

MINIATURE CIRCUIT BREAKERS

Crabtree MCBs comply fully with BS EN 60898 and therefore enable the requirements of BS 7671 to be met.

TYPE CLASSIFICATION

BS EN 60898 specifies different tripping characteristics for different types of MCB, depending on the level of overload current required to make the MCB trip out in less than 100 milliseconds. Crabtree MCBs within this publication are available as types B and C, enabling installation designers to choose an MCB with a characteristic closely matched to the circuit requirement.



FAULT LEVELS

Regulation 432.1 of BS 7671 requires that a device providing protection against overload currents and fault currents shall be capable of breaking any overcurrent up to and including the prospective fault current at the point where the device is installed.

In domestic situations this could be as high as 16kA, in industrial situations it could be even higher.

According to regulation 434.5.1, the prospective fault current can be higher than the breaking capacity of the protective device if another protective device having the necessary breaking capacity is installed on the supply side. This means that MCBs can be backed up by devices of greater capacity such as HRC fuses.

When providing back-up protection, consideration must be given to discrimination. Discrimination is said to occur when the device nearest the fault operates first.

AMBIENT TEMPERATURE CONSIDERATIONS

Starbreaker and Loadstar MCBs are calibrated to meet the requirements of BS EN 60898, 30°C Reference Calibration Temperature. At other temperatures the following rating factors should be used:

At 40°C 0.9 At 20°C 1.0 At 0°C 1.1

Adjacent thermal-magnetic MCBs should not be continuously loaded at or approaching their nominal rated currents when mounted in enclosures. It is good engineering practice to apply generous de-rating factors or make provision for adequate free air between devices. In these situations, and in common with other manufacturers, we recommend a 70% diversity factor is applied to the MCB nominal rated current where it is intended to load the MCBs continuously (in excess of 1 hour).

OPERATING CHARACTERISTICS FOR MCBs

MCB type	BS EN 60898 type	Instantaneous trip current range	Typical application
B	B	3–5 I_n	Domestic
C	C	5–10 I_n	Commercial Light Industrial
D	D	10–20 I_n	General Industrial
1*	–	2.7–4 I_n	Domestic
2*	–	4–7 I_n	Commercial
3*	–	7–10 I_n	General Industrial

* MCBs, type 1, 2 & 3 to BS 3871

FAULT PROTECTION

BS 7671, formerly the IEE Wiring Regulations requires that measures are taken to protect against the risk of electric shock, which can be the result of contact with live parts.

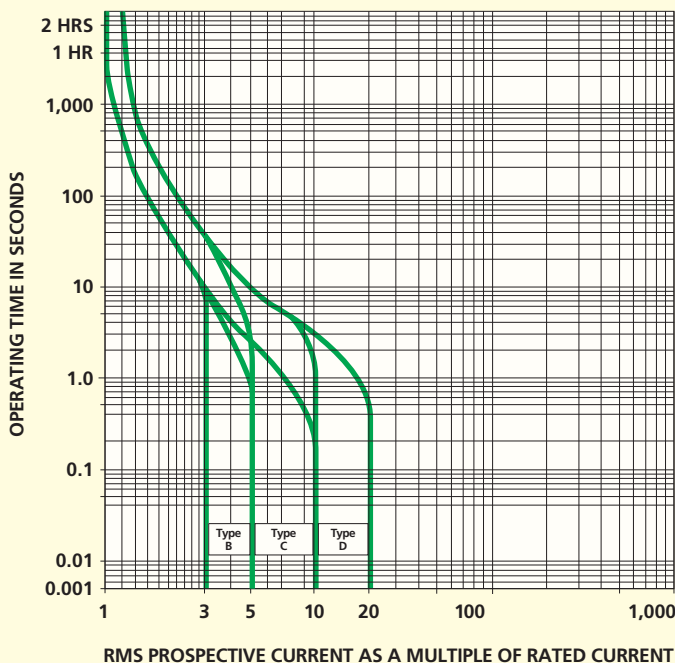
MCBs can be used in conjunction with earthed equipotential bonding to achieve disconnection times of 0.4 seconds (411.3.2.2) for final circuits not exceeding 32A and 5 seconds (411.3.2.3) for final circuits exceeding 32A (TN Systems).

EARTH FAULT LOOP IMPEDANCES (Z_s OHMS) TO GIVE COMPLIANCE WITH BS 7671 REGULATION 411.3.2.2 AND 411.3.2.3 AT 230V

Maximum earth fault loop impedance in ohms for instantaneous operation of devices giving compliance with the 0.4 second disconnection time of Regulation 411.3.2.2 and 5 second disconnection time of Regulation 411.3.2.3.

		RATINGS						
DEVICE	BS EN	6A	10A	16A	20A	32A	40A	50A
MCB Type B	60898	7.666	4.599	2.874	2.299	1.439	1.149	0.919
MCB Type C	60898	3.829	2.299	1.439	1.149	0.719	0.569	0.459
RCBO 30mA Type B	61009	1667	1667	1667	1667	1667	1667	1667
RCBO 30mA Type C	61009	1667	1667	1667	1667	1667	1667	1667

- The values in these tables should be modified to allow for the cable temperature at time of test
- RCBO values reflect the rated residual operating current characteristics of the device (table 41.5). For the overcurrent characteristics read as related MCB values.



