Load Line range of Moulded Case Circuit Breakers are designed and manufactured to world-class standards. Loadline series MCCBs provide overload and short-circuit protection for all applications. The thermal & magnetic elements, adjustable over a wide band, make these MCCBs ideal for any distribution application.

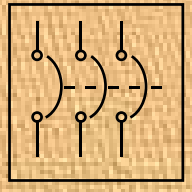
Range :
25A to 1600A in 5 frame sizes in single pole, three pole and four pole with switched neutral execution.

Specification :
Conforms to IEC:60947-1&2 / IS:13947-1&2.

Features :

- Wide range : 25A to 1600A (AC)
- Compact dimensions
- Adjustable thermal setting (70-100% I_n).
- Adjustable magnetic setting (5-10 times I_n / 4-10 times I_n).
- Suitable for use as switch disconnector
- In 4PwSN version, neutral makes first and breaks last
- Push to trip button provision
- Uniform front escutcheon plate
- Positive dolly position indication
- Suitable for DC application upto 1600A
- Separate main and arcing contacts
- Wide range of accessories


Airbreak



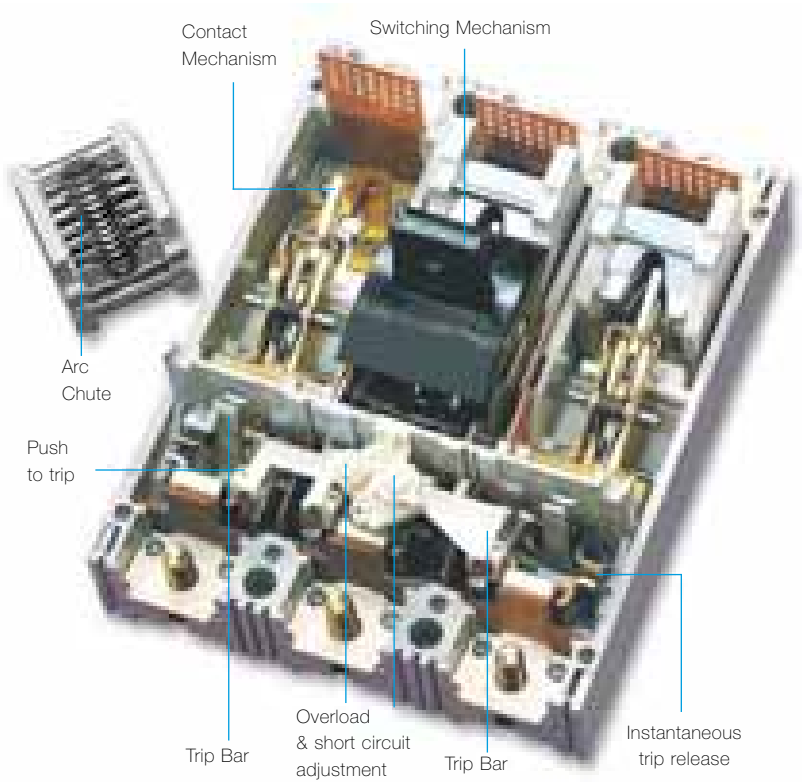
Construction

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 dissipiation 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.

Technical Information — G-Frame

Standard conformity : IEC 60947-2/IS:13947-2
Rated operational voltage : 415V AC
Rated Insulation Voltage : 690V 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		1P / 3P / 4PwSN	1P / 3P / 4PwSN	3P / 4PwSN
Standard current range / rating (I_n)	A	25-125*	25-125*	25-100*
Thermal relelase 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) Icm	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	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	2.5	2.5	2.5
Internal Accessories				
Auxiliary Switch (1 C/O or 2C/O)		•	•	•
Shunt Trip		•	•	•
Under Voltage Release		•	•	•
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
• Available, - Not Available, + Supplied alongwith the MCCB as standard.

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

Standard conformity	:	IEC 60947-2/IS:13947-2
Rated operational voltage	:	415V AC
Rated Insulation Voltage	:	690V 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		AAS		AAN	
No. of Poles		1P / 3P / 4PwSN		1P / 3P / 4PwSN	
Standard current range / ratings (I_n)	A	25-200*		25-250*	
Thermal release setting (Adjustable)		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	
50A -125A AM Frame		-		-	
160A -250A AM Frame		-		-	
Rated short circuit making capacity (Peak) Icm	KA	52.5	32	73.5	52.5
Rated ultimate short circuit breaking		(25-125A)	(160-200A)	(25-125A)	(160-250A)
capacity(Icu), KA	240V	40	25	50	40
(at different voltages)	380V	35	16	35	35
	415V	25	16	35	25
	500V	18	12	25	18
Weight SP (Single Pole)	Kg	0.7		0.7	
TP (Triple Pole)	Kg	1.8		1.8	
FPwSN(Four Pole Switched Neutral)	Kg	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	
Internal Accessories					
Auxiliary Switch (1 C/O or 2C/O)		•		•	
Shunt Trip		•		•	
Under Voltage Release		•		•	
Alarm Switch (1 C/O) Factory Fitted		•		•	
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..

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

Technical Information — F-Frame

Standard conformity : IEC 60947-2/IS:13947-2
Rated operational voltage : 415V AC
Rated Insulation Voltage : 690V 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

Frame			F N	F H
No. of Poles			3P / 4PwSN	3P / 4PwSN
Standard Current ratings (In)		A	25-250*	25-250*
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	50	70
(at different voltages)		380V	35	50
		415V	35	50
		500V	25	35
Weight TP (Triple Pole) / FPwSN		Kg	2.9 / 3.8	2.9 / 3.8
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) # (Factory Fitted)			•	•
External Accessories				
Earth Fault Relay			•	•
Rotary Handle			•	•
Back Studs			•	•
Extended Terminals (above 63A)			+	+
Dolly Extension			-	-
Phase Barriers			+	+
Terminal Shrouds (only in 3P MCCB)			•	•
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.

\# Factory Fitted

3P - Three Pole

4PwSN - Four Pole with Switched Neutral

Standard conformity : IEC 60947-2/IS:13947-2
Rated operational voltage : 415V AC
Rated Insulation Voltage : 690V 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/4PwSN
Standard current ratings (I_n)	A	160-800*	160-800*	1000-1600*
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		-	-	4000-10,000A
Rated short circuit making capacity (Peak) I_{cm}	KA	73.5	105	105
Rated ultimate short circuit breaking capacity(Icu), KA (at different voltages)	240V	50	70	70
	380V	35	50	50
	415V	35	50	50
	500V	25	35	35
Weight TP (Triple Pole)	Kg	9.2	9.2	17#/19**
FPwSN (Four Pole with Switched Neutral)	Kg	11.6	11.6	22/25
Terminal capacity (cable)	Sq.mm	-	-	-
(Bus bar width)	mm	40	40	45** upto 1000A 60** upto 1250A 65** upto 1600A 35.5# upto 1600A
Internal Accessories				
Auxiliary Switch (1 C/O or 2 C/O)		•	•	•
Shunt Trip		•	•	•
Under Voltage Release, Alarm Switch (1 C/O) # Factory Filled		•	•	•
External Accessories				
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

DC MCCBs

Standard conformity : IEC 60947-2/IS:13947-2
Rated operational voltage : 250V DC
Rated Insulation Voltage : 690V 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 I_n		A	25-125*	160-250*	160-800*	1000-1600*
Thermal release setting			Fixed	Adjustable (70-100% of I_n)	Adjustable (70-100% of I_n)	Adjustable (70-100% of I_n)
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_n	-
400-800A	CH Frame		-	-	4 - 10 times I_n	-
800-1600A	DN frame		-	-	-	4000-10,000A
Rated ultimate short circuit breaking capacity (Icu), at 250V DC		KA	5	10	20	20
Weight		Kg	0.93	1.8	9.2	17#/19**
Terminal capacity (cable)		Sq.mm	70	70(upto 100A)/150 (125A-250A)	-	-
(bus bar width)		mm	10	25	40	45** upto 1000A 60** upto 1250A 65** upto 1600A 35.5# upto 1600A
Recommended Torque		Nm	2.5	10	-	-
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 5KA, 10KA & 20KA.

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 upto 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.

G Frame Single Pole MCCB

Current Rating (A)	Icu 10kA Cat. No.	Icu 16kA Cat. No.
25	IHLGSS0025	IHLGNS0025
32	IHLGSS0032	IHLGNS0032
40	IHLGSS0040	IHLGNS0040
50	IHLGSS0050	IHLGNS0050
63	IHLGSS0063	IHLGNS0063
80	IHLGSS0080	IHLGNS0080
100	IHLGSS0100	IHLGNS0100
125	IHLGSS0125	IHLGNS0125

G Frame Three Pole MCCB

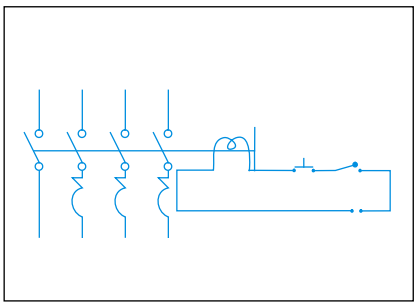
Current Rating (A)	Icu 10kA Cat. No.	Icu 16kA Cat. No.	Icu 25kA Cat. No.
25	IHLGST0025	IHLGNT0025	IHLGHT0025
32	IHLGST0032	IHLGNT0032	IHLGHT0032
40	IHLGST0040	IHLGNT0040	IHLGHT0040
50	IHLGST0050	IHLGNT0050	IHLGHT0050
63	IHLGST0063	IHLGNT0063	IHLGHT0063
80	IHLGST0080	IHLGNT0080	IHLGHT0080
100	IHLGST0100	IHLGNT0100	IHLGHT0100
125	IHLGST0125	IHLGNT0125	--
160	IHLGST0160	IHLGNT0160	--

G Frame Four Pole wSN MCCB

Current Rating (A)	Icu 10kA Cat. No.	Icu 16kA Cat. No.	Icu 25kA Cat. No.
25	IHLGSF0025	IHLGNF0025	IHLGHF0025
32	IHLGSF0032	IHLGNF0032	IHLGHF0032
40	IHLGSF0040	IHLGNF0040	IHLGHF0040
50	IHLGSF0050	IHLGNF0050	IHLGHF0050
63	IHLGSF0063	IHLGNF0063	IHLGHF0063
80	IHLGSF0080	IHLGNF0080	IHLGHF0080
100	IHLGSF0100	IHLGNF0100	IHLGHF0100
125	IHLGSF0125	--	--

G Frame Accessories (Accessories are for 3P / 4P wSN)

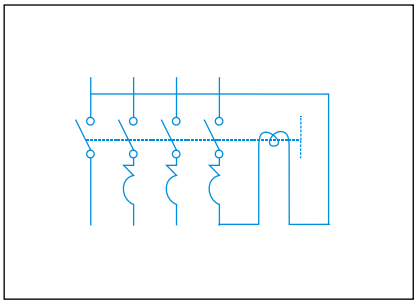
SHUNT TRIP



Voltage	Cat No.
18-30Vac/12-36Vdc	IHLLSTG030
110-110Vac	IHLLSTG110
220-240Vac	IHLLSTG240

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	IHLUVRG110
220-240 Vac	IHLUVRG240
380-440 Vac	IHLUVRG440

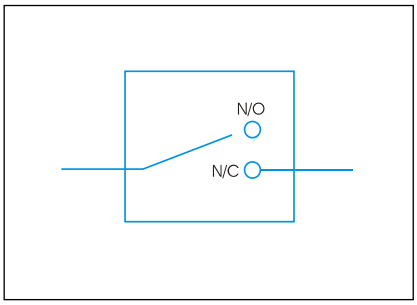
The breaker trips if the supply voltage dips below 70% to 35% of the rated voltage.

