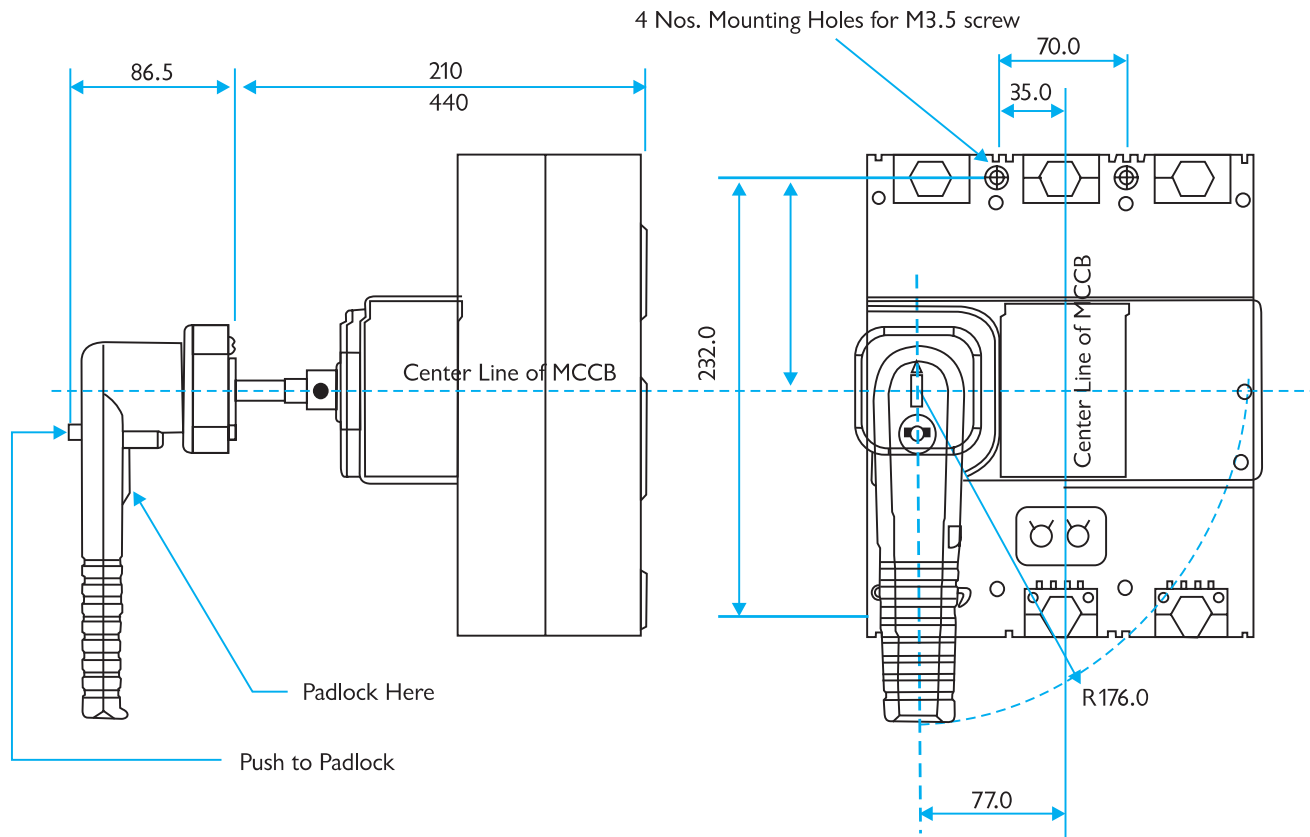
**Three Pole with Extended Terminals**



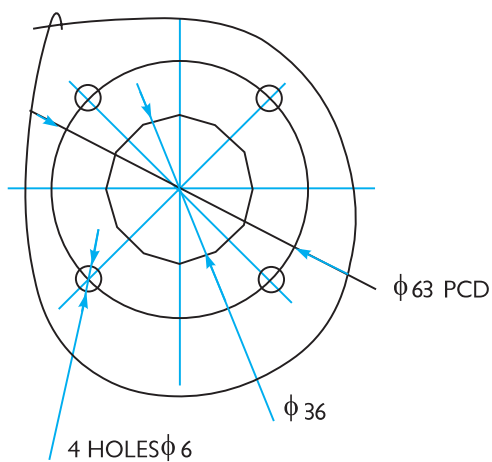
**For Export Market**

### DIMENSIONS (IN MM) - ROTARY HANDLE

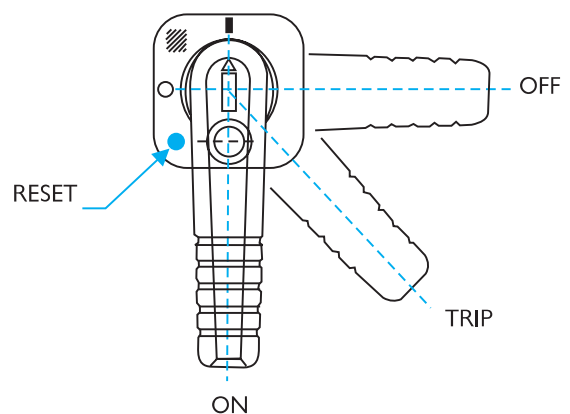
#### HANDLE FIXING DETAILS - 'C' FRAME



#### DOOR CUT-OUT



#### ROTARY HANDLE POSITION



- I - MCCB ON
- O - MCCB OFF
- TRIP - (In between I and O positions)  
MCCB tripped by release or push to trip
- To re-close the MCCB move the handle towards position 'RESET' first till MCCB resets and then switch to position - 'I'.

