Innovative GFSA filter design solves urgent offshore safety issue

Case Study

The Background

GFSA was approached by a major oil company that was experiencing a significant problem with both safety and financial implications. Having recently completed the construction of a new offshore platform, the oil company discovered a problem. The firewater system on the platform was not operating effectively.

They believed that the problem related to a pressure drop across the existing filtration equipment. The problem manifested itself in reduced flow and pressure to the various sprinkler systems topside of the platform.

The lack of an effective fire control system on the platform was obviously something that required an immediate solution as the platform needed to commence operations. As an interim measure, the oil company was forced to station fireboats around the platform at considerable cost.

The need to provide an effective solution was obviously pressing from both a safety and financial point-of-view. As acknowledged specialists in filtration systems within the Oil & Gas Industry, GFSA was approached to propose a permanent solution.

The Challenge

The initial analysis was undertaken by GFSA's Technical and Engineering departments. Within a few days they had identified the problem. It was discovered that the primary issue was not actually with the filtration equipment, as originally thought.

Analysis of the flow rates and volumes delivered by the main pipework from the seawater intake pumps to the various topside systems proved that they were of insufficient size to deliver the required flow and pressure.

GFSA's calculations demonstrated that the pipework diameter required, if using conventional filtration, was at least 20" nb but the platform had been constructed with 18" nb diameter pipework.

The challenge, therefore, was to design and manufacture a bespoke filtration system, that could work within the existing pipework while delivering minimal pressure loss.

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The Solution

If the pipework had been of the required size, then the existing filtration system would have been more than adequate. It was the most efficient available and delivered the lowest pressure differential available at the time.

In less than 7 days, the team at GFSA designed a completely new type of filter supported by drawings and calculations, which demonstrated that it would provide an effective solution – much to the delight of the client. The new filter design would work by controlling the directional flow of the seawater as it passed through the filter.

The calculations looked impressive but the stakes involved were high, so a prototype was commissioned to test for flow and pressure -drop (see Figure 2). The prototype was on site at a facility in Norway within 4 weeks and an extraordinary test sequence was initiated.

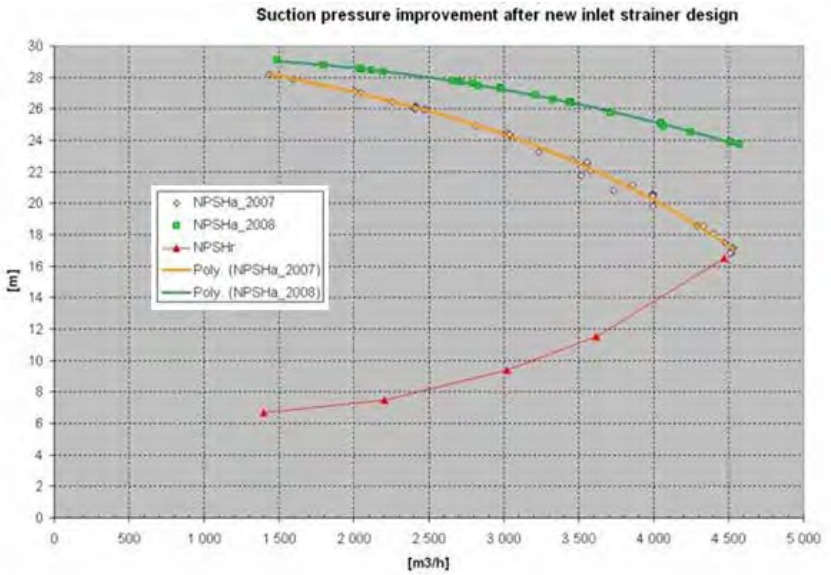

Figure 1: Detailed calculations proved that the new design would work

Figure 2: The Prototype used to test for flow and pressure drop performance

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The Result

After almost an hour of testing at full flow conditions, virtually no pressure-drop was recorded by the differential pressure instrumentation (less than 0.8m head). At that point it was decided to stop the test to check the instrumentation for malfunction and calibration. The instrumentation was found to be working perfectly. Following further running with similar results the client's test team decided to stop the test again so they could open the unit and check for damage to the filter element. One member commented, "Let's check to see if there is anything inside this unit, maybe they forgot to fit the filter element!".

Figure 3 shows the filter element that was removed, clearly showing that not only was it in place but it was working very effectively.

