
A new method for optimum selection of two-stage turbocharger for heavy duty diesel engine

Sepehr Sanaye*,

Shahram Sedghi Ghadikolaee

and Seyed Ahmad Akbari Moghadam

School of Mechanical Engineering,
Director of Energy Systems Improvement
Laboratory, Iran University of Science and
Technology, Narmak, Tehran, 16844 Iran
Email: sepehr@iust.ac.ir
Email: shsedghi@iust.ac.ir
Email: ahmad_akbari@mecheng.iust.ac.ir

*Corresponding author

Abstract: For selecting an optimum two-stage turbocharger, a new approach is proposed here which uses thermodynamic and turbomachinery modelling, genetic algorithm (GA) optimisation technique and GT-Power software. In the primary step, the optimum high pressure (HP) and low pressure (LP) turbochargers were selected by minimising an objective function (the sum of losses in compressors and turbines). Design parameters in the optimisation procedure were geometrical and aerodynamic parameters of compressors and turbines. The final step consisted of adding control valves to achieve the optimal engine performance at various engine speeds. In this step, brake specific fuel consumption (bsfc) was the objective function which was minimised. Design parameters in final step were mass flow multipliers of HP and LP compressors and turbines, flow control valve positions and fuel injection mass flow rate. Based on the results of optimum value of design parameters in the final step, HP and LP turbochargers were reselected with 9.2% increase in brake power and 2.4% decrease in bsfc as the mean values in comparison with a single-stage turbocharger for a specific studied engine.