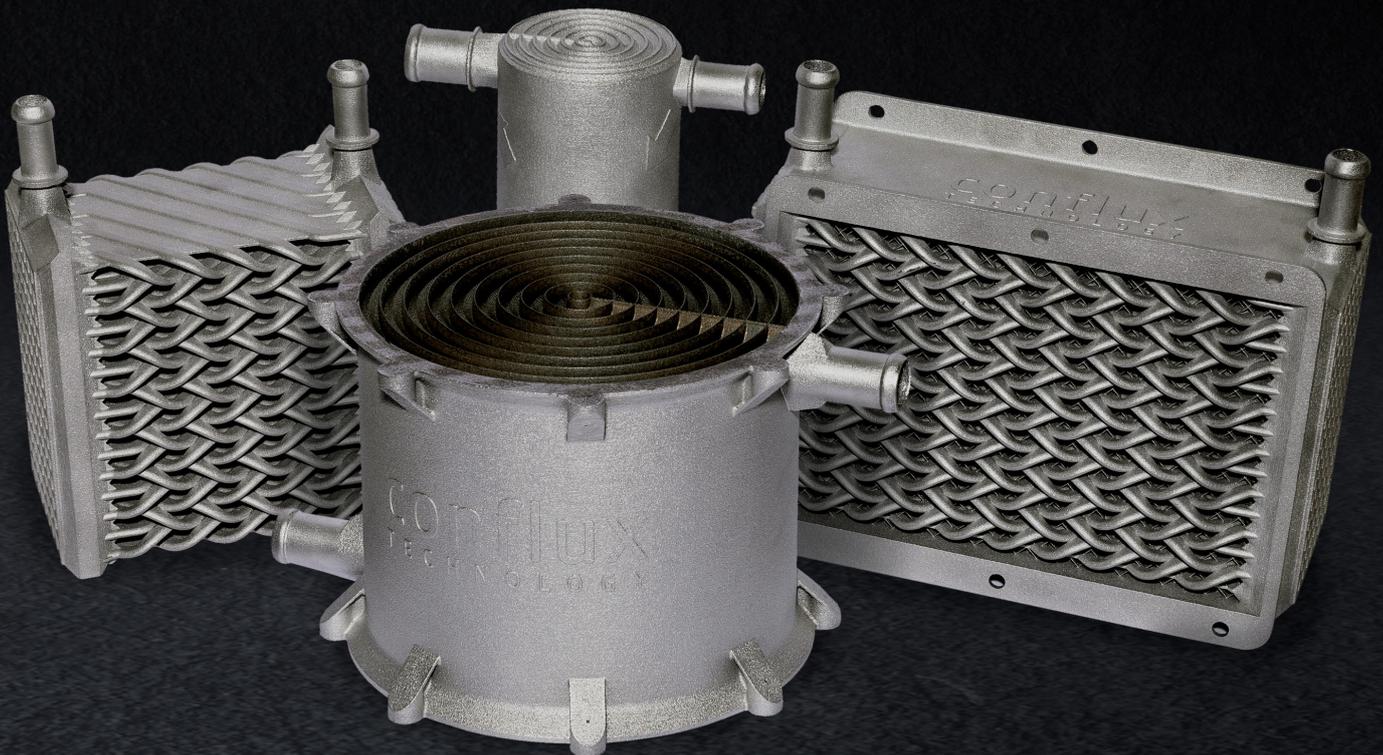


conflux
TECHNOLOGY

Heat exchange solutions for automotive & motorsport

Unlock the power of additive manufacturing



Transform performance

Conflux is driving innovation in motorsport technology through cutting-edge solutions for high performance heat exchange.

Our mission: to pioneer thermal technology. With 100+ years of accumulated experience, and years of dedicated research into thermal solutions using additive manufacturing, we are positioned to support the increasing demands of new vehicles.

By working solely on additive manufacturing heat transfer applications, we've developed deep specialist knowledge delivering industry leading products and reliable serial production. It is this honing of the technology that sets our solutions apart.



Ultra-high performance heat exchangers

Lighter, smaller and more effective. Industry leading technology in every way.



