ENGINEERING TOMORROW

VTT Rotor: Back EMF Test Fixture Spring Presentation I

Team #4:

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Date: 1/22/2015

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Presentation Outline

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- Background and Motivation
- Design Challenges
- Final Prototype
- Key Design Components:
  - Extruded Aluminum Baseplate
  - Ball Screw
  - Live Center Assembly
- Current Status
- Work Breakdown Structure/Gantt Chart
- Conclusion

Motivation and Goal

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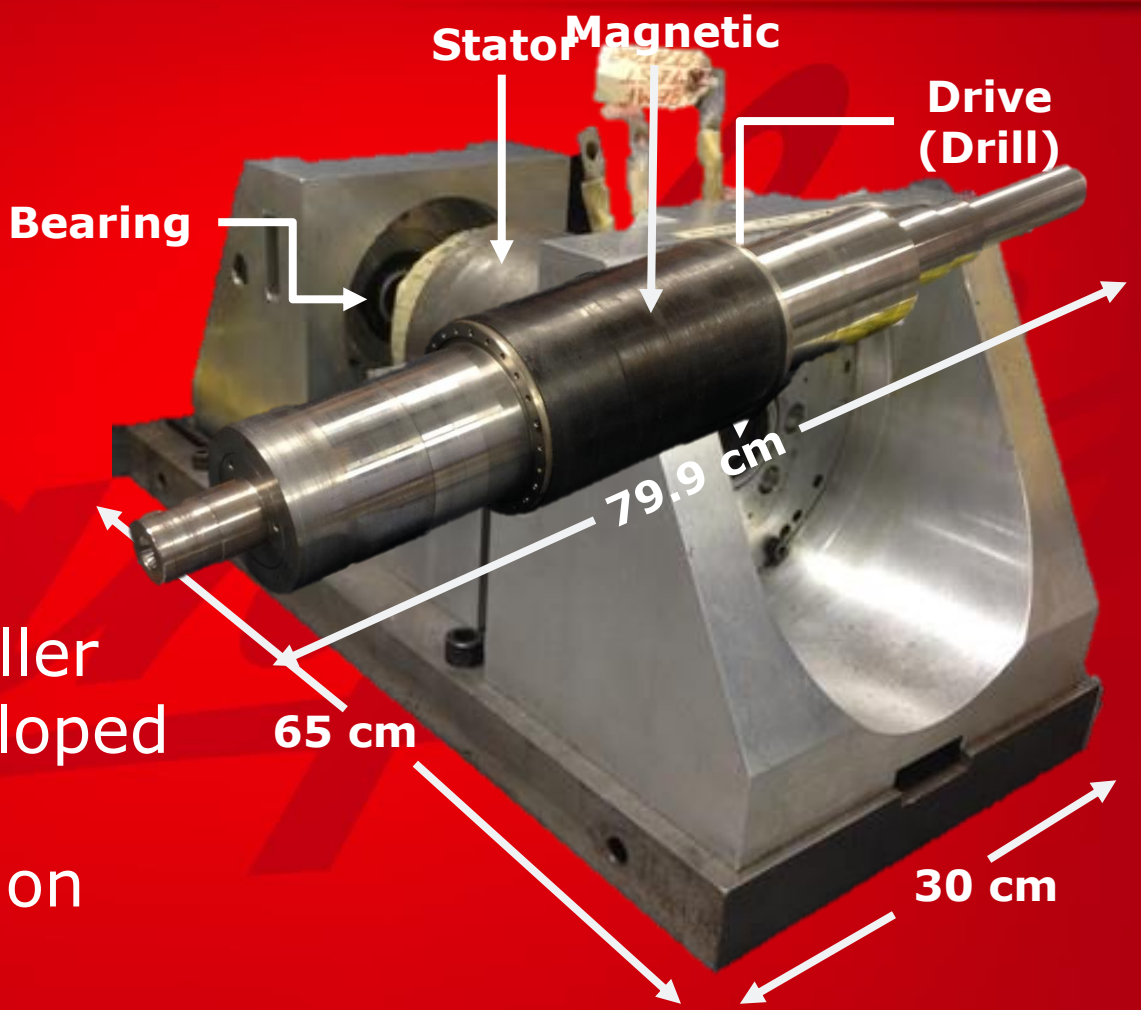
- Need test fixture to qualify rotors
- Will measure back electromotive force (EMF)
- Test fixture for smaller rotors already developed
- Several constraints on design



