Miniature circuit breakers

Din-T DC series
6 kA (0.5-63 A) interrupting capacity 'C' curve

- Standard AS/NZS 3947-2
- Current range 0.5-63 Amps, 1 and 2 pole
- DC voltage, 250 V 1 pole, 440 V 2 pole
- Can be used for AC and DC applications
- Sealable and lockable handle
- DIN rail mounting
- Padlockable in OFF position
- Suits CD type chassis
- Industrial applications

DTCBDC
DC applications

Operation

Din-T DC MCBs are equipped with a permanent magnet which aids arc extinguishing under fault conditions, making this range of MCBs suitable for DC voltages up to 250 V DC (1 pole) and 440 V DC (2 poles in series).

Curve type: C (5 - 10 I_n)

Single pole		Double pole	
Amps	**Cat. No.**	**Amps**	**Cat. No.**
0.5	i **DTCBDC105C**	0.5	**DTCBDC205C**
1	i **DTCBDC101C**	1	**DTCBDC201C**
2	i **DTCBDC102C**	2	**DTCBDC202C**
4	i **DTCBDC104C**	4	**DTCBDC204C**
6	**DTCBDC106C**	6	**DTCBDC206C**
10	**DTCBDC110C**	10	**DTCBDC210C**
16	**DTCBDC116C**	16	**DTCBDC216C**
20	**DTCBDC120C**	20	**DTCBDC220C**
25	**DTCBDC125C**	25	**DTCBDC225C**
32	**DTCBDC132C**	32	**DTCBDC232C**
40	**DTCBDC140C**	40	**DTCBDC240C**
50	**DTCBDC150C**	50	**DTCBDC250C**
63	**DTCBDC163C**	63	**DTCBDC263C**

Notes: **The line side is the 'OFF' or bottom side of the MCB, and connects to CD chassis tee off's.**
i Available on indent only.

Short circuit capacity (kA)

AC/DC acc. to EN 60898

Poles	V Max	Icn (kA)
1	250 DC	6
2	440 DC	6

Shock resistance (In X, Y, Z directions).

20 g with shock duration 10 ms (minimum 18 shocks).
40 g with shock duration 5 ms (minimum 18 shocks).
Half sinusoidal according to IEC 60068-2-27.

Vibration resistance (In X, Y, Z directions).

3 g in frequency range 10 to 55 Hz
(operating time at least 30 min).
According to IEC 60068-2-6.

Storage temperature

From -55 °C to +55 °C, according to IEC 88 part 2 - 1 (duration 96 hours).

Operating temperature

From -25 °C to +55 °C, according to VDE 0664 parts 1 and 2.

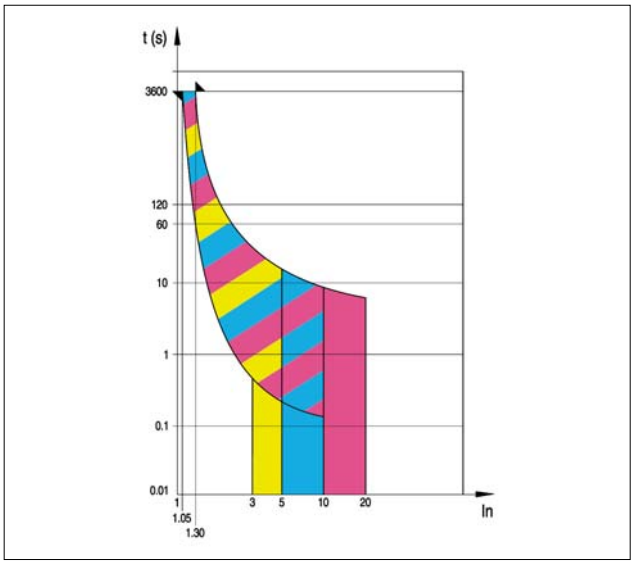
For DC applications

Din-T MCBs Technical data

Characteristics according to EN 60947-2

Miniature Circuit Breakers are intended for the protection of the lines against both overloads and short-circuits in **industrial** wiring installations where normal operation is done by **instructed** people

Tripping characteristic curves



Magnetic release

An electromagnet with plunger ensures instantaneous tripping in the event of short-circuit. The standard leaves the calibration of magnetic release to the manufacturers discretion.

