
# Senior Design Team 509

## Environment-Controlled Test Stand Chamber

Michael Stoddard, Meghan Fonda, Donald Laughlin, & Dai (Bill) Truong

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# Team Introductions

**Michael Stoddard**
Project Manager &
Validation Engineer

**Meghan Fonda**
Quality and Test Engineer

**Donald Laughlin**
Thermal Fluids Engineer

**Dai (Bill) Truong**
Design Engineer

# Sponsor and Advisor


<u>Sponsor</u>

Jerry Huang

*R&D Engineering Manager*


FAMU-FSU College of Engineering

<u>Academic Advisor</u>

Dorr Campbell, Ph.D.

# Objective

*The objective of this project is to design and construct a temperature and humidity-controlled testing chamber for the TT and TG models of Danfoss Turbocor Compressors.*

# Project Recap

# Danfoss Turbocor Compressors

Refrigerant: HFC134a

**TT Model**

- Can operate under standard water cooled and low lift chiller operation or at high lift for air cooled or heat recovery operation
- 788mm x 518mm x 487mm
- Capacity ranging from 60 tons/200 kW to 200 tons/700 kW

Refrigerant: HFO-1234ze

**TG Model**

- Can operate under standard water cooled and low lift chiller operation or at high lift for air cooled or heat recovery operation
- 788mm x 518mm x 487mm
- Capacity ranging from 40 tons/140 kW to 150 tons/540 kW

# Project Scope

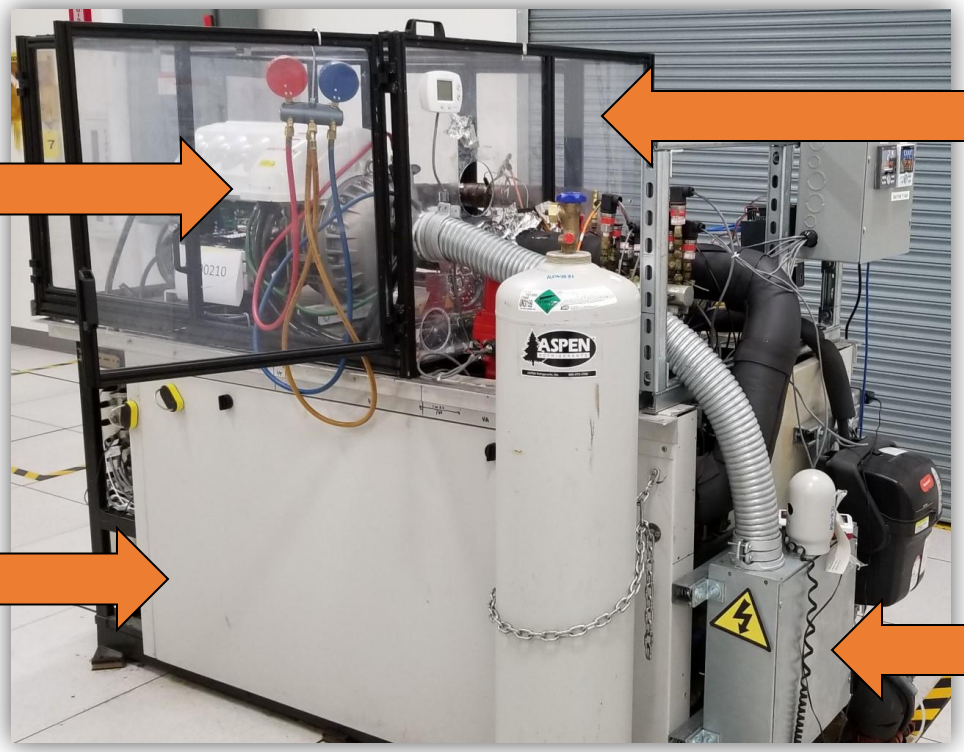
## Goals

- Achieve a temperature range of 16 to 55°C (adjusted)
- Maintain a reasonable humidity range (10 to 90%)
- Keep lab personnel safe throughout the testing procedure
- Easy to assemble and disassemble

## Assumptions

- Dimensions of compressors being tested inside the chamber are constant
- Device will be used inside a Danfoss facility
- Power comes from the testing rig
- The chamber will sit atop the rig
- The College of Engineering will provide some machining services