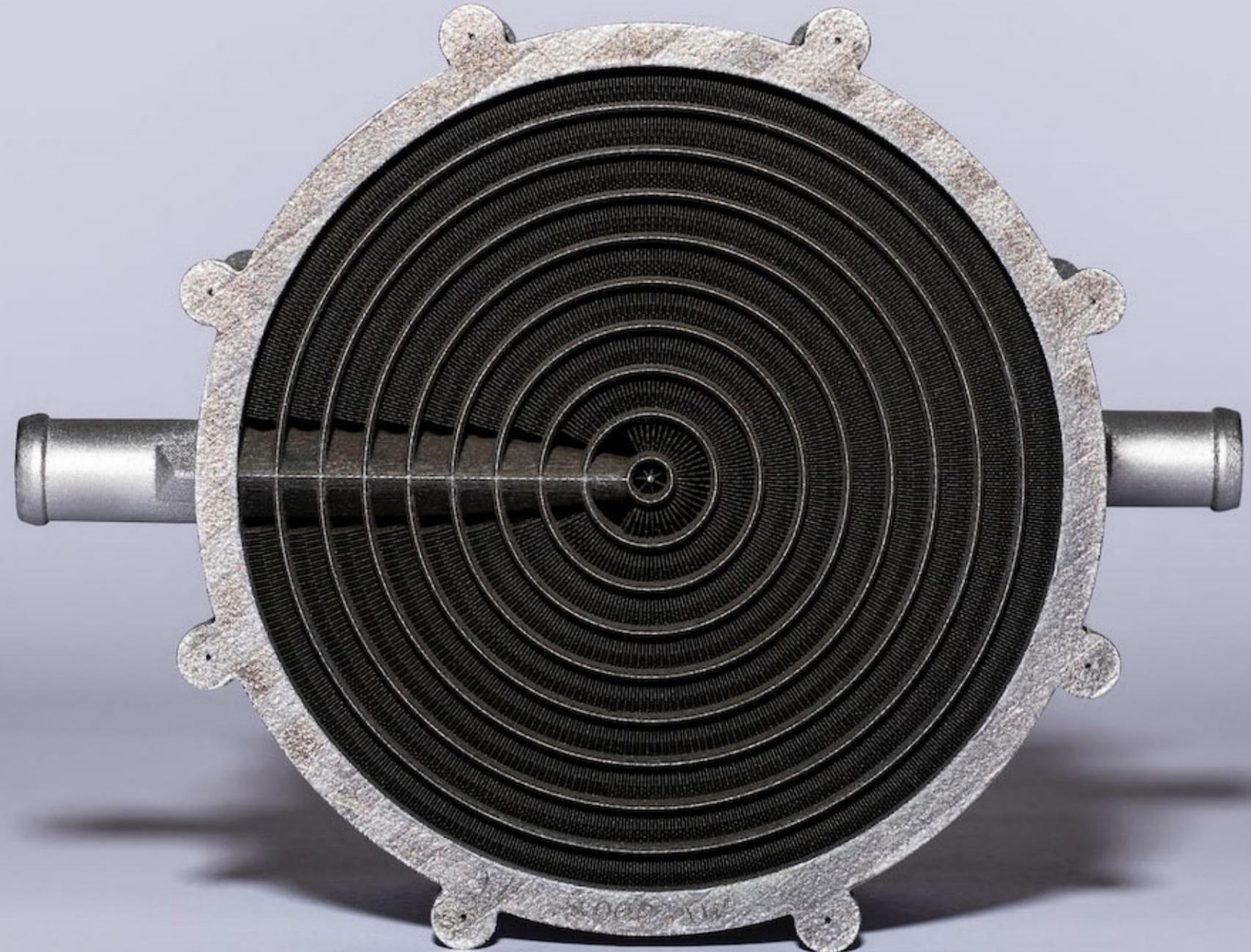
Configurable products with the Conflux Core™

Compressed timeframes and low R&D costs, whilst meeting your packaging requirements through configurable products



Reliable, serial production

Leverage our vertically integrated organisation to support verification, production readiness and serial production



Upgrade your cooling solutions using additive manufacturing

A modern vehicle has a multitude of heat exchangers, and with the complexity of cooling systems increasing substantially in recent times, heat exchange performance has never been so critical.

Where traditionally manufactured heat exchangers offer relatively basic and linear geometries due to the limitations in manufacturing techniques, additively manufactured heat exchangers offer the potential to conform to abstract spaces and increase compactness whilst improving or maintaining performance.

Specifically, AM heat exchangers provide several performance benefits;



Higher thermal Exchange

Enhanced surface area density to volume ratio results in high thermal exchange performance



Reduced weight

Higher thermal performance and monolithic parts translate to step changes in part size