NHP offers instantaneous tripping ranges:

- release between 5 and 10 In
- release between 10 and 20 In

Thermal release

The release is initiated by a bimetal strip in the event of overload. The standard defines the range of release for two special overload values. Reference ambient temperature is 40 °C.

Test current	Tripping time
1.05 x In	$t \geq 1$ h (In $\leq$ 63 A) $t \geq 2$ h (In > 63 A)
1.30 x In	$t < 1$ h (In $\leq$ 63 A) $t < 2$ h (In > 63 A)

Rated ultimate short-circuit breaking capacity (Icu)

Is the value of the short-circuit that the MCB is capable of withstanding in the following test of sequence of operations: O-t-CO.

After the test the MCB is capable, without maintenance, to withstand a dielectric strength test at a test voltage of 1000 V. Moreover the MCB shall be capable of tripping when loaded with 2.5 In within the time corresponding to 2 In but greater than 0.1 s.

Rated service short-circuit breaking capacity (Ics)

Is the value of the short-circuit that the MCB is capable of withstanding in the following test of sequence of operations: O-t-CO-t-CO.

After the test the MCB is capable, without maintenance, to withstand a dielectric strength test at a test voltage of twice its rated insulation voltage with a minimum of 1000 V.
A verification of the overload releases on In and moreover the MCB shall trip within 1 h when current is 1.45 In (for In<63 A) and 2 h (for In>63 A).

O - Represents an opening operation

C - Represents a closing operation followed by an automatic opening.

t - Represents the time interval between two successive short-circuit operations: 3 minutes.

Category A: Without a short-time withstand current rating.

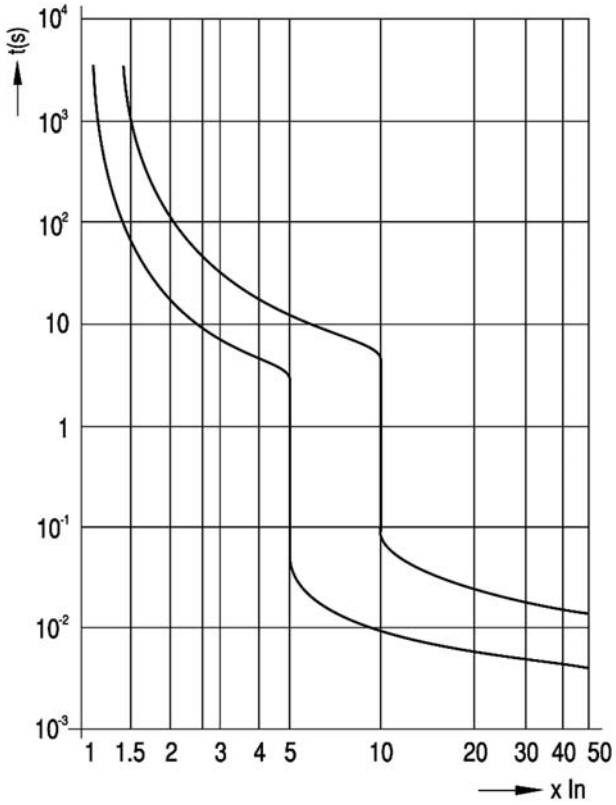
Utilization category	Application with respect to selectivity
A	Circuit breakers not specifically intended for selectivity under short-circuit conditions with respect to other short-circuit protective devices in series on the load side, i.e. without an intentional short-time delay provided for selectivity under short-circuit conditions, and therefore without a short-time withstand current rating according to 4.3.5.4
B	Circuit breakers specifically intended for selectivity under short-circuit conditions with respect to other short-circuit protective devices in series on the load side, i.e. without an intentional short-time delay (which may be adjustable), provided for selectivity under short-circuit conditions. Such circuit-breakers have a short-time withstand current rating according to 4.3.5.4

Din-T MCBs Technical data

Tripping curves according to EN 60898

The following tables show the average tripping curves of the Terasaki Din-T MCBs based on the thermal and magnetic characteristics.

Curve C



Din-T MCBs Technical data

Definitions related to circuit breakers

MCB = Miniature Circuit Breaker

Short-circuit (making and breaking) capacity
Alternating component of the prospective current, expressed by its RMS value, which the circuit breaker is designed to make, to carry for its opening time and to break under specified conditions.

