

INTISARI

Strainer pada sistem pelumasan *turbocharger* lokomotif diesel elektrik CC201 dan CC206 berfungsi untuk menyaring partikel kontaminan akibat kerusakan gasket Victaulic, namun keberadaannya menimbulkan penurunan tekanan (*Pressure drop*) yang berpotensi mengurangi suplai pelumasan menuju *turbocharger*. Penelitian ini bertujuan untuk menganalisis pengaruh *strainer* terhadap *Pressure drop* pada sistem pelumasan *turbocharger* menggunakan simulasi *Computational Fluid Dynamics* (CFD), serta melakukan optimasi desain *strainer* untuk menurunkan *Pressure drop* tersebut. Simulasi dilakukan pada dua kondisi operasi, yaitu *idle* dan *full speed*, dengan model aliran laminar. Validasi model CFD terhadap perhitungan analitis Darcy–Weisbach menghasilkan kesalahan relatif sebesar 18,4%. Hasil simulasi pada *strainer eksisting* menunjukkan bahwa *strainer* panjang dengan *Open Area Ratio* (OAR) 12,9% menghasilkan *Pressure drop* yang lebih rendah dibandingkan *strainer* pendek dengan OAR 6,33%, baik pada kondisi *idle* (7,9434 psi berbanding 21,5187 psi) maupun *full speed* (29,7966 psi berbanding 87,2234 psi). Optimasi desain dilakukan dengan meningkatkan nilai OAR melalui modifikasi jumlah lubang, pitch, dan perubahan geometri dari silinder menjadi cone. Hasil optimasi menunjukkan bahwa peningkatan OAR berbanding terbalik dengan *Pressure drop*, dengan titik diminishing return pada OAR di atas 23,91%. Desain optimum diperoleh pada Variasi 1 dengan OAR 32,92%, jumlah lubang 673, dan geometri cone, yang menghasilkan *Pressure drop* sebesar 2,1766 psi pada kondisi *idle* dan 6,6213 psi pada kondisi *full speed*. Dibandingkan *strainer* panjang eksisting, desain optimum tersebut berhasil menurunkan *Pressure drop* sebesar -72,6% pada kondisi *idle* dan -77,78% pada kondisi *full speed*, sehingga memenuhi target penurunan *Pressure drop* yang ditetapkan sebesar $\geq 60\%$ pada kedua kondisi operasi.

Kata kunci: *Pressure drop*, *strainer*, *Open Area Ratio* (OAR), *Computational Fluid Dynamics* (CFD), optimasi desain, *turbocharger* lokomotif.

ABSTRACT

The strainer in the lubrication system of CC201 and CC206 diesel-electric locomotive turbochargers functions to filter contaminant particles resulting from Victaulic gasket failure. However, its presence causes a Pressure drop that may reduce the lubrication supply to the turbocharger. This study aims to analyze the effect of the strainer on Pressure drop in the turbocharger lubrication system using Computational Fluid Dynamics (CFD) simulation, as well as to optimize the strainer design to reduce the resulting Pressure drop. Simulations were conducted under two operating conditions, idle and full speed, using a laminar flow model. Validation of the CFD model against the Darcy–Weisbach analytical calculation resulted in a relative error of 18.4%. Simulation results on the existing strainers showed that the long strainer, with an Open Area Ratio (OAR) of 12.9%, produced a lower Pressure drop than the short strainer with an OAR of 6.33%, both under idle conditions (7.9434 psi versus 21.5187 psi) and full speed conditions (29.7966 psi versus 87.2234 psi). Design optimization was carried out by increasing the OAR value through modification of the number of holes, pitch, and a geometric change from cylindrical to conical shape. The optimization results showed that increasing OAR is inversely proportional to Pressure drop, with a diminishing return point observed above an OAR of 23.91%. The optimum design was obtained in Variation 1, with an OAR of 32.92%, 673 holes, and a conical geometry, which produced a Pressure drop of 2.1766 psi under idle conditions and 6.6213 psi under full speed conditions. Compared to the existing long strainer, the optimum design successfully reduced the Pressure drop by -72.6% under idle conditions and -77.78% under full speed conditions, thereby meeting the target Pressure drop reduction of $\geq 60\%$ under both operating conditions.

Keywords: Pressure drop, strainer, Open Area Ratio (OAR), Computational Fluid Dynamics (CFD), design optimization, locomotive turbocharger.