ENGINEERING TOMORROW

VTT Rotor: Back EMF Test Fixture Interim Design Review

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Date: 3/19/2015

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Presentation Outline

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- Background and Motivation
- Design Challenges
- Animated Prototype
- Current Status and Look Ahead
- Manufacturing Challenges
- Testing
- Final Goal
- Conclusion/Future Work

Motivation and Goal

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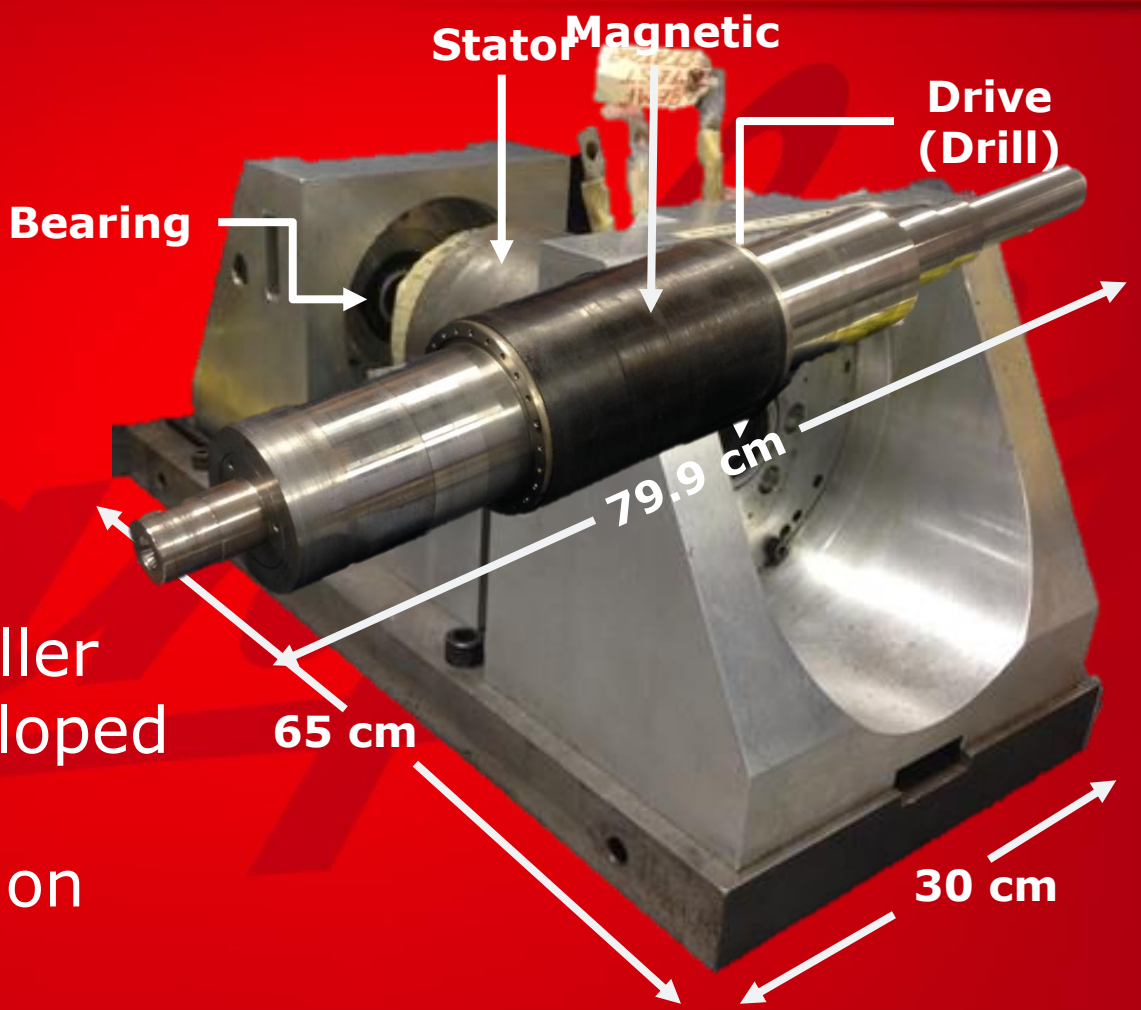
- Need test fixture to qualify rotors
- Will measure back electromotive force (EMF)
- Test fixture for smaller rotors already developed
- Several constraints on design



Design Challenges

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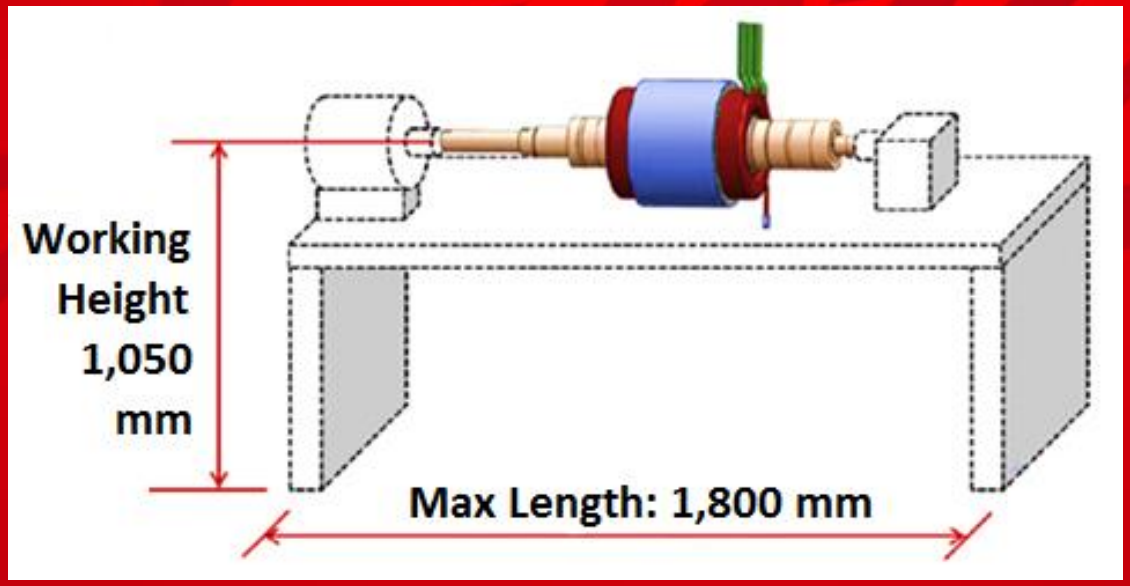
- Overcoming magnetic force of 60-80 pounds
- Centering rotor within stator
  - Deviations in the height of components will compromise validity of quality tests
- Spatial Constraints:



Final Prototype

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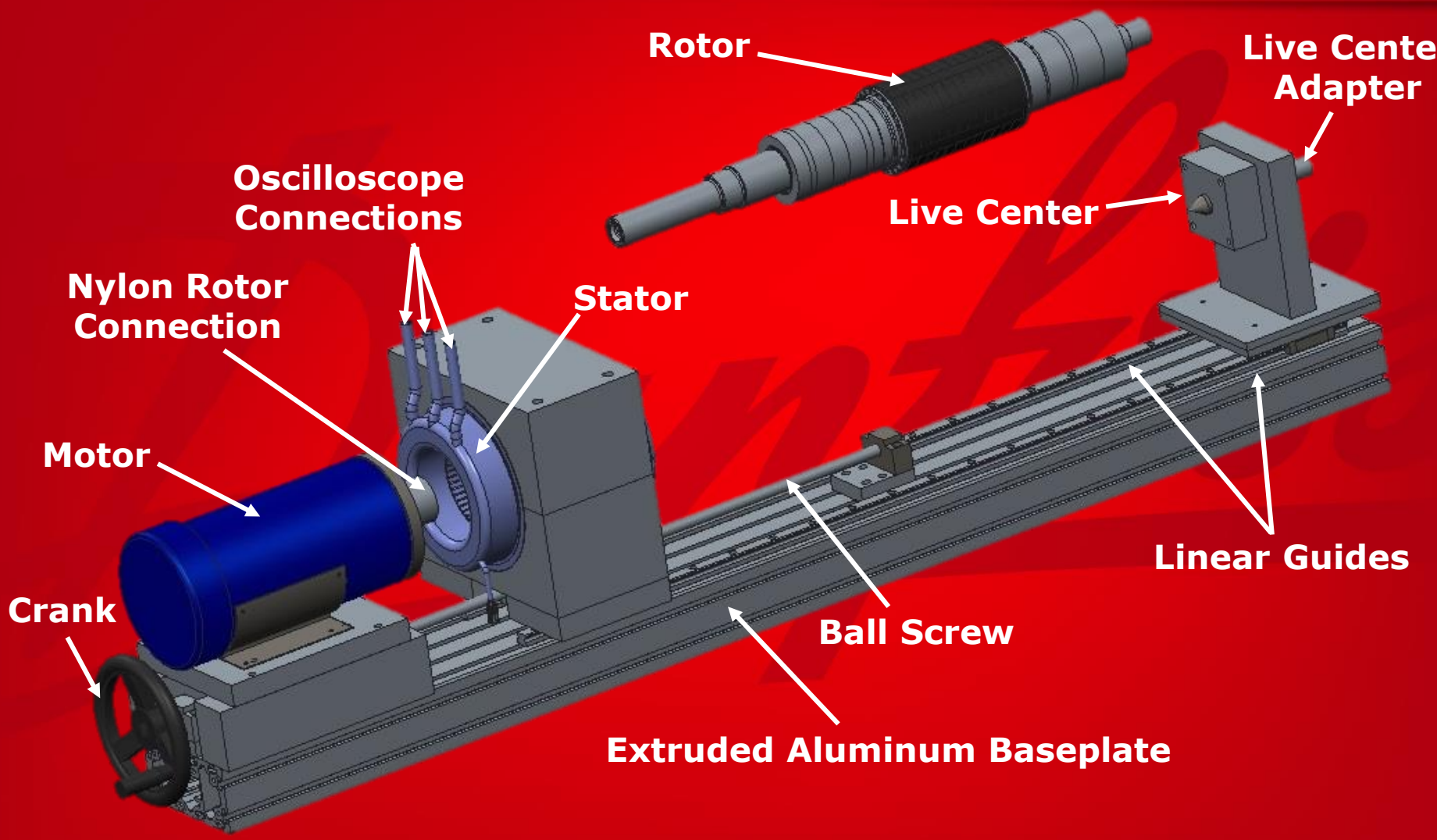