# The Current Chamber



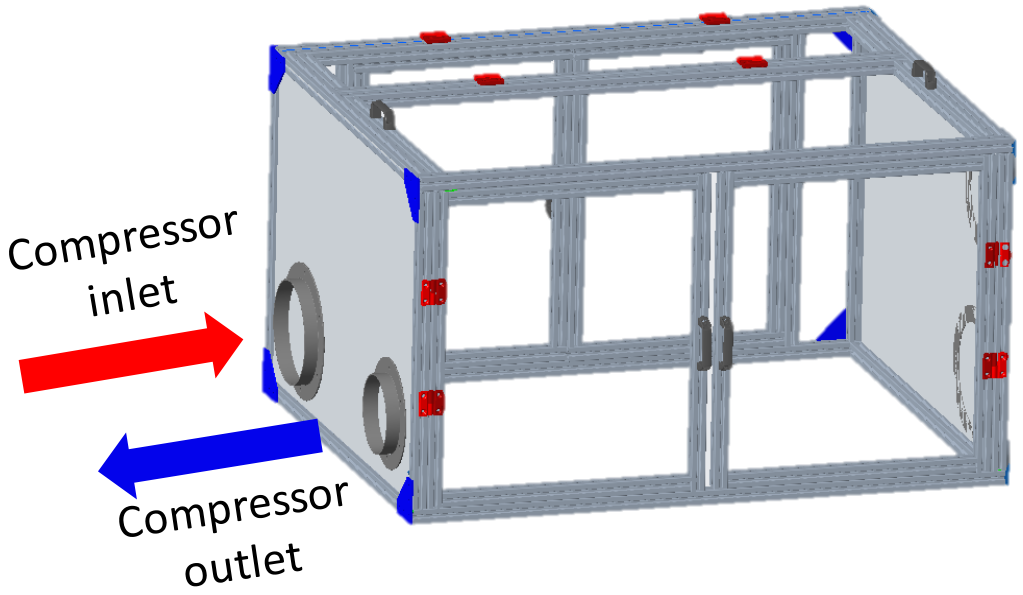
# Our Design

# The Chamber

**Key:**

**Hinges**

**Brackets**




Roof folds back all the way with 270° range of motion

