

Custom High-Temperature Heat Exchanger

Engineered for supercritical steam cooling from **650°C to 400°C** — where standard materials fail and precision engineering prevails.

The Objective

Design a high-performance heat exchanger capable of cooling supercritical steam from 650°C to 400°C while preventing coolant boiling. The exchanger needed to withstand extreme temperatures and pressures with durable, reliable materials.

The Challenge

Supercritical steam applications present extreme operating conditions. Precise cooling across a significant temperature drop was required, with water as the coolant. Standard stainless steel was insufficient for the high thermal stress, necessitating a specialized alloy solution.

The Solution

Exergy engineered a custom **tube-in-tube heat exchanger** with a single coil design. The inner tube was fabricated from **Inconel** for superior strength and oxidation resistance. Outer tube: ½ inch; inner tube: ¼ inch; heat transfer area: **0.11 ft²**.

The Results

Efficient cooling from 650°C to 400°C achieved with full coolant stability. Inconel's durability enabled safe, reliable operation under severe conditions where stainless steel would fail. The compact design delivered a robust supercritical steam solution.

Key Design Specifications

Configuration	Tube-in-Tube, Single Coil
Inner Tube Material	Inconel
Outer Tube Diameter	½ inch
Inner Tube Diameter	¼ inch
Heat Transfer Area	0.11 ft ²
Steam Inlet Temp	650°C
Steam Outlet Temp	400°C
Coolant	Water (non-boiling)

Why Inconel?

- Superior oxidation resistance at supercritical temperatures
- Maintains structural integrity under extreme thermal stress
- Outperforms stainless steel in high-pressure environments
- Long-term durability for reliable, safe operation