Design Challenges

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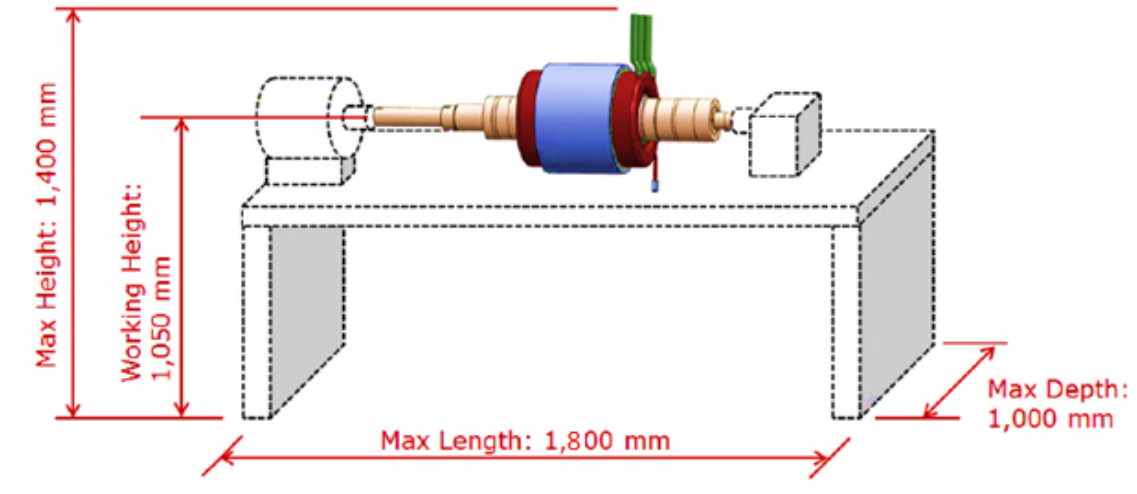
- Budget: $4,000
- Overcoming magnetic force of 60-80 pounds
- Centering rotor within stator
  - Deviations in the height of components will compromise validity of quality tests
  - Motor shank needs to support rotor weight
- Spatial Constraints:



Final Prototype

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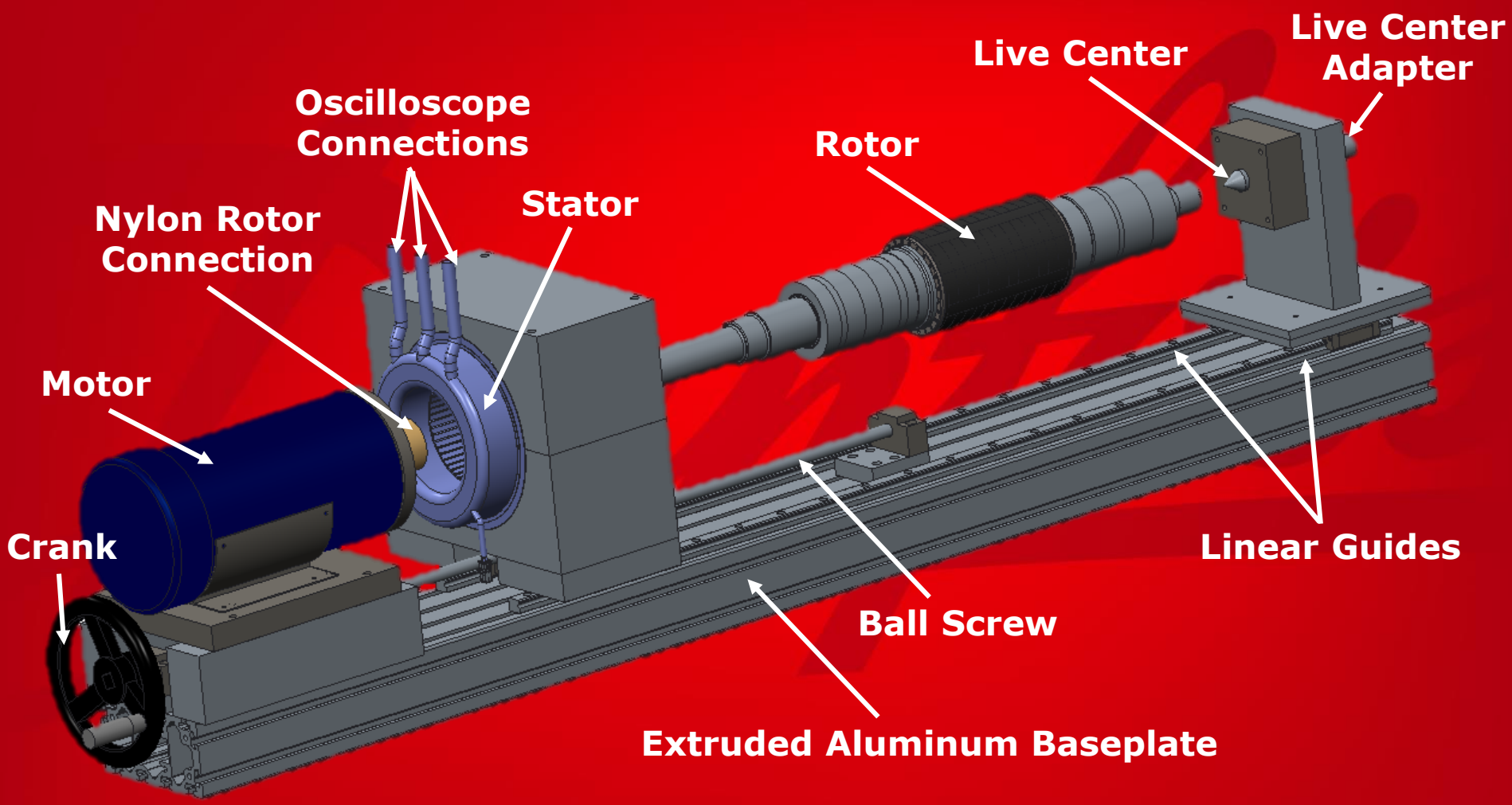

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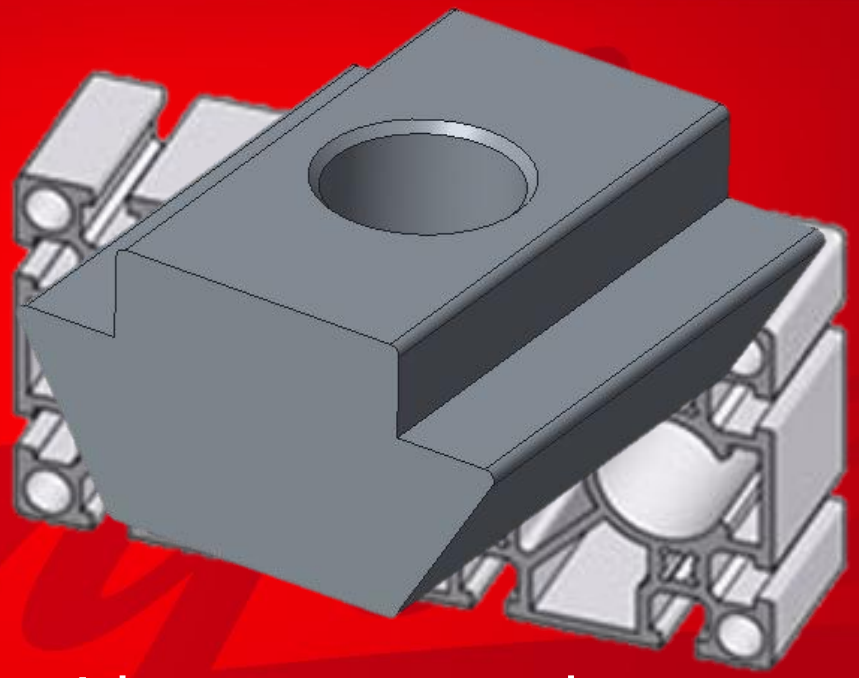
Extruded Aluminum Baseplate