Doors open 180°

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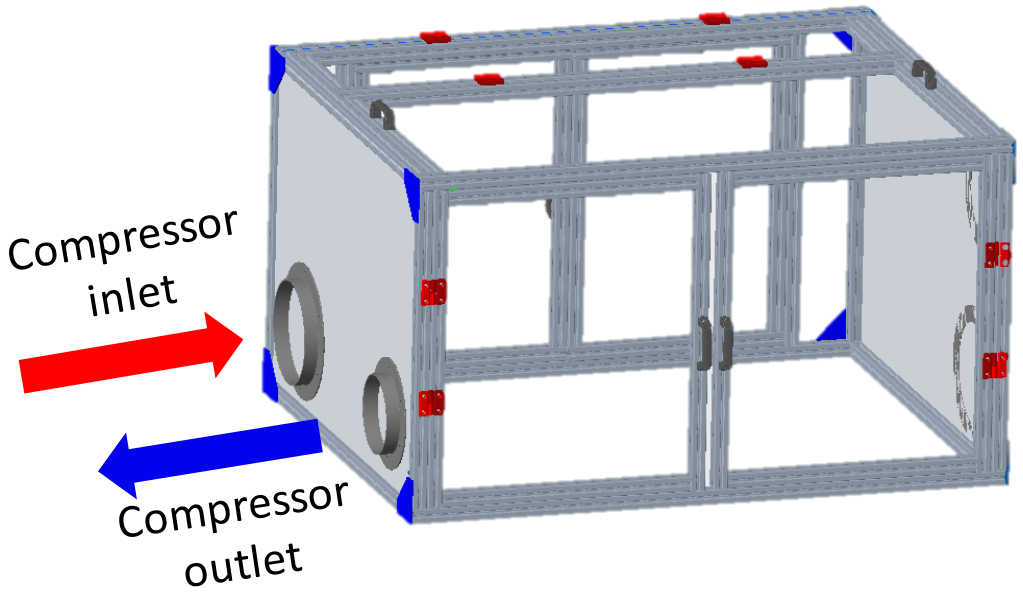
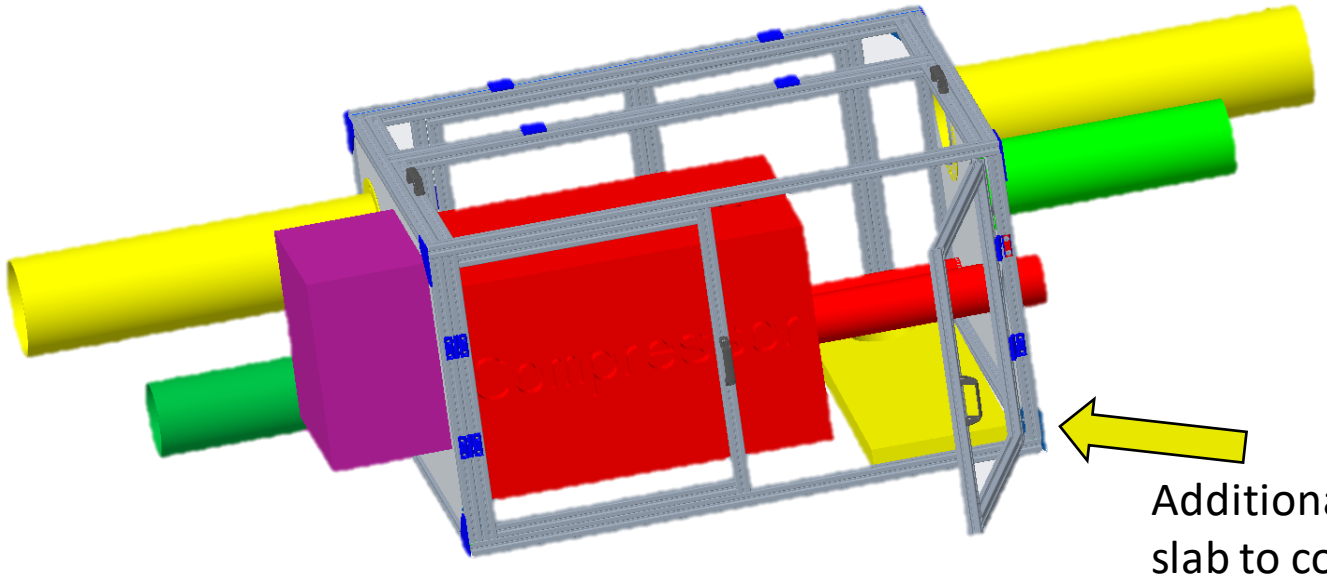