Final Prototype

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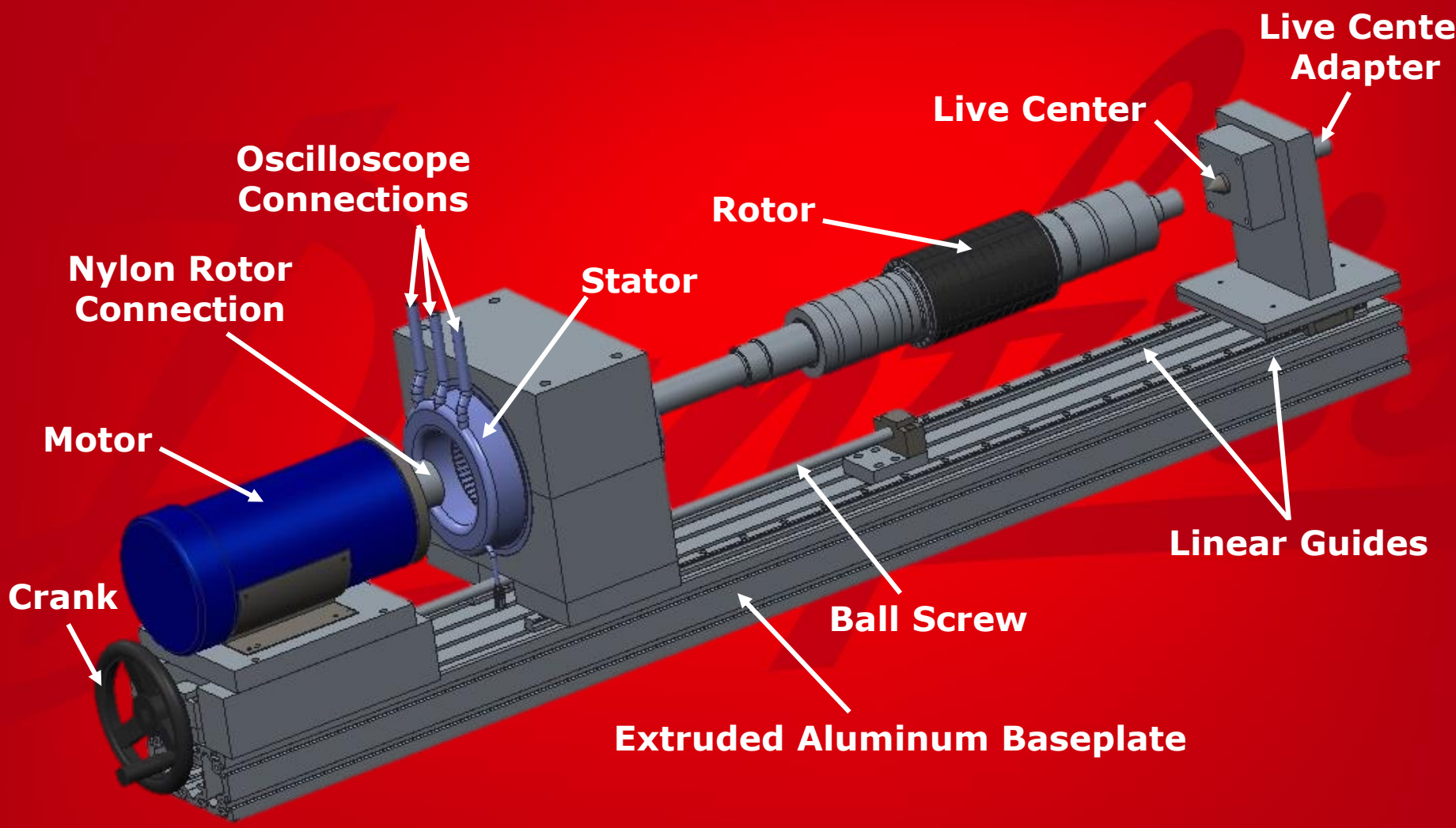

Final Prototype

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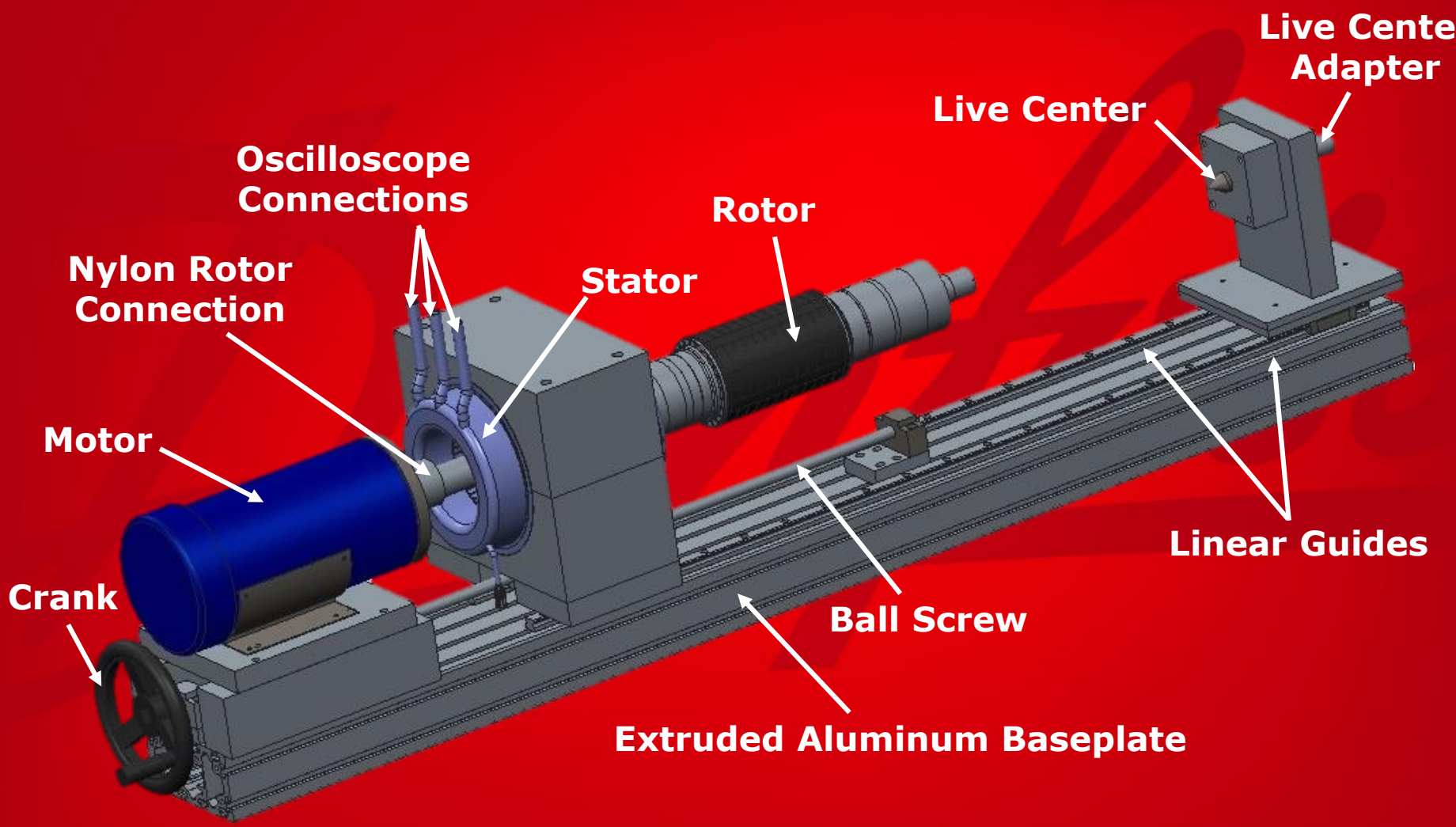