Ultimate or rated short-circuit breaking capacity (Icn - EN 60898)
A breaking capacity for which the prescribed conditions, according to a specified test sequence, do not include the capability of the MCB to carry 0.96 times its rated current for the conventional time.

Ultimate short-circuit breaking capacity (Icu - EN 60947-2)
A breaking capacity for which the prescribed conditions, according to a specified test sequence, do not include the capability of the MCB to carry its rated current for the conventional time.

Service short-circuit breaking capacity (Ics - EN 60898)
A breaking capacity for which the prescribed conditions, according to a specified test sequence, include the capability of the MCB to carry 0.96 times its rated current for the conventional time.

Prospective current
The current that would flow in the circuit, if each main current path of the MCB were replaced by a conductor of negligible impedance.

Conventional non-tripping current (Int)
A specified value of current which the circuit breaker is capable of carrying for a specified time without tripping.

Open position
The position in which the predetermined clearance between open contacts in the main circuit of the MCB is secured.

Closed position
The position in which the predetermined continuity of the main circuit of the MCB is secured.

Maximum prospective peak current (Ip)
The prospective peak current when the initiation of the current takes place at the instant which leads to the highest possible value.

Din-T MCBs Technical data

Influence of ambient air temperature on the rated current

The maximum value of the current which can flow through an MCB depends on the nominal current of the MCB, the conductor cross-section and the ambient air temperature.

The values shown in the table below are for devices in free air. For devices installed with other modular devices in the same switchboard, a correction factor (K) shall be applied relative to the mounting situation of the MCB, the ambient temperature and the number of main circuits in the installation.

No of devices	K [1])
2 or 3	0.9
4 or 5	0.8
6 or 9	0.7
> 10	0.6

Calculation example

Within a distribution board consisting of eight 2 Pole, 16 A, 'C' curve type MCBs, with an operating ambient temperature of 45 °C, which is the highest temperature the MCB can operate at without unwanted tripping?

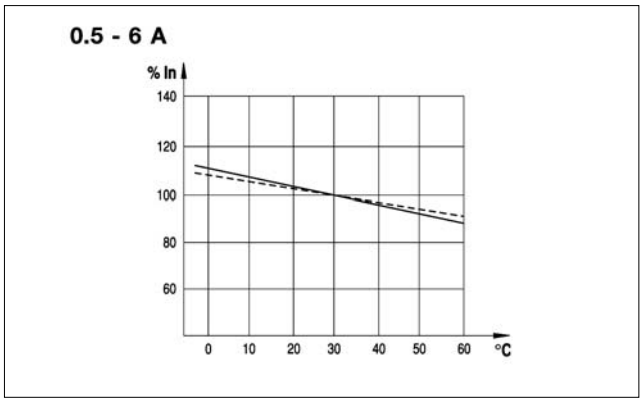
Calculation

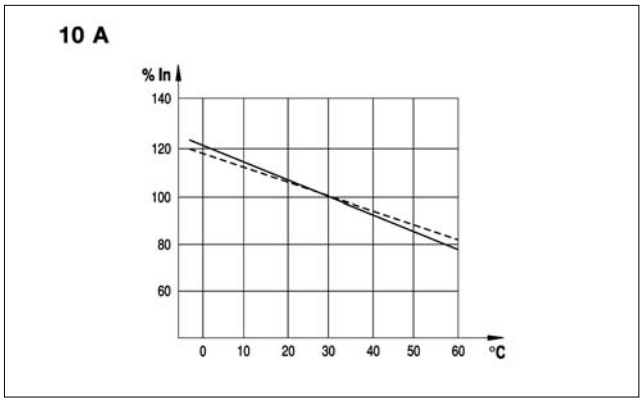
The correction factor K = 0.7, for use in an eight circuit installation: 16 A x 0.7 = 11.2 A