- All components will be fastened to 90x180 mm Extruded Aluminum Baseplate
- Components connected with fastening nuts
- Allows for alignment
- Large cross section will provide support and prevent deflection
- Cost:
  - $391.12 for baseplate, $33.10 for nuts (x100)

Ball Screw, Linear Guides

- Misumi Ball Screw selected with block mounting nut
  - 15 mm diameter, 10 mm lead
  - $344.91
  - Must also purchase bearing blocks
- Misumi Heavy Load Linear Guides selected with clamps
  - **Update to design: 1240 mm total length, two connecting blocks per guide**
  - Total Cost (Ball Screw, Guides, Clamps, Bearing Blocks): **$1217.48**

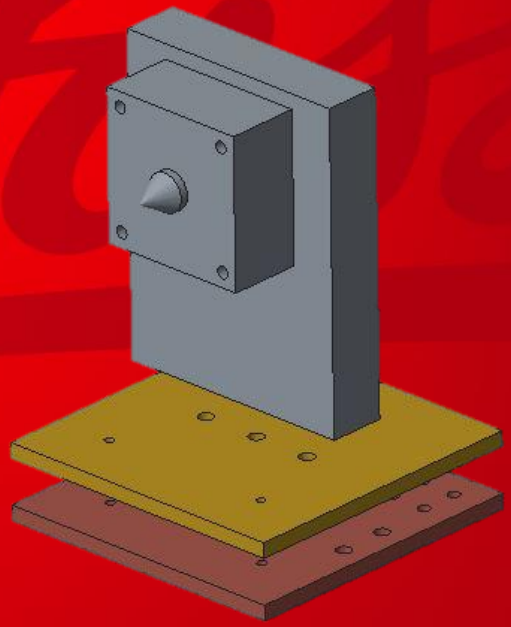
Misumi BSBR1510-1100 Ball Screw

Misumi SX2R28-1240 Linear Guides

Live Center and Housing

- Live Center used to center the rotor
- Will be press fit into the support system
  - Secured by outside plate screwed into front of live center
- Original live center support rode inside grooved track
  - Issues with wear over time
- New design involves live center support connecting to linear guides
  - Held in place by linear guide clamp

Live Center Selected



Live Center Housing

Current Project Status

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- Final Design Review was held at Turbocor at the end of the Fall 2014 semester
  - Design approved
  - Purchase order forms submitted
- First meeting with Turbocor to be held next week
  - Drawings for custom made parts will be finalized
- Next step: Manufacturing Stage
  - As parts arrive from suppliers and custom made parts are machined, assembly of test fixture can begin

