Formula 1

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Formula 2

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Formula 3

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Detailed Explanation

IEC 60287-1-1:2022 specifies the analytical method for determining the steady-state current rating of cables based on thermal equilibrium: the heat generated by electrical losses must be balanced by heat dissipation through surrounding materials and ambient media. The Excel workbook operationalizes this standard by structuring inputs (e.g., conductor material/resistivity, insulation type, burial depth, soil thermal resistivity, ambient temperature, load factor) and systematically computing thermal resistances (R1–R5 per IEC 60287 nomenclature), alternating current resistance (including skin and proximity effects), dielectric losses, and overall thermal circuit equivalents. It employs iterative solvers (e.g., Goal Seek or custom VBA routines) to converge on the conductor temperature that satisfies the rated maximum permissible temperature (e.g., 90°C for XLPE), thereby deriving the corresponding ampacity. The workbook supports multiple installation methods (e.g., buried direct, in ducts, in air, trefoil or flat formation) and accommodates multi-layer thermal environments—including backfill, bedding, and soil—with user-defined thermal resistivity profiles. Validation features (e.g., unit consistency checks, boundary condition alerts, and intermediate result visibility) enhance reliability and support compliance auditing during design reviews or regulatory submissions.

Key Components

#	Component
1	Thermal Resistance Network Calculator (R1–R5)
2	AC Resistance & Losses Engine (including skin/proximity correction)
3	Iterative Temperature Convergence Solver

Applications

#	Application
1	Power distribution system design for utilities and industrial plants
2	Compliance verification for project-specific cable specifications (e.g., tender submissions)
3	Comparative analysis of cable types, sizes, and installation configurations for cost-optimal ampacity

Related Concepts

#	Concept
1	IEC 60287-2-1 (thermal resistances of surrounding media)
2	Cable derating factors
3	Neher-McGrath method (US counterpart)

Tags

> cable engineering, ampacity, IEC standards, thermal modeling, power systems design