

## **Development of evaporative intercooler heat exchanger for vehicle charge air enhancement using CFD simulation**

### **ABSTRACT**

Nowadays, the concern of vehicle manufacturers towards improving engine performance, reducing fuel consumption and exhaust emissions that can cause the pollution of the atmosphere, concerns of strict emission pollution control regulations. Intercooler heat exchanger devices are used for engine charge air temperature improving for engine performance and emissions reduction. This paper introduces a new add-on technology of intercooler heat exchanger-(IHE) developed for utilizing in intake charge air density enhancement in engine combustion for better performance. Presenting a challenge in contributing a framework process for geometry designing development procedure for accurate and reliable scale design size of an air-vapour gas shell-and-tube IHE type, used refrigerant coolant medium. The process presents effective IHE in design time consumption, accurate in scale with higher performance and reliability operation in all environment weather due to reversibility system. A selected design geometry of 60 bunches of tubes with 7.53 mm inner diameter and 150 mm long placed. Effectiveness and design parameter geometry calculation are conditions of the IHE dependent relations of the shell size to tube length in condition of engine space availability control. Pressure drop and cooling capacity of IHE configuration design are proportional to the availability of design space or pressure drop control by the engine. Numerical and simulation results expressed a significant ability of IHE of 2–13 kW cooling load and process applicability for qualified design geometry configuration for selected IHE type. The developments present significant geometry flexibility design with the ability of cooling load or heating effect if reversible system, which offered multipurpose use in widely all vehicle types.

**Keyword:** Heat transfer; Intercooler; Shell-and-tube; Evaporative heat exchanger; Charge air