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	IHLLASG1C2	(1NO+1NC)
250Vac/250Vdc	3 Amps	IHLLASG2C2	2(1NO+1NC)
450Vac/250Vdc	3 Amps	IHLLASG1C4	(1NO+1NC)
450Vac/250Vdc	3 Amps	IHLLASG2C4	2(1NO+1NC)

ROTARY HANDLE

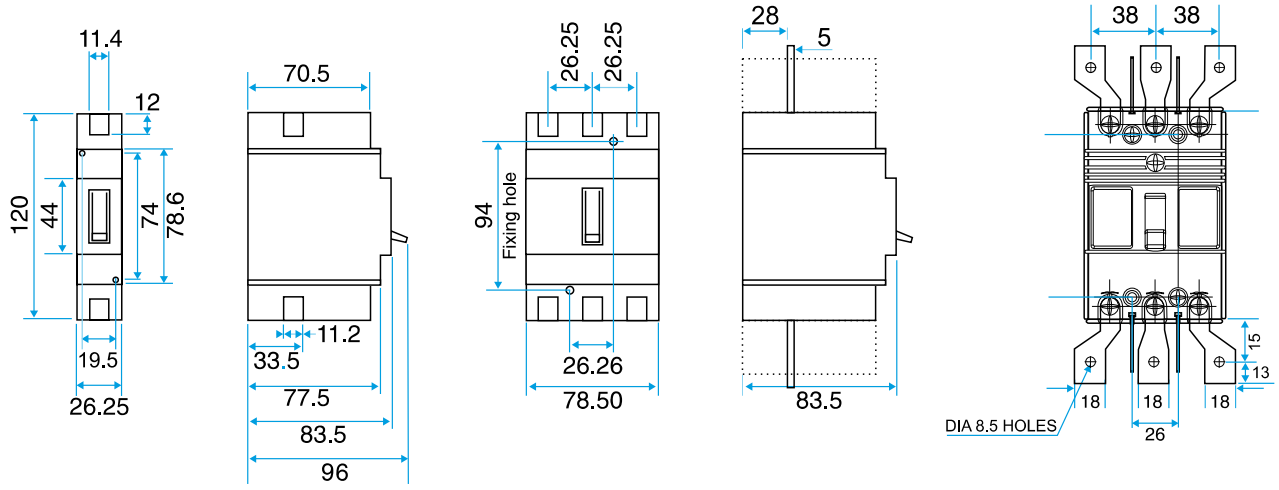
	Cat No.
With Door interlock and 300mm remote shaft	IHLLRRHG30

G Frame Accessories (Accessories are for 3P / 3P wSN)

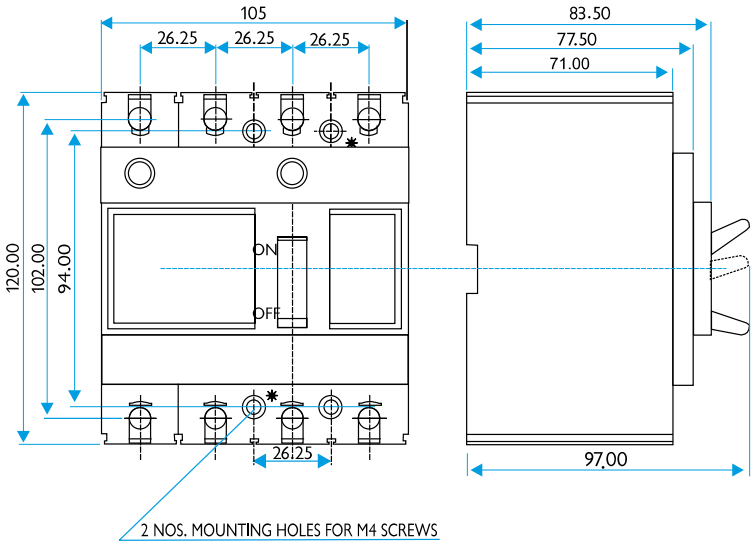
OTHER ACCESSORIES

	Cat. No.
Dolly Pad locking device	IHLLDPG125
Extended terminals	IHLLETG125
Phase Barriers	IHLLPBG125
Terminal Shrouds Single Pole	IHLLTSGS00
Three Pole	IHLLTSGT00
Four Pole wSN	IHLLTSGF00

Dimensions (in mm)



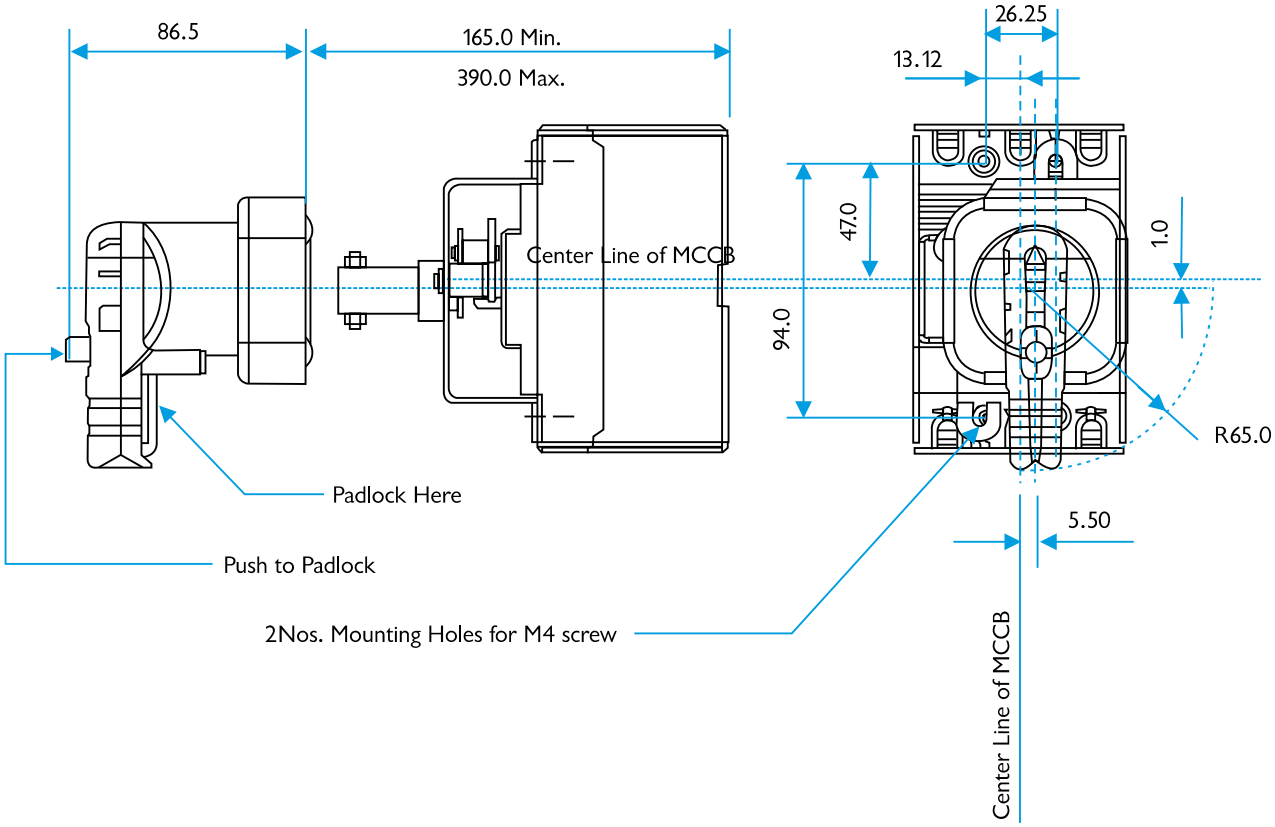
Single Pole Three Pole Three Pole with Extended Terminals



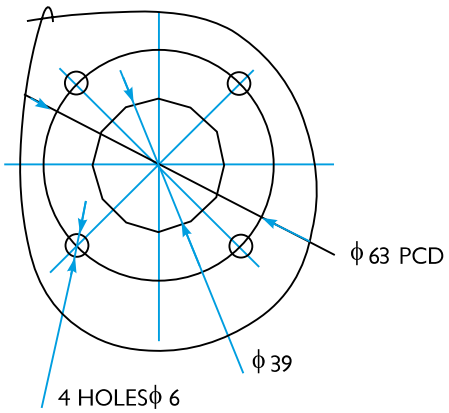
Four Pole with Switched Neutral

Dimensions (in mm) - Rotary Handle

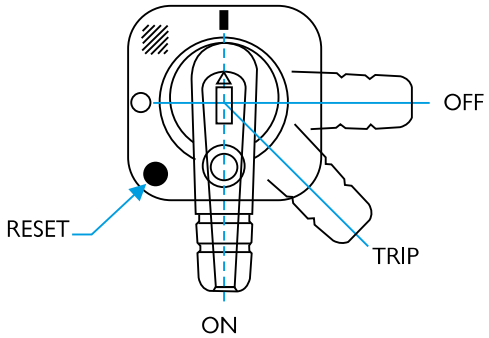
Handle Fixing Details - 'G' Frame



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'.