Final Prototype

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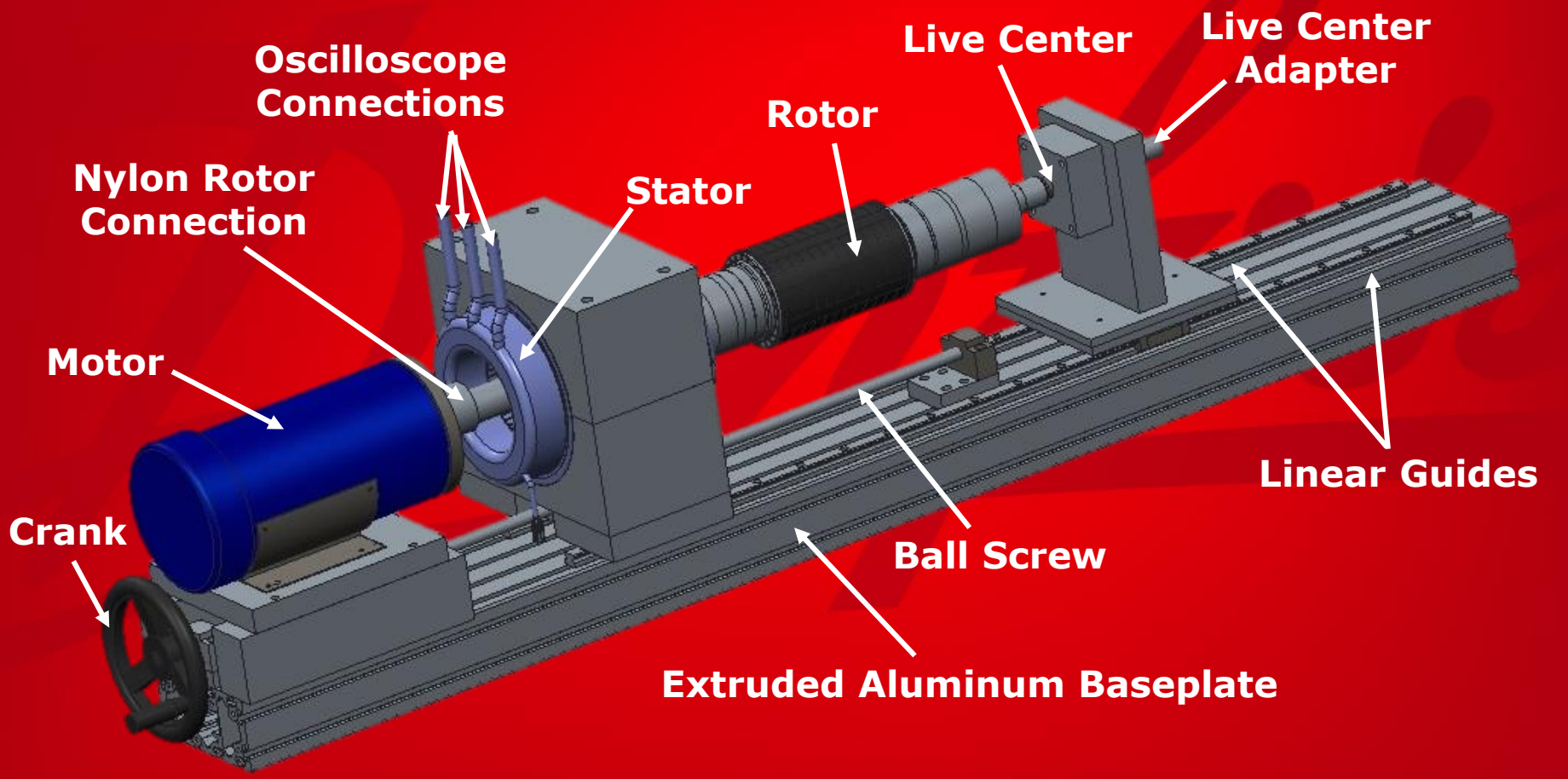

Final Prototype

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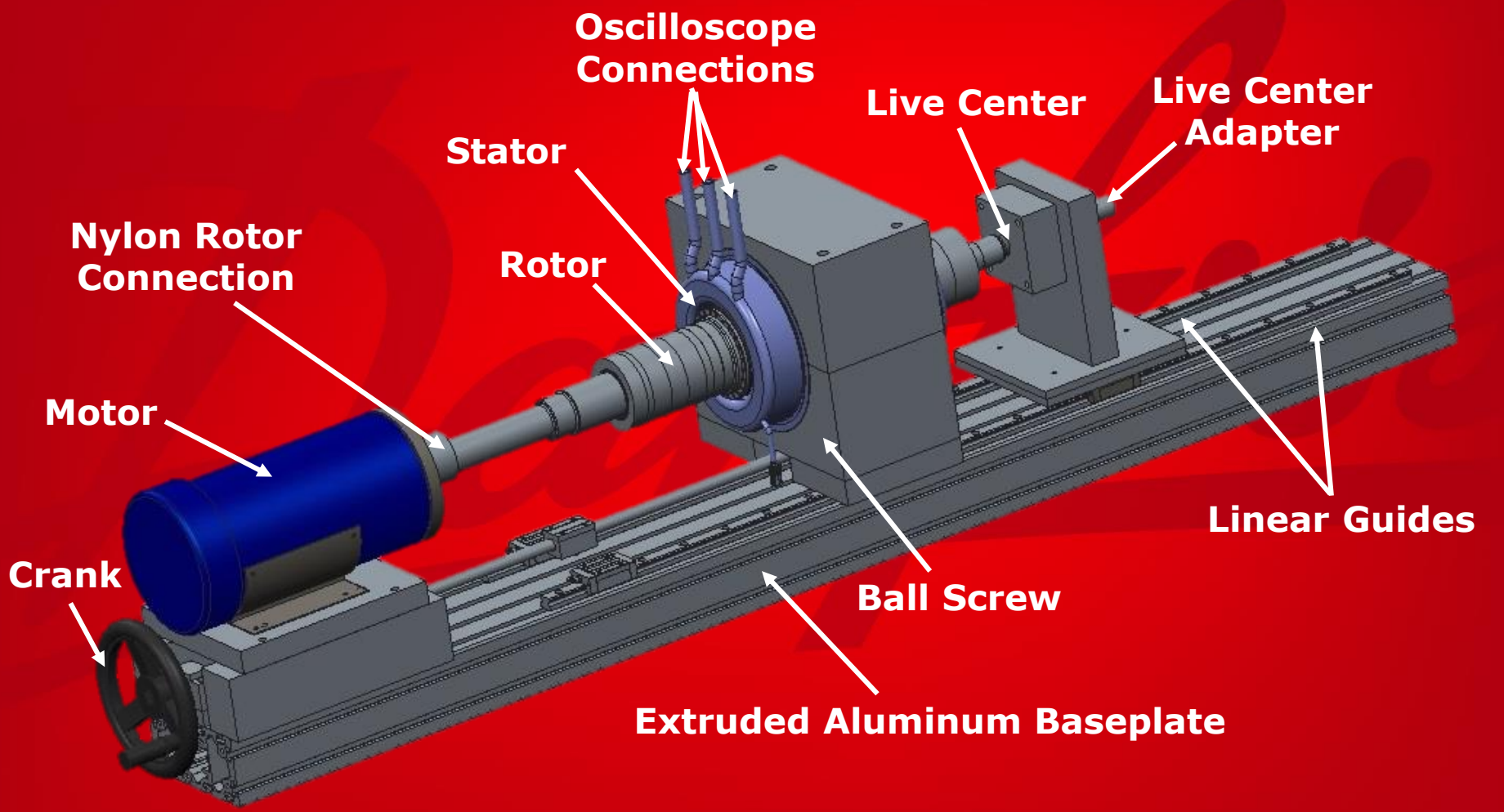

Final Prototype

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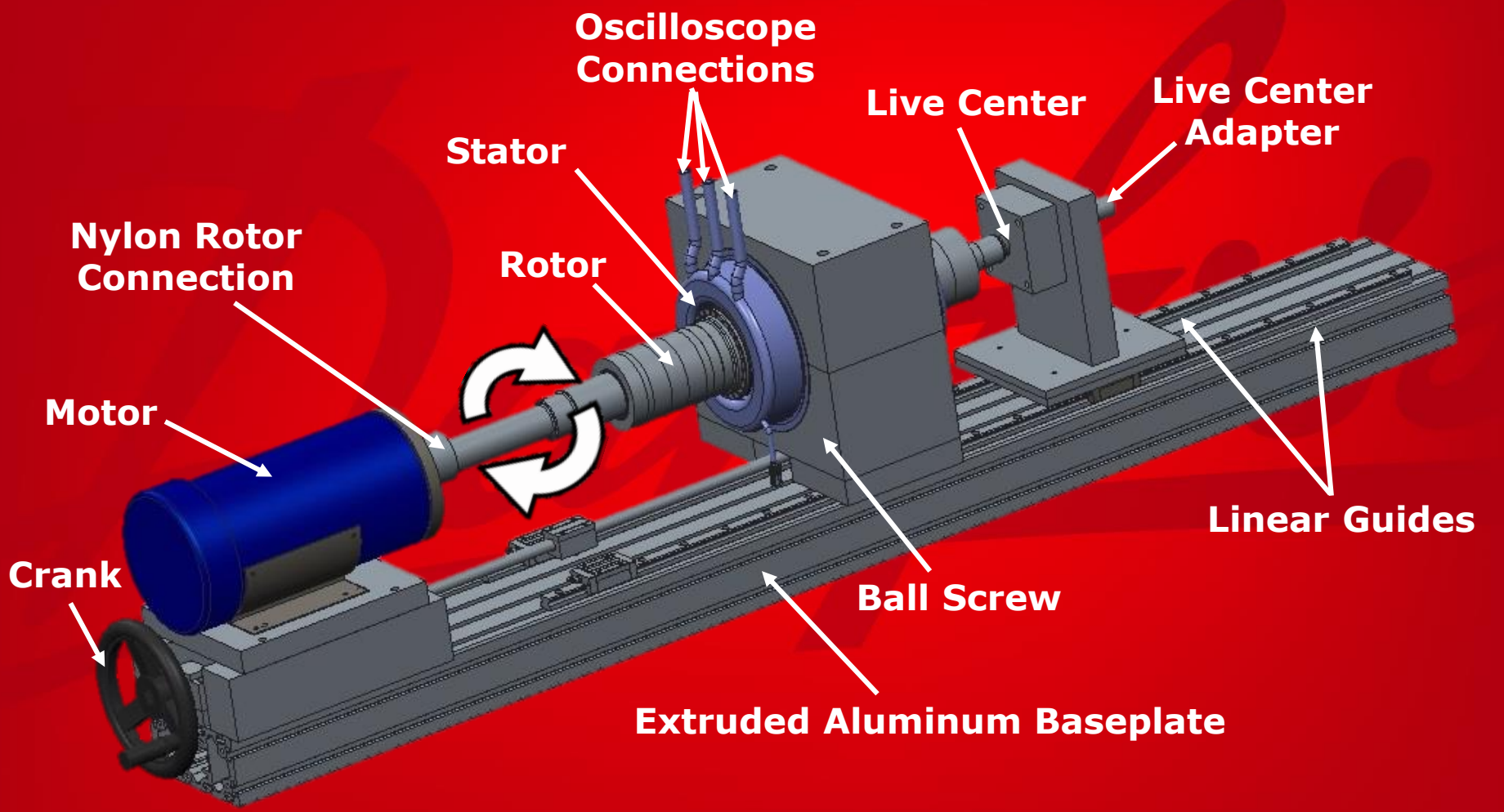