Work Breakdown Structure

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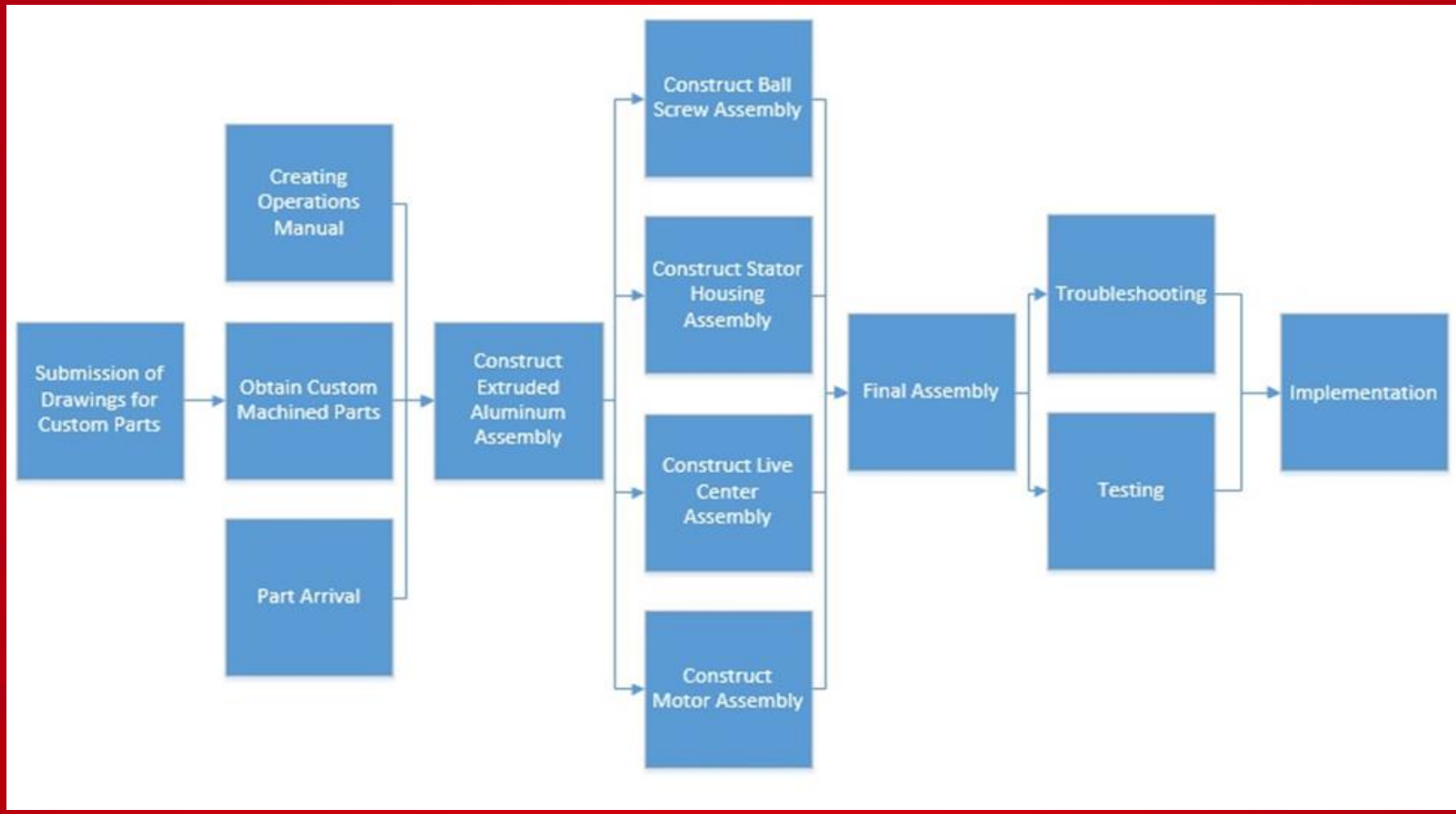