Low pressure drop

Optimised flow design reduces pressure drop and improves system efficiency



Morphed topology

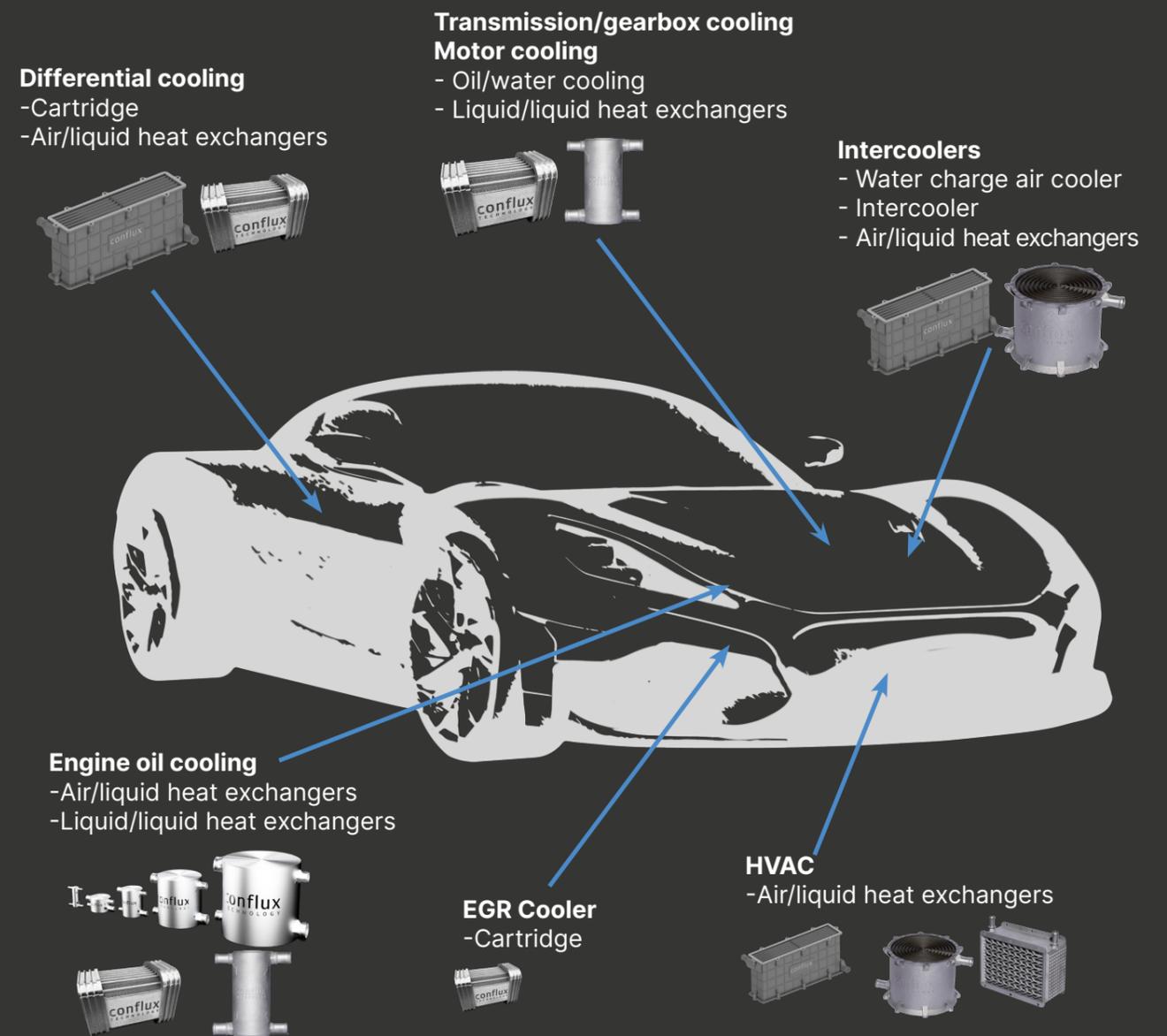
Design freedom gives flexibility in form factor; geometry can be morphed to fit the space available

Other benefits include;

- ✓ Smaller / conformal shapes that offer packaging options unobtainable with traditional manufacturing
- ✓ Reduction of lead times for the production of parts
- ✓ Potential scope for hybrid functions of HX components
- ✓ Part consolidation - the amalgamation of components and sub-assemblies have positive impacts on the entire supply chain from ordering to handling, storage and dispatch of finished article
- ✓ Lower R&D costs and faster prototyping and design iteration
- ✓ No (re)tooling costs

Applications

- ✓ Engine and gear box oil/water coolers
- ✓ Intercoolers/water charge air coolers
- ✓ Power chillers
- ✓ Electronics cooling
- ✓ Battery cooling
- ✓ Air/air heat exchangers
- ✓ Air/liquid heat exchangers
- ✓ Liquid/liquid heat exchangers





Rapidly mature your heat exchange applications with the exclusive patented technology of the Conflux Core™

Leading innovation with configurable products

Conflux configurable heat exchanger products deliver an expedited solution. These products are scalable and configurable to your unique boundary conditions, performance and packaging requirements.

Our adaptive solutions not only minimise both development and lead time, they're also tailored to your specifications and deliver outstanding performance.

Our expert design tools and cutting-edge capabilities combined with additive manufacturing enable rapid configuration to adapt features and fittings required for your application.