Current Status

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- All drawings for machined parts have been completed
- Most ordered parts have arrived
- Raw aluminum is in, needs to be machined so that assembly can begin

Extruded Aluminum Fasteners

Live Center

Motor Drive

Ball Screw Crank

Look Ahead

- Custom parts to be machined over the next 2-3 weeks
- Assembly to begin as custom machined parts are completed
- Tests to be performed after assembly is complete prior to implementation
- Goal: Implementation ready by April 14th, 2015

Raw Aluminum

Manufacturing Challenges

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- Stator housing is 7 inches thick, Turbocor cannot cut out the center in their machine shop
- Solution: Needs to be water jetted
- Must be done at HPMI, COE is not capable
- Lead time at Turbocor machine shop causing delays in manufacturing

Raw Aluminum for Stator Housing

Testing

- Tests need to be performed prior to implementation
  - Equipment damage would be catastrophic
- Alignment is key:
  - Level test (using dial gage)
  - Measure rotor deviation from the centerline
- Motor drive operation (VFD)
- Emergency stop test
- Full test run through with “dummy” rotor

Dial Gage

Final Project Goal

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- Implementation of Test Fixture at Turbocor:
  - April 14th, 2015
- All tests discussed must be completed prior to implementation

- Assembled test fixture will conform to all constraints
- Operation manual to include information on use of fixture, bill of materials, and drawings of custom parts

Poster Competitions

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- Team Four is participating in several poster competitions to represent the Senior Design class:

1) Accepted into ASEE-SE poster competition
   - Date: April 12th – 14th
   - Location: University of Florida, Gainesville, FL

2) Participating in ASME SPDC poster competition
   - Student Professional Development Conference
   - Date: April 3rd – 5th
   - Location: Embry Riddle University, Daytona Beach, FL

Conclusion & Future Work

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- Now that parts have begun arriving, we will begin assembly after custom parts are machined
- Testing will occur during and after assembly, complete run through to be performed before implementation
- Implementation Goal: April 14th, 2015
- Team Four representing Senior Design class in poster competitions in April 2015

Questions or Comments?

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- For more information, see our website:
  http://eng.fsu.edu/me/senior_design/2015/team04/

Bearing Block Support

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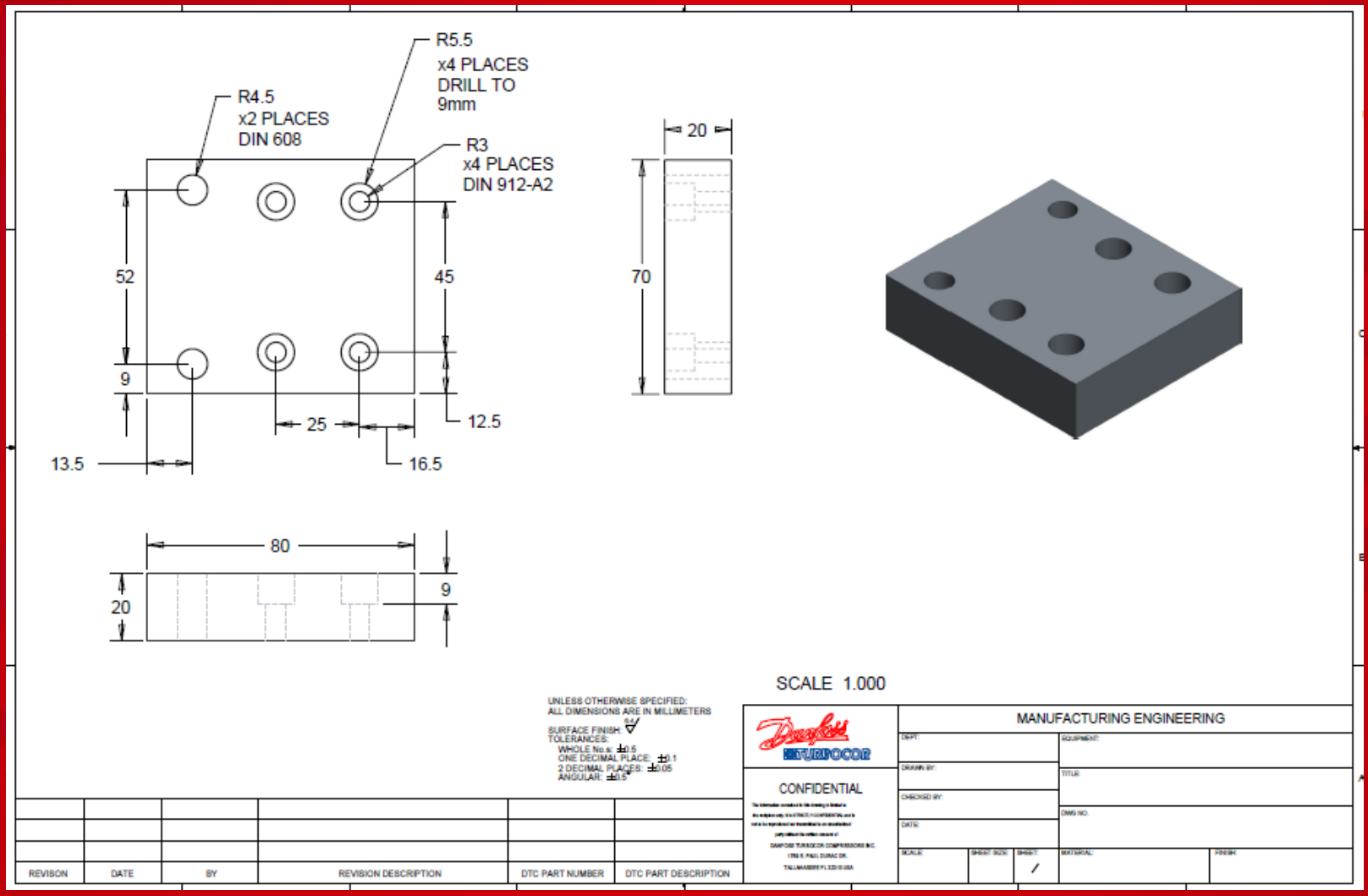

