

# POCKET GUIDE 18

## Maximum measured values of earth fault loop impedance ( $Z_s$ )

The values of maximum earth fault loop impedance ( $Z_s$ ) given in Tables 41.2, 41.3 and 41.4 in Chapter 41 of *BS 7671: 2008*, for commonly-used overcurrent protective devices, should not be exceeded when the conductors are at their normal operating temperature (such as up to 70 °C for thermoplastic insulated conductors).

However, values of  $Z_s$  are generally measured under no-load conditions, when the conductors are at ambient temperature (usually not to exceed 20 °C) and their resistance is therefore lower than when at normal operating temperature.

Where this is the case, then as indicated in Appendix 14 of *BS 7671*, the fault protection requirements of Regulations 411.4.5 (TN system) or 411.5.4 (TT system) are considered to be met when the measured value of  $Z_s$  does not exceed 80% of the applicable maximum value (such as that given in Tables 41.2, 41.3 and 41.4 of *BS 7671*).

Tables 1 and 2 of this Pocket Guide give maximum measured values of  $Z_s$  for fuses and circuit-breakers or the overcurrent characteristic of RCBOs, equal to 80% (rounded down) of the applicable maximum values given in Tables 41.2, 41.3 and 41.4 of *BS 7671*.

**Table 1 – Maximum measured values of  $Z_s$  for fuses**

Rated current (A)	Fuses									
	BS 88 (gG) Parts 2 and 6		BS 1361 or BS 1362		BS 3036		BS 88-2 Fuse systems E (bolted) and G (clip in)		BS 88-3 Fuse system C	
	0.4 s	5 s	0.4 s	5 s	0.4 s	5 s	0.4 s	5 s	0.4 s	5 s
2	N/A	N/A	N/A	N/A	N/A	N/A	26.48	34.96	N/A	N/A
3	N/A	N/A	12.46	17.63	N/A	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A	N/A	12.48	16.64	N/A	N/A
5	N/A	N/A	7.94	12.48	7.28	13.44	N/A	N/A	7.94	11.64
6	6.47	10.28	N/A	N/A	N/A	N/A	6.24	9.70	N/A	N/A
10	3.88	5.63	N/A	N/A	N/A	N/A	3.71	5.45	3.71	5.45
13	N/A	N/A	1.83	2.90	N/A	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	2.49	3.80	1.93	4.06	N/A	N/A	N/A	N/A
16	2.05	3.17	N/A	N/A	N/A	N/A	1.93	3.17	1.84	3.12
20	1.34	2.20	1.28	2.12	1.34	2.91	1.34	2.24	1.54	2.56
25	1.08	1.74	N/A	N/A	N/A	N/A	1.02	1.74	N/A	N/A
30	N/A	N/A	0.87	1.39	0.83	2.00	N/A	N/A	N/A	N/A
32	0.79	1.39	N/A	N/A	N/A	N/A	0.79	1.39	0.72	1.24
40	0.62	1.02	N/A	N/A	N/A	N/A	N/A	1.02	N/A	N/A
45	N/A	N/A	0.43	0.72	0.44	1.20	N/A	N/A	N/A	0.79
50	0.45	0.79	N/A	N/A	N/A	N/A	N/A	0.79	N/A	N/A
60	N/A	N/A	0.28	0.52	0.31	0.84	N/A	N/A	N/A	N/A
63	0.34	0.62	N/A	N/A	N/A	N/A	N/A	0.62	N/A	0.54
80	0.23	0.43	0.21	0.37	N/A	N/A	N/A	0.43	N/A	0.40
100	0.17	0.31	0.14	0.27	0.14	0.40	N/A	0.33	N/A	0.29
125	0.12	0.24	N/A	N/A	N/A	N/A	N/A	0.25	N/A	N/A
160	0.09	0.19	N/A	N/A	N/A	N/A	N/A	0.20	N/A	N/A
200	0.07	0.14	N/A	N/A	N/A	N/A	N/A	0.14	N/A	N/A

Note: Values of  $Z_s$  for disconnection times other than 0.4 s or 5 s shown may be required by *BS 7671*. For example, 0.2 s may be required for a 230 V final circuit not exceeding 32 A in a TT system (Table 41.1 refers).



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## Maximum measured values of earth fault loop impedance ( $Z_s$ )

**Table 2** – Maximum measured values of  $Z_s$  for circuit-breakers or the overcurrent characteristic of RCBOs

Rated current (A)	Circuit-breakers to BS 3871 or BS EN 60898 or RCBOs to BS EN 61009					
	Type 1	Type 2	Type B	Type 3 and C	Type D	
	0.4 s to 5 s				0.4 s	5 s
2	N/A	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	11.64	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A	N/A
5	8.73	4.99	N/A	3.49	1.74	3.49
6	7.28	4.16	5.82	2.91	1.45	2.91
10	4.36	2.49	3.49	1.74	0.87	1.74
13	N/A	N/A	N/A	N/A	N/A	N/A
15	2.91	1.66	N/A	1.16	0.57	1.16
16	2.72	1.56	2.18	1.08	0.54	1.08
20	2.18	1.24	1.74	0.87	0.43	0.87
25	1.74	0.99	1.39	0.69	0.34	0.69
30	1.45	0.83	N/A	0.57	0.28	0.57
32	1.36	0.77	1.08	0.54	0.27	0.54
40	1.08	0.62	0.87	0.43	0.21	0.43
45	0.96	0.55	0.77	0.38	0.19	0.38
50	0.87	0.49	0.69	0.34	0.16	0.34
60	N/A	N/A	N/A	N/A	N/A	N/A
63	0.68	0.39	0.55	0.27	0.13	0.27
80	0.54	0.31	0.43	0.21	0.10	0.21
100	0.43	0.24	0.34	0.16	0.08	0.16
125	N/A	N/A	0.27	0.13	0.06	0.13
160	N/A	N/A	N/A	N/A	N/A	N/A
200	N/A	N/A	N/A	N/A	N/A	N/A

N/A (Not Applicable) – indicates that the device is not available or not appropriate.

The values of  $Z_s$  in Tables 1 and 2 are based on the ‘worst case limits’ of BS 7671. Some manufacturers’ protective devices operate at higher values of  $Z_s$  than the values shown.

Where a measured value of  $Z_s$  exceeds the value given in Table 1 or 2, as applicable, a more precise assessment of compliance with Regulation 411.4.5 or 411.5.4 may be made by evaluating the value of  $Z_s$  using the procedure given towards the end of Appendix 14 of BS 7671.

Guidance on measuring and reporting measured values of  $Z_s$  is given in NICEIC and ELECSA books *Domestic Periodic Inspection, Testing and Reporting and Inspection, Testing and Certification*. Values of  $Z_s$  given in this Pocket Guide are taken from tables given in these books.

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