PACKAGING AND CONFIGURATION

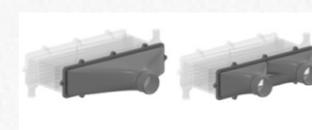
Form factor & packaging



Min and max dimensions



Ducts



Port location, fittings and configuration



Materials

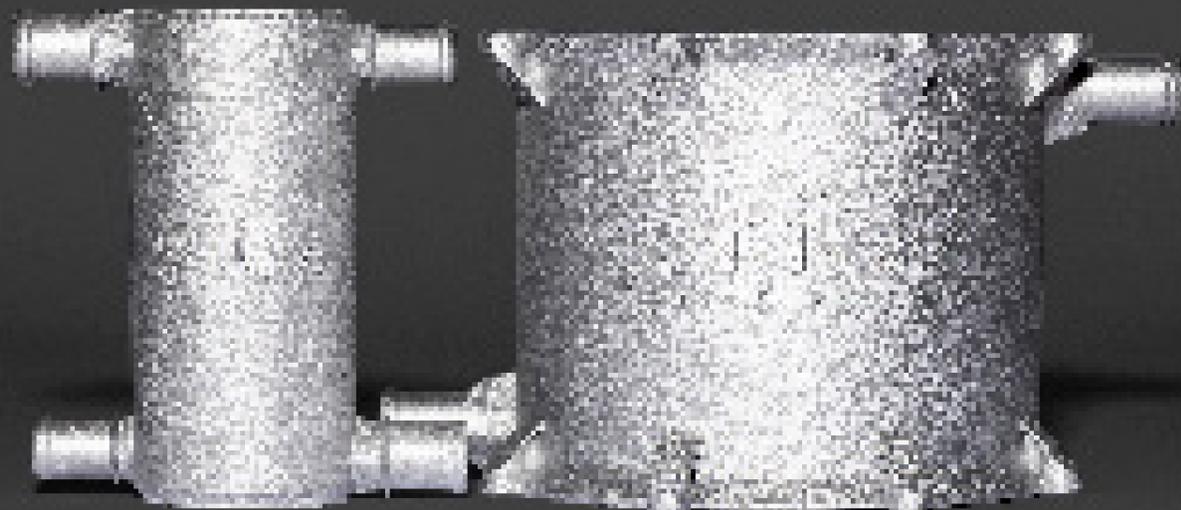
Conflux manufactures in common and bespoke AM materials. Material selection is influenced by customer boundary conditions (fluid, temperature, pressure, flow rate) and performance requirements (heat exchange, pressure drop, weight reduction, durability).

Port locations can be configured to match packaging requirements. Port fittings are printed or machined during post processing to specification. Most global standard port connections can be accommodated.

Fully flexible heat exchangers

For solutions with unique challenges, Conflux offers enhanced product development services. Utilising our patented Conflux Core™ technology we adapt designs to your specific application.

For a walk through of our product offerings and process, get in touch with our team to learn more. Email: info@confluxtechnology.com



Conflux water charge air cooler

The Conflux water charge air cooler (WCAC) delivers industry-leading heat exchange with lower pressure drop, volume and weight. It is competitively priced and benchmarked with the best and configured and printed to meet your exacting requirements.



Adaptable design

The design process facilitates scaling, configuration and manufacture unique to your boundary conditions, performance and packaging requirements.



The AM advantage

Complex geometries and micro features unachievable with traditional manufacturing drive the core performance, alongside fins and thin wall designs that accommodate the changing fluid dynamics throughout the heat exchanger.



High efficiency, low mass

The high surface area to mass ratio inside the core is enhanced by a holistic design that optimises fluid distribution and flow, providing more heat exchange per unit of weight or volume.

CASE STUDY SUMMARY: CONFLUX FORMULA 1 WCAC

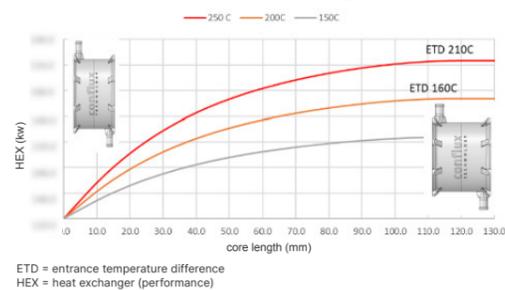
Objective: To create an ultra-high performing AM WCAC for performance vehicles priced to complete.

Specifically to achieve the a target heat transfer performance of 124kW alongside key performance enhancing benefits: reduced part size, reduced weight, reduced airside pressure drop, reduced coolant pressure drop.

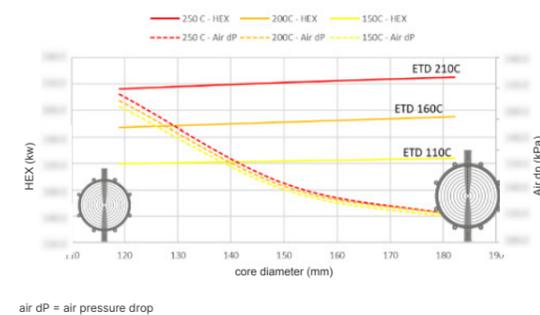
Results summary: When benchmarked against leading microtube WCAC with constant heat exchange:

- 82% reduction in water side pressure drop
- 24% reduction in air-side pressure drop
- 39% reduction in wet weight
- 15% smaller core volume