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Appendix Slide I

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Motor Bearing Support

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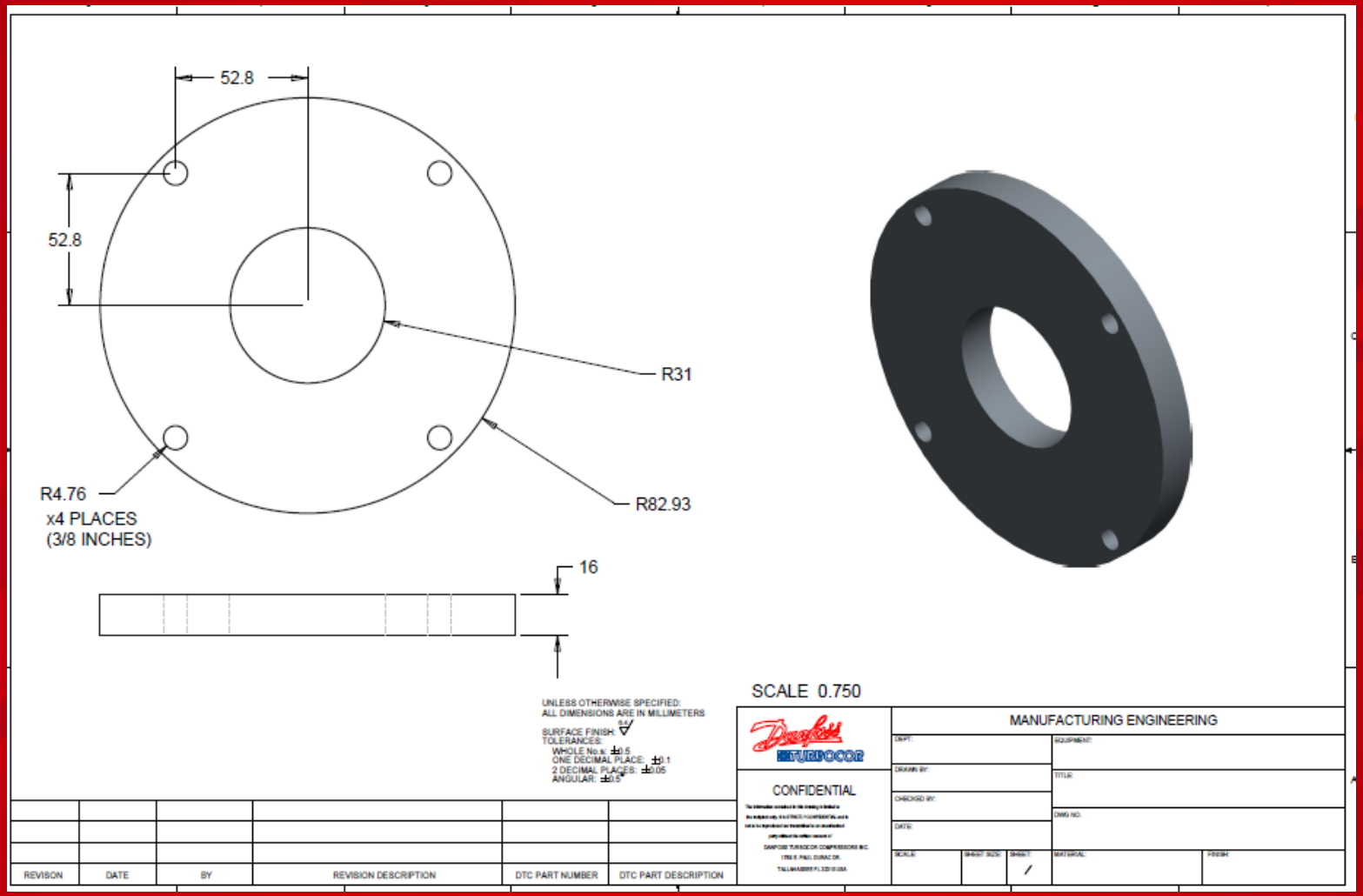

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Appendix Slide II

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Bottom of Stator Housing

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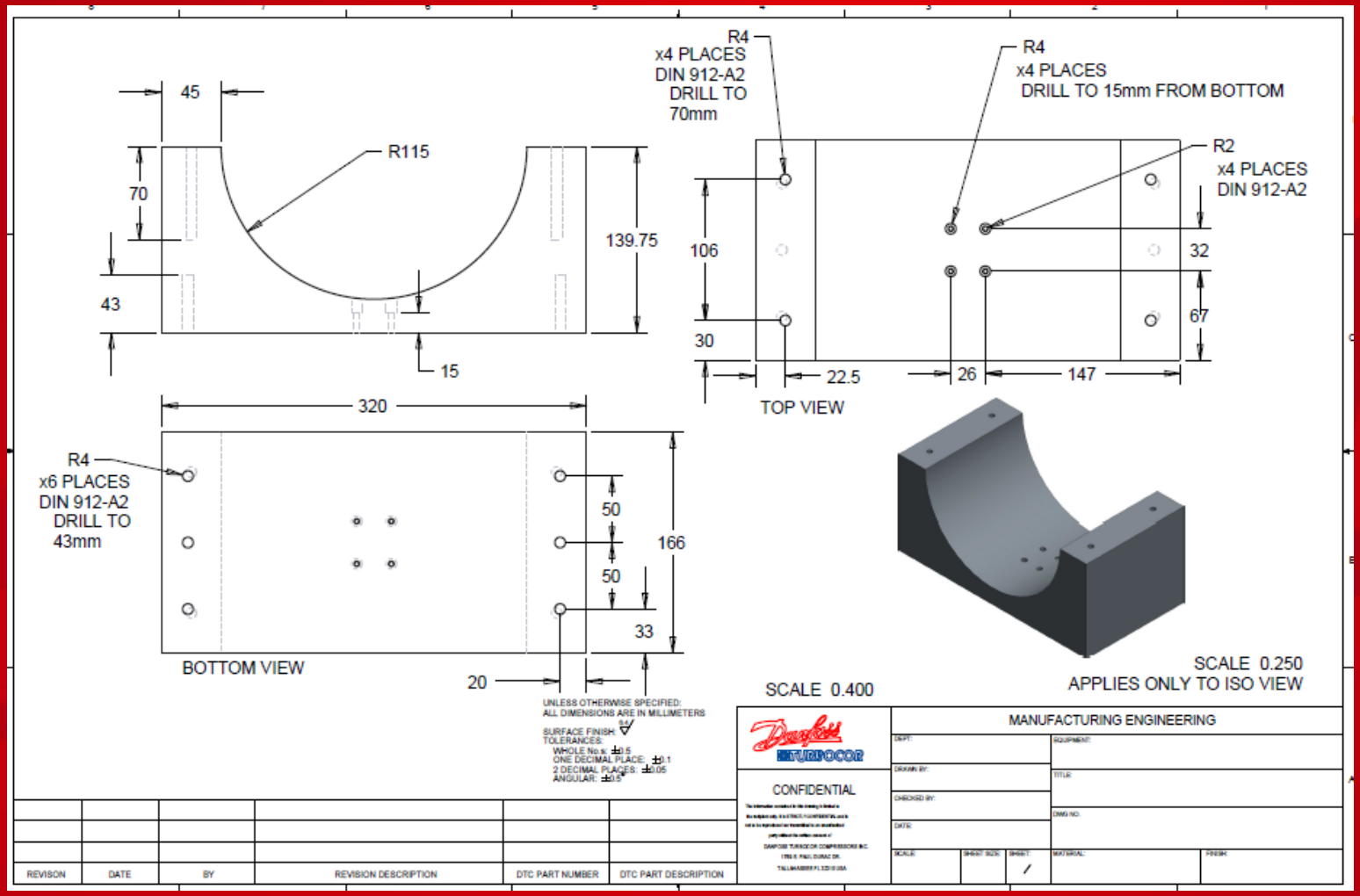

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Top of Stator Housing

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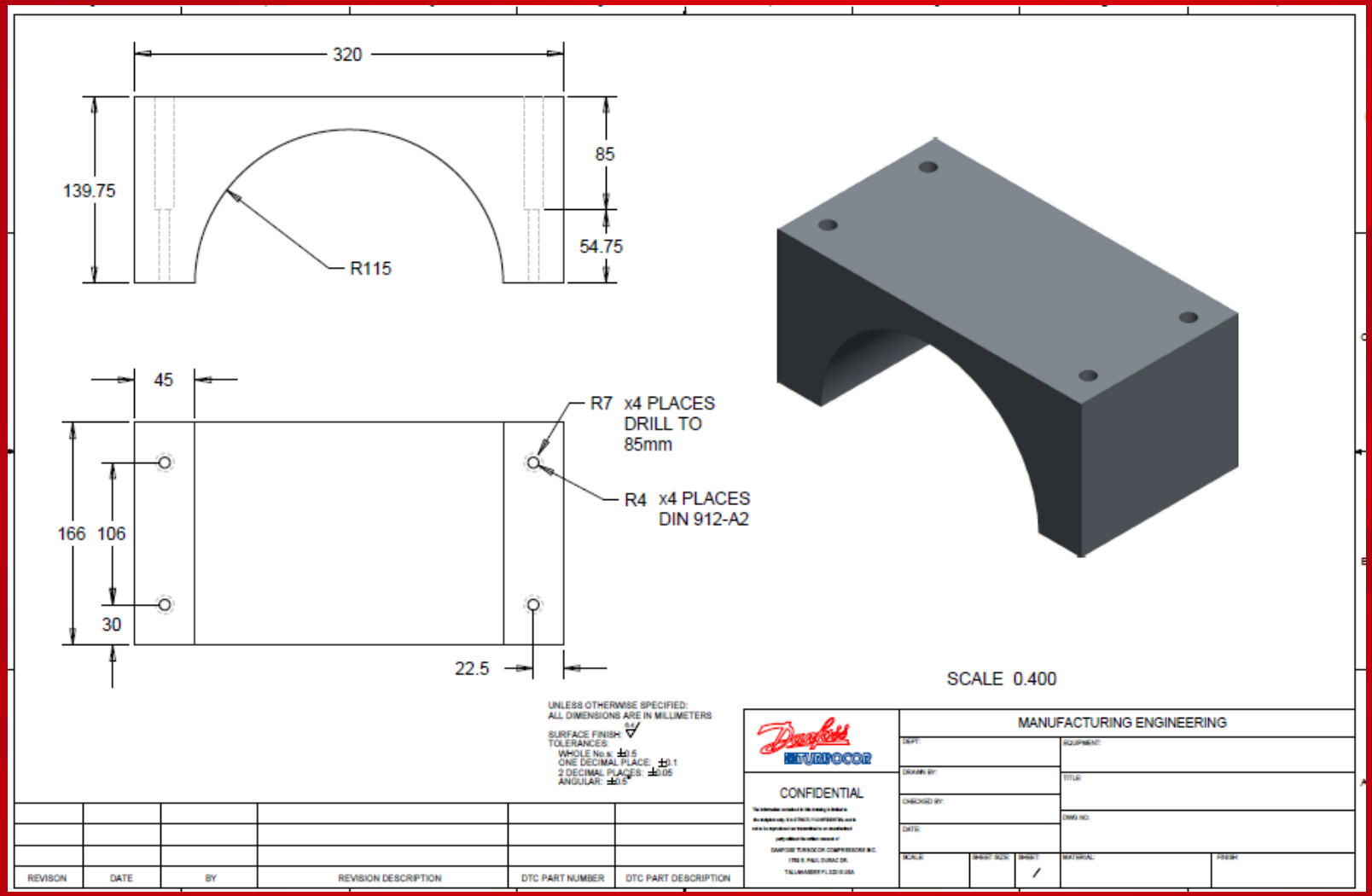