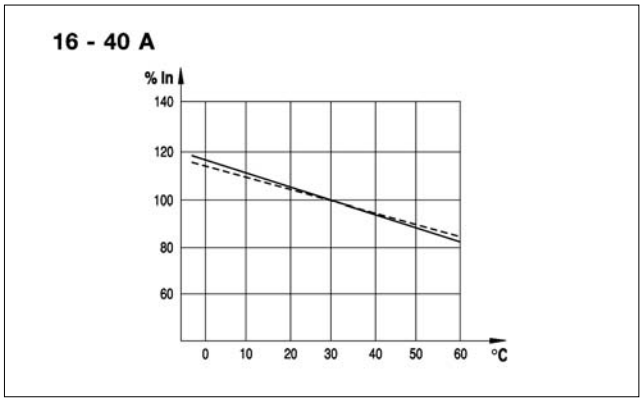
As the MCB is working at 45 °C it shall be given another factor (90 % = 0.9):
In at 45 °C = In at 30 °C x 0.9 = 11.2 A x 0.9 = 10.1 A.

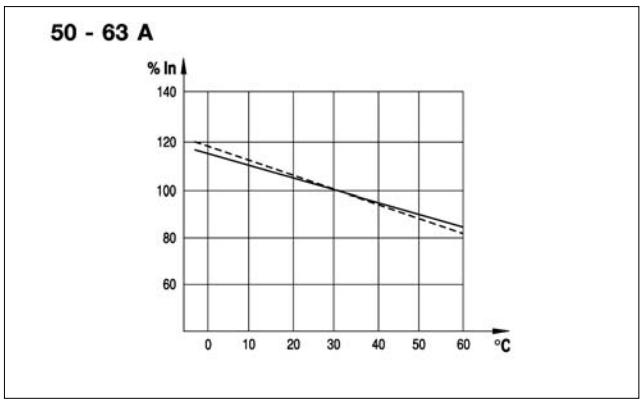
Note: [1]) Applicable for MCBs working at maximum rated currents.

The thermal calibration of the MCBs was carried out at an ambient temperature of 30 °C. Ambient temperatures different from 30 °C influence the bimetal and this results in earlier or later thermal tripping.









——— : 1P (single pole)

- - - - - - - - : mP (multi-pole)

Din-T MCBs Technical data

Effects of frequency on the tripping characteristic

All the MCBs are designed to work at frequencies of 50-60 Hz, therefore to work at different values, consideration must be given to the variation of the tripping characteristics. The thermal tripping does not change with variation of the frequency but the magnetic tripping values can be up to 50 % higher than the ones at 50-60 Hz.

Tripping current variation

60 Hz	100 Hz	200 Hz	300 Hz	400 Hz
1	1.1	1.2	1.4	1.5

Power losses

The power losses are calculated by measuring the voltage drop between the incoming and the outgoing terminals of the device at rated current.

Power loss per pole

In (A)	Voltage drop (V)	Energy loss (W)	Resistance (mOhm)
0.5	2.230	1.115	4458.00
1	1.270	1.272	1272.00
2	0.620	1.240	310.00
3	0.520	1.557	173.00
4	0.370	1.488	93.00
6	0.260	1.570	43.60
8	0.160	1.242	19.40
10	0.160	1.560	15.60
13	0.155	2.011	11.90
16	0.162	2.586	10.10
20	0.138	2.760	6.90
25	0.128	3.188	5.10
32	0.096	3.072	3.00
40	0.100	4.000	2.50
50	0.090	4.500	1.80
63	0.082	5.160	1.30

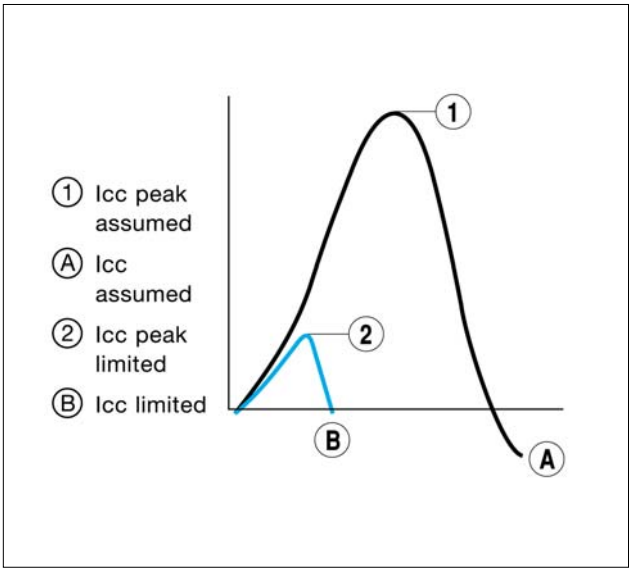
Limitation curves

Let-through energy I^2t

The limitation capacity of an MCB in short-circuit conditions, is its capacity to reduce the value of the let-through energy that the short-circuit would be generating.