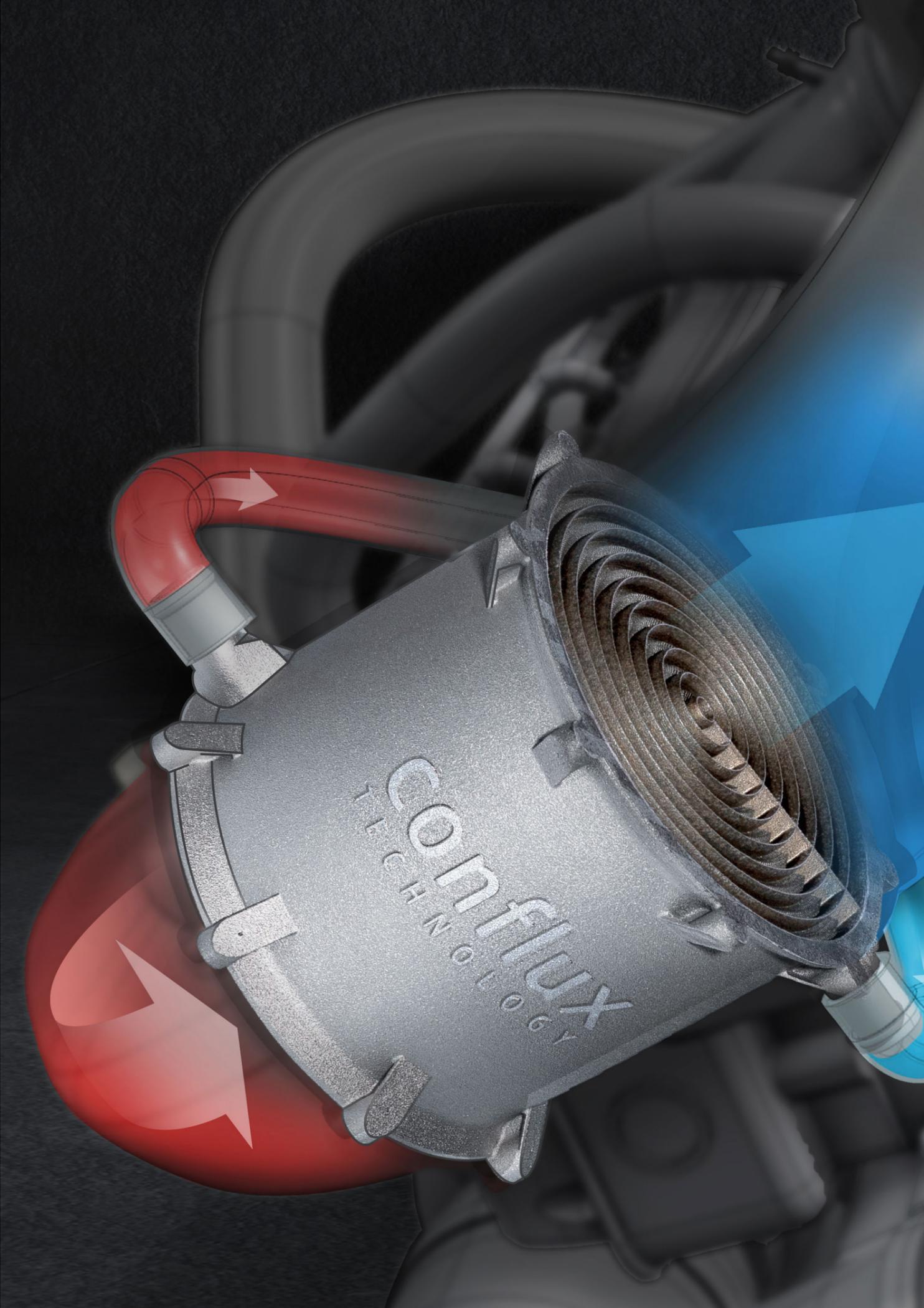
Graph: Performance with HX diameter of 150mm at varying core length and air inlet temperature



Graph: Performance with varying core diameter and air inlet temperature



Read the full case study and more at www.confluxtechnology.com/case-studies



Conflux cartridge

The Conflux cartridge heat exchanger is a complex 3D printed core that can be embedded in a traditionally manufactured part or casing. The 'cartridge' features the patented technology of a Conflux Core™, resulting in a compact, serviceable, customisable, and interchangeable form of heat exchanger that offers a multitude of benefits across a wide range of applications.



High performance

Conflux Cartridge AM heat exchangers outperform competitive technologies, delivering lower pressure drop and higher heat transfer.



Integration

Integrated cartridge heat exchangers enable thermal transfer closer to the point of heat generation within a system, reducing fluid transport and resultant pressure drop, plumbing and leakage risk.

Conflux AM cartridges offer configuration to available space and packaging constraints.



Accessibility and maintainability

In systems where fowling or regular inspection must be accommodated, cartridges offer access for service, swap outs and upgrades, lowering maintenance costs and downtime.

A legacy cartridge can be replaced with newer technology or adapted for new conditions.

