

LV Circuit Breaker Coordination and Selectivity

cBallast · IEC 60364-5-53:2020 · Design guide

Why coordination matters

Several breakers stand in series between incoming supply and load. A fault should trip only the nearest upstream breaker, isolating the smallest possible portion. If upstream trips first, fault cascaded; every load fed through goes dark unnecessarily. Coordinated selectivity prevents cascading.

Three coordination strategies

Strategy	Meaning	Use when
Full selectivity	Downstream always trips first, any current up to its I_{cn}	Critical loads, hospital IT, data centres
Partial (limited) selectivity	Selectivity to defined I_s ; above both trip	General industrial
Cascading (back-up)	Downstream $I_{cn} < \text{prospective SCC}$; both trip	Cost-driven, small sub-panel

Coordination principles

Current selectivity: downstream magnetic trip lower than upstream instantaneous. Overload = thermal band; short-circuit = magnetic band. Time selectivity: upstream short-time delay (STD) longer than downstream clearing. Every hierarchy level = ~100 ms intentional delay. Energy (I^2t) selectivity: fast (current-limiting) breakers — downstream let-through $I^2t < \text{upstream non-tripping } I^2t$. Zone selectivity interlocking (ZSI): modern ACB/MCCB share hard-wired signal so upstream holds when downstream confirms fault. Real-time zone selectivity, no artificial delay.

Three-level example (fault 5 kA)

Level	Breaker	Rating	Icu	Setting
ACB main	ABB Emax E2.2N	2000 A	65 kA	$I_r 1.0 \times I_n$, $I_{sd} 5 \times I_n$, tsd 200ms
MCCB	ABB Tmax XT4 250	250 A	36 kA	$I_r 0.8 \times I_n$, $I_{sd} 8 \times I_r$, instant
MCB	ABB S203 C63	63 A	10 kA	C curve ($5\text{--}10 \times I_n$ mag)

Cascading examples

Upstream	Downstream	Down Icu	Enhanced Icu
Schneider iC60N 63A	iC60H 20A	10 kA	50 kA back-up
ABB S203 32A	S201 6A	6 kA	25 kA back-up

ABB Tmax XT2 160

S203 63A

10 kA

36 kA back-up

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