Gantt Chart

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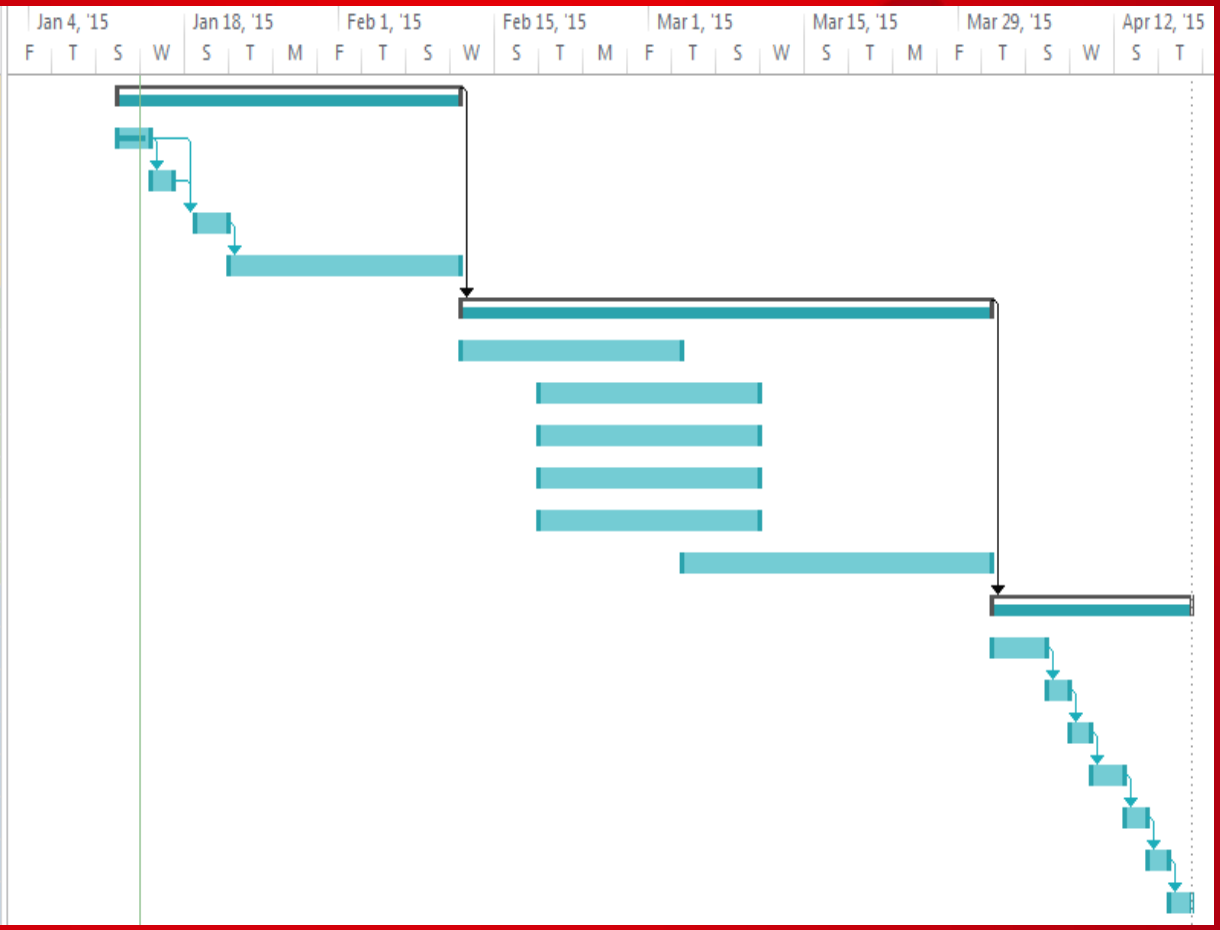
Danfoss

Task Name	% Complete
Parts Ordering	**10%**
Submission of Drawings for Custom Parts	80%
Creating Operations Manual	0%
Part Arrival	0%
Obtain Custom Machined Parts	0%
Assembly	**0%**
Construct Extruded Aluminum Subassembly	0%
Construct Stator Housing Subassembly	0%
Construct Live Center Subassembly	0%
Construct Motor Subassembly	0%
Construct Ball Screw Subassembly	0%
Construct Final Assembly	0%
Testing and Presentation	**0%**
Rotor Fitment & Alignment Testing	0%
Motor Operation Testing	0%
Emergency Stop Testing	0%
Oscilloscope Fitment and Testing	0%
Testing Prototype	0%
Troubleshooting Prototype (If Necessary)	0%
Presentation and Final Test at Turbocor	0%