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Linear Guide Spacer

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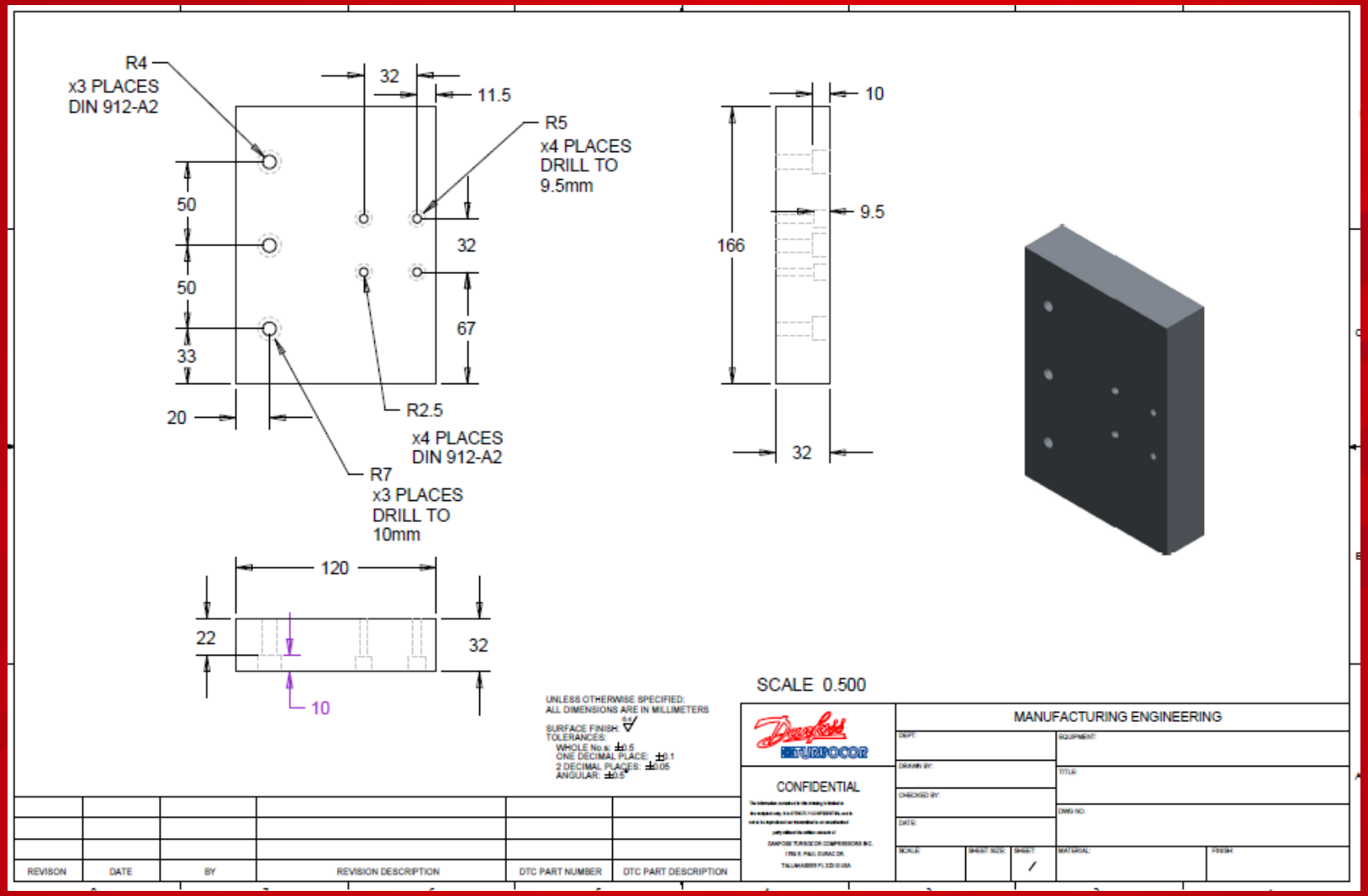

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Appendix Slide V

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Live Center Baseplate

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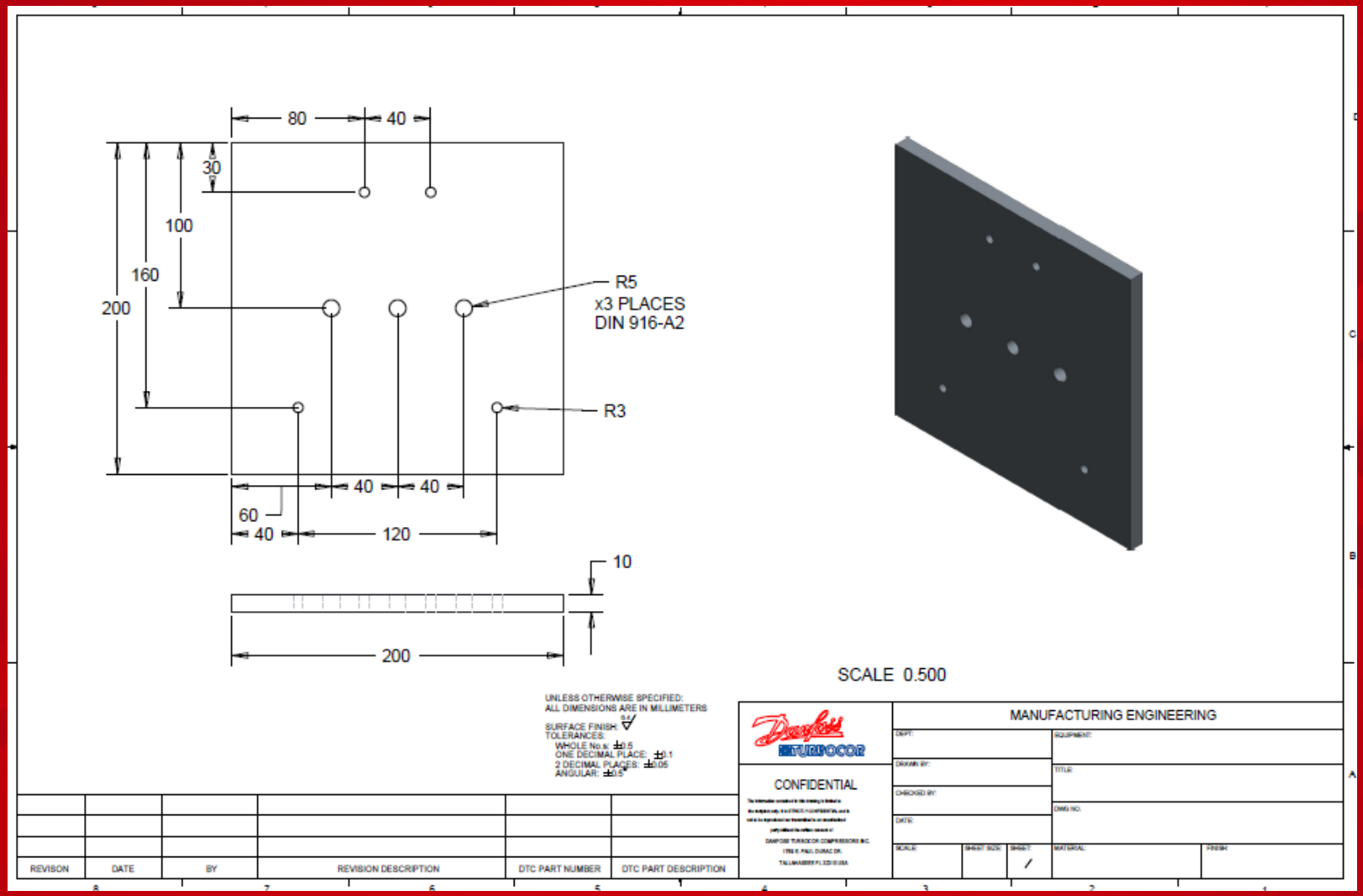

