

Chemical cleaning: Self-clean filtration for nuclear submarines

Large nuclear submarines in the UK needed an efficient, fully-automated system to strain sea-creatures from their cleaning materials. Oxford Filtration developed a self-clean filter which used specially-designed wiper blades to do the job.

Most large submarines are propelled by means of a nuclear reactor which uses a steam turbine to drive a generator. By removing the requirement for atmospheric oxygen, these submarines can remain submerged indefinitely.

Prolonged submersion, however, could put the vessel in contact with seawater for longer. This in turn could lead to additional contamination issues when chemicals are used to remove organic matter from the submarine's systems.

Finding the ideal strainer

Oxford Filtration Limited, based in Windsor, UK, were asked to provide filtration for a propriety de-scaling solution based on 10% hydrogen chloride diluted 50:50 with fresh water, which is being used to clean heat exchangers aboard HM Navy nuclear submarines. The hydrogen chloride is used to remove vertebrates, mainly mussels, and other organic matter along with with scaling. After circulation of the chemical, the shells and scaling are dissolved, and the remains of the vertebrates are mixed with sea grass.

Whilst Oxford have supplied strainers for virtually all fluid duties in the past, this was a new opportunity for this strainer specialist and discussions as to the ideal strainer style were held. Options suggested by the company included Simplex or Duplex basket strainers, wiper blade style or backwash self clean filters. After initial discussions, the company decided to use a wiper blade style self clean filter, in which specially designed wiper style

blades rotate around the outside surface of a contoured stainless steel screen to remove debris from the fluid.

In this instance, the self-cleaning filter would need to be fully automated, featuring a drive motor/gearbox, differential pressure switch, auto drain valve and a control panel. When the screen becomes contaminated and solids have built up, the differential pressure rises and this signal or the timer activates the cleaning cycle. After a preset time period the unit returns to its clean state, and should exceptional circumstances demand it, the cleaning cycle would continue. After a certain time period, or when the cleaning cycle has occurred for a preset number of times and the dirt content has build up inside the filter bowl, then the auto valve would open for a preset time. The control panel variables can enable the filter unit to be operated in the most efficient manner for the duty so enabling continuous filtration of the fluid with minimal loss of fluid with the contaminants.

Filtering variable contaminants

In the submarines, the duty flow can be up to 120 m³/hr. Because the contamination of the chemical is variable – including shells and organic matter – and can be fibrous in nature, Oxford Filtration decided to run initial trials of their filters using a DN80 3 inch standard design self cleaner (OXLPS80F), with T-port connections. It was then decided that the pipe work configuration, the ability to easily remove the filter element and wiper blades, and the paddle arrangement of the LPH

model would an ideal solution. The solids loading also dictated the need to increase the size of the unit to suit DN100 4 inch pipe work (OXLPHS100F), along with the parallel duplex arrangement to give increased surface area. The unit was fully automated, and was operated by both a timed and pressure differential controller. The screen used has a 200 micron slot opening, and all wetted parts are stainless steel. As part of the pre-filtration a DN100 Duplex basket strainer was also fitted to remove larger particles prior to the inlet of the self clean filter.

After the initial trials, the unit has proven to be a great success, operating under arduous conditions, the company says. Oxford Filtration manufactures and supplies a comprehensive range of strainers and self cleaning filters for virtually any fluid duty. The wiper blade style self clean filter often removes the need for, or extends the life of filters which use disposable media saving or at least reducing the cost of the actual disposable filter and the labour to maintain it, the company claims. Whilst the application above used a wiper style self clean filter (which can be used on virtually any fluid type including water, oil, paint, resins, adhesives), for larger quantities of water a backwash filter is often used. ●

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