FEA of High-Pressure Air Bottle

Chesterfield Special Cylinders required some modifications to an existing wide-neck cylinder flanged adaptor. Wilde undertook Finite Element Analysis to assess the viability of various options to achieve this objective.

Company

Chesterfield Special Cylinders Ltd is world-leading provider of bespoke, high-pressure gas containing solutions. Based in Sheffield, it was established more than a century ago, and specialises in the design and manufacture of cylinders.

Additionally, it offers re-testing and refurbishment services on existing vessels. The company has major clients across the global energy and defence markets.

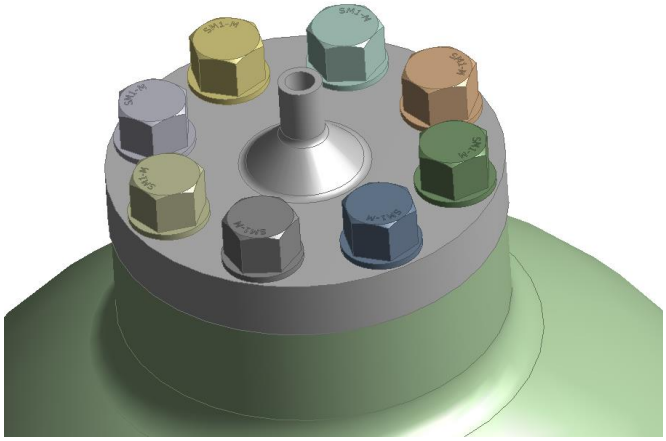

Fig. 1: HP air bottle flanged adaptor (Courtesy: Chesterfield Special Cylinders)

Challenge

On an existing wide-neck cylinder, a flanged adaptor is attached using 8 bolts. Removal of these bolts resulted in some of the threads stripping. As part of the refurbishment, it was proposed to use slightly larger bolts where the existing bolts have failed.

However, to minimise the changes to the current design to accommodate these larger bolts, an alternative was to use studs. This would mean that only the tapped holes in the cylinder would need to be modified. An additional concern related to both the selection of material and a geometric feature in the mating face with the vessel.

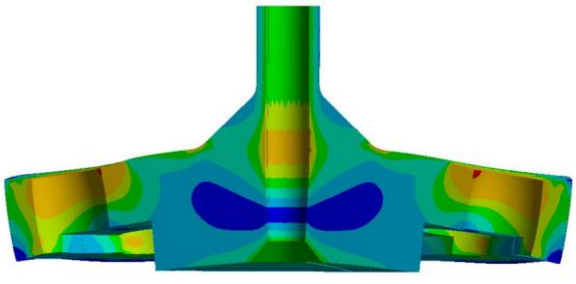

Fig. 3: Stress plot of flange with bolt preload applied (Courtesy: Chesterfield Special Cylinders)

Solution

Finite element methods were used to substantiate the structural integrity of the existing design of the flanged adaptor. Stresses were calculated and compared to the different material's yield strength to determine the suitability of each choice and the effect of increasing the bolt-hole diameters.

Business Benefits

> "This was a key project we had originally planned to do in-house, but our internal resources were pushed to the limit. So, we asked Wilde to complete it at very short notice. They responded immediately and **completed everything very quickly**, with minimal input from us. They were **the perfect solution**, and provided **excellent value for money** compared to other companies we have used.