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Live Center Frontplate

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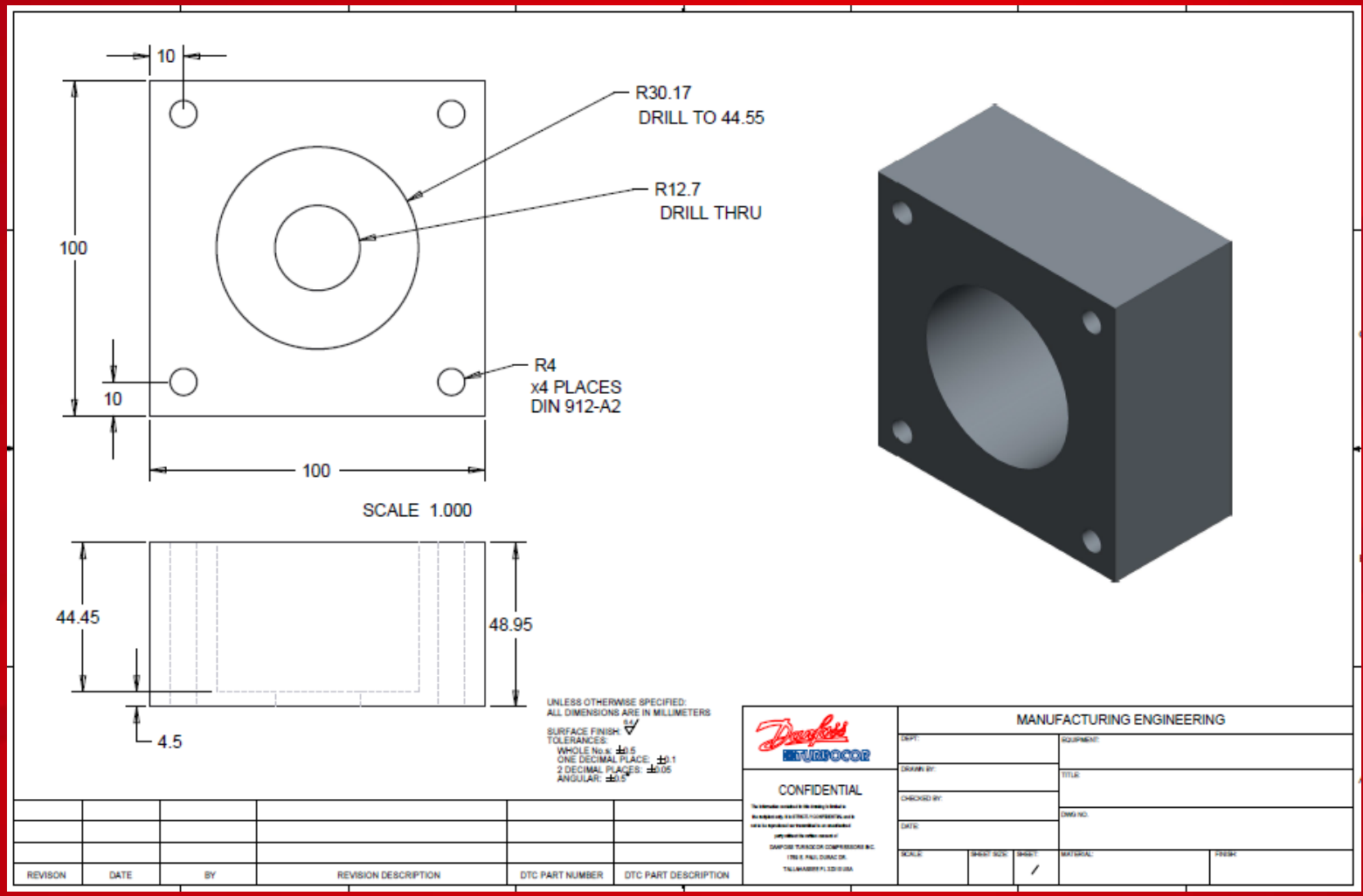

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Linear Guide Connector

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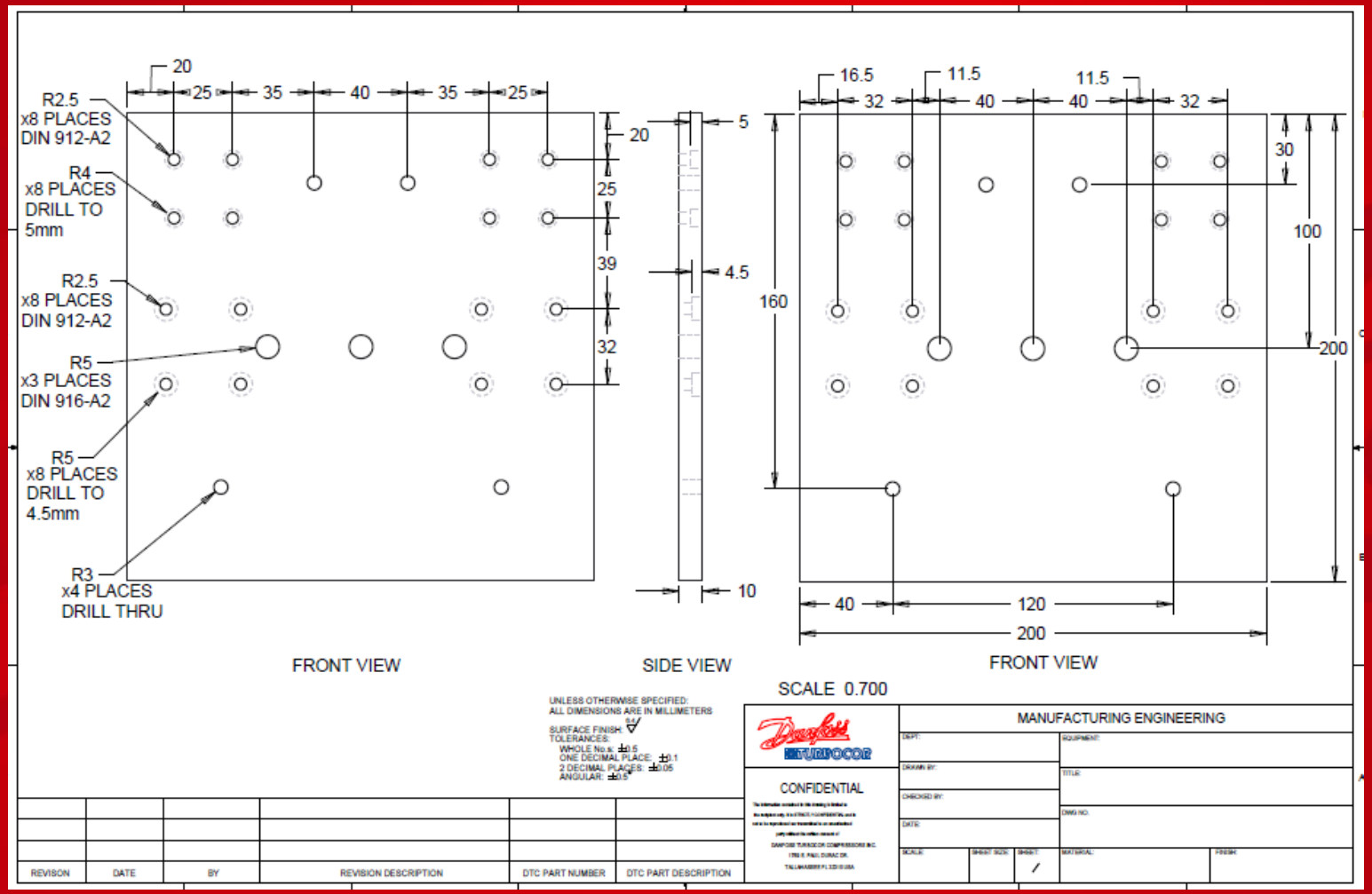

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Appendix Slide VIII

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Live Center Upright Support

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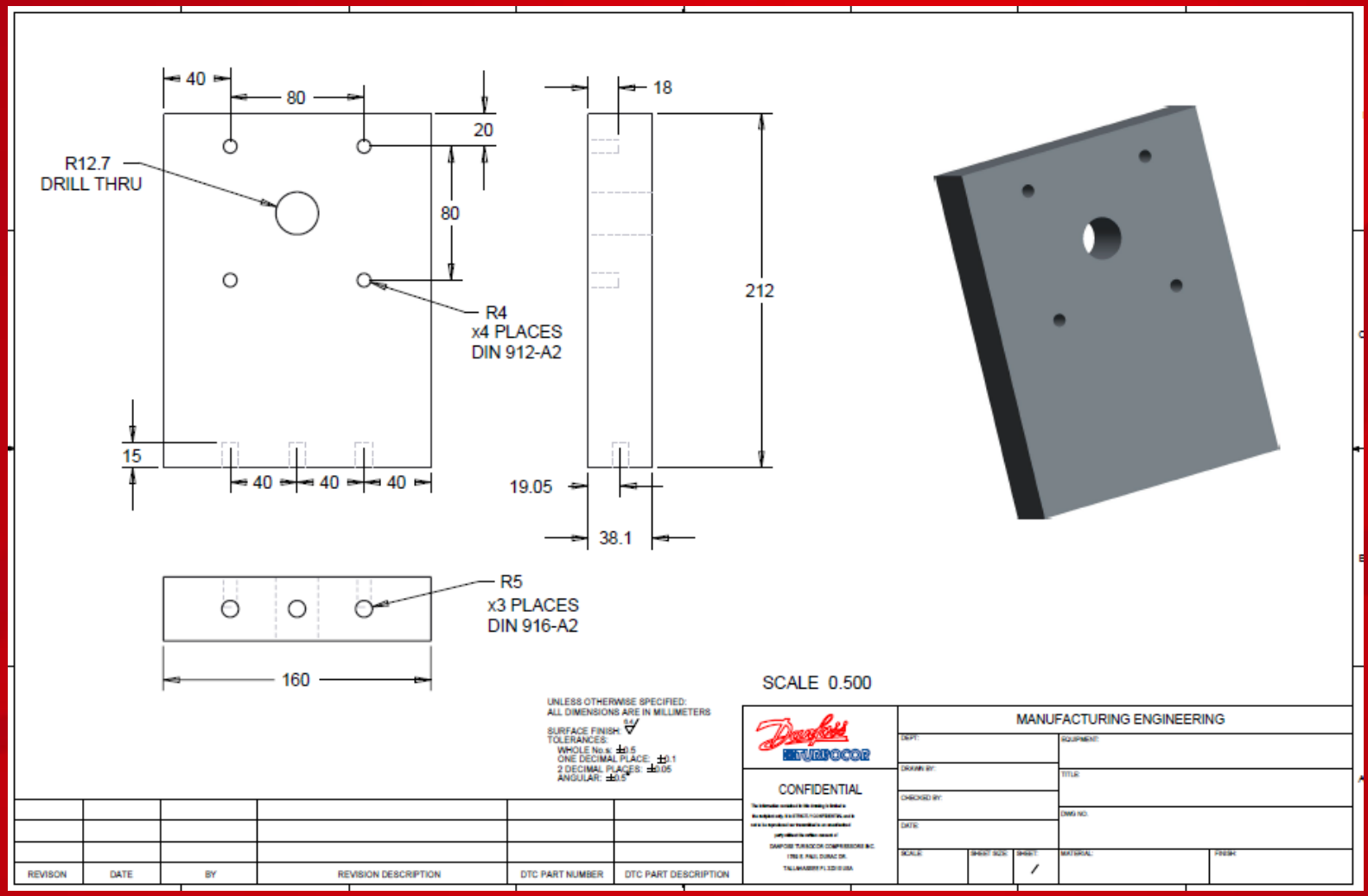