Peak current Ip

Is the value of the maximum peak of the short-circuit current limited by the MCB.



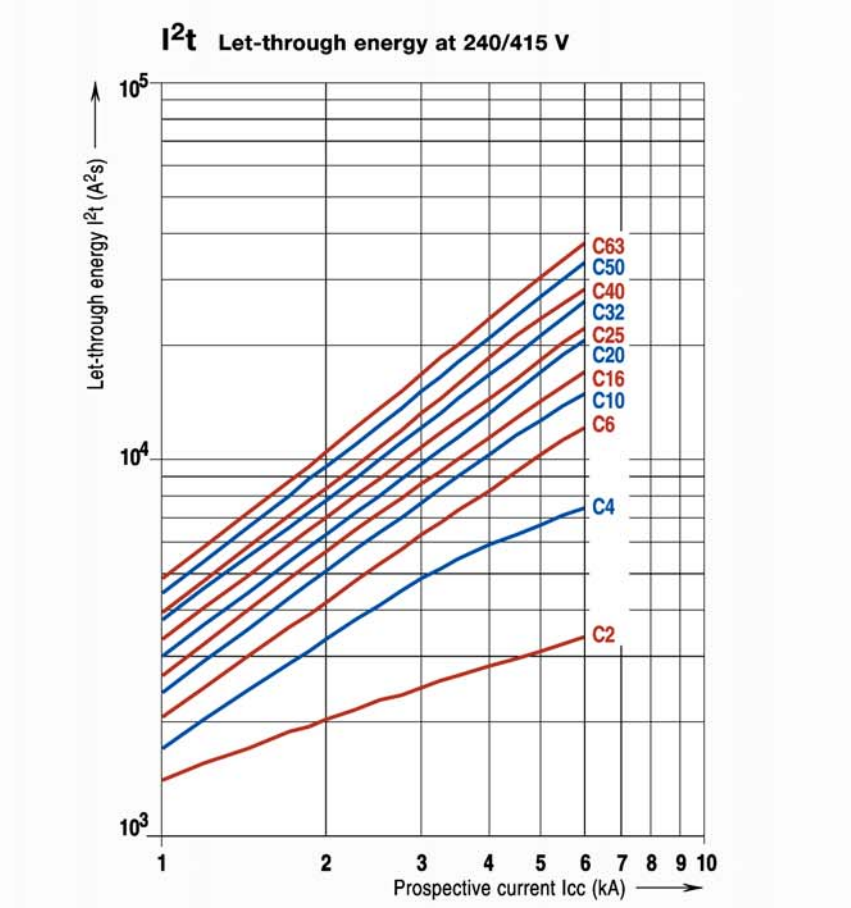
See following pages

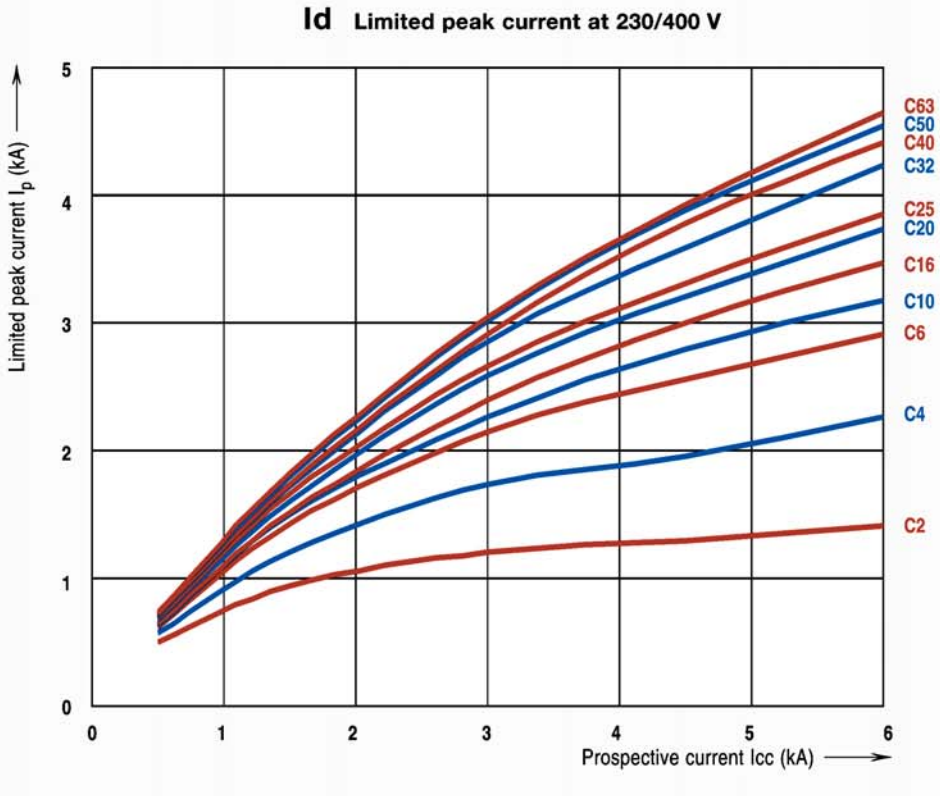
Din-T MCBs Technical data

Din-T 6

6 kA

C curve





Din-T MCBs Technical data

Use in DC

Selection criteria

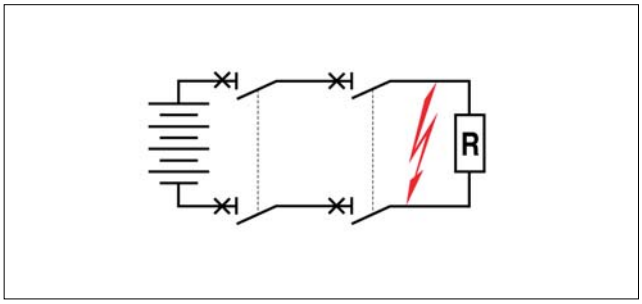
The selection of an MCB to protect a DC installation depends on the following parameters:

- The nominal current
- The nominal voltage of the power supply, which determines the number of poles to switch the device
- The maximum short-circuit current, to determine the short-circuit capacity of the MCB
- Type of power supply

In the event of an insulation fault, it is considered as an overload when one pole or an intermediate connection of the power supply is connected to earth, and the conductive parts of the installation are also connected to earth.