# Moulded Case Circuit Breaker

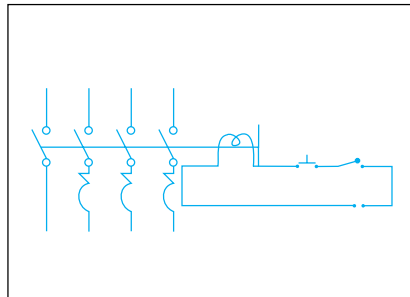
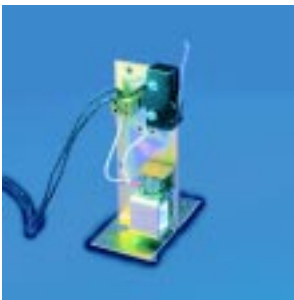
## DN FRAME MCCB - THREE POLE



Current Rating (A)	Icu 50kA Cat. No.
1000	LDNT1000
1250	LDNT1250
1600	LDNT1600

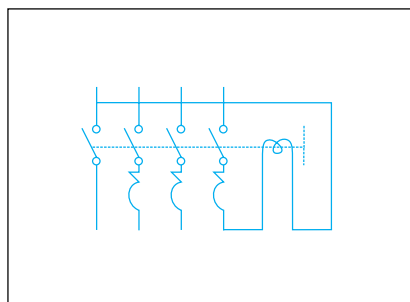
## D FRAME ACCESSORIES

### SHUNT TRIP



Voltage	Cat. No.
18-30Vdc/12-36Vdc	LLSTD030
100-110Vac	LLSTD110
220-240Vac	LLSTD240
380-415 Vac	LLSTD415

### UNDER VOLTAGE RELEASE



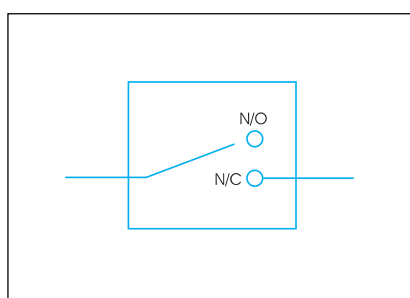
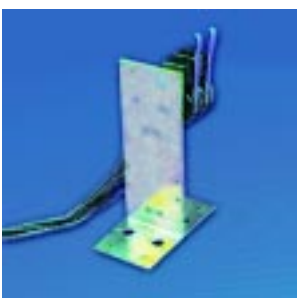
Voltage	Cat. No.
110-120 Vac	LUVRD110
220-240 Vac	LUVRD240
380-440 Vac	LUVRD440

The breaker trips if the supply voltage dips below 85% of the rated voltage.

The breaker cannot be switched ON unless there is a supply to the UVR. (NVNC feature).

Supplied with external mounting Power pack to operate on AC supplies. Additional transformer is supplied with LUVRD440 & LUVRD110.

### AUXILIARY SWITCH



Voltage	Current Rating (AC I5)	Cat. No.	Config.
250Vac/250Vdc	4 Amps	LLASD1CO	(1NO+1NC)
250Vac/250Vdc	4 Amps	LLASD2CO	2(1NO+1NC)
450Vac/250Vdc	4 Amps	LLASD1CO	(1NO+1NC)
450Vac/250Vdc	4 Amps	LLASD2CO	2(1NO+1NC)





## Moulded Case Circuit Breaker

### D FRAME ACCESSORIES

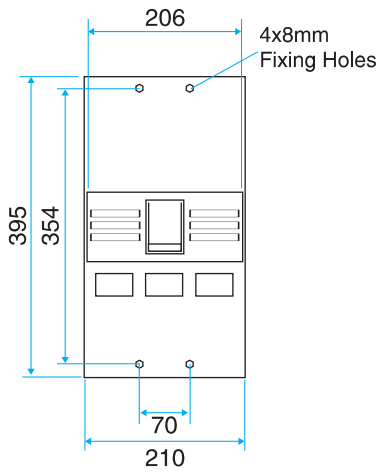
#### ROTARY HANDLE

	Cat. No.
Direct Padlockable	LLDRHD00
With Door interlock and 300mm remote shaft	LLRRHD30

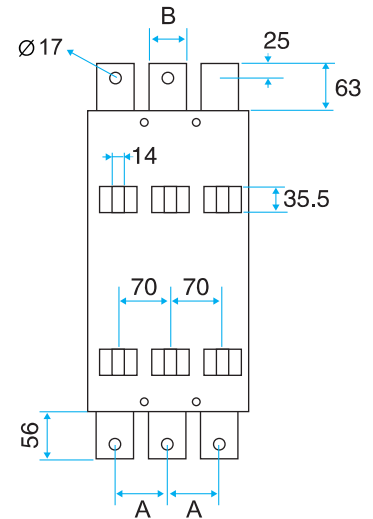
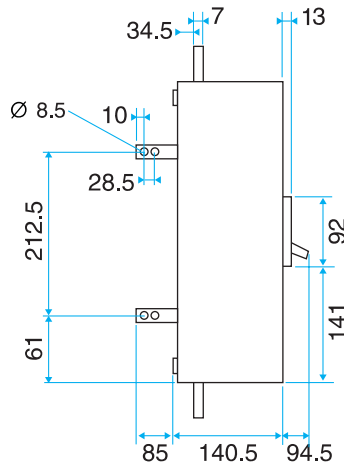
#### OTHER ACCESSORIES

	Cat. No.
Dolly Pad locking device	LLDPD160
Dolly Extension	LLDED160

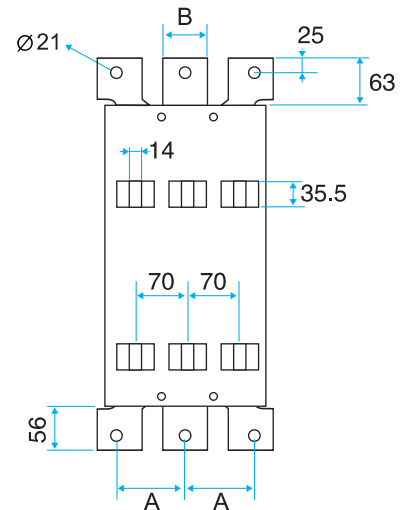
### DIMENSIONS (IN MM)