Roof folds back all the way with 270° range of motion

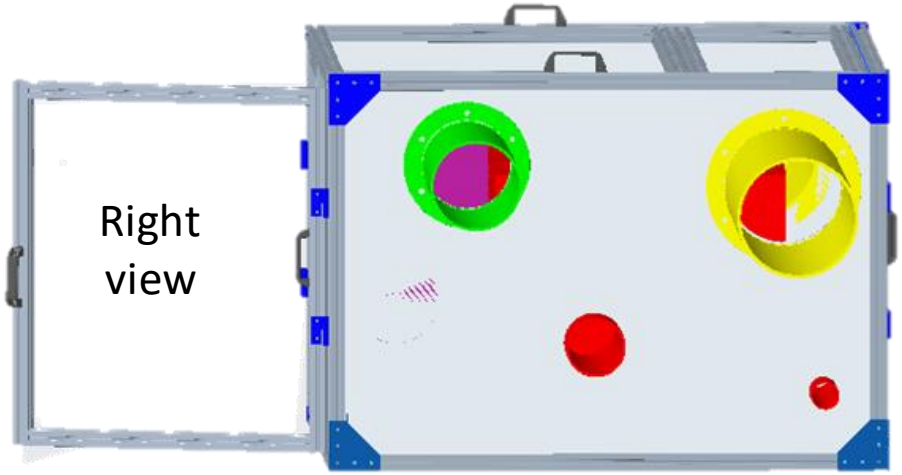
Doors open 180°

Allows better access for both the crane and operator

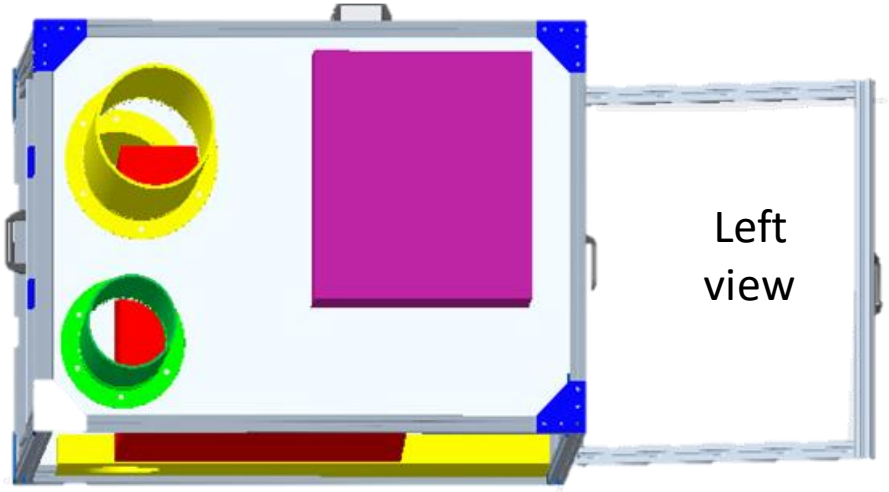



Additional metal slab to cover gap below chamber

- **Compressor**
- **Humidifier**
- **AC Inlet and outlet**
- **Dehumidifier inlet and outlet**



Right view



Left view

# Our Systems

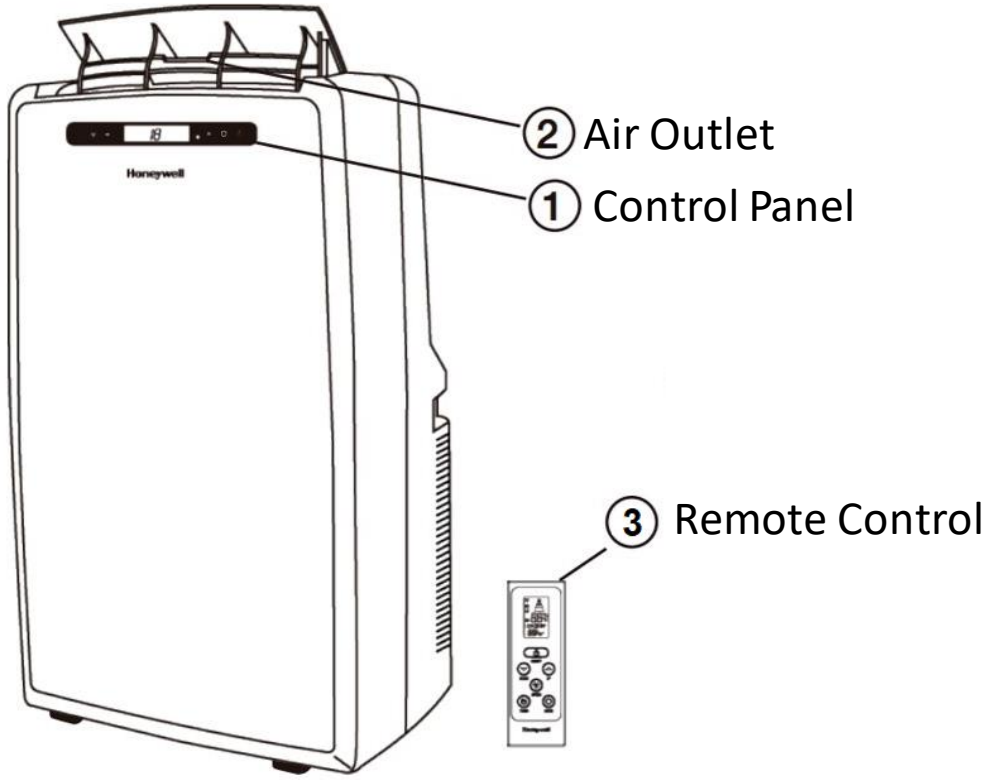
1. Air Conditioning Unit
2. Heating Element
3. Humidifier
4. Dehumidifier