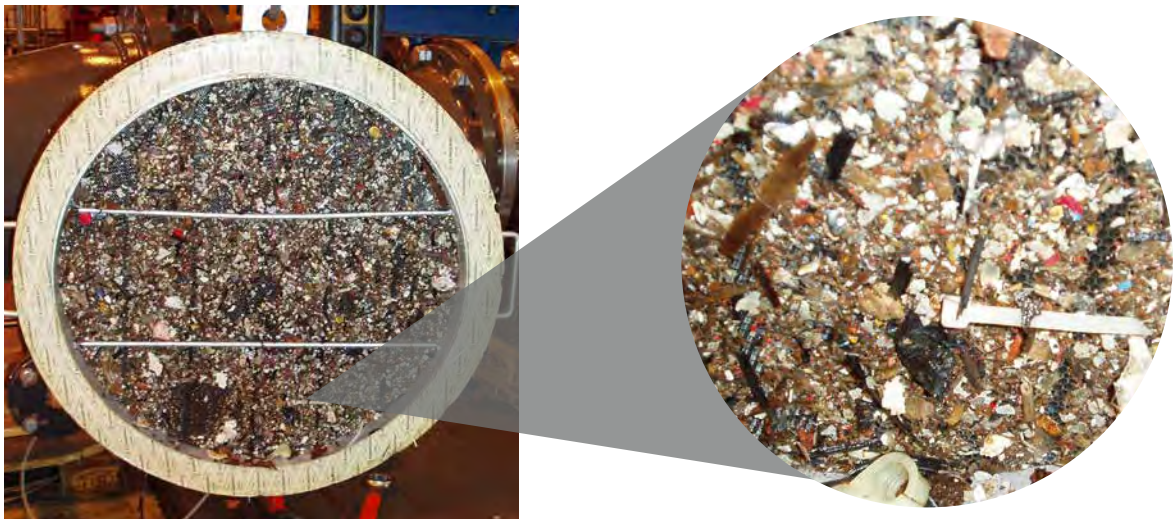

Figure 3: Filter element from the prototype

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The Result

The remarkable results led the test team to experiment by blocking off first 60% of the filtration area (Figure 4), then 80% (Figure 5) and although the pressure differential increased each time it was still within the required parameters.

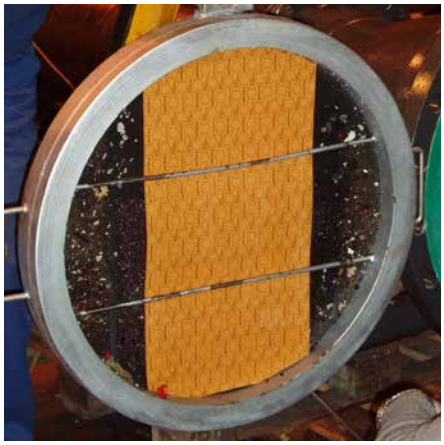

Figure 4: 60% of filtration area covered

Figure 5: 80% of filtration area covered

Finally, the team decided to carry out a filter element collapse pressure test by blanking off 100% of the filter area before applying flow-plus pressure to one side of the filter. The filter element withstood the build-up of pressure to 5 Bar.g before it failed. Even at 5 Bar.g differential pressure there was minimal damage to the element and although deformed it was relatively intact and held within the housing. The client's requirement was for just 3 Bar.g but subsequent modifications to the design by GFSA raised the collapse pressure to over 10 Bar.g.

On completion of the tests the oil company immediately ordered four 18" nb units which were all manufactured in Grade 2 Titanium to NORSOK standards.

This filter design has since been used on a recently commissioned FPSO with a similar firewater filtration issue. On that occasion, four 20" nb units were manufactured in Super Duplex (UNS S32760) Stainless Steel to NORSOK standards in just 10 weeks from the initial enquiry.

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About GFSA

GFSA specialises in the design and manufacture of customised, high integrity filters, strainers and flame arresters in carbon steel, stainless steel, duplex, titanium and many other exotic alloys. Established in the UK in 1997 we have become a leading supplier to the oil and gas, petrochemical, power generation, water and process industries world-wide.

In addition to GFSA's core range of filters, strainers and flame arresters, we also manufacture a variety of related process equipment, including hydro-cyclones, stripping columns, heater vessels, pig launchers and receivers, tanks and pipework manifolds. This equipment can be supplied either as single units or as fully assembled skid packages.

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