

Table 4: Convection model validation results. Simulation temperatures compared with industrial heat sink performance targets for typical operating conditions.

Material	Simulation Temp (°C)	Absolute Temp (°C)	Industrial Target (°C)	Status
Silver	30.0	51.0	40-55	✓ Realistic
Copper	29.0	50.0	45-60	✓ Realistic
Steel (carbon)	91.7	112.7	70-120	✓ Realistic
Convection effectiveness				
Silver	38.7%	—	85-95%	Lower (high diffusivity)
Copper	50.1%	—	85-95%	Moderate
Steel (carbon)	92.9%	—	85-95%	✓ Literature match