

Sanitary Heat Exchanger for LPBF Process Gas Cooling

CASE STUDY LPBF / METAL 3D PRINTING

Exergy engineered a customized sanitary shell & tube heat exchanger to cool **Helistar A1025** process gas (90% He / 7.5% Ar / 2.5% CO₂) for a laser powder bed fusion metal printing operation — meeting strict sanitary standards while solving a unique soot-fouling challenge.

The Challenge

Custom Connections & Cleaning

Customer required KF50 flanges and a removable bundle for soot cleaning. Exergy does not manufacture disassemblable units — a non-removal cleaning strategy was needed.

Material Compatibility

Exchanger surfaces needed to resist fouling, minimize soot adherence, facilitate in-place cleaning, and maintain a compact footprint compatible with the existing LPBF system envelope.

Unknown Soot Properties

Soot generated during LPBF printing agglomerates and coalesces on metal surfaces, threatening exchanger performance and maintenance cycles with no baseline characterization data available.

The Solution — Exergy 73 Series (P/N 05257-03)

20-Inch Shell Length

Compact form factor providing ample heat transfer surface area for integration into the LPBF system without modifying existing infrastructure.

316L SS + Dursan® Coating

SilcoTek's Dursan® CVD coating applied over 316L stainless steel delivers non-stick, hydrophobic surfaces with enhanced corrosion resistance against the Helistar A1025 gas mixture.

KF50 Flanges

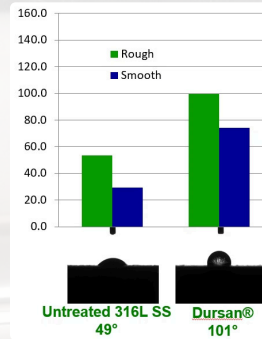
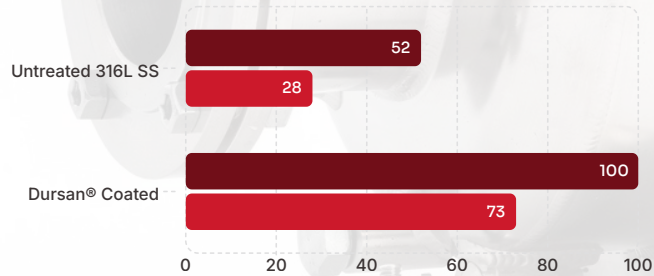
Industry-standard KF50 connections ensure seamless drop-in integration with the customer's existing process gas plumbing — no system redesign required.

Results: Dursan® Coating Performance

Dursan® dramatically reduces surface energy on 316L stainless steel, rendering treated surfaces hydrophobic and non-stick. Contact angle measurement — the angle between the metal surface and a sessile water droplet — quantifies this effect directly.

■ Rough (°) ■ Smooth (°)

Surface



Contact angle (degrees) — higher values indicate greater hydrophobicity and reduced soot adhesion potential. Dursan® nearly doubles the contact angle on both rough and smooth surface finishes.

101°

Dursan® Contact Angle

Smooth surface — surpassing the hydrophobic threshold of 90°, confirming effective non-stick performance.

49°

Untreated SS Angle

Smooth 316L stainless steel baseline — well below hydrophobic threshold, prone to soot adhesion and fouling.

2x

Cleaning Efficiency Gain

Dursan® coating approximately doubles contact angle, significantly reducing maintenance downtime for in-place cleaning cycles.

Dursan®-coated 316L SS eliminates the need for bundle removal — enabling in-place cleaning of the KF50-integrated exchanger while extending service life in soot-laden LPBF gas streams.