Three Pole



800A - 1000A



1250A - 1600A

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

## Moulded Case Circuit Breaker

### GN FRAME THREE POLE

### DC MCCB



Current Rating (A)	Icu 10kA Cat. No.
25	LDCGNT0025
32	LDCGNT0032
40	LDCGNT0040
50	LDCGNT0050
63	LDCGNT0063
80	LDCGNT0080
100	LDCGNT0100
125	LDCGNT0125

### AN FRAME THREE POLE

### DC MCCB



Current Rating (A)	Icu 10kA Cat. No.
160	LDCANT0160
200	LDCANT0200
250	LDCANT0250

### CH FRAME THREE POLE

### DC MCCB



Current Rating (A)	Icu 40kA Cat. No.
160	LDCCHT0160
200	LDCCHT0200
250	LDCCHT0250
315	LDCCHT0315
400	LDCCHT0400
500	LDCCHT0500
630	LDCCHT0630
800	LDCCHT0800

### DN FRAME THREE POLE

### DC MCCB



Current Rating (A)	Icu 40kA Cat. No.
1000	LDCDNT1000
1250	LDCDNT1250
1600	LDCDNT1600



## Moulded Case Circuit Breaker

### EARTH FAULT RELAY

The Earth Fault Relay is a common accessory for use in conjunction with all MCCB frames.

The Earth Fault detection system for use with Loadline 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-connections 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 in the range of 200m. sec - 5 sec. The required sensitivity and time delay should be selected by the DIP switches provided on the facia of the relay.

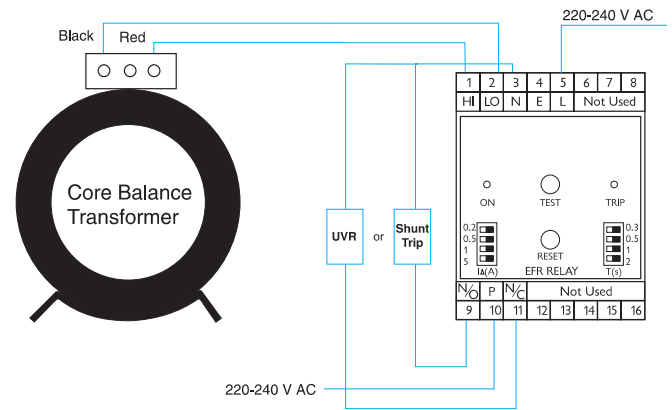


### FEATURES

- 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

### TECHNICAL INFORMATION

Supply Voltage	220/240 V AC, 50/60 Hz
Changeover contact	5A AC-15 250V
Sensitivity	300mA, 500mA, 1A, 2A
Time delay (m. sec.)	200, 500, 1000, 5000



Connection Diagram

### 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



# Moulded Case Circuit Breaker

## EARTH FAULT RELAY



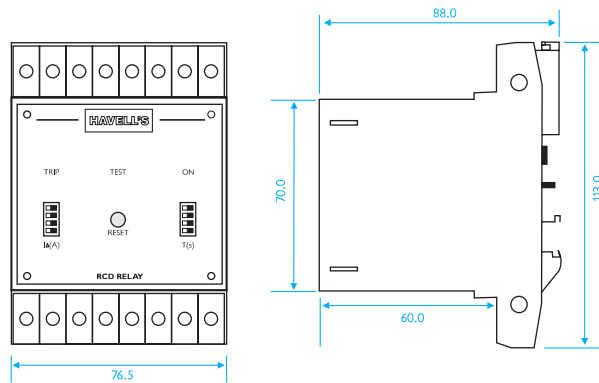
### MCCB Current Rating (A)

### Cat. No.

25 - 100	LEFR1100
125-200	LEFR2200
250-400	LEFR3400
500-800	LEFR4800
1000-1600	LEFR1600

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.

## DIMENSIONS (IN MM)



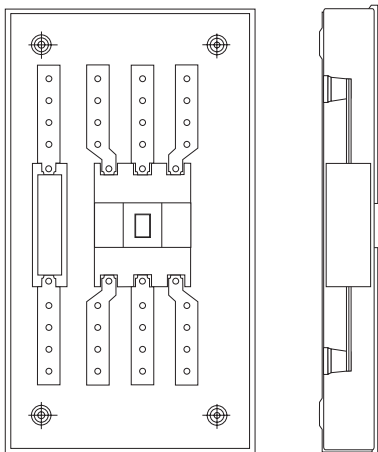
# LOADLINE

## Moulded Case Circuit Breaker

### GENERAL PURPOSE ENCLOSURE

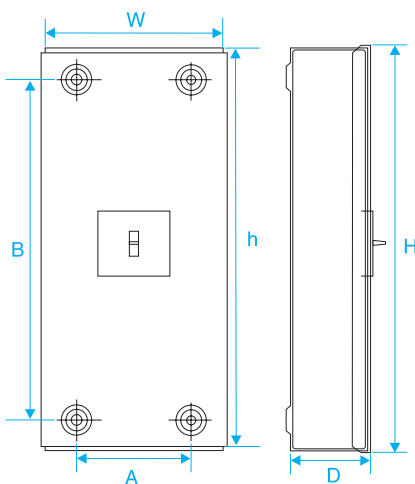


Enclosures made of special grade CRCA steel are available for housing G, A and C Frame MCCBs upto 800A. They are manufactured with latest technology using CNC Punch and Brake presses to attain highest degree of perfection. The enclosures are painted with latest techniques in powder coating using epoxy 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.
G Frame SP	DLE00GSP
G Frame TP	DLE00GTP
G Frame FP	DLE00GFP
A Frame SP	DLE00ASP
A Frame TP	DLE00ATP
A Frame FP	DLE00AFP
C Frame TP (400A)	DLE00CTP
C Frame FP (400A)	DLE00CFP
C Frame TP (800A)	DLE00CTS
C Frame FP (800A)	DLE00CFS

