



High Speed Motor Test Stand

Virtual Design Review 1



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FAMU-FSU COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING

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FAMU-FSU COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING

➤ Danfoss

- Located in Tallahassee, FL
- Designs and builds condensing units, pumps, motors, commercial compressors, and other accessories for HVAC (Heating, Ventilation, and Air Conditioning) applications.
- Utilizes magnetic bearings that allow the shaft in the compressor to rotate at speeds of up to 40,000 rpm

Emily Simmons



Project Brief Summary



Danfoss needs a testing apparatus to determine motor efficiency of their compressors.

The apparatus should be mounted onto a stand.

The apparatus should be safe to operate.

Emily Simmons



Previous Teams' Progress

➤ 2016 Team

- Chose to use second compressor as load
- Focused on shaft alignment and frame design
- Built the Test Stand frame
- Used a dial indicator for alignment
 - 26 μm accuracy
- Bought a coupler for motor shafts
 - Weight of coupler limited maximum speed

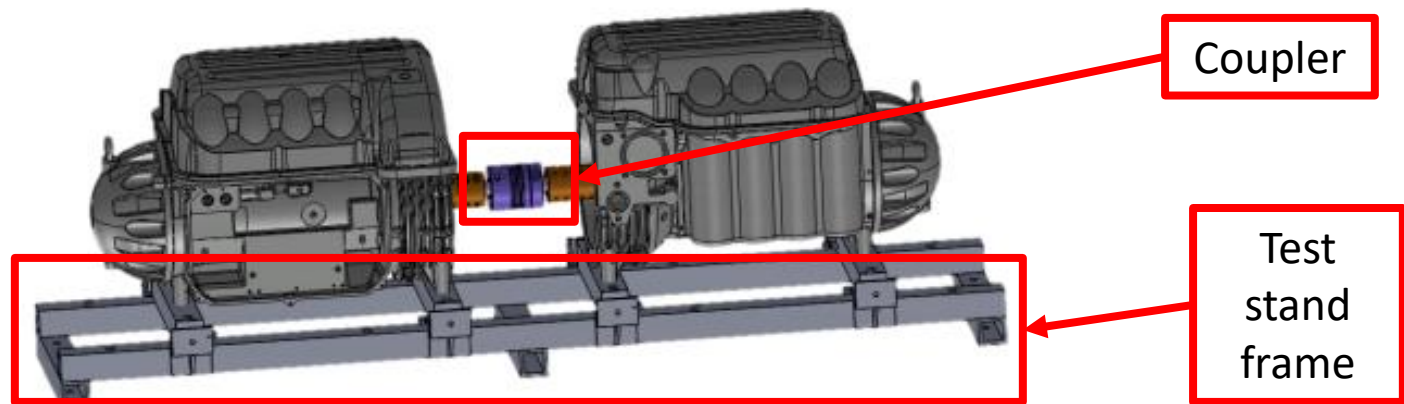


Figure 1: 2016 Team Final Design

Jacob Quigley

Previous Teams' Progress

➤ 2017 Team

- Focused on improving alignment and coupling
- Implemented laser alignment system
 - 5 μm accuracy
- Bought a high speed flexible coupler
- Designed a safety shield

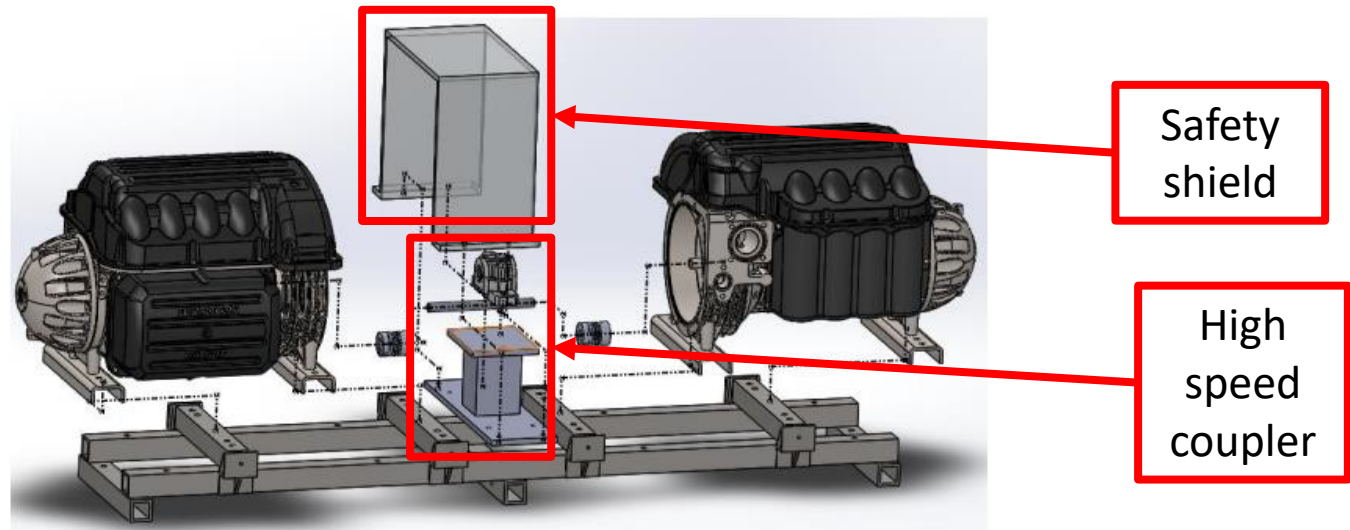


Figure 2: 2017 Team Final Design

Jacob Quigley

➤ Description

- Design a system that can measure motor efficiency at standard operating speeds for various Danfoss TurboCor compressors

➤ Goals

- Determine how to measure output power for efficiency calculations
- Maintain safe operating conditions during testing
- Create system that can be operated efficiently

➤ Market

- Danfoss research and development

Jacob Quigley



Customer Needs



Customer Statement

I would like for the tester to run at our top operating speed of 40,000 rpm.

I don't like the tester being on the floor, but it is too heavy for an ordinary table.

The tester does not have any guarding around it, so the operator is not safe.



Interpreted Need

The system operates at a range of 13,000 to 40,000 rpm.

The tester will have a special stand designed to hold it at an ergonomic operating height.

A safety structure will surround the tester to protect the operator.

Charles Daher



Functional Decomposition



		Main Functions			
		Measure Motor Efficiency	Hold the Weight of Motor Testing System	Protect Operator while Testing	Interface with Testing Software
Sub-Functions	Operate at standard motor speeds	☐			
	Attach safety shield			☐	
	Measures torque with torque transducer	☐			
	Build with appropriate material		☐	☐	
	Add accessible E-stops			☐	
	Maintain stability		☐		
	Prevents operator from handling tester while testing			☐	
	Communicate motor shaft speed to software				☐

Charles Daher



Next Steps for the Project



- Target Catalog
 - Add targets to the project functions
- Target Summary
 - Establish targets
 - Highlight targets that apply to the customer
- Concept Generation
 - Brainstorm ideas
 - Refine ideas

Charles Daher



References

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