CASE STUDY SUMMARY: CONFLUX TRANSMISSION OIL CARTRIDGE

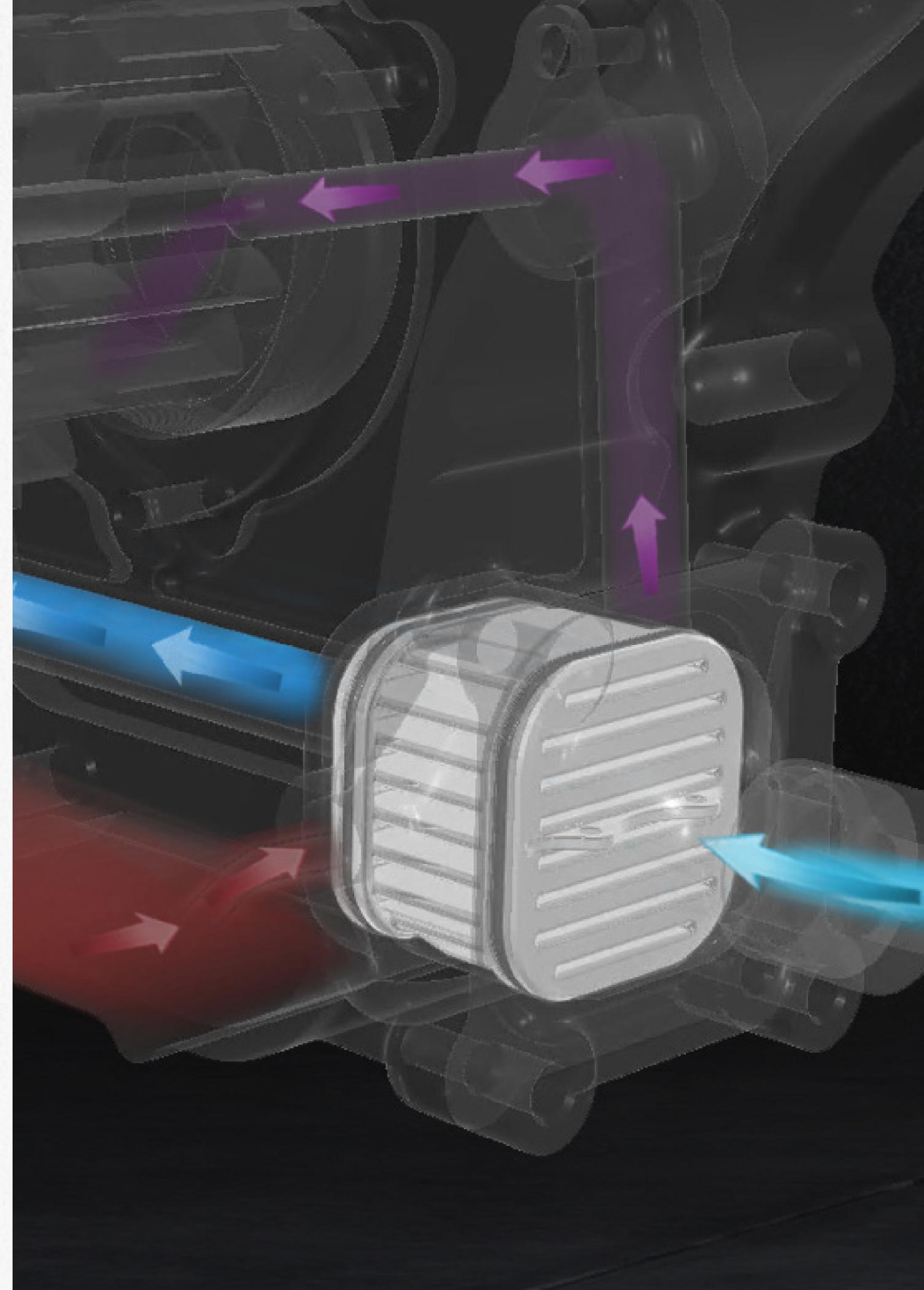
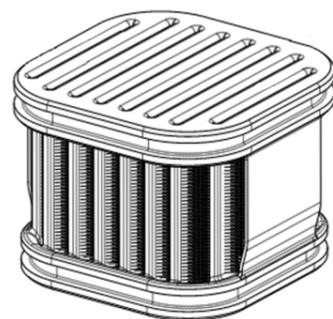
Objective: To create a compact, cartridge heat exchanger that delivers industry leading performance. To prove this design could offer our customers unparalleled levels of customisability and serviceability not previously possible with a more traditional heat exchanger design.

Results summary:

- Cartridge volume of 40mm x 40mm x 30mm
- Achieved target heat exchange rate of 5.7kW
- Achieved pressure drop targets for both fluids
- Dry weight = 43g, wet weight = 60g

Table: General performance figure from Use Case

Inlet Condition	
Oil Type	Texaco 7045E
Coolant	Water
Oil in Temp [C]	105
Oil Flow Rate [LPM]	10
Coolant In Temp [C]	55
Coolant Flow Rate [LPM]	18
Performance Figure	
Size [mm]	40x40x30
Dry Weight [g]	43
Heat Transfer [kW]	5.7
Oil dP [kPa]	19
Coolant dp [kPa]	34



Pathway to success

Rapidly delivered adaptive design

The Conflux design process facilitates scaling, configuration and simulation of your unique boundary conditions, performance, and packaging requirements.

We leverage a configurable product suite and our accumulated design library of geometries to provide the optimum heat exchange performance in multiple scenarios.