AA Frame Single Pole MCCB

Current Rating (A)	Icu 25kA Cat. No.
25	IHLASS0025
32	IHLASS0032
40	IHLASS0040
50	IHLASS0050
63	IHLASS0063
80	IHLASS0080
100	IHLASS0100
125	IHLASS0125
160	IHLANS0160
200	IHLANS0200
250	IHLANS0250

AA Frame Three Pole MCCB

Current Rating (A)	Icu 16kA Cat. No.	Icu 25ka Cat. No.
25	--	IHLAST0025
32	--	IHLAST0032
40	--	IHLAST0040
50	--	IHLAST0050
63	--	IHLAST0063
80	--	IHLAST0080
100	--	IHLAST0100
125	--	IHLAST0125
160	IHLAST0160	IHLANT0160
200	IHLAST0200	IHLANT0200
250	--	IHLANT0250

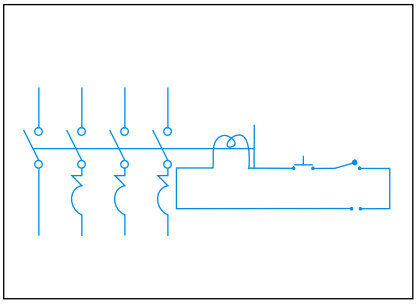
AA Frame Four Pole wSN MCCB

Current Rating (A)	Icu 16kA Cat. No.	Icu 25kA Cat. No.	Icu 35kA Cat. No.
25	--	IHLASF0025	IHLANF0025
32	--	IHLASF0032	IHLANF0032
40	--	IHLASF0040	IHLANF0040
50	--	IHLASF0050	IHLANF0050
63	--	IHLASF0063	IHLANF0063
80	--	IHLASF0080	IHLANF0080
100	--	IHLASF0100	IHLANF0100
125	--	IHLASF0125	IHLANF0125
160	IHLASF0160	IHLANF0160	--
200	IHLASF0200	IHLANF0200	--
250	--	IHLANF0250	--

AA Frame Accessories

(Accessories are for 3P / 4P wSN)

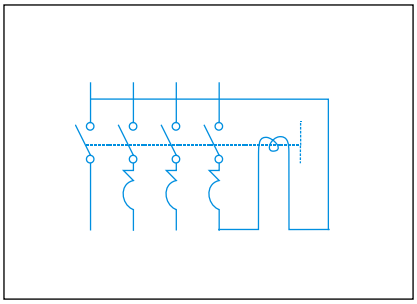
SHUNT TRIP



Voltage	Cat. No.
18-30Vac/12-36Vdc	IHLLSTA030
100-110Vac	IHLLSTA110
220-240Vac	IHLLSTA240
380-415 Vac	IHLLSTA415

AA Frame Accessories (Accessories are for 3P / 4P wSN)

UNDER VOLTAGE RELEASE



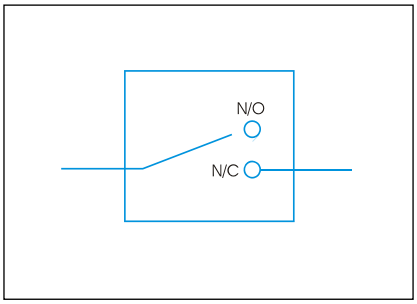
Voltage	Cat. No.
110-120 Vac	IHLUVRA110
220-240 Vac	IHLUVRA240
380-440 Vac	IHLUVRA440

The breaker trips if the supply voltage dips below 70% to 35% 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	IHLLASA1C2	(1NO+1NC)
250Vac/250Vdc	4 Amps	LLASA2C2	2(1NO+1NC)
450Vac/250Vdc	4 Amps	IHLLASA1C4	(1NO+1NC)
450Vac/250Vdc	4 Amps	IHLLASA2C4	2(1NO+1NC)

ROTARY HANDLE

	Cat. No.
With Door interlock and 300mm remote shaft	IHLLRRHA30

AA Frame Accessories (Accessories are for 3P / 4P wSN)

BACK STUDS

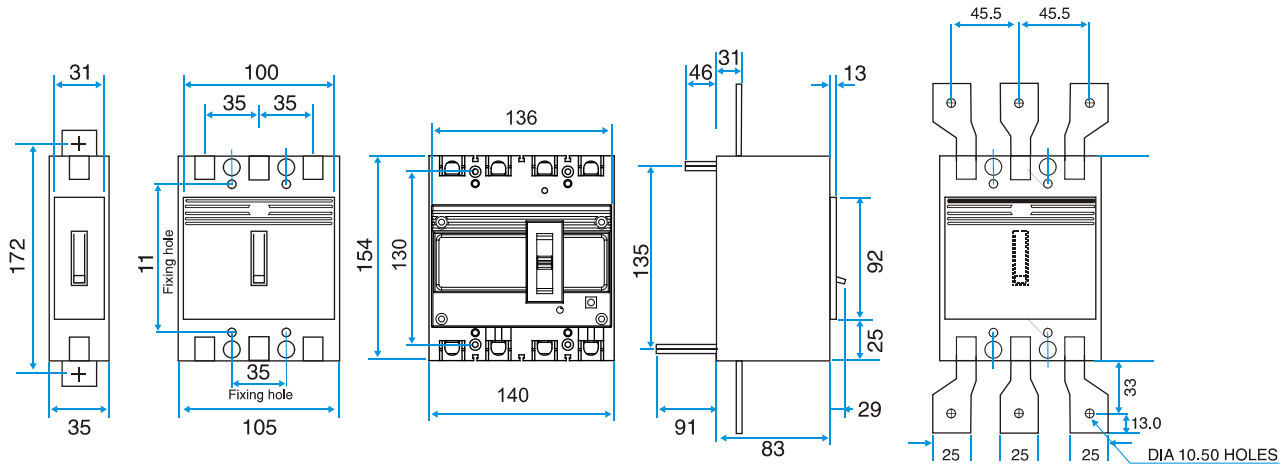
	Cat. No.
Upto 250A	IHLLBSA250

OTHER ACCESSORIES

		Cat. No.
Dolly Pad locking device		IHLLDPA250
Extended terminals		IHLLETA250
Phase Barriers		IHLLPBA250
Terminal Shrouds	Three Pole	IHLLTSAT00
	Four Pole wSN	IHLLTSAF00

Handle fixing details of 'A' Frame are given on page 48

Dimensions (in mm)



Single Pole | Three Pole | Four Pole with Switched Neutral | Three Pole with Extended Terminals

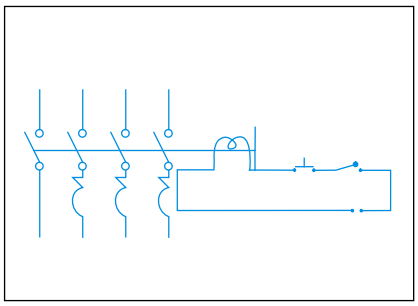
FN/FH Frame Three Pole / Four Pole with Switch Neutral

Current Rating (A)	Icu 35kA Cat. No.	Icu 50kA Cat. No.	Icu 35kA Cat. No.	Icu 50kA Cat. No.
	THREE POLE		FOUR POLE	
25	IHLFNT0025	IHLFHT0025	IHLFNF0025	IHLFHF0025
32	IHLFNT0032	IHLFHT0032	IHLFNF0032	IHLFHF0032
40	IHLFNT0040	IHLFHT0040	IHLFNF0040	IHLFHF0040
50	IHLFNT0050	IHLFHT0050	IHLFNF0050	IHLFHF0050
63	IHLFNT0063	IHLFHT0063	IHLFNF0063	IHLFHF0063
80	IHLFNT0080	IHLFHT0080	IHLFNF0080	IHLFHF0080
100	IHLFNT0100	IHLFHT0100	IHLFNF0100	IHLFHF0100
125	IHLFNT0125	IHLFHT0125	IHLFNF0125	IHLFHF0125
160	IHLFNT0160	IHLFHT0160	IHLFNF0160	IHLFHF0160
200	IHLFNT0200	IHLFHT0200	IHLFNF0200	IHLFHF0200
250	IHLFNT0250	IHLFHT0250	IHLFNF0250	IHLFHF0250

FN/FH Frame Accessories

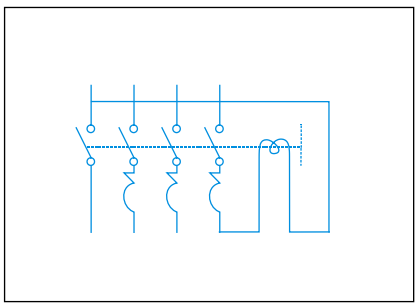
(Accessories are for 3P / 4P wSN)

SHUNT TRIP



Voltage	Cat No.
18-30Vac/12-36Vdc	IHLLSTF030
100-110Vac	IHLLSTF110
220-240Vac	IHLLSTF240
380-415 Vac	IHLLSTF415

UNDER VOLTAGE RELEASE



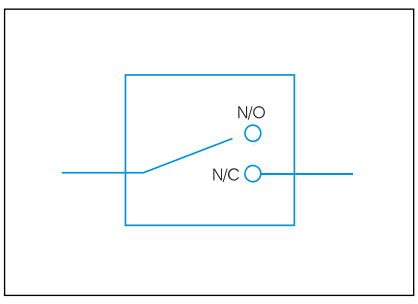
Voltage	Cat No.
110-120 Vac	IHLUVRF110
220-240 Vac	IHLUVRF240
380-440 Vac	IHLUVRF440

The breaker trips if the supply voltage dips below 70% to 35% 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	IHLLASF1C2	(1NO+1NC)
250Vac/250Vdc	4 Amps	IHLLASF2C2	2(1NO+1NC)
450Vac/250Vdc	4 Amps	IHLLASF1C4	(1NO+1NC)
450Vac/250Vdc	4 Amps	IHLLASF2C4	2(1NO+1NC)

FN/FH Frame Accessories (Accessories are for 3P / 4PwSN)

ROTARY HANDLE

	Cat. No.
With Door interlock and 300mm remote shaft	IHLLRRHF30

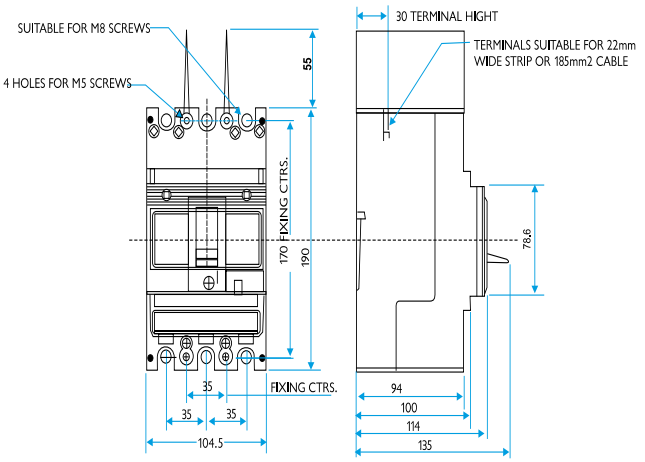
OTHER ACCESSORIES

		Cat. No.
Dolly Pad locking device		IHLLDPF250
Extended terminals		IHLLETF250
Phase Barriers		IHLLPBF250
Terminal Shrouds	Three Pole	IHLLTSFT00
	Four Pole with Switch Neutral	IHLLTSFF00