### DIMENSIONS (IN MM)



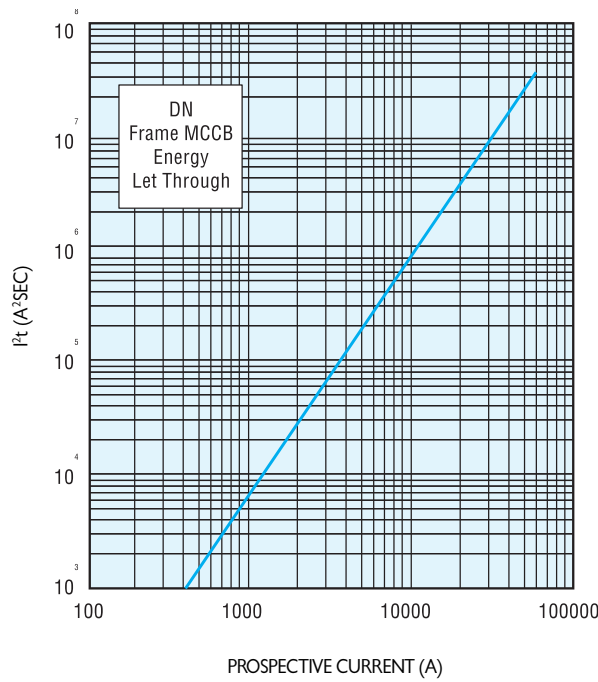
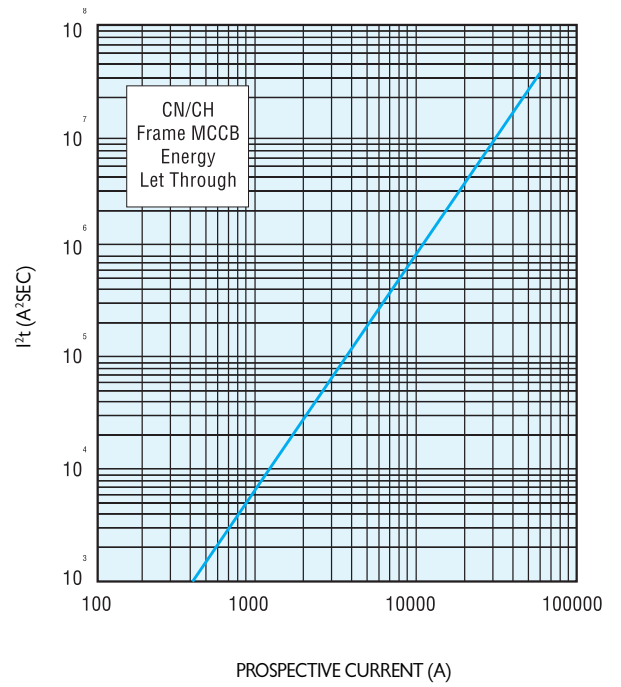
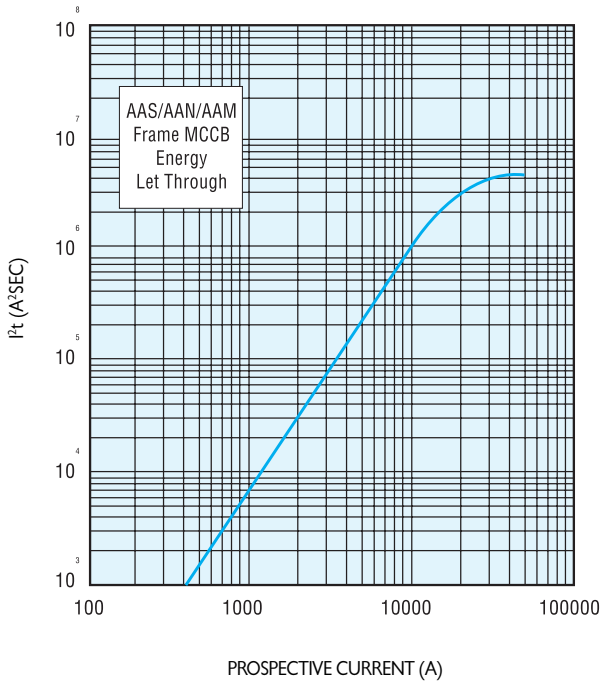
Description	W	D	h	H	AxB
G Frame	260	108	360	370	160x360
AA Frame	260	108	558	570	160x480
C Frame upto 400 A	440	122	960	975	280x802
C Frame upto 800 A	540	122	960	975	380x802



