MINIATURE CIRCUIT BREAKERS

RATING	POLES	MODULES	LIST No Type B	Type C
6A	1	1	**6MSB06**	**6MSC06**
10A	1	1	**6MSB10**	**6MSC10**
16A	1	1	**6MSB16**	**6MSC16**
20A	1	1	**6MSB20**	**6MSC20**
32A	1	1	**6MSB32**	**6MSC32**
40A	1	1	**6MSB40**	**6MSC40**
50A	1	1	**6MSB50**	**6MSC50**

- BS EN 60898; 6kA-240V 50Hz
- Type B classification (3-5 In). Type C classification (5-10In)
- 25mm^2 terminal capacity

RESIDUAL CURRENT CIRCUIT BREAKER WITH OVERCURRENT PROTECTION (RCBOs)

RATING	POLES	MODULES	LIST No 30mA Type B	30mA Type C
6A	1	1	**6FSR06/30B**	**6FSR06/30C**
10A	1	1	**6FSR10/30B**	**6FSR10/30C**
16A	1	1	**6FSR16/30B**	**6FSR16/30C**
20A	1	1	**6FSR20/30B**	**6FSR20/30C**
32A	1	1	**6FSR32/30B**	**6FSR32/30C**
40A	1	1	**6FSR40/30B**	**6FSR40/30C**
50A	1	1	**6FSR50/30B**	**6FSR50/30C**

- BS EN 61009
- 230 (240)V AC 50/60 Hz
- 16mm^2 terminal capacity (outgoing)

SP & SWN RESIDUAL CURRENT CIRCUIT BREAKER WITH OVERCURRENT PROTECTION (RCBOs)

RATING	POLES	MODULES	LIST No 30mA Type C
6A	2	2	**6FSNR063/C**
10A	2	2	**6FSNR103/C**
16A	2	2	**6FSNR163/C**
20A	2	2	**6FSNR203/C**
32A	2	2	**6FSNR323/C**
40A	2	2	**6FSNR403/C**

- BS EN 61009
- 230 (240)V AC 50/60 Hz
- 16mm^2 terminal capacity (outgoing)

ACCESSORIES

Description	LIST No
MCB Padlocking Device	**MCBLD**
Blanking Piece	**443**
Blanking Unit	**CSB1**
Blanking Unit twist fit	**CSBC**

TRIPLE POLE & NEUTRAL 415V 50Hz AC

Description BS EN 60947-3	LIST No
With switched Neutral for surface mounting within a metal enclosure. 133mm x 114mm x 61mm	**1932**
With switched Neutral for flush mounting within a metal enclosure. 150mm x 125mm x 61mm	**1932/F**

DP DOMESTIC SWITCH FUSE

Description	LIST No
DP Domestic Switch Fuse complete with 63A fuse	**191002/63**
DP Domestic Switch Fuse complete with 80A fuse	**191002/80**
DP Domestic Switch Fuse complete with 100A fuse	**191002/100**

The Crabtree Domestic Switch Fuse has a robust steel construction and is complete with a 100A Double Pole Isolator and either 63A, 80A or 100A BS88 Fuse.

Approximate dimensions: Height 305mm, Width178mm, Depth 76mm

For Technical Information see pages 178-181

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*	*3–5In*	*Domestic*
C	*C*	*5–10In*	*Commercial Light Industrial*
D	*D*	*10–20In*	*General Industrial*
*1**	*–*	*2.7–4In*	*Domestic*
*2**	*–*	*4–7In*	*Commercial*
*3**	*–*	*7–10In*	*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).

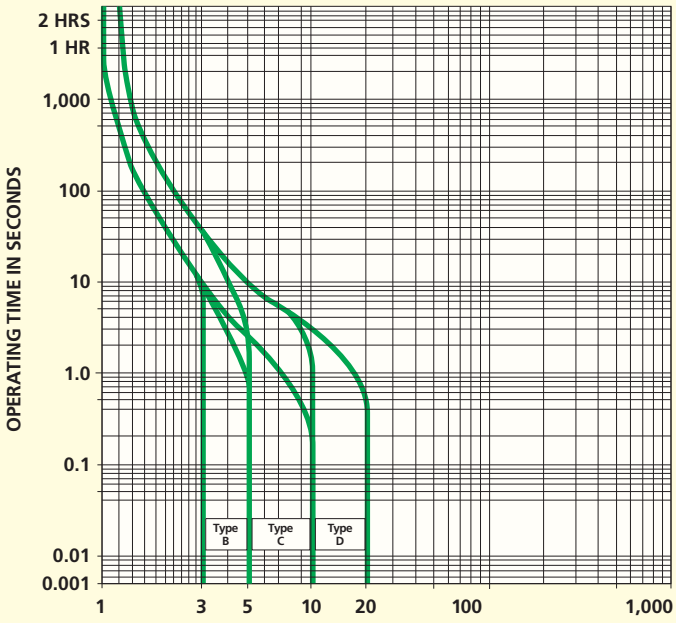
EARTH FAULT LOOP IMPEDANCES (Z_S OHMS) TO GIVE COMPLIANCE WITH BS 7671 REGULATION 411.3.2.2 AND 411.3.2.3 AT 230V

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 30m 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.