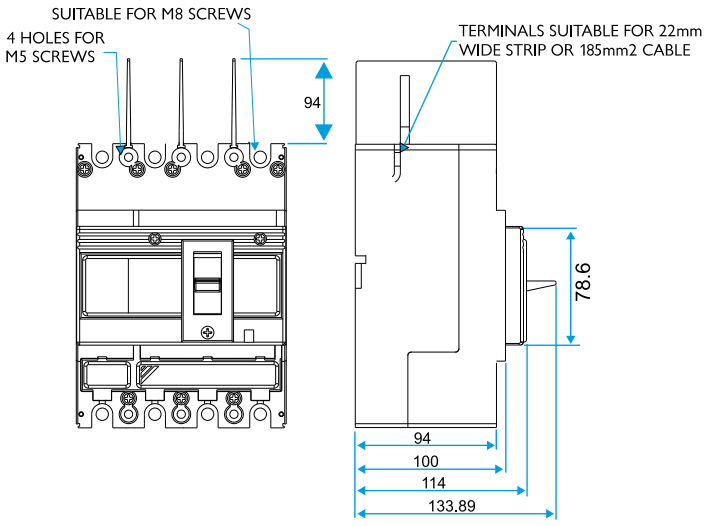
Handle fixing details of 'F' Frame are given on page 48

Dimensions (in mm)

Three Pole

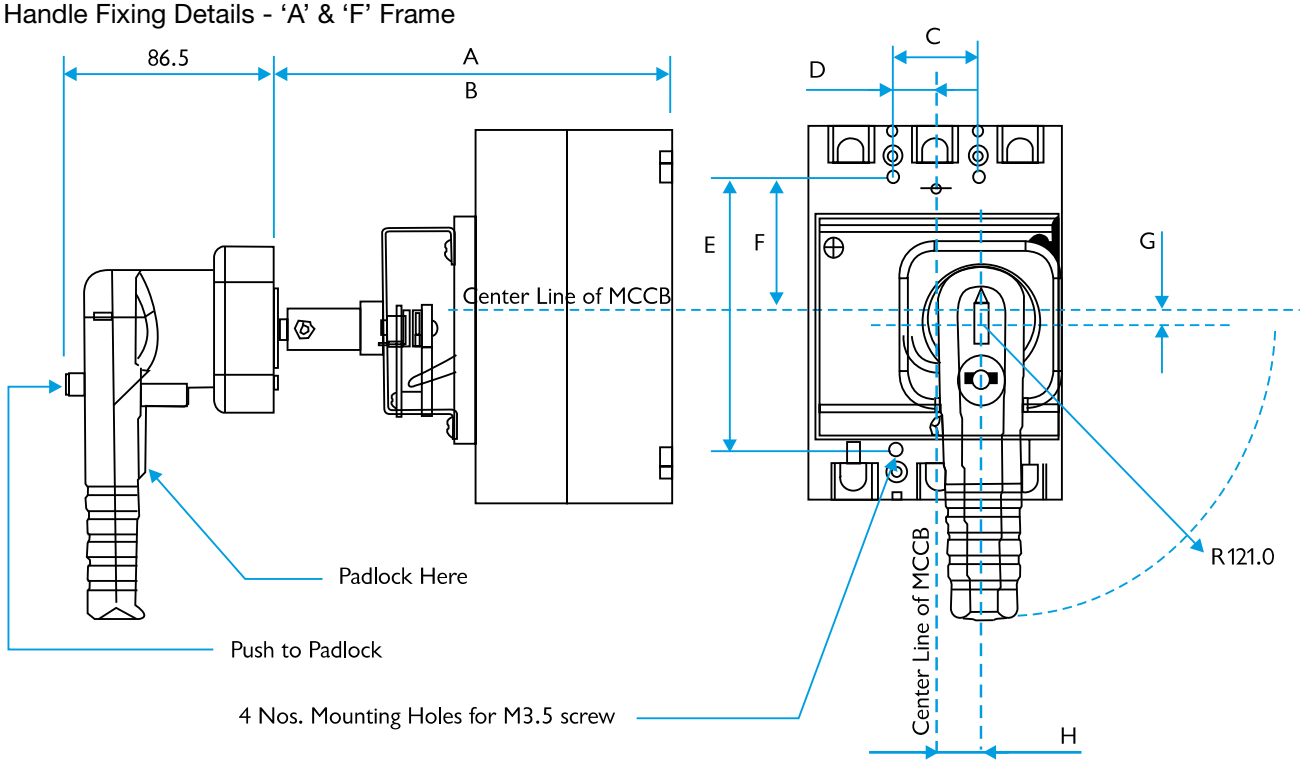


Four Pole with Switch Neutral



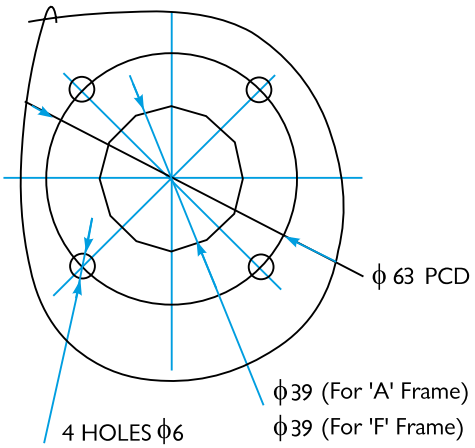
Dimensions (in mm) - Rotary Handle

Handle Fixing Details - 'A' & 'F' Frame

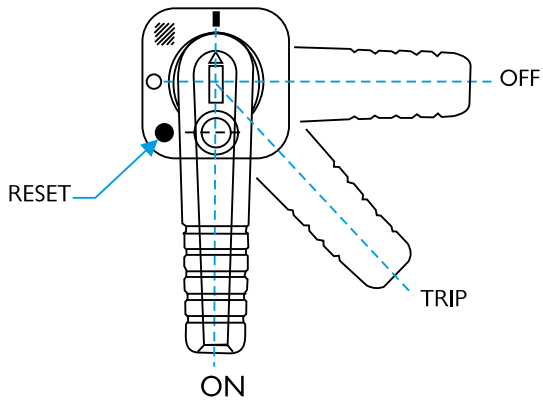


S. No.	Frame	A	B	C	D	E	F	G	H
1	F	190.0	4.25.0	35.0	17.5	170.0	85.0	3.75	15.0
2	A	165.0	400.0	35.0	17.5	112.0	56.0	5.0	18.0

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'.

CN Frame Three Pole MCCB

Current Rating (A)	Icu 35kA Cat. No.
160	IHLCNT0160
200	IHLCNT0200
250	IHLCNT0250
315	IHLCNT0315
400	IHLCNT0400
500	IHLCNT0500
630	IHLCNT0630
800	IHLCNT0800

CN Frame Four Pole wSN MCCB

Current Rating (A)	Icu 35kA Cat. No.
160	IHLCNF0160
200	IHLCNF0200
250	IHLCNF0250
315	IHLCNF0315
400	IHLCNF0400
500	IHLCNF0500
630	IHLCNF0630
800	IHLCNF0800

CH Frame Three Pole MCCB

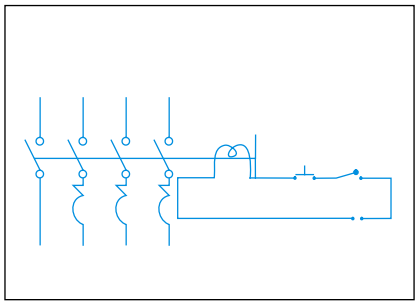
Current Rating (A)	Icu 50kA Cat. No.
160	IHLCHT0160
200	IHLCHT0200
250	IHLCHT0250
315	IHLCHT0315
400	IHLCHT0400
500	IHLCHT0500
630	IHLCHT0630
800	IHLCHT0800

CH Frame Four Pole wSN MCCB

Current Rating (A)	Icu 50kA Cat. No.
160	IHLCHF0160
200	IHLCHF0200
250	IHLCHF0250
315	IHLCHF0315
400	IHLCHF0400
500	IHLCHF0500
630	IHLCHF0630
800	IHLCHF0800

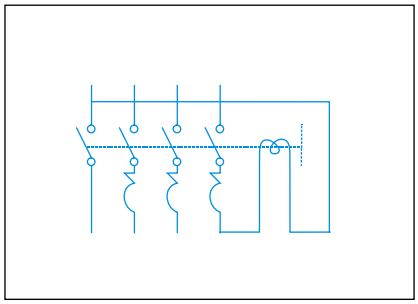
CN/CH Frame Accessories (Accessories are for 3P / 4PwSN)

SHUNT TRIP



Voltage	Cat. No.
18-30Vac/12-36Vdc	IHLLSTC030
100-110Vac	IHLLSTC110
220-240Vac	IHLLSTC240
380-415 Vac	IHLLSTC415

UNDER VOLTAGE RELEASE



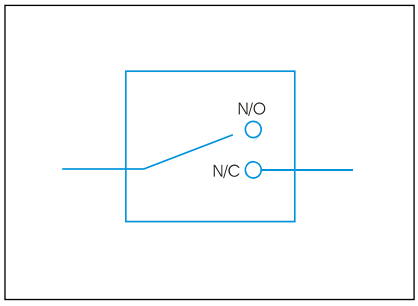
Voltage	Cat. No.
110-120 Vac	IHLUVRC110
220-240 Vac	IHLUVRC240
380-440 Vac	IHLUVRC440

The breaker trips if the supply voltage dips below 70% to 35% 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	IHLLASC1C2	(1NO+1NC)
250Vac/250Vdc	4 Amps	IHLLASC2C2	2(1NO+1NC)
450Vac/250Vdc	4 Amps	IHLLASC1C4	(1NO+1NC)
450Vac/250Vdc	4 Amps	IHLLASC2C4	2(1NO+1NC)

ROTARY HANDLE

	Cat. No.
With Door interlock and 300mm remote shaft	IHLLRRHC30

CN/CH Frame Accessories

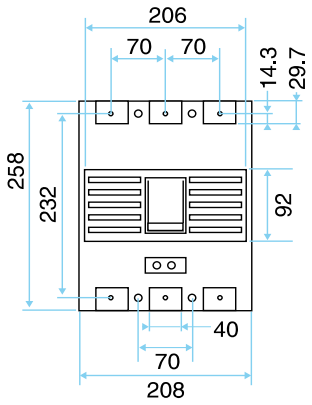
BACK STUDS

	Cat. No.
Upto 400A	IHLLBSC400

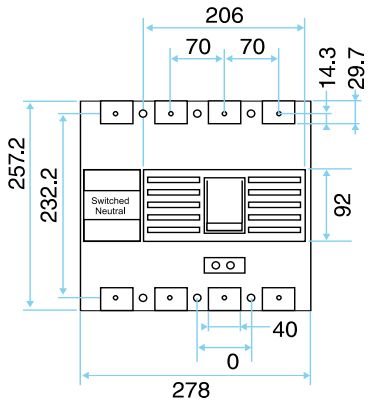
OTHER ACCESSORIES

	Cat. No.
Dolly Pad locking device	IHLLDPC800
Phase Barriers	IHLLPBC800
Dolly Extension	IHLLDEC800