# Honeywell Air Conditioner

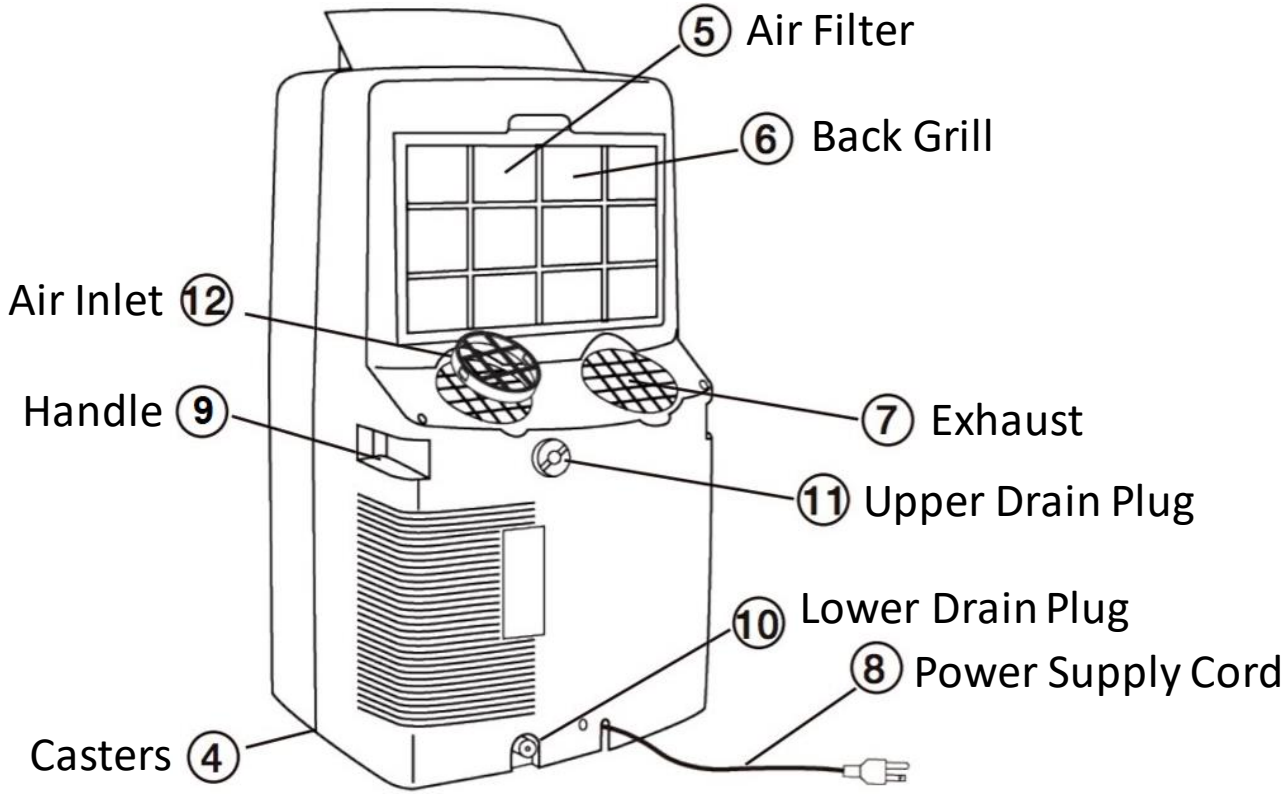
**$659.95**

- 14,000 BTU cooling capacity
  - Calculated 4500 BTU needed for cooling
  - Exceeds cooling capacity requirements by a factor of 3
  - Cools chamber in ~10 minutes, exceeding the max cooling requirement of 30 minutes
- Four modes:
  - Cooling Mode
  - Heating Mode (Max temperature of 26°C)
  - Fan-Only Mode
  - Dehumidifier Mode (up to 90 pints a day)

# Honeywell Air Conditioner Front View



# Honeywell Air Conditioner Back View



# HE200 TrueEASE 17 Gallon Basic Bypass Evaporative Humidifier

**$365.64**

- 17 gallons/day capacity
- ¼" water supply line
- Compatible with Honeywell humidistat controller

# Honeywell Pint Dehumidifier With Built in Drain Pump

**$339.95**

- 70 pints/day dehumidifying capacity
- Built-in auto-drain pump
- 182 CFM
- Built-in humidistat control system


# HumidiPRO Digital Humidistat Controller

## $60.89

- Our current solution for humidity control
- Manual humidification control
- Manual dehumidification control
- Adjustable high and low range stops (10-90%)
- Compatible with the selected Honeywell humidifier and dehumidifier

# Temperature Control System

- Need to first integrate the AC/heating unit with the additional heater
- Need to select from 3 different types of sensors
  - Pt sensor
  - Thermocouple
  - Thermistor
- We are currently working to find the best solution for a central control system, incorporating both temperature and humidity elements

# 5 Most Important Points

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5. We plan to select the additional heater and dehumidifier in order to have all ordering completed by the end of the month.

# References


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# Questions?