



IMPACT PAPER

Thermal Analysis Partners optimizes coil design to reduce manufacturing costs by 10% or increase heat capacity by 7%.

The Customer- YORK International Corporation is a global provider of heating, ventilating, air conditioning and refrigeration (HVAC&R) products and services. YORK is the largest independent supplier of HVAC&R equipment in the United States and a leading competitor in the industry internationally. YORK engaged Thermal Analysis Partners (TAP) to provide software and services to optimize the design of one of its existing condensing units.

The Challenge - The current design objectives were based on the requirements specified by the manufacturer of the condensing unit and comprised of both economic and performance related objectives. The economic parameters considered here are the cost of the coil, fans, fan motors and housing which is a function of the number of tubes in the condenser, the fins per inch (FPI), number of fans, type and drives, the width and height of the coil and the housing. The performance parameter was the heat rejection capacity of the condensing unit, for given air and refrigerant inlet conditions. It is important to mention here that both objectives are equally important and conflicting (reduced cost usually leads to lower heat rejection capacity and vice versa). The ultimate solution was affected by multiple design constraints. Items that needed to be considered include:

- Refrigerant Pressure Drop must stay within specified limits
- Fan width vs tube length
- Coil height could not increase
- Tube Length could not increase
- Air side pressure drop
- Various domain constraints where upper and lower boundaries can not be exceeded

The Design and Optimization Method – TAP began solving the problem by modeling the existing coil design in its proprietary coil design software, HXDesigner. The software was tuned to match the coil performance test data. We then used proprietary Multi Objective Genetic Algorithms to intelligently search for condensing units that met all performance constraints and showed reduced cost and/or improved heat rejection capacities.

Our Impact – Using its HXDesigner software to design, simulate and optimize performance, TAP was able to provide manufacturing optimization recommendations that provided an average of 10% cost reduction(for the same performance) OR 7% increase in performance (for the same cost). This study was performed for an existing condensing unit and under direct consideration of the manufacturer’s tooling capabilities and therefore bound by its inherent constraints. Using HXDesigner earlier in the product development cycle may provide even greater benefit. Moreover, multiple options along the “trade-off curve” (Pareto Curve) were presented to YORK to provide maximum flexibility to the decision maker/designers.

About Thermal Analysis Partners - Thermal Analysis Partners’ (TAP) offers software and services for the design, simulation and optimization of thermal management and energy conversion systems. Using our products our customers minimize product development, manufacturing and operating costs as well as system weight and volume while maximizing reliability and efficiency. The expertise and capabilities of TAP are based on the experience and software tools resulting from research conducted at the University of Maryland’s Center for Environmental Energy Engineering (CEEE). TAP’s customers include many of the industries largest manufacturers and represent businesses on three continents.