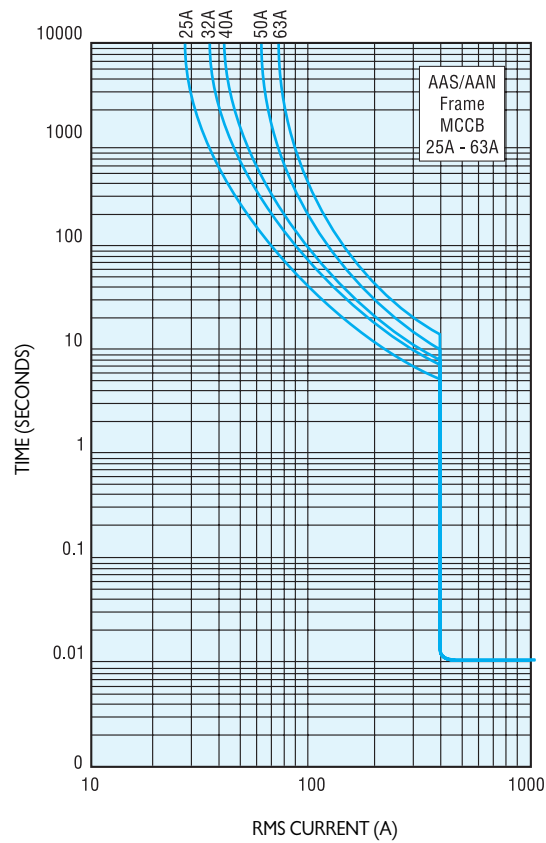
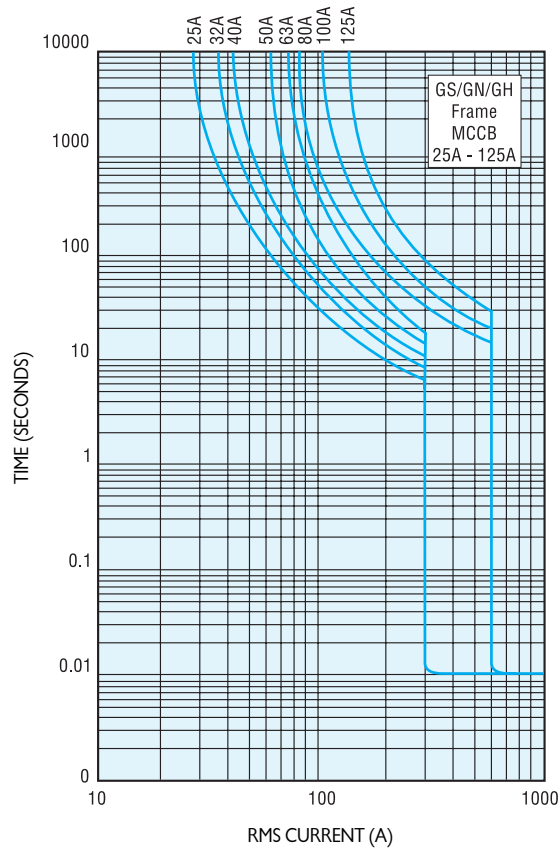


# Moulded Case Circuit Breaker

## LET THROUGH ENERGY ( $I^2t$ ) CHARACTERISTICS

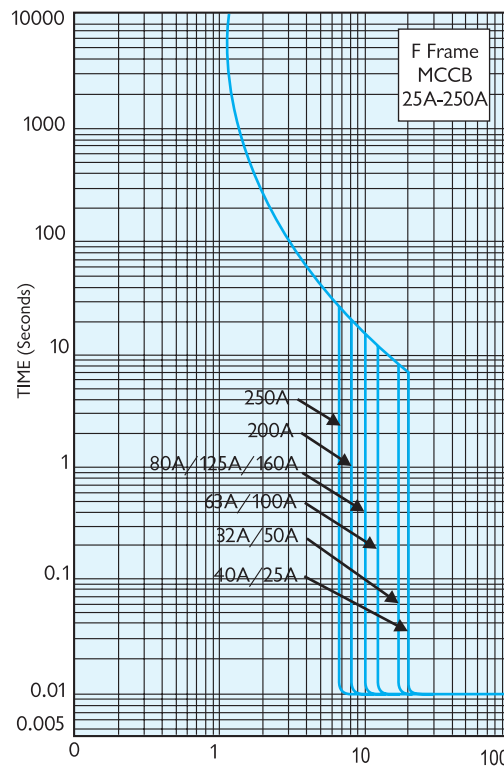
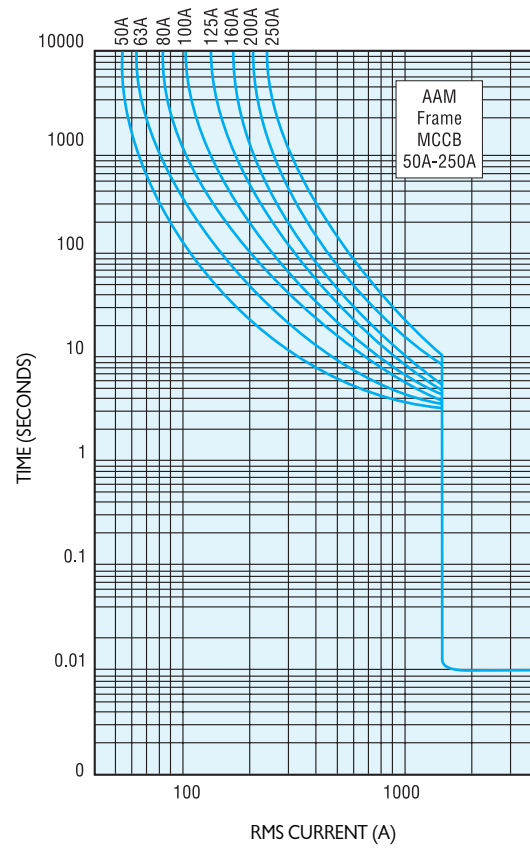
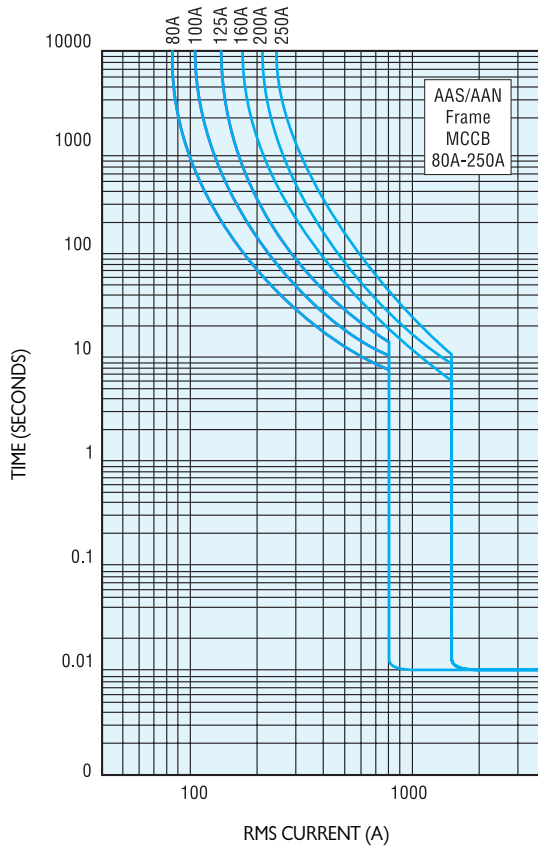


