

Application & Guidance Notes



Miniature Circuit Breakers C6/C10

Normal service conditions

IMO Miniature Circuit Breakers are designed to operate at ambient temperature values between -5°C and $+40^{\circ}\text{C}$. For specific applications at ambient temperature values other than the ones mentioned above, please, use the correction factors in table 6 and 7.

The upper limit of humidity is of the 50% relative humidity at a maximum temperature of $+40^{\circ}\text{C}$, although the breakers can operate at higher relative humidities for lower temperatures

(e.g.: a relative humidity of the 90% at $+20^{\circ}\text{C}$ ambient temperature would be acceptable).

The specifications of IMO MCBs are for altitudes that do not exceed the 2.000m. For installations at higher altitudes, it is necessary to take into account the reduction of the dielectric strength and of the cooling effect of the air.

The ambient temperature during transport and storage must not exceed the interval between -25°C and $+70^{\circ}\text{C}$. For short periods not exceeding 24 hours up to $+85^{\circ}\text{C}$ can be reached with a relative humidity of 30%. During this period it is important to avoid water condensation inside the breakers, otherwise, oxidation and stain spots might appear affecting thus the normal operation of the breaker.

Installation

IMO breakers are devised to be mounted directly on to a 35mm Din rail in accordance with the EN 50022 Standard. The fastening device of the breaker is made of plastic, with a bi-stable position that enables its removal when it is placed between other breakers and wired with comb busbars, without any need to disassemble the busbar and keeping the other breakers functioning. It can be disassembled with only one hand.

The connecting method is not related to the mechanical fastening device of the breaker. Input and output can be either on the top or on the bottom side.

The terminal of IMO MCBs is of the stirrup type. The terminal screw can be tightened up with a Philips t1 and t2 screwdriver or a 5mm flat blade screwdriver. Its size and characteristics enable the connection of conductors of 1 up to 35 mm² wire section (rigid and/or flexible), as well as grouped conductors of various sections and connecting busbars.

The recommended torque of the terminals is of 1.7 up to 2 Nm. It is advisable to check the torque of the terminals every so often in order to avoid overheating produced by a loss of pressure in the connections. Higher torques are not needed and they can cause deformation of the terminal or the screw.

Standard

Manufactured according to EN 60898 and EN 60947-2 in those cases where it is applicable.

Likewise, they comply with the Low Voltage Directive (72/23/CEE).

Rated Voltage

The rated operational voltage (U_e) or rated voltage of IMO MCBs is as follows:

Poles	Type B, C and D
Single pole	230/400 V~
Single pole with neutral	230 V~
Two, three and four pole	400 V~

Protection

The degree of protection is IP2X in accordance with the established by Standard EN 60.947-1

Rated insulation voltage

The rated insulation voltage (U_i) has been established at 660V~. The dielectric tests and the leakage path tests have been carried out at that voltage.

Rated current

The nature of supply is alternating current with frequencies of 50/60Hz. For this alternating current the following rated currents (I_n) are established for each type of tripping characteristics.

Type B and C: 6 - 8 - 10 - 13 - 16 - 20 - 25 - 32 - 40 - 50 - 63A

Type D: 0.3 - 0.5 - 0.75 - 1 - 1.6 - 2 - 2.5 - 3 - 3.5 - 4 - 6 - 8 - 10 - 13 - 16 - 20 - 25 - 32 - 40 - 50 - 63A

Tripping time

The magnetic tripping time of the IMO breaker ranges between 8 and 20ms depending on the overcurrent value.

Impulse withstand test voltage U_{imp}

The impulse withstand test voltage is 4kV Shock wave 1.2/50ms

Security distance

The security distance values for the detection of the emission of ionised gases on the upper side are established at 40mm for the C6 series and at 80mm for the C10 series.

Energy limiting

The energy limiting class obtained in the tests is as follows:

C6 series Tripping curve C / Class 3

CH series Tripping curve B / Class 3

The maximum real let-through energy values (I^2t) of IMO breakers are stated in the tables shown.

Breaking capacity

The breaking capacity of the IMO MCBs comprises three different categories according to Standard EN 60898

By applying the Standard EN 60947-2 (which does not correspond strictly to these devices) higher short circuit values are obtained reaching thus up to 10000A in the C6 series, in all current ratings.

MCBs according to Standard EN 60898

C6 series of application in the domestic and commercial sectors

Breaking capacity of 6kA of I_{cn} and I_{cs} with $\cos\varphi=0.65-0.7$

C10 series of application in the commercial and industrial sectors

Breaking capacity of 10kA I_{cn} , with I_{cs} 7.5kA up to 32A and 6kA I_{cn} and I_{cs} for 40, 50 and 63A, in both cases $\cos\varphi=0.45-0.5$

Operations

Electrical endurance: 30,000 operations

Mechanical endurance: 40,000 operations

Mechanical shock and impact

IMO breakers have been subjected to accelerations of up to 22g without provoking the mechanical tripping of the breaker.

