

ABSTRACT

A surge tank is an essential component in water injection systems in the oil and gas industry, serving as a temporary storage unit to maintain stable fluid flow before the injection process. The structural reliability of a surge tank depends on the proper design of the shell thickness to withstand hydrostatic pressure during operation. This study aims to design a 600 m³ shell surge tank based on the API 650 standard using the One-Foot Method, analyze its structural response through Finite Element Analysis (FEA), and evaluate its fatigue life and corrosion service life. Two shell course configurations were compared: Model A with four shell courses and Model B with three shell courses. The design results indicate that both models satisfy the API 650 requirements. Under the minimum required thickness (t_{min}) condition, the maximum von Mises stresses were 77,37 MPa and 77,41 MPa, while the maximum displacements were 1,636 mm and 1,639 mm for Models A and B, respectively. After considering the reduction in shell thickness due to corrosion allowance ($t_{min} - CA$), the maximum stresses increased to 154,2 MPa for Model A and 143,3 MPa for Model B, whereas the minimum safety factors decreased to 1,621 and 1,745, respectively. Both models remained within the allowable safety limits. The fatigue analysis indicated an Infinite Life for both models, with an estimated corrosion service life of 39,69 years. Based on the comparative results, Model B exhibited lower stress, smaller displacement, and a higher safety factor after considering corrosion effects, making it the more optimal shell configuration for the design of a 600 m³ surge tank.

Keywords: Tank, API 650, Hydrostatic, Shell

INTISARI

Surge tank merupakan komponen penting pada sistem *water injection* di industri minyak dan gas yang berfungsi sebagai penampung sementara untuk menjaga kestabilan aliran fluida sebelum proses injeksi. Keandalan struktur *surge tank* dipengaruhi oleh ketepatan perancangan ketebalan *shell* agar mampu menahan tekanan hidrostatik selama masa operasi. Penelitian ini bertujuan merancang *shell surge tank* kapasitas 600 m³ berdasarkan standar API 650 menggunakan metode *One-Foot Method*, menganalisis respons struktur dengan *Finite Element Analysis* (FEA), serta mengevaluasi *fatigue life* dan *corrosion service life*. Dua konfigurasi *shell course* dibandingkan, yaitu Model A (empat *shell course*) dan Model B (tiga *shell course*). Hasil perancangan menunjukkan bahwa kedua model memenuhi persyaratan. Pada kondisi ketebalan minimum (*t_{min}*), tegangan maksimum masing-masing sebesar 77,37 MPa dan 77,41 MPa dengan *displacement* maksimum 1,636 mm dan 1,639 mm. Setelah mempertimbangkan pengurangan ketebalan akibat *corrosion allowance* (*t_{min}* – CA), tegangan maksimum meningkat menjadi 154,2 MPa pada Model A dan 143,3 MPa pada Model B, sedangkan *safety factor* menurun menjadi 1,621 dan 1,745, namun keduanya masih berada pada kondisi aman. Hasil analisis menunjukkan kedua model memiliki kategori *Infinite Life* dengan estimasi *corrosion service life* selama 39,69 tahun. Berdasarkan hasil perbandingan, Model B memberikan distribusi tegangan yang lebih rendah, *displacement* yang lebih kecil, dan *safety factor* yang lebih tinggi setelah mempertimbangkan korosi, sehingga direkomendasikan sebagai konfigurasi *shell* yang lebih optimum untuk surge tank kapasitas 600 m³.

Kata kunci: Tangki, API 650, Hidrostatik, *Shell*