By rapidly developing multiple design concepts throughout the phase, we're able to quickly converge on the most innovative solution.

We perform CFD (Computational Fluid Dynamics) simulation and FEA (Finite Element Analysis) to predict the performance of our parts and ensure we maximise design potential. Characteristics such as heat rejection and pressure drop are improved as we optimise heat flux and fluid flow.



Reliable manufacturing for peak performance

Laser Bed Powder Fusion (LBPF) is our metal AM technology. A layer-by-layer build process, LBPF uses a fibre laser to selectively melt fine metal powder to form the desired three-dimensional object.

LBPF technology has the ability to create the highly dense, thin walled, complex features that are critical for optimising the performance of AM heat exchangers.

Whether you are moving into this area of manufacturing or accelerating your existing program, you'll need extensive knowledge to leverage the full benefits of the technology.

Our state of the art facilities enable reliable, serial production and make full use of "lights-out" manufacturing, accelerating delivery times.

Machines

A machine type fit for the fine geometries of a Conflux heat exchanger.

MACHINE	KEY PROPERTIES	BENEFITS
EOS M300-4	<ul style="list-style-type: none"> 4 x high peak power lasers that emit clean, ultrafast pulse Lasers work in unison, not restricted to own quadrant Build capacity of 300 × 300 × 400 mm 	<ul style="list-style-type: none"> Advanced productivity with larger build volume Faster print times Superior reliability and quality
EOS M290	<ul style="list-style-type: none"> Direct Metal Laser Sintering technology 400-watt fiber laser Build capacity of 250 × 250 × 325 mm 	<ul style="list-style-type: none"> Design freedom, allows for complex internal geometry Remarkable high beam quality (automotive applications, high temperature charge coolers, or exhaust cooling catalysts, etc.) Can be used to create geometry with very thin walls and fine features

Custom parameter sets and scan strategies - pushing the limits of additive manufacturing

At Conflux we develop 'custom parameter sets' to allow the printing of far finer features as to not be constrained by the limitations of standard parameter sets for materials. This results in better quality parts with finer features, consistent density, reduced scrap rate and reduced build times.

Material selection

Conflux manufactures in common and bespoke AM materials. Material selection is influenced by customer boundary conditions (fluid, temperature, pressure, flow rate) and performance requirements (heat exchange, pressure drop, weight reduction, durability).

We choose the ideal material to solve our customers' heat transfer requirements and develop printing parameters specifically for the materials chosen to get the best possible performance. Although not limited to, Conflux primarily uses AlSi10Mg due to its superior AM printing properties or Stainless Steel for higher temperature applications and where greater strength and/or resistance to corrosion is required.

MATERIAL	KEY PROPERTIES	APPLICATIONS
AlSi10Mg – Aluminum	Offers best balance for thermal conductivity, weight, strength and durability.	Suited to many applications and widely used as well understood.
Stainless Steel	Strength and/or resistance to corrosion.	Higher temp applications and those requiring strength at temperature such as aerospace or automotive applications. High temperature charge coolers or exhaust cooling, catalysts etc. Can be used to create geometry with very thin walls and fine features.

Quality at every step

We utilise unique methods and use informed test data throughout our process, not just at post processing. Our in-depth and robust development programmes employ a range of physical tests like; pressure and leak testing, calorimetric testing, test rig durability testing: pressure pulsation, thermal cycling, shock and vibration are performed to investigate durability and gain more statistical confidence.

We ensure validity by utilising trusted independent testers and Platform based testing to confirm performance and durability in real world conditions.



Advanced techniques for deep analytics

Conflux Quantify®

Conflux Quantify (CQ) is our proprietary software developed specifically for our unique heat exchanger geometries and manufacturing.

CQ provides improved quality control, informs parameter development resulting in lighter/thinner/higher performance HXs due to improved development capabilities and cheaper HXs with the reduced need for trial-and-error development process.

It provides quantified analysis of large CT data sets allowing us to look at areas such as surface roughness, wall thickness and pore morphology.

Using the Australian Synchrotron

We use the Australian Synchrotron to see anomalies hidden inside completed parts by way of CT. We are able to verify the outcomes of our custom parameter development as well as inspecting for critical defects. Resulting in improved performance, increased part quality and reduced development times for our customers.

The Synchrotron uses electrons to produce intense beams of light more than a million times brighter than the sun. It applies magnetic fields to 'synchronise' and force these high energy electrons into a circular orbit.

The perturbation of these electrons results in an intense beam of x-rays that can be harnessed to investigate our heat exchangers on a sub-macroscopic level. With the scale and resolution this gives, our inspection capability is vastly increased.



De-powdering complex parts and beyond

Powder removal postproduction from complex, monolithic parts with tight channels is challenging and is considered at the design stage of all projects. For Conflux Heat Exchangers it's not just about depowdering, it's also about cleanliness. We have heavily invested time in defining de-powdering and validation processes and techniques for increasingly complex geometries.