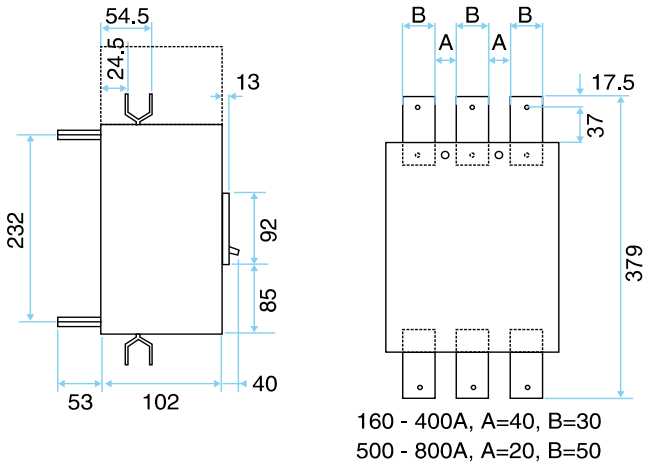
Dimensions (in mm)



Three Pole

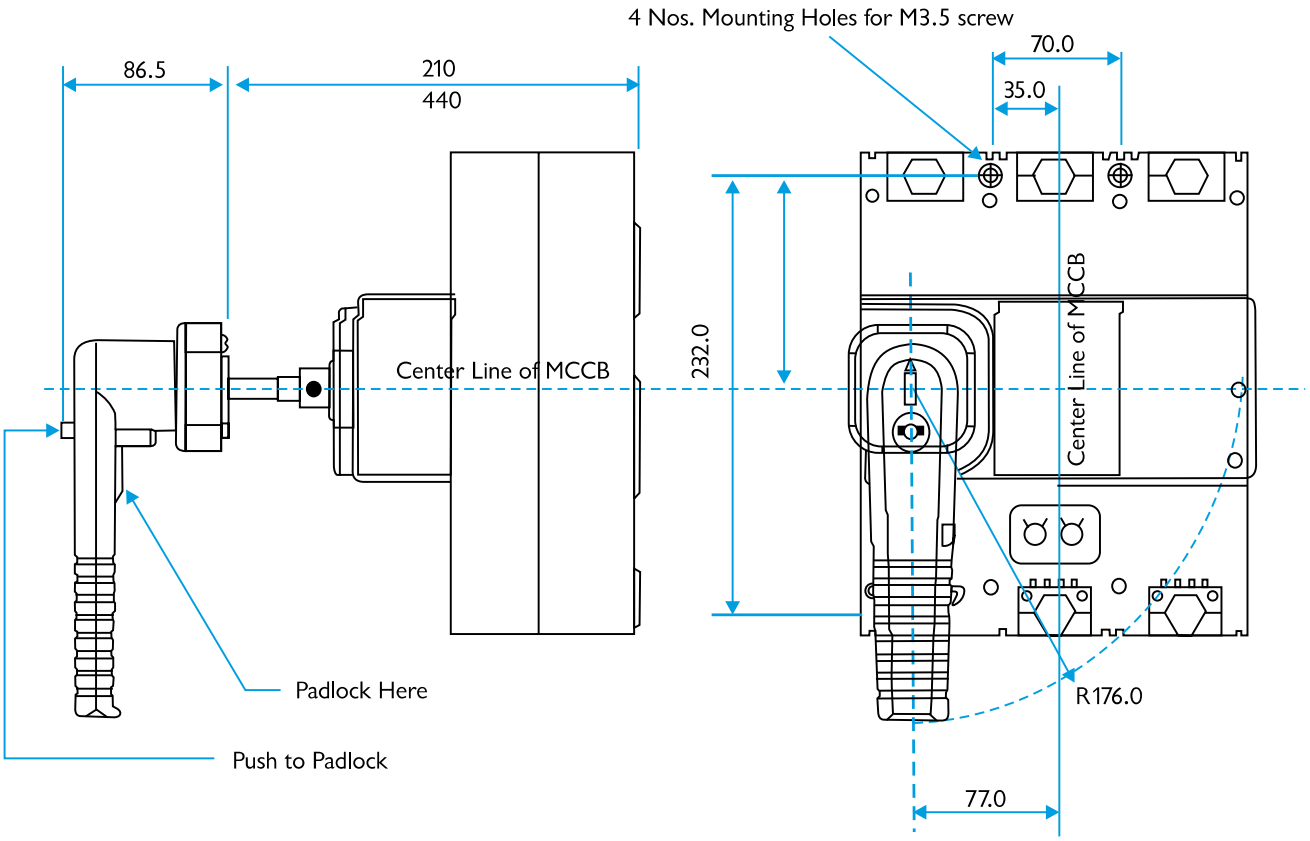


Four Pole with Switched Neutral

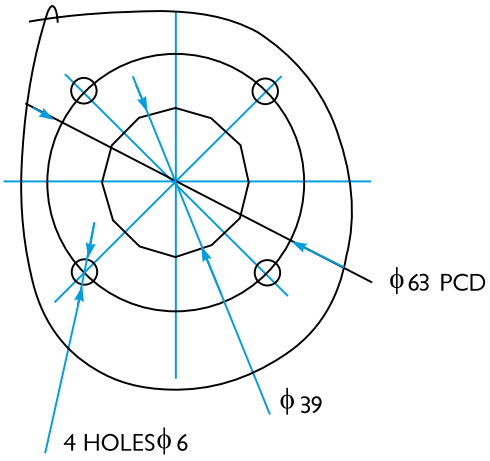


Three Pole with Extended Terminals

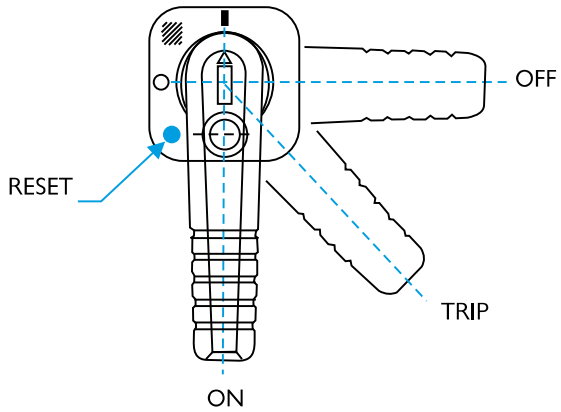
HANDLE FIXING DETAILS - 'C' FRAME



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'.

DN Frame MCCB - Three Pole / Four Pole with Switched Neutral

THREE POLE

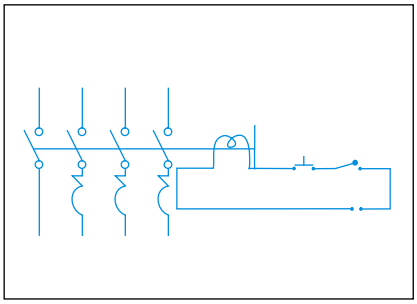
Current Rating (A)	Icu 50kA Cat. No.
800	IHLDNT0800
1000	IHLDNT1000
1250	IHLDNT1250
1600	IHLDNT1600

FOUR POLE

Current Rating (A)	Icu 35kA Cat. No.
1000	IHLDNF1000
1250	IHLDNF1250

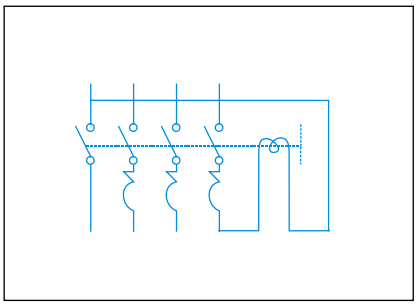
D Frame Accessories

SHUNT TRIP



Voltage	Cat. No.
18-30Vac/12-36Vdc	IHLLSTD030
100-110Vac	IHLLSTD110
220-240Vac	IHLLSTD240
380-415 Vac	IHLLSTD415

UNDER VOLTAGE RELEASE



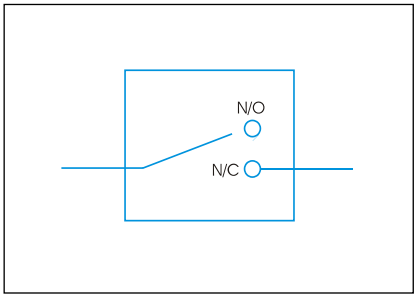
Voltage	Cat. No.
110-120 Vac	IHLUVRD110
220-240 Vac	IHLUVRD240
380-440 Vac	IHLUVRD440

The breaker trips if the supply voltage dips below 70% to 35% 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 (AC15)	Cat. No.	Config.
250Vac/250Vdc	4 Amps	IHLLASD1C2	(1NO+1NC)
250Vac/250Vdc	4 Amps	IHLLASD2C2	2(1NO+1NC)
450Vac/250Vdc	4 Amps	IHLLASD1C4	(1NO+1NC)
450Vac/250Vdc	4 Amps	IHLLASD2C4	2(1NO+1NC)

D Frame Accessories

Rotary Handle

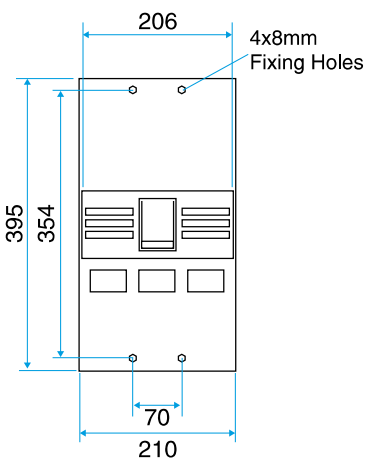
	Cat. No.
With Door interlock and 300mm remote shaft	IHLLRRHD30

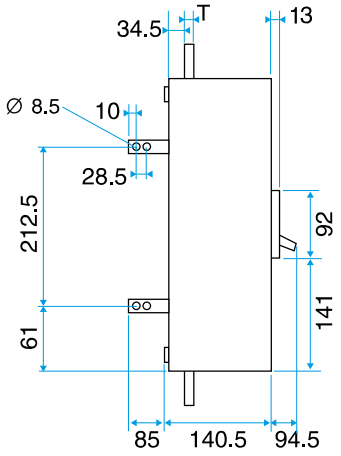
Other Accessories

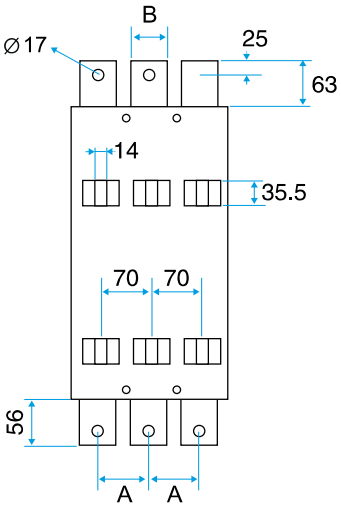
	Cat. No.
Dolly Pad locking device	IHLLDPD160
Dolly Extension	IHLLDED160

