High Performance Production Through 3D-Printing Pilot

E-LLUM Thermal Vector Exchanger

VANGUARD INITIATIVE

E-WENCO pure energy

Challenges

- Improving heat exchanger performance
- Reducing component costs

Project duration: 7 months

Industrial sectors: Manufacturing

Consortium coverage: Italy, France

E-Wenco is an Italian technology company which was created in 2015 and has since grown to become a centre with expertise in thermal and energy processes as well as the chemical and physical properties of materials. This expertise is used to provide its customers with new process & product solutions, with every solution being characterised by energy efficiency, energy saving, competitive advantages, unique features and economic saving.

The Challenge

E-Wenco has developed a new thermal fluid knows as E-LLUM Thermal Vector (ETV) which is capable of transporting large amounts of energy, more than any other currently known adiabatic fluid. Parallel to the fluid, E-Wenco has also developed a heat exchanger which makes use of the ETV fluid. Currently, the ETV exchanger has been produced using more traditional subtractive manufacturing methods. However, the use of these methods creates certain limitations to the operational capabilities of the exchanger and the behaviour of the ETV fluid. These limitations are most directly associated with the heating-up times of the exchanger and the fluid as well as maintaining adequate temperate control within the exchanger. In order to overcome these limitations, E-Wenco set out to completely redesign the internals of the exchanger. By making the necessary changes, E-Wenco strived to improve the performance of the current exchangers, manufactured through subtractive manufacturing, by reducing the required heating-up time by at least 20% and reducing the absorbed peak power by at least 20%. Parallel to the these operational targets, E-Wenco set the target to reduce the overall cost of the newly designed ETV exchanger to make them more commercially viable and better marketable products.

The Project

Within E-LLUM Thermal Vector Exchanger, the goal was to produce a new exchanger using the same exterior dimensions as the original ETV exchanger, but with a redesigned interior to improve the overall performance of the ETV exchanger. Specifically, the aim was to increase the overall contact surface between the heating source and the vector, reduce the overall weight of the exchanger, and improving the heating-up time of the ETV fluid and exchanger. By capitalising on the benefits of additive manufacturing, internal channels with a micro-meter diameter can be incorporated into the design and the final product, channels which otherwise would have been larger using subtractive manufacturing methods. The introduction of these smaller channels, as well as the required post-processing to clean and smoothen the channels, were projected to deliver significant improvements in the operational characteristics of the ETV exchanger.

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Role of the Facility Centres

Within this project, E-Wenco partnered up with a Facility Centre based in Italy, Aidro, as well as La Precision based in France. Studio Vaghi was also involved as an additive manufacturing expert to support E-Wenco in various phases of the project. Initially, the expertise of Studio Vaghi was used the designing phase of the new ETV exchanger. The redesign of the internals of the exchanger was conducted together with Aidro in order to take into account potential optimisation for the metal 3D printing process. Once the design had been completed, Aidro printed the first samples which were subsequently tested by both Studio Vaghi and Aidro to analyse the performance of the exchanger and to make design modifications where necessary. La Precision is specialised in the manufacturing of high-prevision micro-mechanical parts and was involved to support with post-production services. Following the various design and production cycles and reiterations, La Precision de-powdered the final full-scale prototype exchanger, ensuring cleanliness and smoothening of the exchangers' internal channels. Finally, La Precision conducted a CT Scan of the prototype for the final analysis and ensuring the de-powdering had been conducted successfully.

Results achieved

With the previous generation of heat exchangers being manufactured using subtractive manufacturing, and the new generation being manufactured using additive manufacturing, E-Wenco could directly compare the overall performance of the two components. The newly developed component, manufactured using metal 3D printing, showed results which exceeded the original expectations, with the new component having a reduced heating up time of over 40%, a reduced peak in absorbed power of 60%, and reducing the overall final cost of the heat exchanger. The successful development of the new ETV exchanger has opened the opportunity for E-Wenco to integrate the exchanger in both new installations which are being realised, as well as the retrofitting of already existing installations but which would be upgraded through the integration of the new component.

VANGUARD INITIATIVE
New growth through smart specialisation

E-WENCO pure energy · aidro Desktop Metal Company · la précision industry · STUDIO VAGHI MECHANICAL DESIGN AND RESEARCH