### TRIPPING CHARACTERISTICS



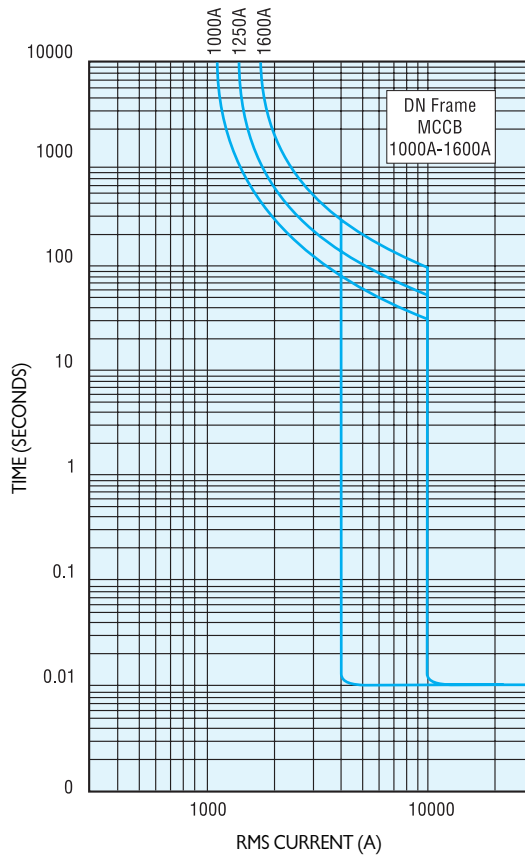
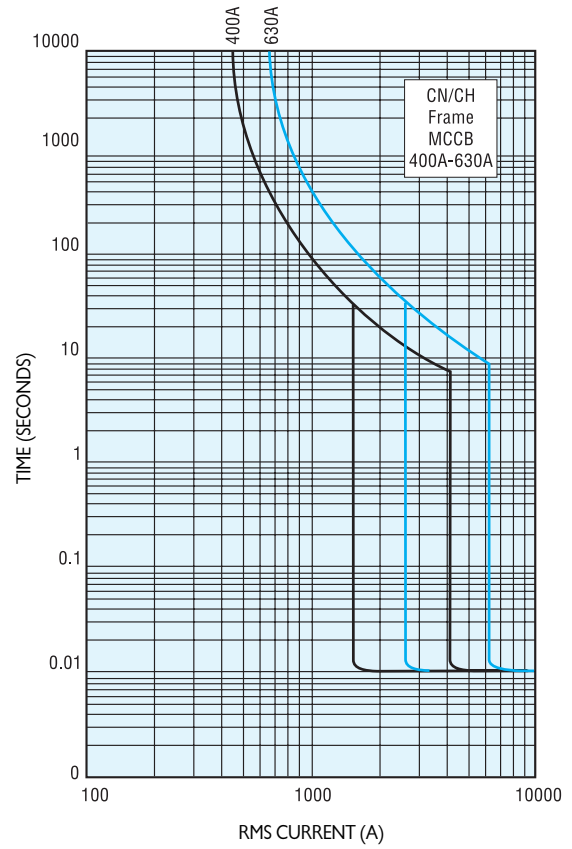
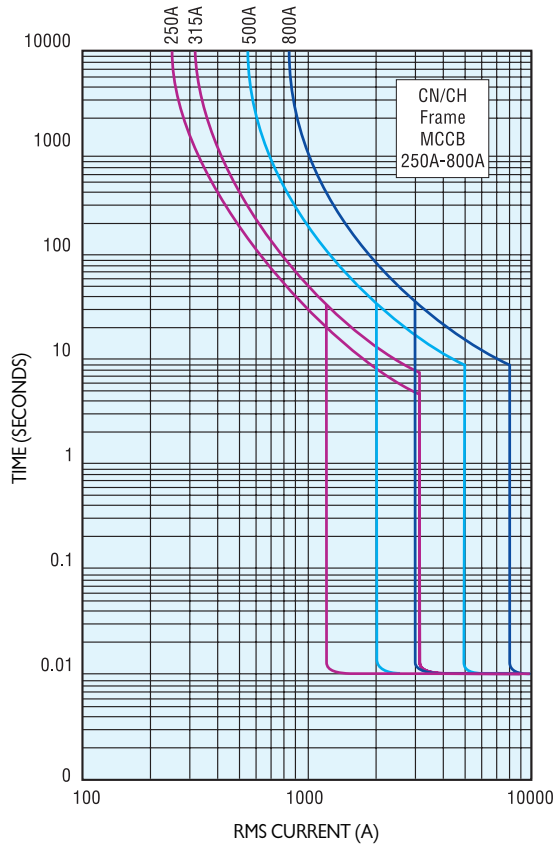
# Moulded Case Circuit Breaker