Dimensions (in mm)

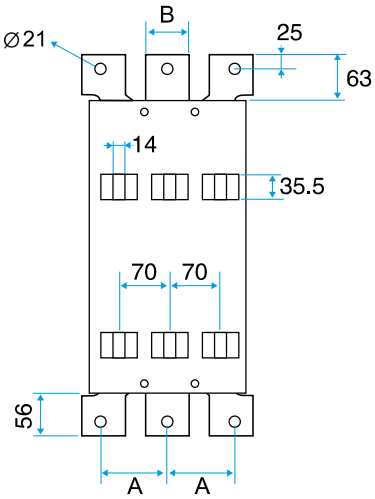
THREE POLE





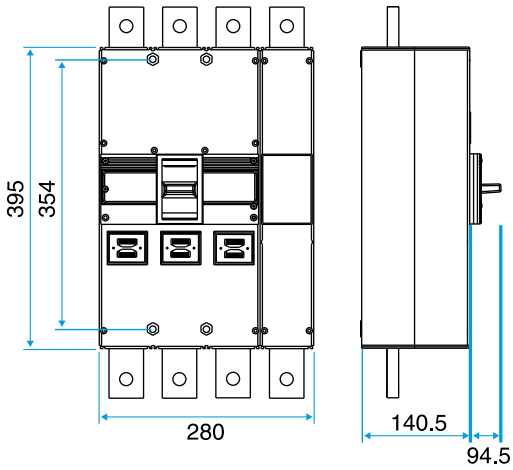


1000A



1250A - 1600A

Four Pole With Switched Neutral



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

GN Frame Three Pole — DC MCCB

Current Rating (A)	Icu 5kA Cat. No.
25	IHLDCGNT0025
32	IHLDCGNT0032
40	IHLDCGNT0040
50	IHLDCGNT0050
63	IHLDCGNT0063
80	IHLDCGNT0080
100	IHLDCGNT0100
125	IHLDCGNT0125

AN Frame Three Pole — DC MCCB

Current Rating (A)	Icu 10kA Cat. No.
160	IHLDCANT0160
200	IHLDCANT0200
250	IHLDCANT0250

CH Frame Three Pole — DC MCCB

Current Rating (A)	Icu 20kA Cat. No.
160	IHLDCCHT0160
200	IHLDCCHT0200
250	IHLDCCHT0250
315	IHLDCCHT0315
400	IHLDCCHT0400
500	IHLDCCHT0500
630	IHLDCCHT0630
800	IHLDCCHT0800

DN Frame Three Pole — DC MCCB

Current Rating (A)	Icu 20kA Cat. No.
1000	IHLDCDNT1000
1250	IHLDCDNT1250
1600	IHLDCDNT1600

Earth Fault Relay

The Earth Fault Relay is a common accessory for use in conjuction 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.

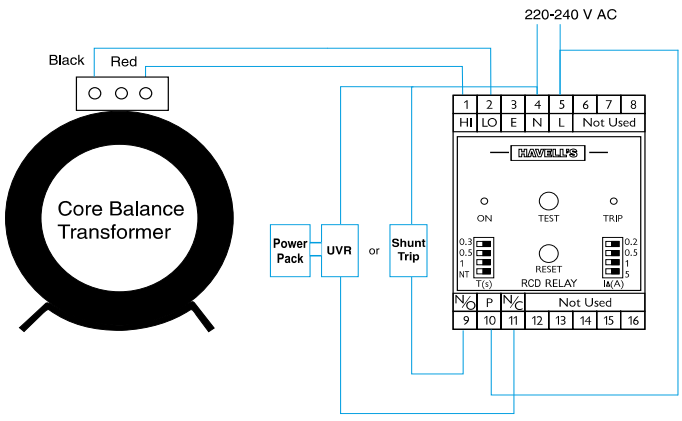
Features

- No nuisance tripping
- DIN rail mounting
- Adjustable time delay
- Choice of sensitivity from 300mA upto 1A
- 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, NT
Time delay (m. sec.)	200, 500, 1000, 5000

Note: Option to By-Pass EFR in NT position available with dip switch.



Connection Diagram

Core Balance Current Transformer

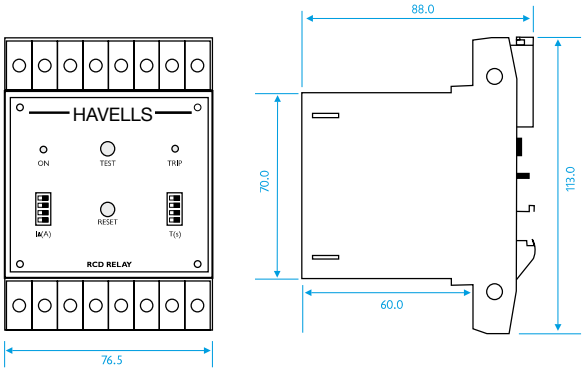
Size	MCCB Current Rating	Internal Dimension	Shape
1.	25-100A	60mm	Circular
2.	125-200A	95mm	Circular
3.	250-400A	145mm	Circular
4.	500-800A	300 x 80 mm	Rectangular

Earth Fault Relay

MCCB Current Rating (A)	Cat. No.
25 - 100	IHLEFR1100
125-200	IHLEFR2200
250-400	IHLEFR3400
500-800	IHLEFR4800

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 seperately.

Dimensions (in mm)

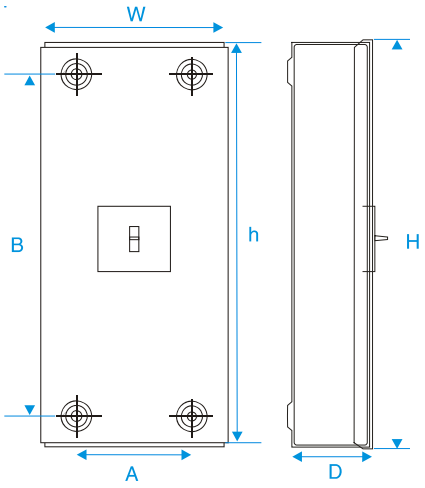


General Purpose Enclosure

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.

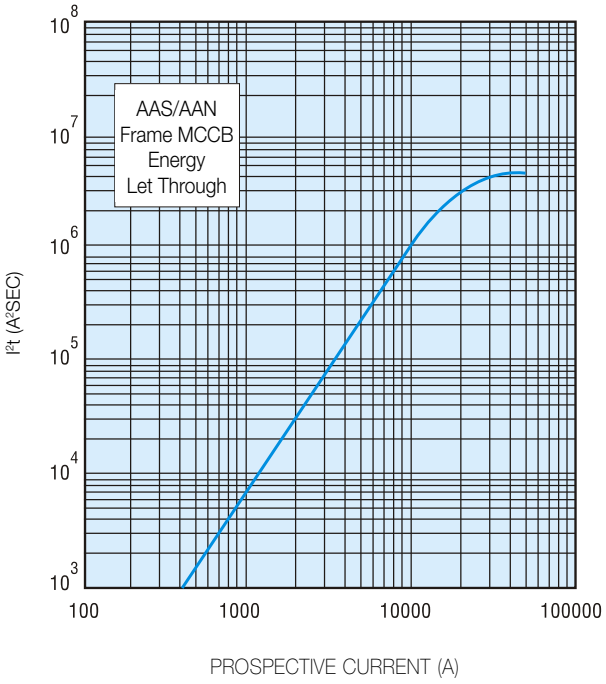
Description	Cat. No.
G Frame SP	IHDLE00GSP
G Frame TP	IHDLE00GTP
G Frame FP	IHDLE00GFP
A Frame SP	IHDLE00ASP
A Frame TP	IHDLE00ATP
A Frame FP	IHDLE00AFP
F Frame TP	IHDLE00FTP
F Frame FP	IHDLE00FFP
C Frame TP (400A)	IHDLE00CTP
C Frame FP (400A)	IHDLE00CFP
C Frame TP (800A)	IHDLE00CTS
C Frame FP (800A)	IHDLE00CFS

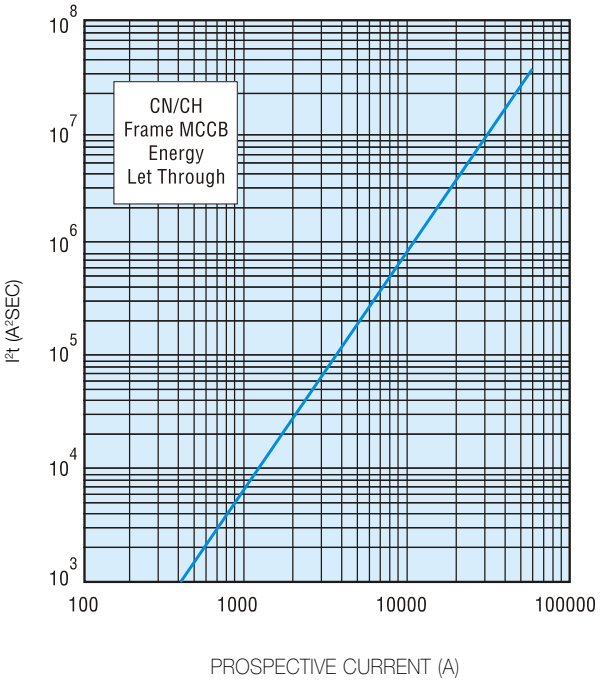
Dimensions (in mm)

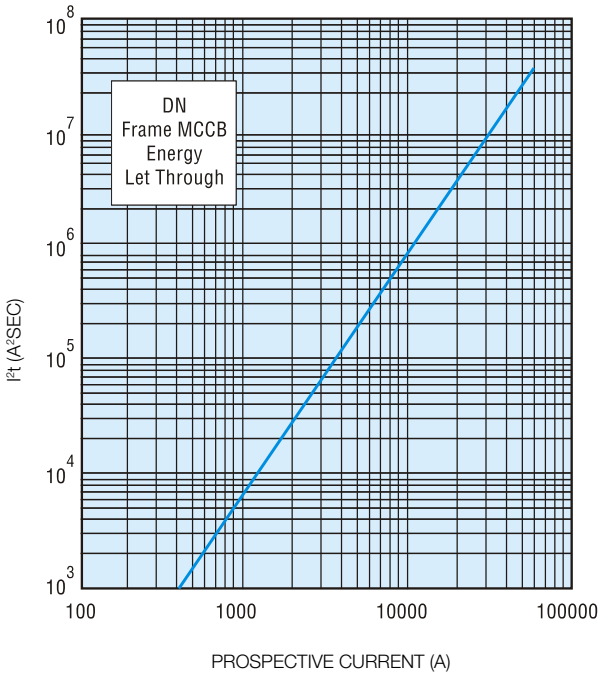


Description	W	D	h	H	AxB
G Frame	260	108	360	370	160x360
AA Frame	260	108	560	570	160x480
F Frame	260	122	560	570	160x480
C Frame upto 400 A	440	122	960	975	280x802
C Frame upto 800 A	540	122	960	975	380x802