We utilise a powder removal cabinet to allow for safe and thorough bulk powder removal within a sealed environment. Vibration, vacuum and air pressure are used to remove the majority of powder at various HX orientations to ensure particles do not become trapped in discrete regions of the complex internals of the HX.

Criteria for success

When evaluating the capabilities of your metal additive manufacturer consider the following:

- Do they develop their own parameter sets and scan strategies?
- Do they understand through evaluation and testing the outcomes on material properties (density, mechanical strength, thermal conductivity) using their parameter sets?
- Do they understand the outcomes for productivity (build time, scrap rate) for the parts built using their parameter sets?

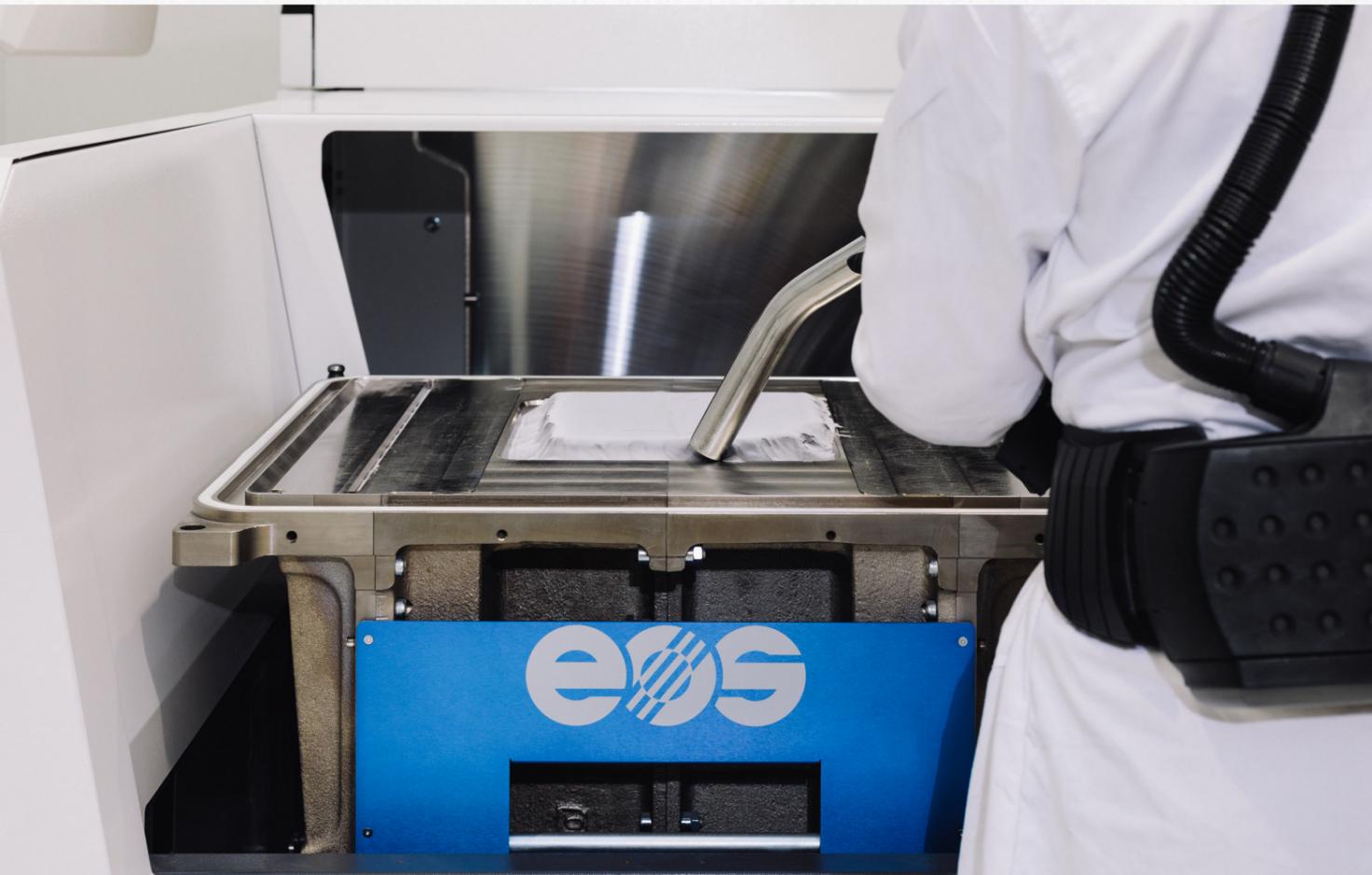
Certified to your needs

We are independently certified to ISO9001:2015 by an accredited certification body and we have commenced AS9100d certification (due for completion early 2023). We have flexibility to work within customer specified Quality Management System (QMS) and are actively working towards expanding our Management System certification to cater for the needs of customers in more specialist sectors. Our experts can outline your path to certification.



Sustainability

We are continuously researching ways that we can minimise our waste. Where possible without compromising material quality, powder from our LBPF process is sieved and recycled to build the next component. We are committed to assessing and reducing the Conflux footprint.



Get in touch



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