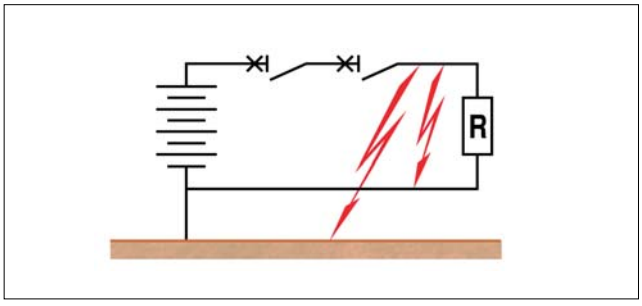
Insulated generator

In insulated generators there is no earth connection, therefore, an earth leakage in any pole has no consequence. In the event of a fault between the two poles (+ and –) there is a short-circuit in the installation, the value of which will depend on the impedance of the installation as well as of the voltage Un. Each polarity shall be provided with the appropriate number of poles.



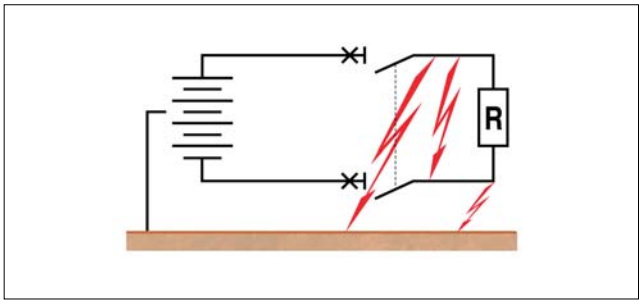
Generator with one earthed pole

In the event of a fault occuring in the earthed pole (-) there is no consequence. In the event of a fault between the two poles (+ and -) or between the pole + and earth, then there is a short-circuit in the installation, the value of which depends on the impedance of the installation as well as of the voltage Un. The unearthed pole (+) shall be provided with the necessary number of poles to break the maximum short-circuit.