RMS PROSPECTIVE CURRENT AS A MULTIPLE OF RATED CURRENT

MINIATURE CIRCUIT BREAKERS

Technical Specifications Starbreaker & Loadstar Domestic

Standard			BSEN 60898
Tripping characteristic			B, C
Rated voltages <i>Un</i>			230/400
Operational voltage	min.	V AC/DC	24
	max.	V DC/pole	60
	max.	V AC	250
Rated short circuit capacity <i>Icn</i>		kA AC	6
Insulation coordination			
● Rated insulation voltage		V AC	250
● Degree of pollution for overvoltage category		2/III	
Touch protection acc. to EN50274			Yes
Handle end position, sealable			Yes
Degree of protection acc. to EN60529			IP20
CFC silicone -free			Yes
Terminals			
● Terminal tightening torque		Nm	2.5 ... 3
Conductor cross-section			
● Solid and stranded		mm ²	0.75 ... 25
● Finely stranded, with end sleeve		mm ²	0.75 ... 25
Mounting position			Any
Service life on average, with rated load			20000 actuations
Ambient temperature		°C	-25 ...+45, occasionally +55, max. 95% humidity, Storage temperature: -40 ... +75

APPLICATIONS

Single pole MCBs with Type B characteristics (3-5In) are suited for use on loads with little or no switching surges, such as occur on domestic applications. In addition, a Type B MCB will give fault risk protection at higher levels of earth loop impedance. All ratings are also available in Type C classification (5-10In). MCBs with type C characteristics are suited for use where fluorescent lighting circuits, small motors etc. may produce switching surges which would operate a type B circuit breaker.

GENERAL CONSTRUCTION

Starbreaker and Loadstar MCBs are of the thermal-magnetic current limiting type, having a compact construction which has been achieved by not only minimising the number of parts but also the number of welded joints and connections. Critical material selection ensures reliability and durability. The MCB has an easy to operate handle with a trip-free toggle mechanism – so even when the handle is held in the 'on' position the MCB is free to trip.

BACK-UP PROTECTION

Back-up protection is required only if the prospective short circuit current at the point of installation exceeds the breaking capacity of the MCB. When providing back-up protection consideration must be given to discrimination between the MCB and fuse.

DISCRIMINATION

It is desirable that the protective device nearest the fault should operate first. The low energy let through of Starbreaker and Loadstar MCBs provides better discrimination with HRC fuse back-up than is given by earlier types of MCB.

METHOD OF OPERATION

1 Moderate overload conditions

Detection of moderate overload conditions is achieved by the use of a thermo-metal element which deflects in response to the current passing through it. The thermo-metal element moves against the trip bar releasing the trip mechanism.

2 Short circuit conditions

When the current flowing through the MCB reaches a predetermined level, the solenoid directly pulls in the plunger which forcibly separates the contacts and simultaneously releases the trip mechanism.

3 Establishment of arc between fixed and moving contacts

As the moving contact moves away from the fixed contact, an arc is established. The arc runs along the arc runner to the arc chamber where it is split up between the plates and extinguished.

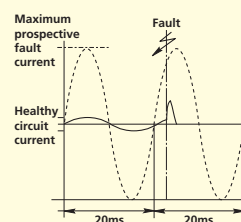
The low inertia and consequent high speed of the moving contact has a limiting effect on the flow of fault current. The rapid development of the arc, together with its accelerated extinction in the arc chamber, gives a typical operating time of 3.5–5 milliseconds.

CURRENT LIMITING ACTION

The high speed current limiting action ensures that the MCB operates before the full prospective fault current is allowed to develop.

Under fault conditions, damage can be sustained to the installation and associated equipment due to the amount of energy that passes before the current is completely interrupted. The total energy let-through depends on the value of current and the time for which it flows, and is denoted by the symbol I^2t . The high speed current limiting action of Starbreaker and Loadstar MCBs ensures that the energy let-through and any subsequent damage is minimised. This reduced energy let-through assists greatly with both back-up and discrimination considerations.

CURRENT LIMITING EFFECT



I^2t ENERGY LET-THROUGH

Typical values of I^2t energy let-through for Starbreaker MCBs are given in the table below:

MCB rating (A)	Total I^2t let-through ($A^2 s$)		MCB rating (A)	Total I^2t let-through ($A^2 s$)	
	Type B	Type C		Type B	Type C
6	10,220	14,890	32	31,760	32,470
10	17,900	18,750	40	31,760	32,470
16	22,260	23,820	50	45,160	44,270
20	22,260	32,470			

Prospective short circuit test current 6000A

MOUNTING THE MCB

In Crabtree consumer units the MCBs are mounted on standard 35mm top hat rail to BS 5584: 1978 EN 50022 giving a projection within the Standard of 70mm. Due to the method of connection onto the busbar it is not possible to use the Starbreaker range for custom built panels.

MAIN SWITCH

• Starbreaker	100/MI2 & 100/2MT
• Loadstar (Domestic)	100SW2
• Specification	IEC 60947-3
• Rating	100A 230V 50Hz
• Utilisation category	AC-22A
• Type	Double pole switch disconnector
• Insulation voltage	250V
• Impulse withstand voltage	4kV
• Rated duty	Continuous
• Short-time withstand current	2kA for 1 second
• Short-circuit making capacity	3.5kA (peak)
• Conditional short-circuit current	16kA when protected by 100A HRC fuse to BS 1361
• Pollution degree	3