## TRIPPING CHARACTERISTICS



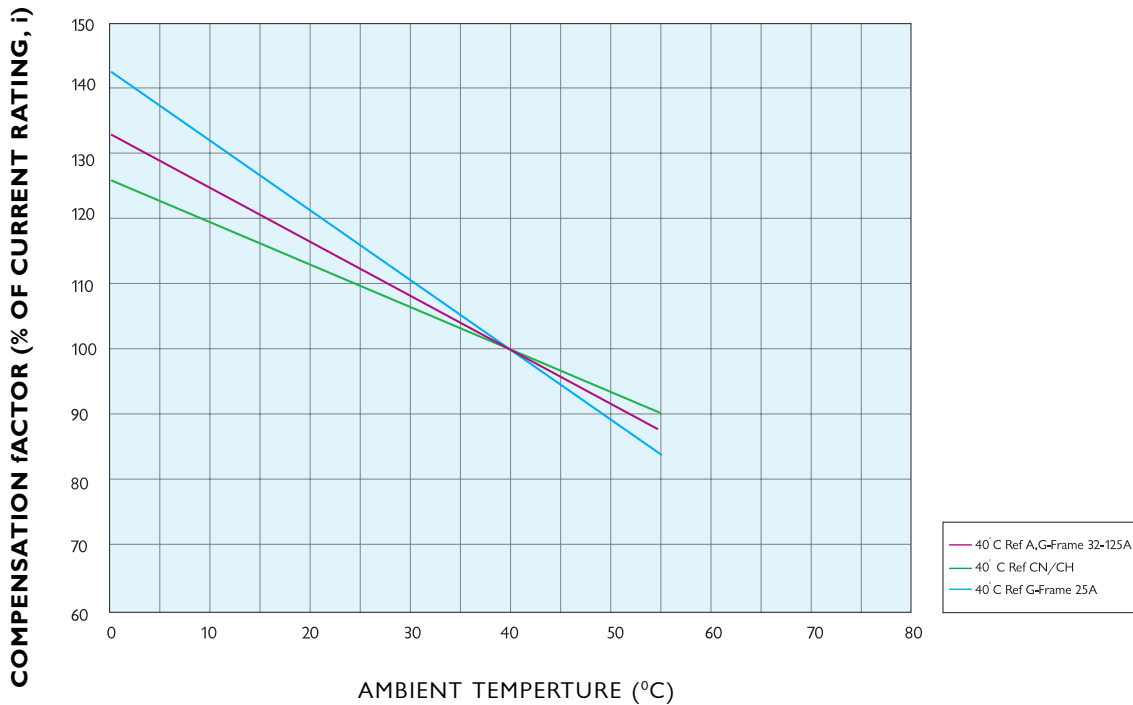
## Moulded Case Circuit Breaker

### TRIPPING CHARACTERISTICS



# Moulded Case Circuit Breaker

## AMBIENT TEMPERATURE COMPENSATION CHART (G, AA, C FRAME MCCBs)



## DISCRIMINATION DATA

### IS : I3703 HBC Fuse - upstream device

Product	Rating (A)	KA @ 415V	Current Rating of HBC Fuses										
			80	100	125	160	200	250	315	400	500	630	800
LOADLINE-AAS/AAN	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
LOADLINE CN/CH	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
LOADLINE DN	800	50											6000

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





# Moulded Case Circuit Breaker

## DISCRIMINATION DATA

LOADLINE MCCB UPSTREAM DEVICE INSTANTANEOUS TRIP SET AT HIGH

Product	RATING	KA@	415V	25	32	40	50	63	80	100	125	160	200	AAM	LOADLINE AAS/AAN	LOADLINE CN/CH	LOADLINE DN
	(A)													ALL	250 315 400 500 630 800	600 800 1000 1250 1600	
LOADLINE AAS/AAN	63	25						800	800	800	800	1600	1600	1600	2500 3000 4000 5000 6300 8000	7400 8300 9200 9200 9200	
	80	25										1600	1600	1600	2500 3000 4000 5000 6300 8000	7400 8300 9200 9200 9200	
	100	25										1600	1600	1600	2500 3000 4000 5000 6300 8000	7400 8300 9200 9200 9200	
	125	25										1600	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	
LOADLINE AAM	ALL	16													2500 3000 4000 5000 6300 8000	7400 8300 9200 9200 9200	
LOADLINE CN/CH	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	
LOADLINE DN	800	50														9200 9200 9200	
	1000	50														9200 9200	
	1250	50														9200	
	1600	50															

LOADLINE MCCB DOWN STREAM DEVICE INSTANTANEOUS TRIP SET AT LOW

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



# Moulded Case Circuit Breaker

## 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

Loadline 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 :

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

' $U_e$ ' 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**

Transformer Rating (KVA)	MCCB Rating in amperes								
	GS 10kA	GN 16kA	GH 25kA	AAS 25kA	AAN 25kA	AAN 35kA	CN 35kA	CH 50kA	DN 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

Loadline 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 :

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

or

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

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
100	160
160	250
200	315
250	400
315	500
400	630
630	1000
750	1200



## Moulded Case Circuit Breaker

### 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 :

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

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.

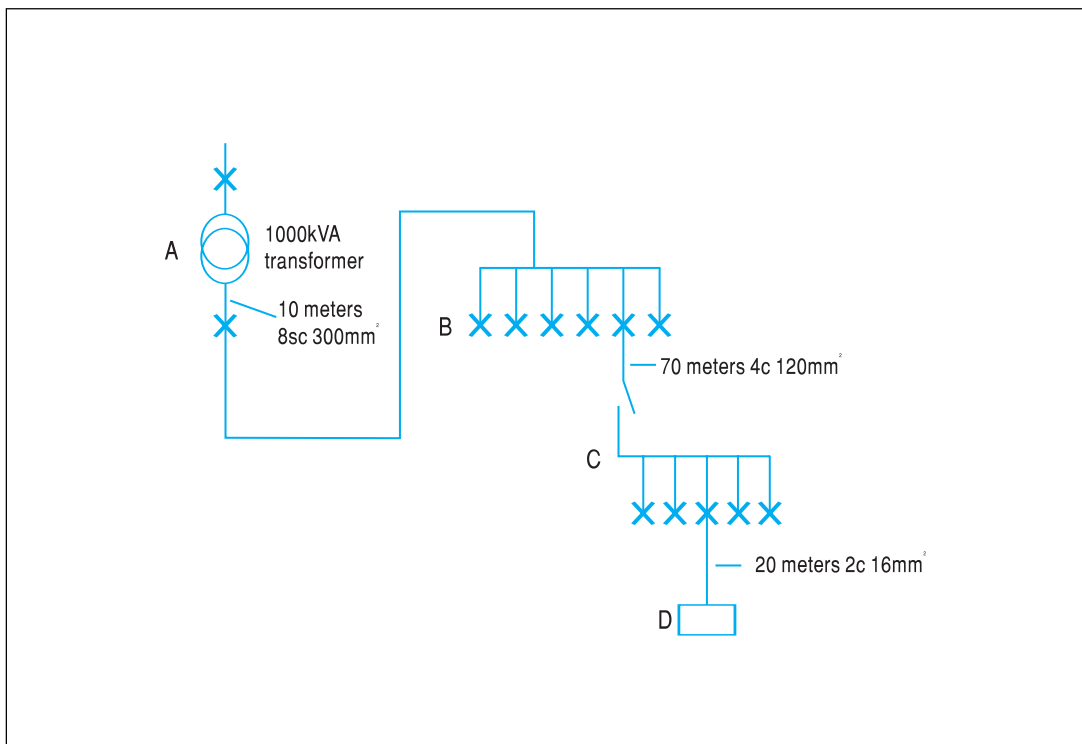
The values assume a symmetrical fault across the three phases. In a single circuit, for line to neutral faults, take the cable resistance value from the table and double it.