Generator with centre point earth connection

In the event of short-circuit between any pole (+ or -) and earth, there is an Isc<Isc max because the voltage is Un/2.
If the fault occurs between the two poles there is a short-circuit in the installation, the value of which depends on the impedance of the installation as well as the voltage Un. Each polarity shall be provided with the necessary number of poles to break the maximum short-circuit at Un/2.



Din-T MCBs Technical data

Use of standard MCB for DC use

For MCBs designed to be used in alternating current but used in installations in direct current, the following should be taken into consideration:

- For protection against overloads it is necessary to connect the two poles to the MCB. In these conditions the tripping characteristic of the MCB in direct current is similar to alternating current.
- For protection against short-circuits it is necessary to connect the two poles to the MCB. In these conditions the tripping characteristic of the MCB in direct current is 40% higher than the one in alternating current.

Use of special MCB Din-T DC for DC use.

(UC = Universal current)

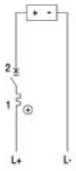
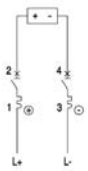
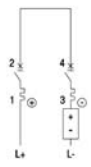
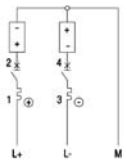
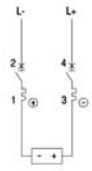
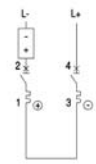
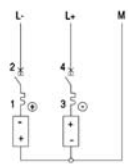
For MCBs designed to work in both alternating and direct current, it is necessary to respect the polarity of the terminals since the device is equipped with a permanent magnet.

Use in DC selection table

Series	Rated current (A)	48 V 1 pole Icu (kA)	110 V 2 poles in series Icu (kA)	250 V 1 pole Icu (kA)	440 V 2 poles in series Icu (kA)
Din-T DC	0.5....63 A	-	-	6	6

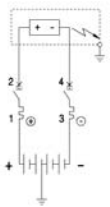
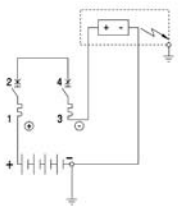
Installation of Din-T DC MCBs in direct current

Example of utilisation for maximum voltage between lines according to the number of poles

MCB	Din-T DC 1 P	Din-T DC 2 P		
Maximum voltage between lines	250 V ⎓	250 V ⎓	440 V ⎓	440 V ⎓
Maximum voltage between lines and earth	250 V ⎓	250 V ⎓	440 V ⎓ [1])	250 V ⎓
Power supply at bottom terminals				
Power supply at top terminals				

Note: [1]) Negative pole connected to earth

Example of utilisation for maximum voltage between lines according to the number of poles

MCB	Din-T DC 2 P	
Maximum voltage between lines	440 V DC Multi-pole breaking	440 V DC Multi-pole breaking
Maximum voltage between lines and earth	250 V DC Generator with centre point earth connection 	440 V DC Generator without earth connection or with one earthed pole 

Din-T MCBs + RCDs Technical data

MCB Series Din-T DC

- According to EN 60898-2 standard
- For DIN rail mounting according to DIN EN 50022; EN 50022; future EN 60715; IEC 60715 (top hat rail 35 mm)
- Grid distance 35 mm
- Working ambient temperature from -25 °C up to +50 °C
- 1 pole is a module of 18 mm wide
- Nominal rated currents are: 0.5/1/2/3/4/6/10/13/16/20/25/32/40/50/63 A
- Tripping characteristic: C
- Number of poles: 1 P, 2 P
- The short-circuit breaking capacity is: 6 kA, "energy limiting" class 3
- Terminal capacity from 1 up to 35 mm^2 rigid wire or 1.5 up to 25 mm^2 flexible wire
- Screw head suitable for flat or Pozidrive screwdriver
- Can be connected by means of both pin or fork busbars
- The toggle can be sealed in the ON or OFF position
- Rapid closing
- Both incoming and outgoing terminals have a protection degree of IP 20 and they are sealable
- Isolator function thanks to Red/Green printing on the toggle.
- Maximum voltage: 1 P - 250 V, 2 P - 440 V Poles in series
- Two position rail clip
- Mechanical shock resistance 40 g (direction x, y, z) minimum 18 shocks 5 ms half-sinusoidal according to IEC 60068-2-27
- Vibration resistance: 3 g (direction x, y, z) minimum 30 min. according to IEC 60068-2-6
- Extensions can be added on both left or right hand side
  - Auxiliary contact
  - Shunt trip
  - Undervoltage release
  - Motor operator
  - Panelboard switch
- Add-on RCD can be coupled