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Motor Base Support

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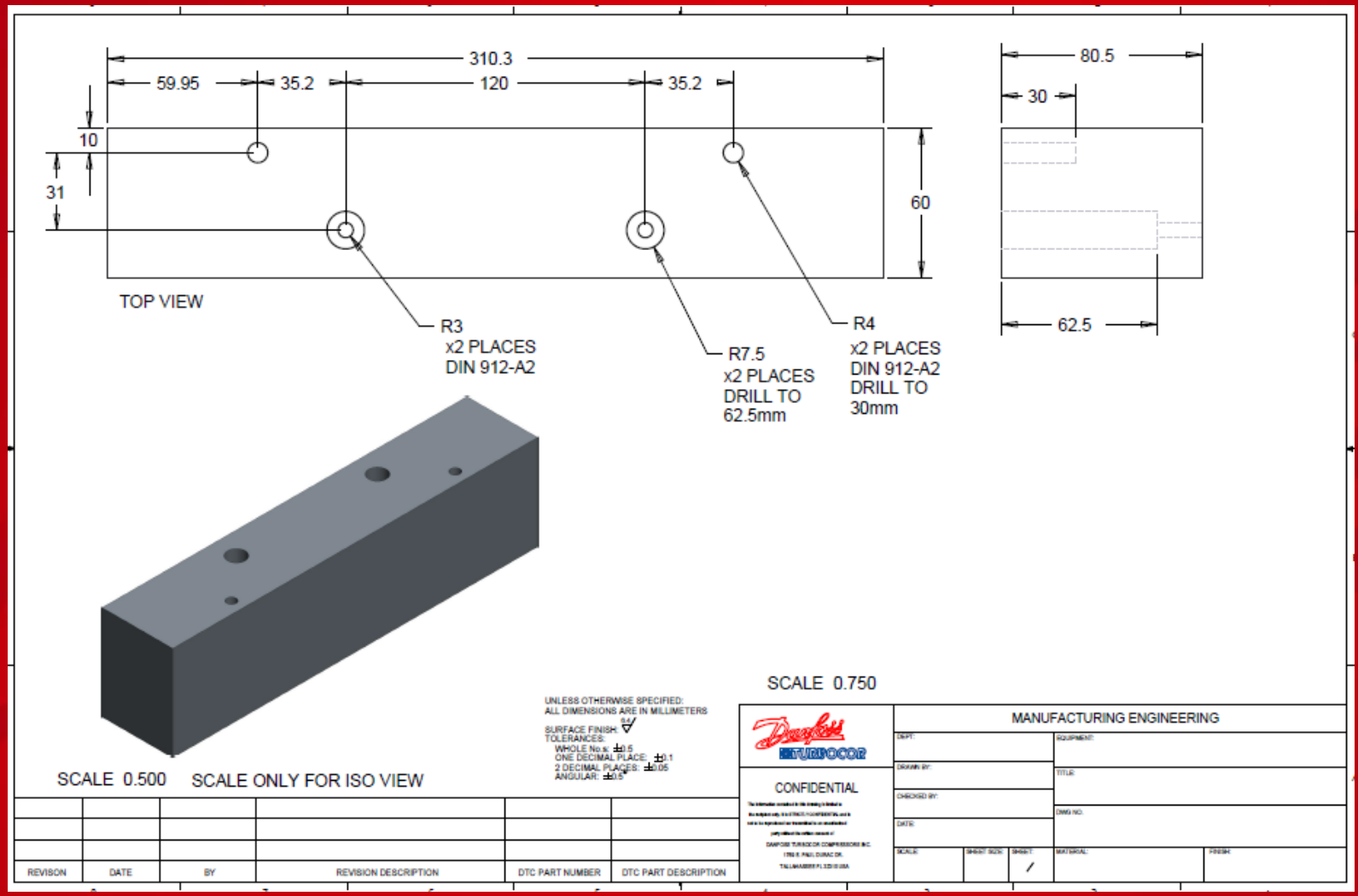

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Prototype Subassemblies

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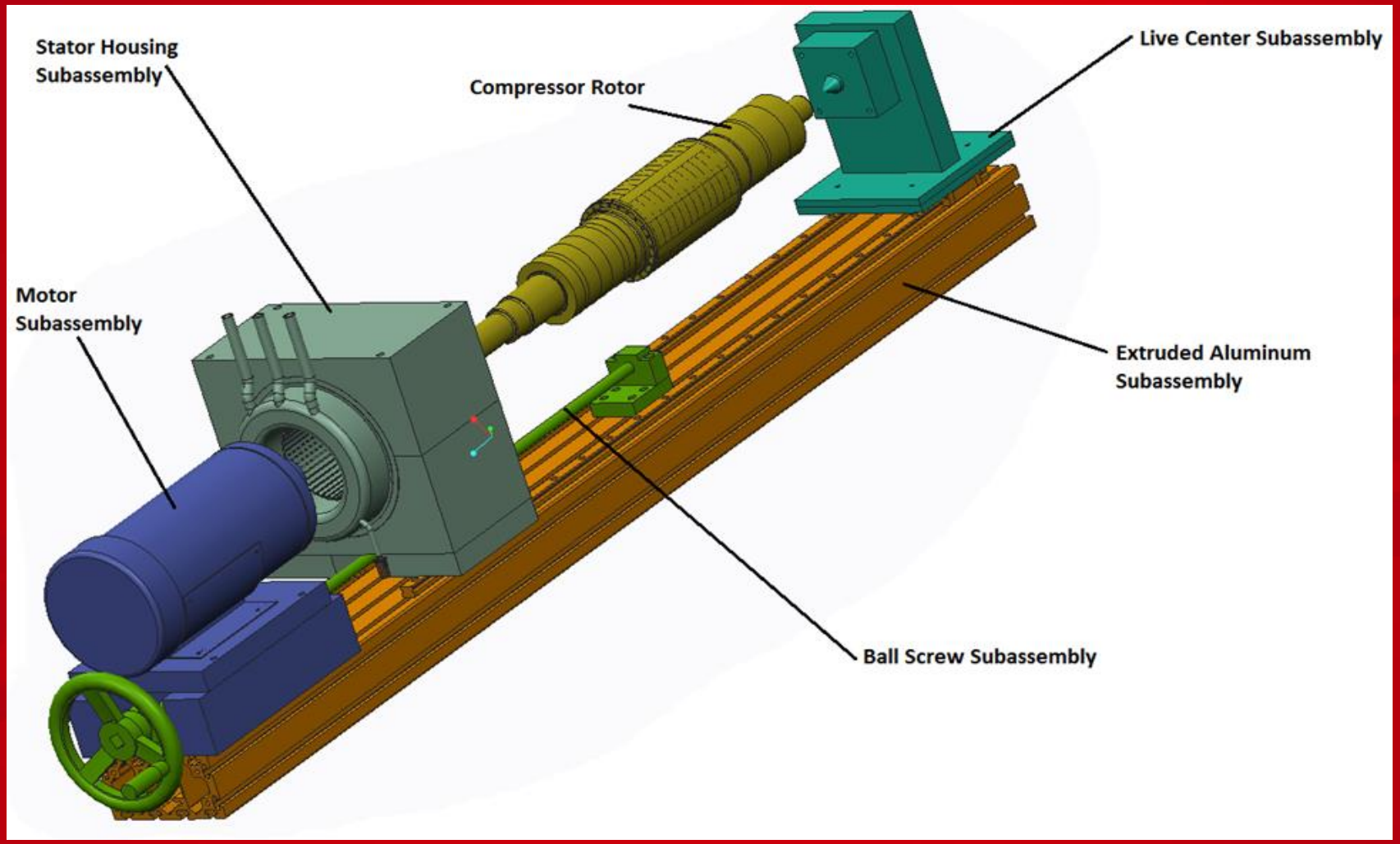

FEM: Rotor Connection

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Stress in MPa
Max Stress: 4.19 MPa
Nylon Tensile Strength: 76 MPa

Displacement in mm
Max: 0.048 mm