S1.6.2 DESIGN AND MANUFACTURE OF METAL FILTRATION PRODUCTS BY ADDITIVE MANUFACTURING

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The use of Additive Manufacturing (AM) enables a different approach to product design. Subtractive manufacture has been around for centuries and involves making a product from materials that are drilled, milled, punched or some other production method that removes material from the original starting position. Additive Manufacturing which builds the part layer by layer, allows for enhanced design freedom, the ability to reduce the weight of components and the ability to turn multi-part to singular part components. As a result of utilising AM technology, filters can be more efficient, reducing the running costs for the filtration system whilst maintaining the standard of filtration required. We have exploited the layer by layer manufacturing technology of Selective Laser Melting, a powder bed AM system, to create complex metal filter designs. One of the challenges here is that Design for Manufacture (DfM) for subtractive processes differs greatly from the considerations for design for additive manufacture.

The first filtration challenge we addressed was to design a filter that reduced turbulence in the fluid flow through the filter to reduce the pressure drop across the filter. AM enabled the apertures in the filter to be designed to align with the fluid flow, eliminating one of the major fluid turning points associated with conventional perforated filter supports. The resultant design had decreased pressure drop across the filter in fluid flow trials. This AM design delivers a decrease in pumping energy required by the end user thus saving costs. We have applied DfM AM considerations to filter housings to direct fluid flow through the housing to decrease turbulence within the housing. Cleaning and maintenance is critical to the lifespan of the filter to deliver effective filtration. For some conventional filters, such as Y strainers, cleaning requires the removal of the filter element, AM has allowed for the development of a prototype where accumulated particulates can be removed without removal of the filter element thus allowing more frequent cleaning and expanded effective filtration time.

Lead time in the supply of wedge wire filters is generally long (6-8 weeks) and AM has the potential to deliver wedge wire filters faster and with specified end-caps and fixings as a single unit. AM wedge wire filters differ from conventional designs as the filter supports do not require to be perpendicular to the wedge wire. By using angled supports for the wedge portion the filtration gap can be maintained through the filter and the overall open area of an AM filter can be greater compared to a comparable conventional wedge filter.

However, one of the major challenges for powder bed AM systems is to recreate woven wire mesh with small apertures. The minimum diameter of strands in a latticework that can be produced by the laser is limited by the powder size and the laser power. Adjacent strands may merge together if too close thus eliminating apertures. However, regular aperture sizes can be created in latticework AM filters that deliver strength and uniform filtration. AM can deliver filtration media with increased efficiency.