Din-T MCBs Technical data

Series					Din-TDC AS/NZS 4898
Standards (Aust / NZ / International)					(2)
Tripping characteristics					C
Nominal current				A	C(0.5-63)
Calibration temperature				°C	30
Number of poles (# mod)					1/2
Neutral pole protected					-
Nominal voltage Un	AC	1 P		V	240/415
		3 P/4 P		V	415
	DC	1 P [1]		V DC	220
		2 P (in series) [1]		V DC	440
Frequency				Hz	50/60
				Hz	DC: magn.trip +40%
				Hz	400: magn.trip +50%
Maximum service voltage Ubmax between two wires				V	250/440; 250/440
Minimum service voltage Ubmin				V	12; 12
Selectivity class (IEC 60898)					3
Isolator application		IEC 60947-2			yes
Rated insulation voltage		Pollution degree 2		V	500
		Pollution degree 3		V	440
Impulse withstand test voltage				kV	6
Insulation resistance				mOhm	10,000
Dielectric rigidity				kV	2.5
Vibration resistance (in x, y, z direction) (IEC 77/16.3)					5 g
Endurance		Electrical at Un, In			1000
		mechanical			20,000
Utilisation category (IEC 60947-2)					A
Protection degree (outside / inside, in enclosure with door)					IP 20/IP 40
Self-extinguish degree (according to UL94)					V2
Tropicalisation (according to IEC 60068-2 / DIN 40046)				°C/RH	+55 °C/95 % RH
Operating temperature				°C	-25/+55
Storage temperature				°C	-55/+55
Terminal capacity Rigid cable min/max (top)				mm²	1/35
		Flexible cable min*/max (top)		mm²	0.75/25
		Rigid cable min/max (bottom)		mm²	1/35
		Flexible cable min*/max (bottom) (* Flexible cable 0.75/1/1.5 mm² with cable lug)		mm²	0.75/25
		Torque		Nm	4.5
Add-on devices (side add-on)		Auxiliary contacts			yes
		UVT			yes
		Shunt trip			yes
		Motor operator			yes
		Panelboard switch			yes
Busbar systems		Pin (top/bottom)			yes/yes
		Fork (top/bottom)			yes/yes
Accessories					yes
Dimensions, weights, packaging					
		(HxDxW) 86x68xW		mm/mod.	18
		Weight/mod.		g	125
		Package		mod.	12
Short-circuit capacity AC			**(kA)**		**AS/NZS 4898**
IEC 60898	Icn		1 P	230/400 V	6 (220 V DC) [3]
			2 P	230/400 V	6 (440 V DC) [4]
			3 P/4 P	230/400 V	-
	Ics (service)				100 % Icn
IEC 60947-2	Icu (ultimate)		1 P	127 V	-
				240 V	10 [5]
				415 V	-
			2 P	127 V	-
				240 V	-
				415 V	10 [5]
			3 P, 4 P	240 V	-
				415 V	-
				440 V	-
	Ics (service)				-
	NEMA AB1 (120/240V)				-
Short-circuit capacity DC			**(kA)**		
IEC 60947-2	Icu (ultimate)		1 P	≤60 V	-
				≤220 V	-
			2 P	≤125 V	-
				≤440 V	-
	Ics (service)				-

Notes Refer pages 3 - 23, 24 for information on SAFE-T MCBs.

[1]) Preferred values of rated control supply voltage (IEC 60947 - 2): 24 V, 48 V, 110 V, 125 V, 250 V

[2]) 0.5-4 A/6-25 A/32-40 A/50-63 A

[3]) 10 (125 V DC)

[4]) 10 (250 V DC)

[5]) On request.

Din-T MCBs + RCDs Technical data

Miniature circuit breakers - Din-T DC

Dimensions in mm.