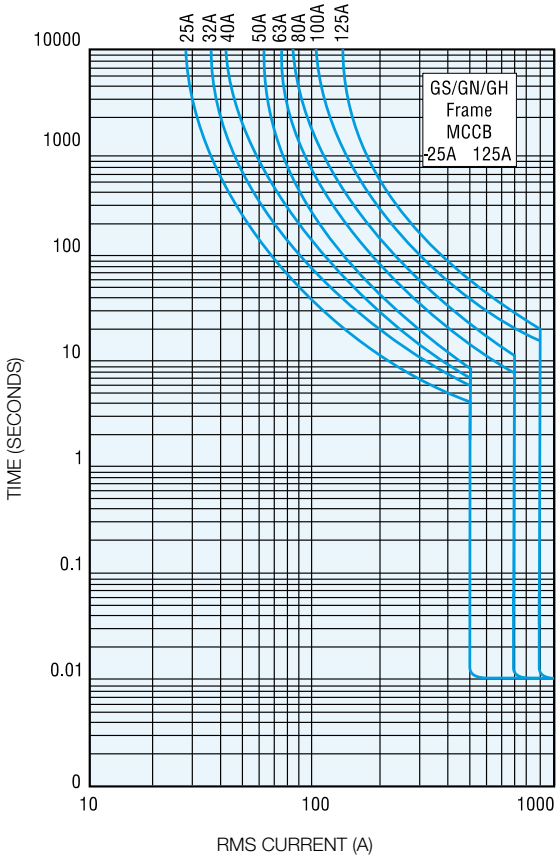
Let Through Energy (I^2t) Characteristics

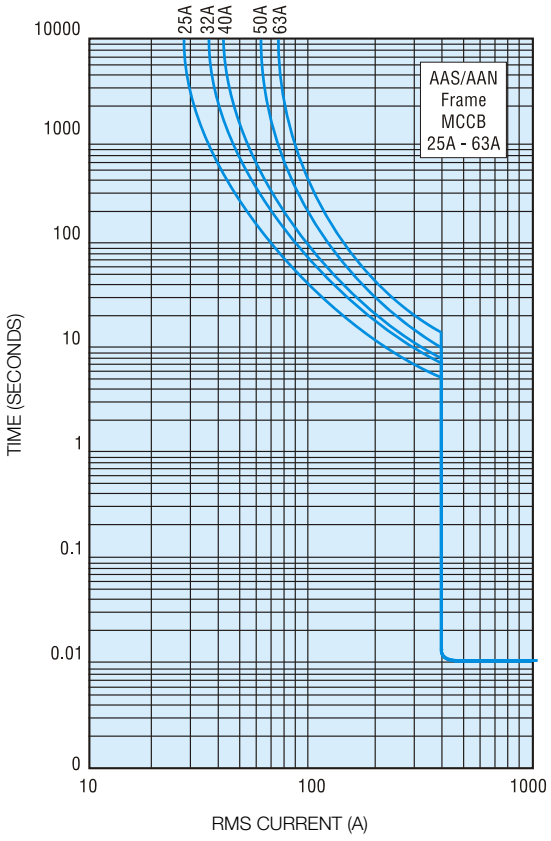




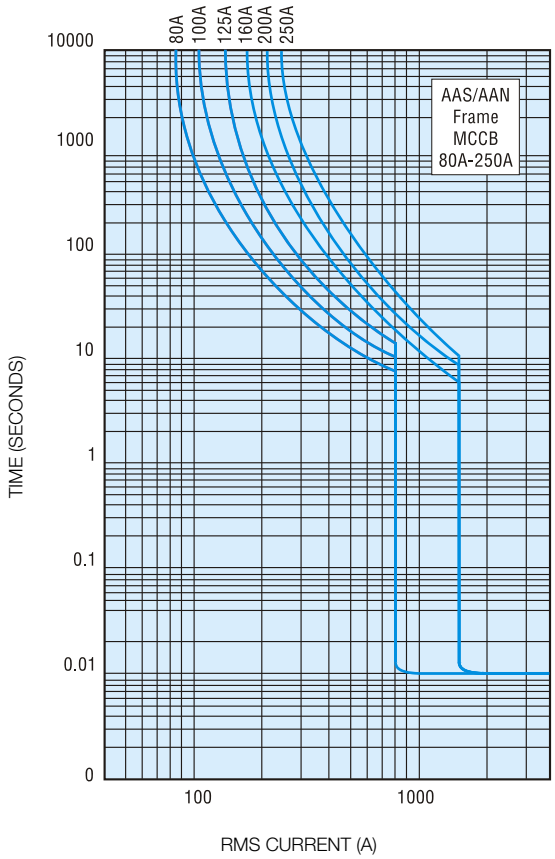


Tripping Characteristics

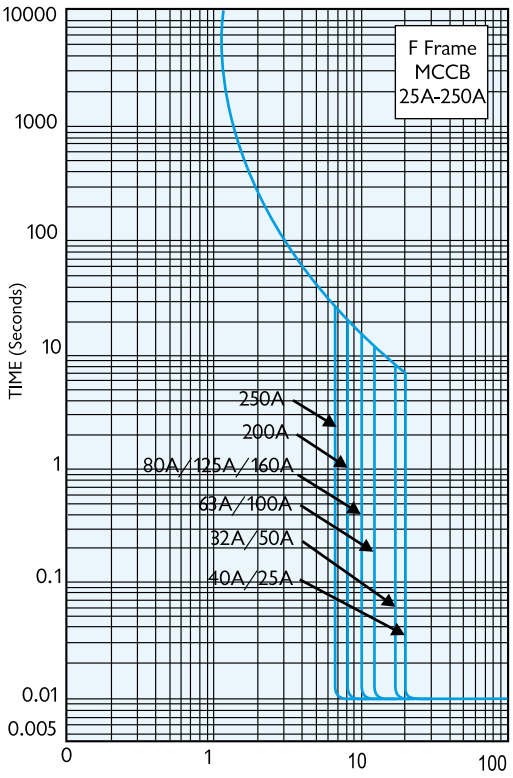




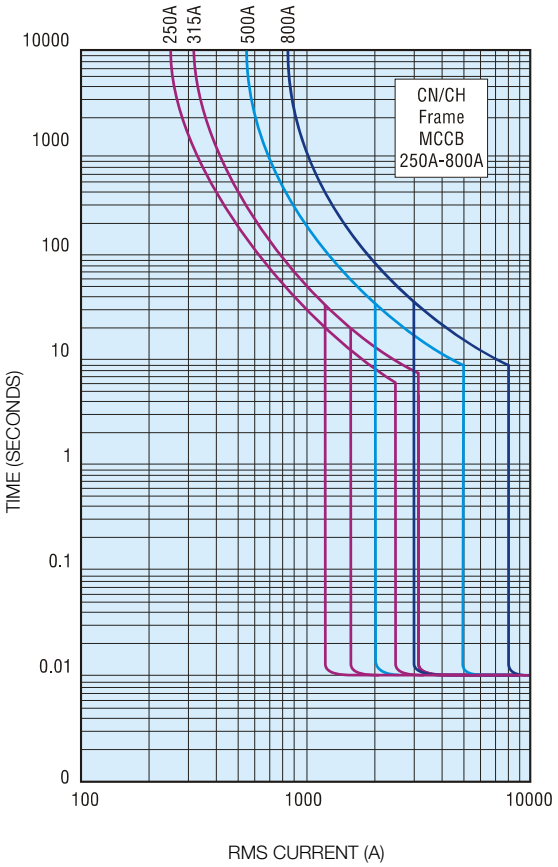
Tripping Characteristics

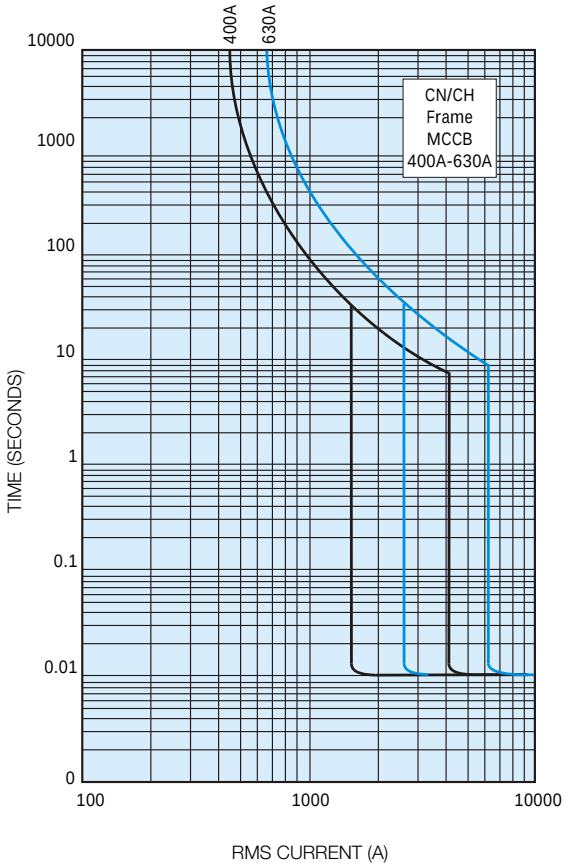


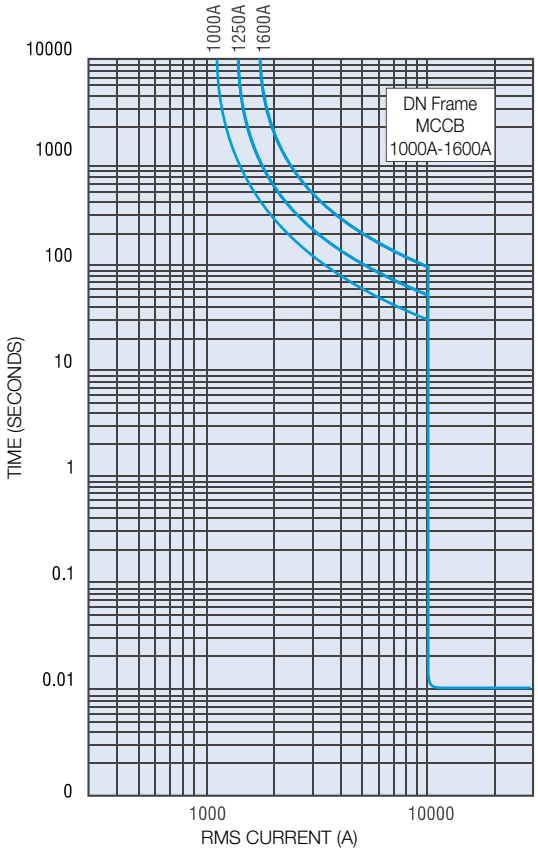
TIME CURRENT CHARACTERISTIC CURVE OF F-FRAME MCCB
TOLERANCE ON INSTANTANEOUS CURRENT +10%