The selection of Loadline 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 A	approximately 27kA
PSC at B resistance A to B (a)	0.30mW = 25kA
PSC at C +resistance A to B +resistance B to C1	0.30mW 10.70mW 11.00mW = 12kA
PSC at D +resistance A to B +resistance B to C +resistance C to D	0.30mW 10.70mW 46.00mW (b) 57.00mW = 3kA

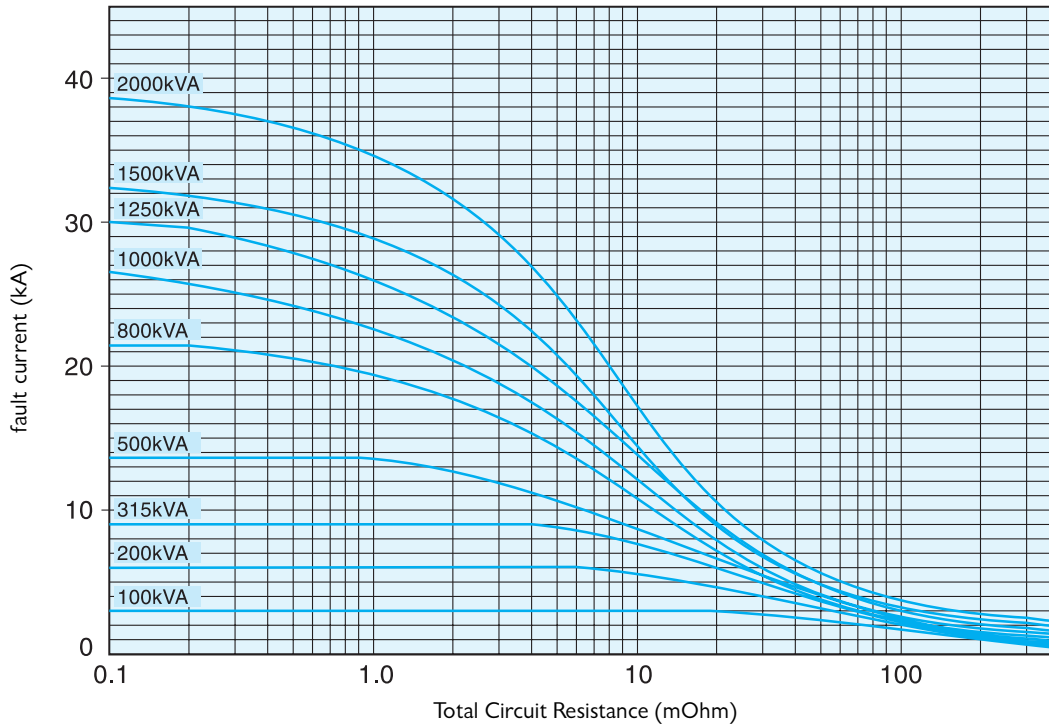
(a) 2 cables per phase divided by 2  
 (b) 2 core cable, multiplied by 2  
 The above calculations have an inbuilt safety margin as they assume a no impedance fault condition which would not be the case in practice.

#### Typical Installation



**SELECTION & APPLICATION**

**Estimating the Prospective Short Circuit Current**



**Maximum Resistance of Copper Conductors at 20°C (μOhm)**

Nominal  
Cross-sectional  
area (mm<sup>2</sup>)

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



## Moulded Case Circuit Breaker

### SELECTION & APPLICATION

#### MOTOR CONTROL

Loadline 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		Approx. Full Load Current (A) at 415V	Direct On Line MCCB Rating/Type			Star/Delta MCCB Rating/Type			
HP	KW		AAN	AAM	CN/CH	AAN	AAM	CN/CH	DN
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	-	50	50	-	-
40	30	52	80	63	-	63	63	-	-
50	37	69	100	80	-	80	80	-	-
60	45	80	-	100	-	100	100	-	-
75	55	97	-	125	-	125	125	-	-
100	75	125	-	160	-	160	160	-	-
125	90	156	-	-	250	-	200	-	-
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

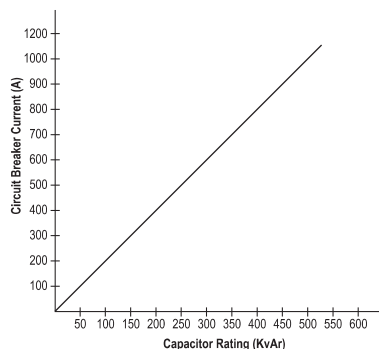
The figures shown are based on following motor starting conditions :-

Direct online 7 X full load current for 5 seconds.

Star/Delta 4 X full load current for 12 seconds.

## SELECTION &amp; APPLICATION

## CAPACITOR 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  $\frac{1}{2}$  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 &amp; 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  $I^2t$  varies for AC and DC. The integral ( $I^2t$ ) for AC will be 1.21 times integral ( $I^2t$ ) 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 &amp; 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.