



Company Information

Company Name	Ingersoll Rand Company	Date Submitted	05/11/2021
Project Title	Electrostatic Oil Demister for a Rotary Screw Air Compressor (IR_DEMISTER)	Planned Starting Semester	Fall 2021

Senior Design Project Description

Personnel

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

Company and Project Overview:

Ingersoll Rand Company (www.irco.com) is a 160 year old diversified industrial equipment manufacturer, with its global headquarters located in Davidson, NC, USA. Driven by an entrepreneurial spirit and ownership mindset, Ingersoll Rand is committed to helping make life better. We provide innovative and mission-critical industrial, energy, medical and specialty vehicle products and services across 40+ respected brands designed to excel in even the most complex and harsh conditions where downtime is especially costly. Our employees connect to customers for life by delivering proven expertise, productivity and efficiency improvements.

This project will focus on a sub-system within the Ingersoll Rand oil-free rotary (OFR) air compressor (<https://www.ingersollrand.com/en-us/air-compressor/oil-free-air-compressors>). OFR air compressors do not allow oil to be introduced to the compression process, as certain customers cannot tolerate oil of any kind into their process. OFR compressors do however use oil to lubricate various bearing and gear surface, so special care is taken in the machine design to keep all oil from contaminating the compressed air. However air containing oil aerosol mist is vented from within the compressor’s main gear box. Oil mist released into the atmosphere is very undesirable for multiple reasons including: general environmental contamination from oil, recirculation of oil mist to the inlet of the oil-free compressor, oil mist settling on surfaces causing slip or other hazards.

This project will focus on the main gear box oil vapor “breather” sub-system. Currently a coalescing process is used to control and minimize the release of oil mist into the atmosphere. However that system has its limitations and it is known that oil very small liquid oil aerosol particles do escape. It is the desire of this project to replace the current coalescing demister system and employ a more effective electrostatic precipitator system.

Project Requirements:

At the start of the project, Ingersoll Rand will provide a variety of files to help you understand the current demisting sub-system, design requirements of the electrostatic demister, expectation of typical oil particle sizes and concentrations into and out of the demister, and composition of the typical oil used. This information will be used by the team to develop a statement of work and specification for the project.

Expected Deliverables/Results:

- Analytical model of the electrostatic precipitator that given the input types of mist and produce results of the output types of mist with reasonable accuracy (i.e.: $\pm 10\%$ of actual measurements). The model should include thermodynamic analysis and electrostatic coalescence due to the energy of the electrostatic field generated. (*The model may be created in EES, MathCAD, Python, or with prior agreement in other engineering tools. Excel is discouraged but will be accepted, if it is necessary.*)
- Mechanical design with complete 3D CAD models and drawings, sufficient to build the final design, and verification to the product content according to the standards of the specification.
- Electrical design of complete electrical system, including circuit boards, wiring, component specifications, logic diagrams and verification to the electrical standards of the specification.
- A complete bill of material that includes a complete cost roll up of all parts (mechanical and electrical), and source of supply for each part, to build a working prototype. It is desirable to keep the final design material cost less than a target of US\$1,000.00.
- A working prototype that is validated with either an air/oil mist mock-up constructed at UNC Charlotte, or on a real OFR at Ingersoll Rand. All test validation data is required along with a list of test instruments used and the test procedure performed.

Disposition of Deliverables at the End of the Project:

All material purchased for this project, including the prototype and all documentation listed in the “Deliverables” must be provided to Ingersoll Rand after the conclusion of the second Expo.

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

- Electrical & electronic circuit design
- Thermodynamics, fluid flow, heat transfer
- 3D-CAD
- Student team must travel to the Ingersoll Rand site in Davidson, NC.