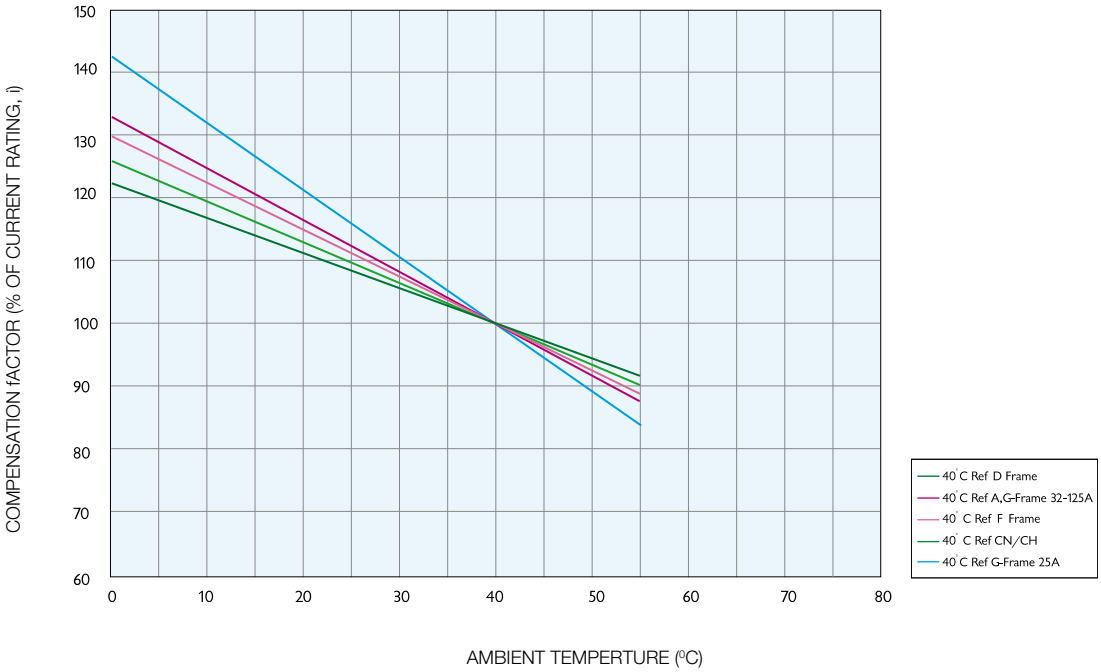
Tripping Characteristics







Ambient Temperature Compensation Chart (G, AA, C Frame MCCBs)



DISCRIMINATION DATA

LOADLINE MCCB UPSTREAM DEVICE INSTANTANEOUS TRIP SET AT HIGH

LOADLINE MCCB DOWN STREAM DEVICE INSTANTANEOUS TRIP SET AT LOW

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

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

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 :

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

'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 35kA	CN 35kA	CH 50kA	DN 50kA
16	25	25	25	25	25			
25	40	40	40	40	40			
63	100	100	100	100	100			
100				160	160	160	160	
160				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 :

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

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

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 :

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

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.

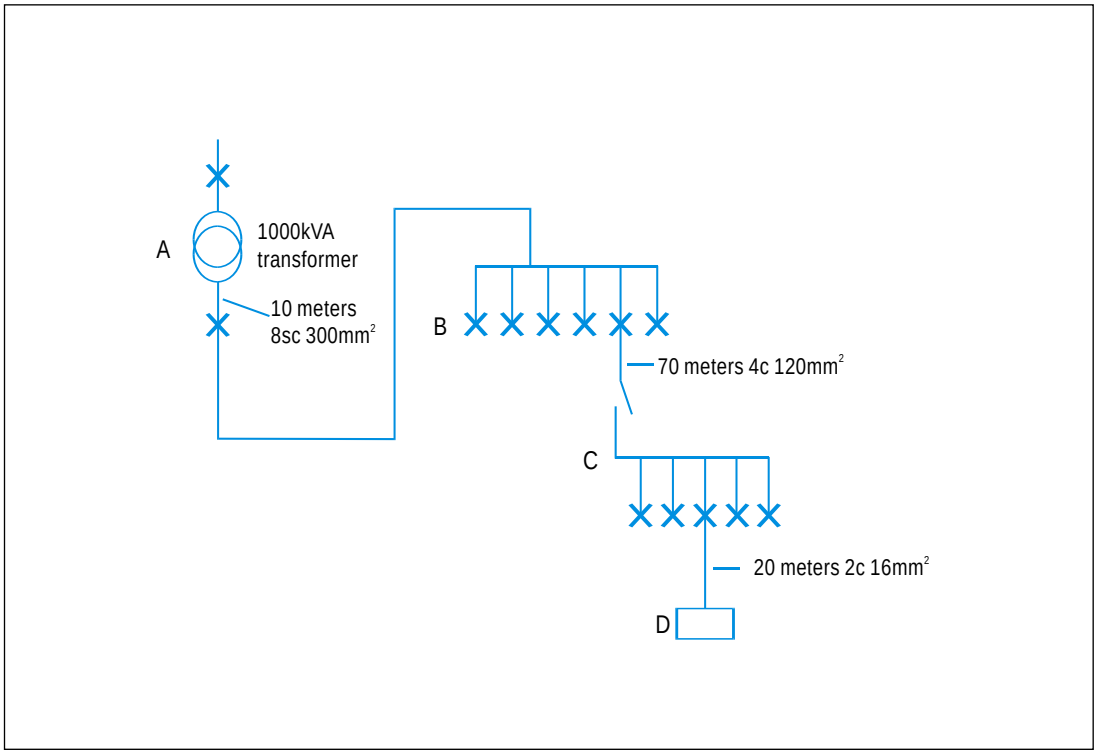
The values assume a symmetrical fault across the three phases. In a single circuit, for line to neutral faults, take the cable resistance value from the table and double it.

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.

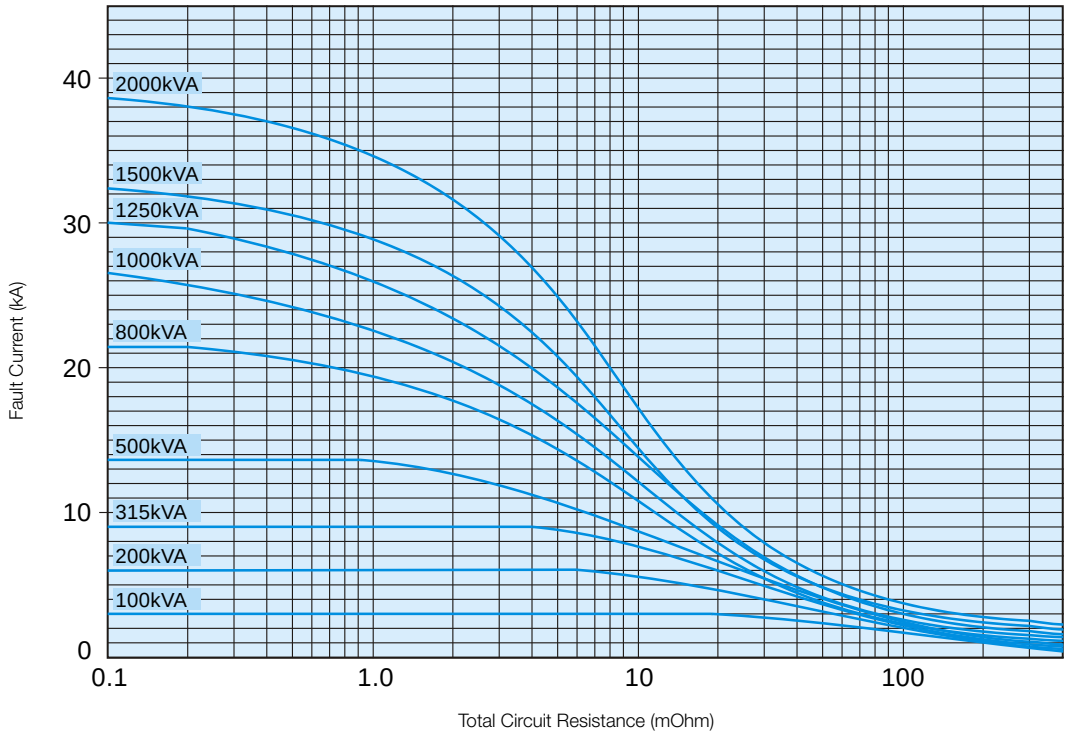
PSC at A	approximately 27kA
PSC at B	
resistance A to B (a)	0.30mΩ = 25kA
PSC at C	
+resistance A to B	0.30mΩ
+resistance B to C1	10.70mΩ
	11.00mΩ = 12kA
PSC at D	
+resistance A to B	0.30mΩ
+resistance B to C	10.70mΩ
+resistance C to D	46.00mΩ (b)
	57.00mΩ = 3kA

(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



Estimating the Prospective Short Circuit Current



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

Nominal Cross-sectional Area (mm^2)	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

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.

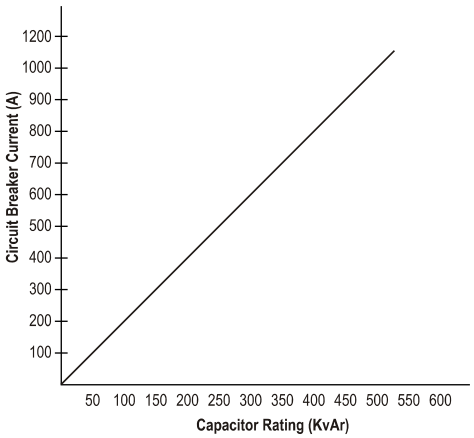
Selection table for Motor Protection

Motor Rating		Approx. Full Load Current	Direct On Line MCCB Rating/Type		Star/Delta MCCB Rating/Type	
HP	KW	(A) at 415V	AAN	CN/CH	AAN	CN/CH
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
300	224	375	-	500	-	500
350	261	449	-	630	-	630
400	298	505	-	630	-	630

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.

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 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^2t varies for AC and DC. The integral (I^2t) for AC will be 1.21 times integral (I^2avt) 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 $½Li^2$

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.