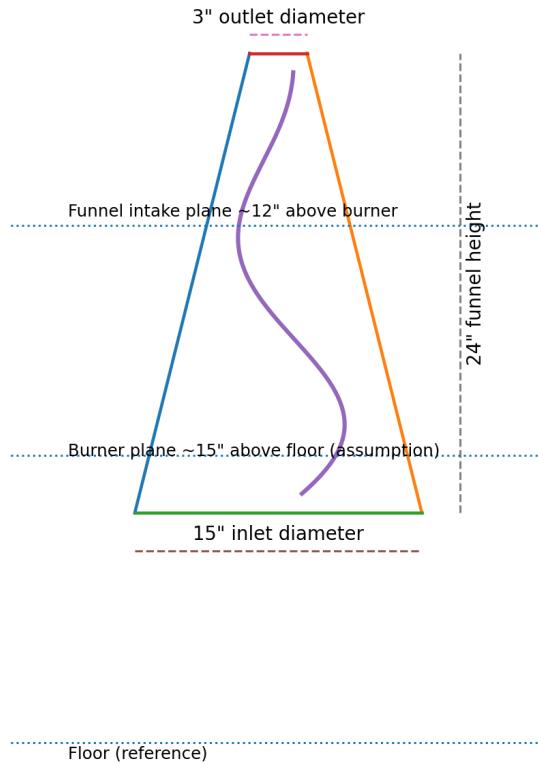


Emitter Model #1: Helical Swirl Vane vs Smooth Funnel

Geometry: 15-inch inlet, 24-inch tall funnel, 3-inch outlet. Material: thin stainless sheet, black ceramic coating inside/outside.

Model #1: 24" funnel emitter with internal helical swirl vane (concept schematic)



Conservative performance comparison (same 3-inch outlet, same plume power assumption)

Assumed plume/convective power potentially capturable: 8.0 kW (from 50k BTU/h input).

Smooth wall case: $UA \approx 12 \text{ W/K} \rightarrow$ captured into wall $\approx 4.07 \text{ kW}$; surface $\approx 328^\circ\text{C}$; net radiated $\approx 2.88 \text{ kW}$.

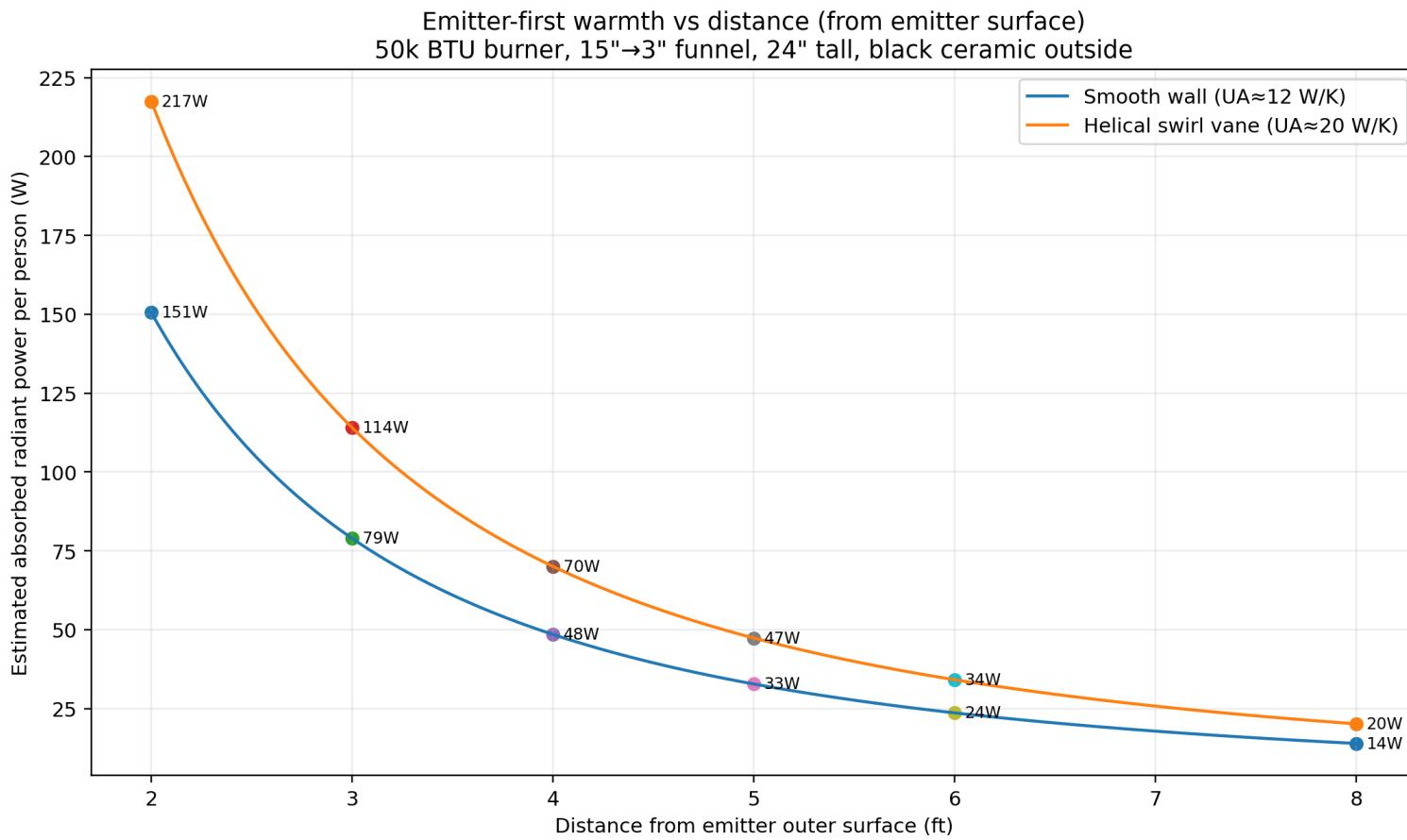
Helical swirl vane case: $UA \approx 20 \text{ W/K} \rightarrow$ captured into wall $\approx 5.55 \text{ kW}$; surface $\approx 384^\circ\text{C}$; net radiated $\approx 4.16 \text{ kW}$.

Flat pattern (outer shell) for sheet forming (approx.):

- Slant height $s \approx 24.7 \text{ in}$
- Developed radii (annular sector): $R_{\text{outer}} \approx 30.9 \text{ in}$, $R_{\text{inner}} \approx 6.2 \text{ in}$
- Sector angle $\theta \approx 87.3^\circ$ (arc length at outer radius equals 15-inch circumference)

Helical vane fabrication (concept): laser-cut stainless strip with tabs; form into 1.0–1.5 turns; spot weld/rivet tabs to interior wall. Use a top damper ring (rotating plate or adjustable annular gap) to tune outlet free area around the 3-inch equivalent target.

How much warmth is felt vs distance (measured from emitter surface)



Point values at common distances (absorbed radiant power per person)

Distance from surface (ft)	Smooth wall (W/person)	Swirl vane (W/person)
2	151	217
3	79	114
4	48	70
5	33	47
6	24	34

Notes: Values are first-order (isotropic radiation). Real results vary with wind, shielding, plume capture fraction, and view factors; use as conservative sizing guide.