Temperature rise

The values of maximum permitted temperature established by the Standards and, therefore, the ones our breakers comply with are as follows:

Type B,C and D

Terminals for external connections	60°C + ambient temperature
External parts which can be touched	40°C + ambient temperature
Other external parts	60°C + ambient temperature

Application & Guidance Notes



Miniature Circuit Breakers C6/C10 (continued)

Protection of motors

The protection of motors against the effects of an internal short circuit must be ensured, allowing at the same time the presence of short duration overcurrents (starting) without causing tripping of the protection element.

This element must also ensure protection of the line, of the contactor and of the thermal relay associated to the motor.

IMO series selection table for 4 pole squirrel cage motors

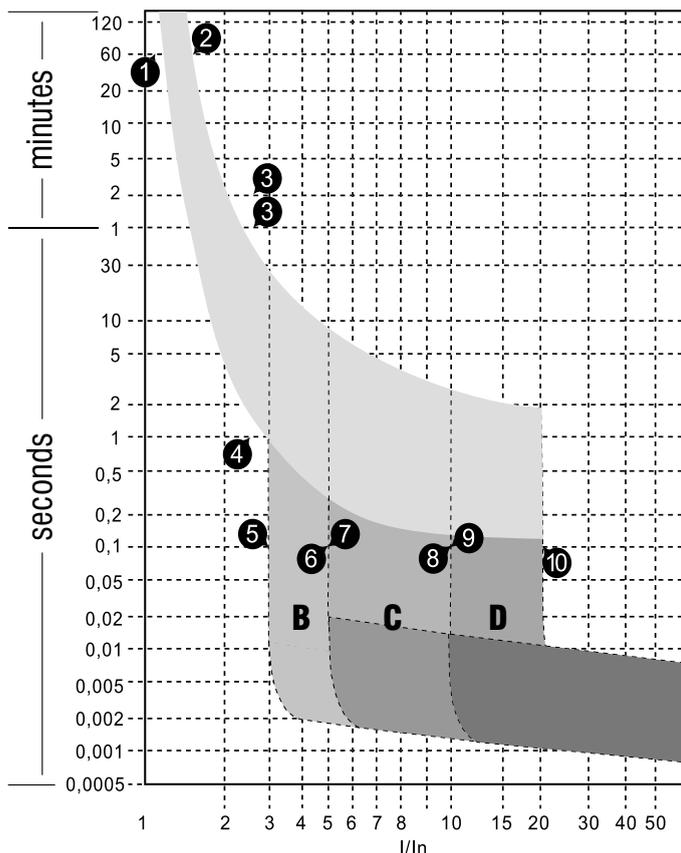
380 / 415 V Kw	50/60 Hz HP	Type D In	Magnetic trip
0.37	0.5	1.6	20
0.55	0.75	2	25
0.75	1	2.5	31.5
1.1	1.5	3	37.5
1.5	2	4	50
2.2	3	6	75
3.7	5	10	125
4	5.5	10	125
7.5	10	20	250
9	12	20	250
10	13.5	25	313
11	15	25	313
15	20	32	400
18.5	25	40	500
22	30	50	625
25	34	50	625
30	40	63	788

Power loss

Maximum power losses per pole established by the Standard EN 60898 are shown in the following table:

In	Drop voltage	Power loss	Maximum power loss by Standard
0.3A	3.032V	0.91W	3W
0.5A	2.309V	1.15W	3W
0.75A	1.114V	0.84W	3W
1A	1.062V	1.06W	3W
1.6A	0.745V	1.19W	3W
2A	0.449V	0.90W	3W
2.5A	0.489V	1.22W	3W
3A	0.412V	1.24W	3W
3.5A	0.333V	1.17W	3W
4A	0.325V	1.30W	3W
6A	0.326V	1.96W	3W
8A	0.185V	1.48W	3W
10A	0.185V	1.85W	3W
13A	0.130V	1.69W	3.5W
16A	0.147V	2.35W	3.5W
20A	0.148V	2.96W	4.5W
25A	0.135V	3.38W	4.5W
32A	0.102V	3.26W	6W
40A	0.082V	3.28W	7.5W
50A	0.073V	3.65W	9W
63A	0.113V	7.12W	13W

B, C and D tripping characteristics to UNE-EN 60.898



- ① Steady current value
 $I_{nt} = 1.13 I_n : t > 1h$
- ② Steady current value
 $I_t = 1.45 I_n : t < 1h$
- ③ 2.55 I_n :
 $t < 1m (I_n \leq 32A)$
 $t < 2m (I_n > 32A)$
- ④ 2.55 I_n :
 $t > 1s$
- Type B**
- ⑤ 3 I_n : $t \geq 0.1s$
- ⑥ 5 I_n : $t < 0.1s$
- Type C**
- ⑦ 5 I_n : $t \geq 0.1s$
- ⑧ 10 I_n : $t < 0.1s$
- Type D**
- ⑨ 10 I_n : $t \geq 0.1s$
- ⑩ 20 I_n : $t < 0.1s$

Application depending on the tripping characteristic of the breakers

This details the various tripping characteristics of the breakers, eg B characteristic is for the protection of lines with resistive load such as electric heating, water heaters, ovens, etc. The breakers of C characteristic are more suitable for general applications such as: lighting, sockets, small motors, etc.

Finally, the use of D characteristic breakers is advised in the protection of lines containing loads with a strong connection current, eg electric motors with direct starting.