

Design Assurance for Seawater Filtration Unit

Wilde used CFD simulation to evaluate two variants of a proposed design for a seawater filtration unit, with the objective of limiting the potential for vibration within acceptable parameters. Wilde was able to identify the best design option to meet MAHLE's requirements.

Company

The amafiltergroup manufactures large, first-stage seawater filtration units for various duties on offshore platforms. Since 2008, the amafiltergroup has been part of MAHLE Industrial Filtration, a company that has been producing high-quality industrial filters for fluid technology, dust filtration, and process technology for many years.

The MAHLE Group is one of the 30 largest companies in the automotive supply industry worldwide. It ranks among the top 3 systems suppliers for combustion engine components, systems and peripherals. MAHLE employs approximately 48,000 employees in 110 production plants and 8 research and development centres. In 2007, MAHLE generated sales in excess of EUR 5 billion (USD 7.5 billion).

Challenge

amafiltergroup manufactures large first-stage seawater filtration units for various duties on offshore platforms. A filtration unit comprises a set of long cylindrical filter elements operating in parallel, mounted inside a vertical vessel. To handle increased flow rates for new installations, the possible design options were either to include:

- more elements of the same shape and size;
- the same number of elements with greater diameter;
- or the same number of elements with increased length.

The first two options implied a larger diameter unit and, since space was at a premium, maintaining the current footprint in a taller vertical unit was a more attractive option. However, longer filter elements would be increasingly prone to vibration.

Having worked successfully with Wilde previously, amafiltergroup asked them to evaluate two variants of a proposed design from this perspective.

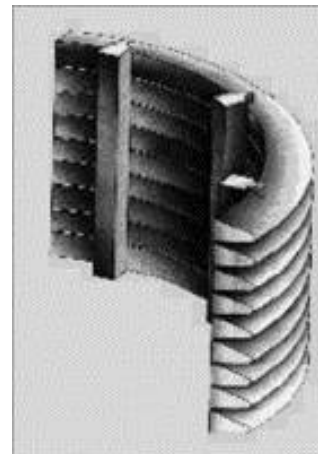


Fig 1: Internal View of Seawater Filtration Elements (Courtesy: MAHLE Industrial Filtration UK Ltd)

Solution

The most damaging flow-induced vibration typically occurs when organised vortex-shedding excites a natural frequency. The resonant frequency of filter elements was calculated from details of their construction and supports. Excitation frequency is determined by flow across

“MAHLE Industrial Filtration UK Ltd have worked with Wilde on a number of previous occasions where independent specialist knowledge, supported by the use of up-to-date computational techniques, were sought to support designs using conventional design processes.”

filter elements. Computational Fluid Dynamics (CFD) was used to investigate internal flow patterns and, in particular, to estimate the flow velocity over filter elements at their most vulnerable location opposite the exit nozzle where velocities were at their highest.

Estimates of vortex-shedding excitation frequency showed that one of the design alternatives carried a risk of resonant vibration of these elements, whilst the alternative design gave a healthy safety margin against this mechanism.

Business Benefits

By simulating equipment performance before manufacture, a potential failure mechanism, with its attendant costs, was identified and avoided, whilst confidence was enhanced in an alternative design.

A better understanding of the internal flow pattern also identified the potential to reduce overall pressure drop with a further incremental design modification.

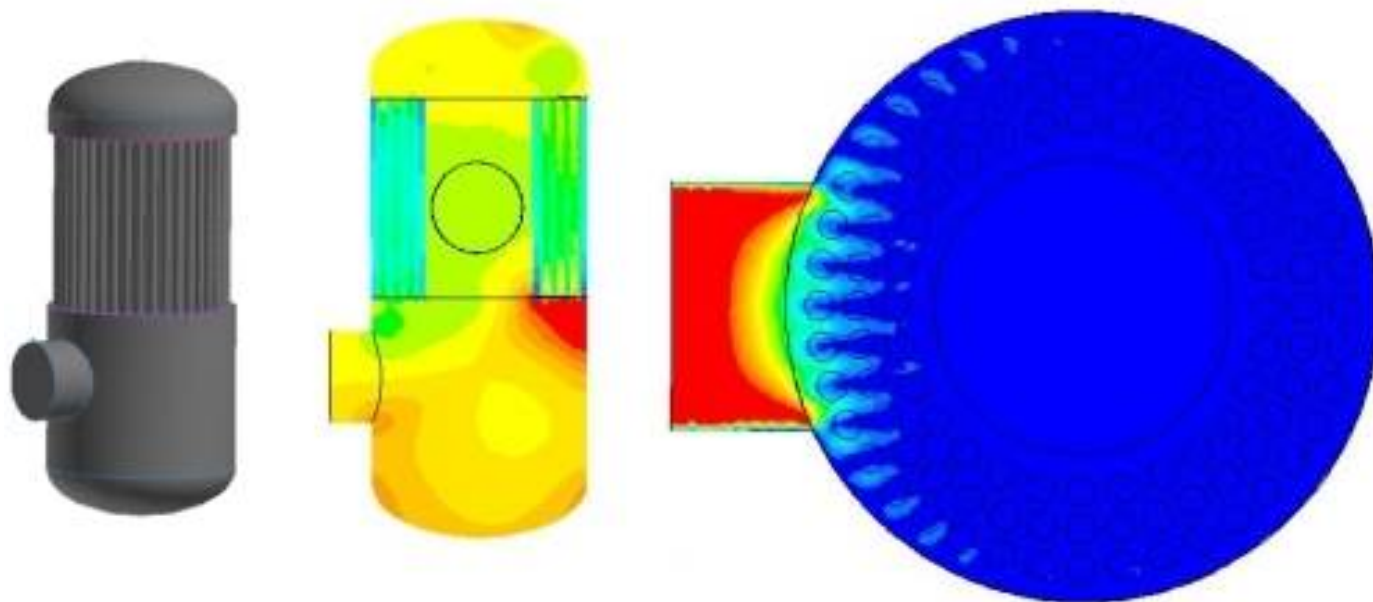


Fig 2: Seawater filtration investigation, including vortex-shedding prediction (Courtesy: MAHLE Industrial Filtration UK Ltd)

“Wilde’s engineers have always demonstrated a knowledgeable and professional understanding of our needs. They have been able to quickly and thoroughly assimilate our requirements, and equally quickly produce the necessary results to support our design process and provide guidance on the solutions best suiting our needs, both commercially and technically.”

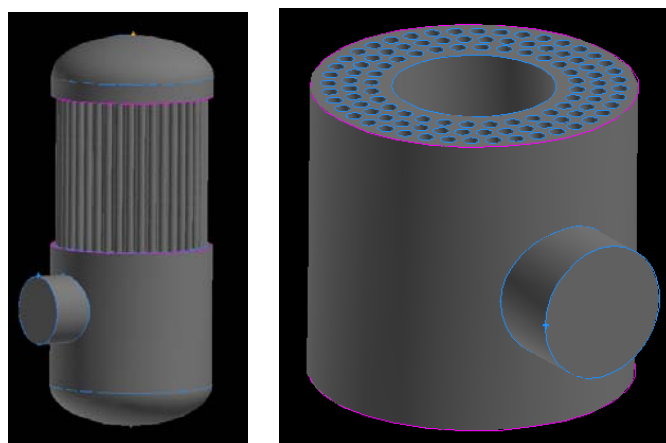


Fig 3: Inlet volume and Outlet volume (Courtesy: MAHLE Industrial Filtration UK Ltd)