Conclusion & Future Work

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- Turbocor approved final design in Fall Semester
- Drawings for custom made parts need to be approved
  - Will go over at next sponsor meeting
- Once drawings are approved and parts start arriving, assembly may begin
- After assembly, several tests need to be performed
- Final goal: Implementation ready by April 30th, 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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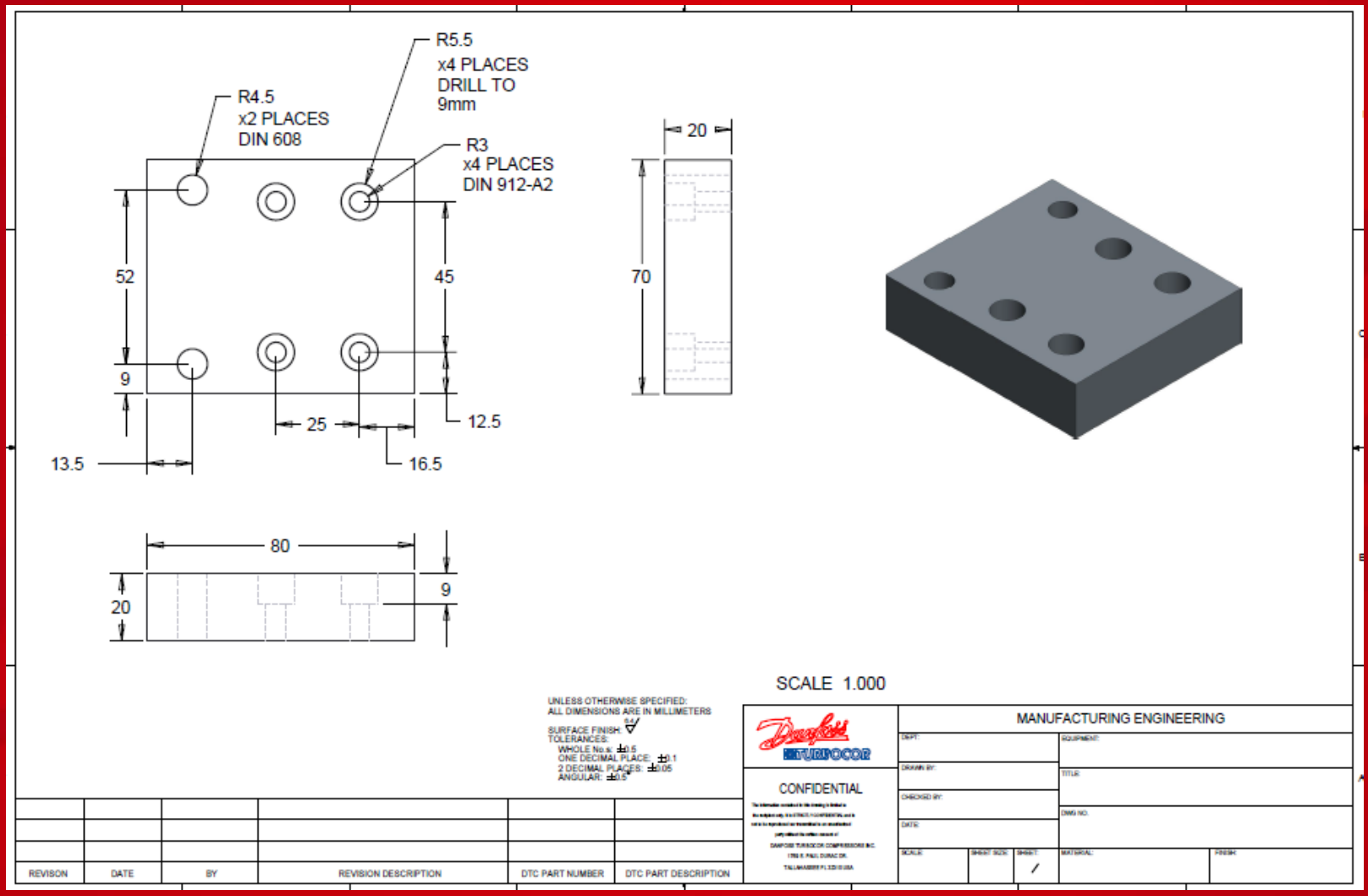