Technical Specifications (RCBOs)			up to 50A
Standards			EN 61009-1, IEC 61009-1
Approved acc.to			IEC/EN 61543
Rated voltages *Un*		V AC	230(240)
Rated frequency *fn*		Hz	50 ... 60
Rated currents *In*		A	6, 10, 16, 20, 32, 40, 50
Rated residual currents $I_{\Delta}n$		mA	30
Rated switching capacity		kA	6
Energy limitation class			3
Terminals/conductor cross-sections			
• Solid and stranded		mm^2	0.75 ... 35
• Finely stranded, with end sleeve		mm^2	0.75 ... 25
Outgoing		mm^2	0.75 ... 16
Terminal tightening torque		Nm	2
Mains connection			Bottom
Mounting position			Any
Degree of protection	acc. to EN60529		IP20 with connected conductors
Touch protection	acc. to EN50274		Finger and back-of-hand safe
Service life	Test cycle acc. to IEC/EN 61009	switching cycles	,10000 actuations
Storage temperature		°C	-40 ...+45
Ambient temperature		°C	-25 ...+45
Resistance to climate acc. to IEC60068-2-30			28 cycles (55°C; 95% rel. air humidity
CFC and silicone free			Yes

APPLICATIONS

RCBOs provide both earth fault and over current protection. The MCB element of Starbreaker and Loadstar devices are available as Type B or Type C making them suitable for domestic or light commercial applications. These Type A Voltage dependent devices are single pole with solid neutral one module wide (18mm) with a flying lead. During interruption of the neutral conductor the protective function is guaranteed when FE and PE conductors are connected. The use of Starbreaker and Loadstar 30mA RCBOs provides independent RCD protection to individual circuits offering both the degree of additional protection that may be required by Regulation 415.1 and the minimum of inconvenience following a single earth fault (Regulation 314.1).

INSTALLATION TESTING – **CAUTION**

As Starbreaker and Loadstar RCBOs employ electronic components they should be disconnected when carrying out the following tests on the electrical installation:

(a) Earth fault loop impedance test

The load terminals should be disconnected if it is intended to parallel-out the unit for test purposes.

It may incur damage if mains potential is maintained on the load terminals of this unit after the trip mechanism has operated.

(b) Insulation test

Whilst RCBOs can withstand the effects of normal insulation testers without damage, false readings may be given on the test instrument. For this reason it is recommended that the device is disconnected during this test.

FAULT CURRENT SENSITIVITY

Semi-conductor devices are now incorporated in equipment used throughout industry, commerce and in the home. Typically, the purpose of these semi-conductor devices is for monitoring and controlling industrial equipment eg speed controls for small motors and temperature controls, along with extensive use in computers, VDUs, printers, washing machines, etc.

As the equipment is fed from the mains electrical supply, in the event of an earth fault the presence of semi-conductors may result in the normal ac waveform being replaced by a non-sinusoidal fault current. In some cases the waveform may be rectified or chopped. These waveforms are said to contain a pulsating dc component which can either partially desensitise or totally disable a standard Type AC RCD.

International standards IEC 61008 (RCCBs) and IEC 61009 (RCBOs) divide RCDs into two performance classes:

Type AC

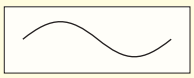
RCDs for which tripping is ensured for residual sinusoidal alternating currents, whether suddenly applied or slowly arising.

Type A

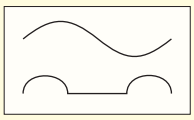
RCDs for which tripping is ensured for residual sinusoidal alternating currents and residual pulsating direct currents, whether suddenly applied or slowly arising.

To ensure the correct level of protection, check for the following symbols:

TYPE AC
normal
ac sensitivity



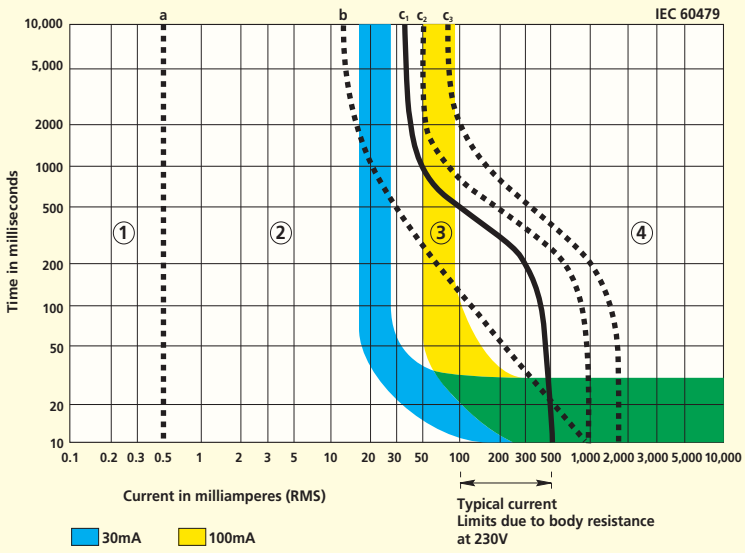
TYPE A
pulsating
dc sensitivity



Crabtree RCCBs are available as both Type AC and Type A devices.

IEC PUBLICATION (60479) CURVES WITH CRABTREE RCD CHARACTERISTICS SUPERIMPOSED

TIME/CURRENT ZONES OF EFFECTS OF AC CURRENT (15–100Hz) ON PERSONS



Zone	Physiological effects
1	Usually no reaction effects.
2	Usually no harmful physiological effects.
3	Usually no organic damage to be expected. Likelihood of muscular contraction and difficulty of breathing, reversible disturbances of formation and conduction of impulses in the heart, and transient cardiac arrest without ventricular fibrillation increases with current magnitude and time.
4	In addition to the effects of zone 3, probability of ventricular fibrillation increased up to 5% (Curve C2) up to 50% (Curve C3) and above 50% beyond Curve C3. Increasing with magnitude and time, pathyphysiological effects such as cardiac arrest, breathing arrest and heavy burns may occur.