

Calculating the maximum allowable earth fault loop impedance.

Earth loop impedance is calculated using the following formulae, (BS7671 2008 clause 411.4.5).

$$Z_s \times I_a \leq U_o$$

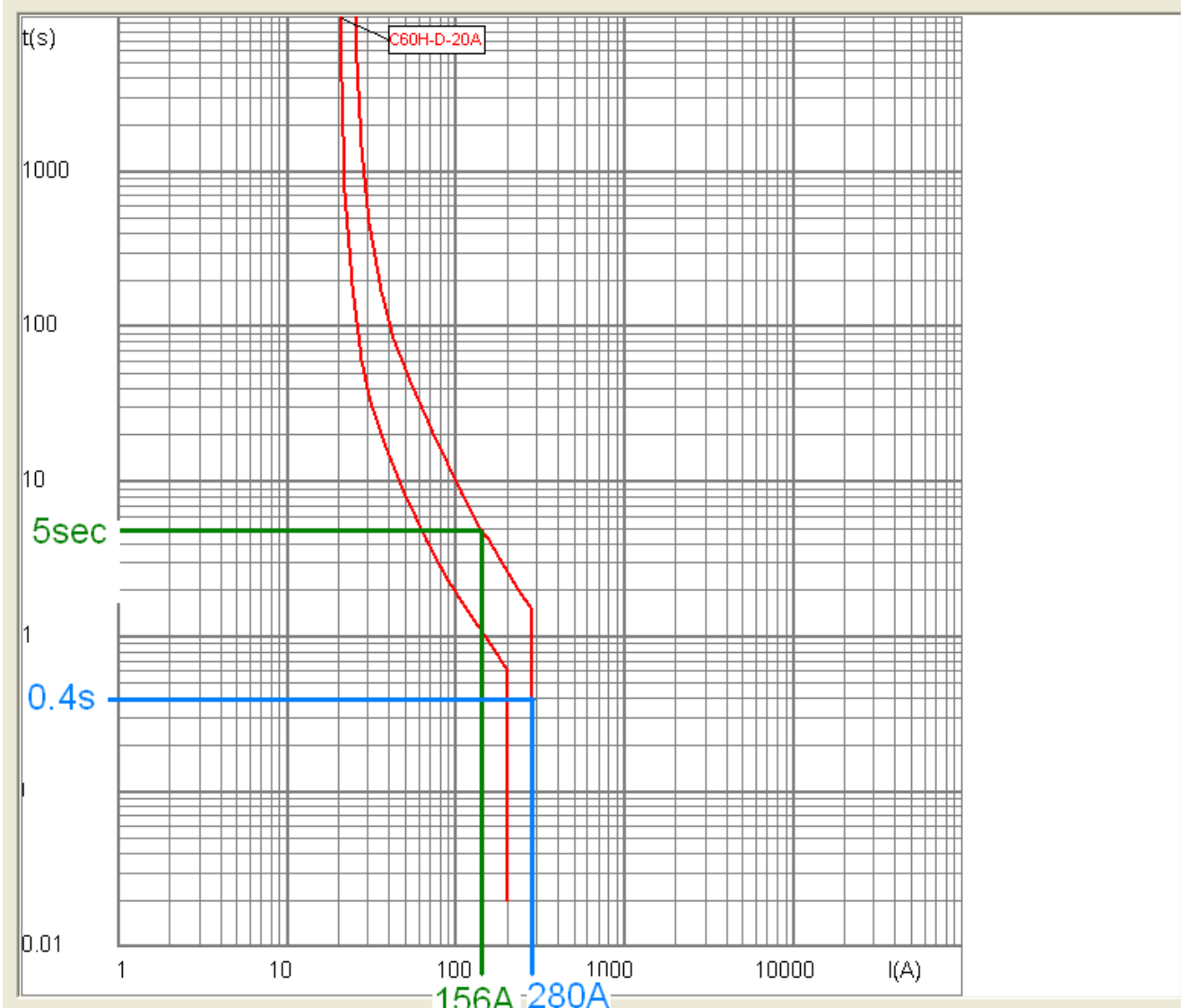
Where:

- Z_s** is the earth fault loop impedance in ohms (Ω).
- U_o** is the nominal line voltage to earth in volts (V).
- I_a** is the current in Amperes (A) required to trip the circuit breaker for the relevant disconnection time.

Current required to trip the circuit breaker (I_a).

- The current required to trip the circuit breaker (I_a) is required to calculate the Z_s value for the circuit.
- To determine I_a the disconnection time for the circuit is required. The disconnection times for 230V systems are as follows;
 - 0.4sec - for portable equipment.
 - 5.0sec - for fixed equipment.
- The relevant disconnection time is plotted on the tripping curve so that I_a can be obtained.
 - Note: The maximum tripping time (higher tolerance limit) must be used on the tripping curve.

An example for a 20A type D MCB is shown on the following slide.



$I_n =$ 20 A
 $I_r =$
 Long-time
 $I_{o1} :$ - +
 $I_r :$ - +
 $t_r :$ - +
 I2T IDMTL: - +
 Long delay Plug:
 Standard settings
 Short-time
 I_m (tsd) - +
 t_m (tsd) - +
 I_t (delay) L \
 Instantaneous
 Inst: 12.0 x I_n - +

Zoom: 100%



Calculating the Zs value when Ia is known.

- **The Zs value is calculated as follows (BS7671 2008 clause 411.4.5).**

- As seen on the previous slide, the current required to trip the circuit breaker can be measured from the tripping curve. e.g. a disconnection time of 5 sec is required, therefore the current required to trip the MCB = 156A (Ia).
- The nominal voltage to earth is 230V (Uo).
- The maximum Zs is calculated using the following formulae:- **$Zs \times Ia \leq Uo$**

$$\text{Max } Zs = Uo / Ia$$

$$230V / 156A = 1.47\text{ohms}$$

Therefore for a 20A Type D MCB the maximum Zs allowable for a 5 second disconnection time is 1.47 ohms.