

UNC Charlotte – Lee College of Engineering Senior Design Program

Senior Design Project Description

Company Name	<i>Carrier Corporation</i>	Date Submitted	<i>05/09/2019</i>
Project Title	<i>Development of water mist system for Evaporative cooling in Chiller Application</i> CARR_MIST	Planned Starting Semester	<i>Fall 2019</i>

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	2
Computer		Systems	
Other ()			

Company and Project Overview:

Carrier is a world leader in high-technology heating, air-conditioning and refrigeration solutions. Carrier is a part of UTC Climate, Controls & Security, a unit of United Technologies Corp., a leading provider to the aerospace and building systems industries worldwide.

Built on Willis Carrier’s invention of modern air conditioning in 1902, Carrier is a global leader in heating, air-conditioning and refrigeration solutions. In addition to the familiar residential products, Carrier has a vast array of heavy capacity commercial products for buildings and hi-rises of all types. These sophisticated units contain a wide variety of technologies including air handlers, air/water chillers, sensors and building automation controls.

The 9701 Old Statesville Rd Charlotte NC Carrier facility contains design engineering, test engineering and manufacturing operations. Some product examples are shown below:



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Project Requirements:

Evaporative cooling is a means for lowering the ambient temperature seen by the heat rejecting heat exchangers (condenser) in an air cooled air-conditioning system (Air cooled Chiller in this case) to the wet bulb temperature of the air. This improves the effectiveness of the heat rejecting heat exchangers and the efficiency of the overall system.

Air Cooled Chiller Example:



Evaporative cooling is achieved by spraying a water mist into the air in the vicinity of the condenser coils which is then pulled into the coils by means of induced draft fans. The water mist creating nozzles are optimally sized and spaced, such that the water use and water pump power consumption is minimal and that there is an even distribution of temperature across the coils.



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The project team is required to analyze the energy cost saving by using an evaporative cooling system on an air cooled chiller product. The team and Carrier will agree upon what model will be used as a pilot test and the project will develop guidelines for scaling up or down based on the size of the coil. The team shall then design a water spray system with appropriate nozzle sizing/spacing, water pump sizing and develop controls such that the water use is minimal and the pump are turned on only in conditions where there is a tangible benefit of using it. Additionally the team needs to 1) make sure that their design does not leave water beads on the condenser coils which would lower the reliability of the coils and 2) provide water quality/softness specs and service recommendations. At the end the team needs to demonstrate their design through testing at Carriers fan life testing pad and document and present their work.

1. Study and analyze the air-cooled chiller system to determine the benefit from evaporative cooling. Determine the operating and load conditions where evaporative cooling would be effective.
2. Design the physical hardware which would include a system on nozzles, water pump, sensors, mist strainers, controls etc.
3. Demonstrate the operations of the system through test and live demo.
4. Determine and provide guidelines for water quality/softness for use in the system and service requirements.

Expected Deliverables/Results:

1. A report out of the project either electronically or hard copy
2. Physical system design and benefit analysis
3. The control codes developed.
4. Demonstration of the system

Disposition of Deliverables at the End of the Project:

Hardware developed is the property of the Industry Supporter. Typically the work product is displayed at the last Expo then immediately handed over to the supporter unless arrangements have been made to deliver at a future date. Please confirm your expectation in this section.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Preference given to students that have taken or will be taking MEGR 3214 – Refrigeration and Air Conditioning