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Motor Bearing Support

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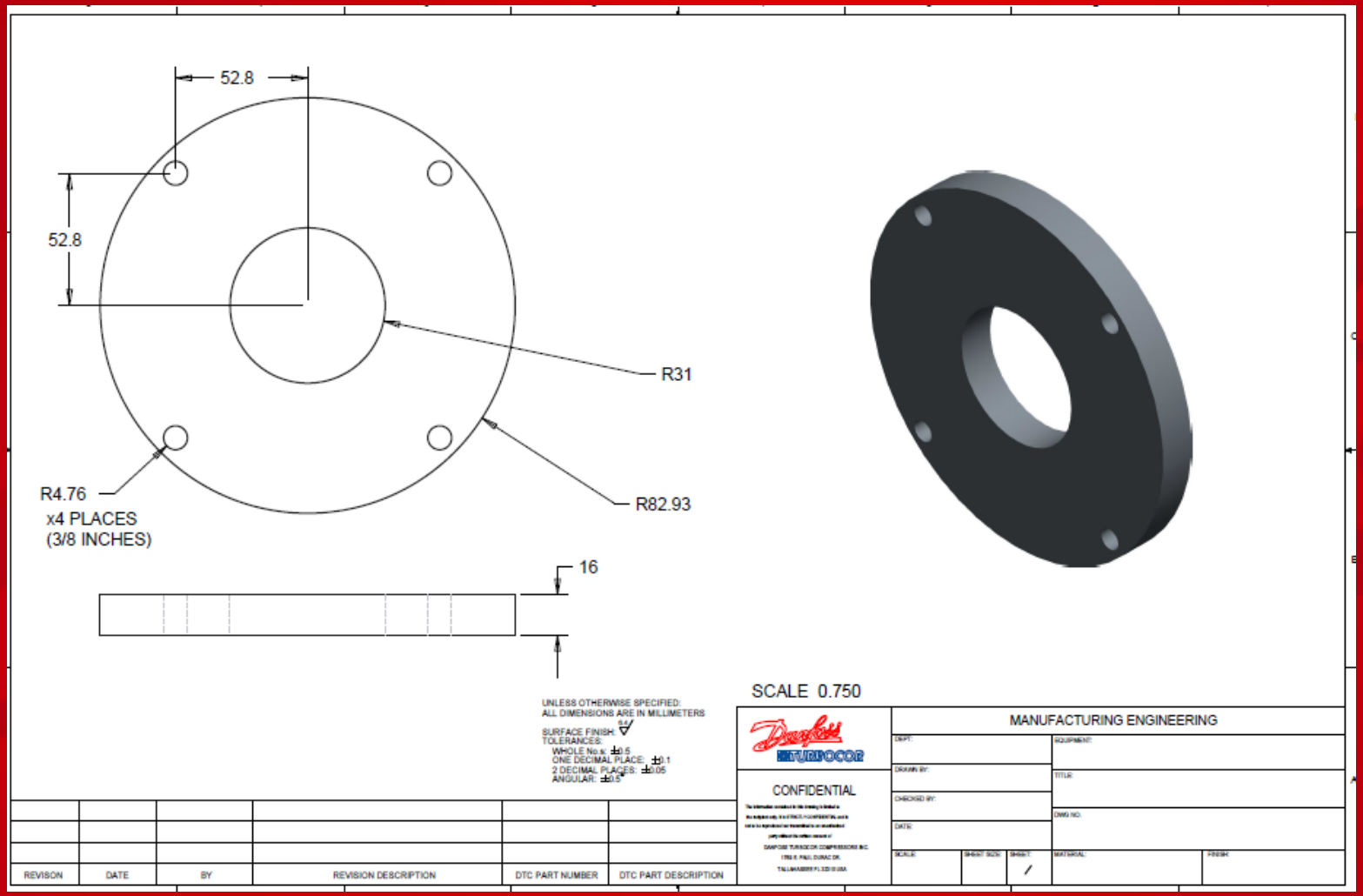

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Bottom of Stator Housing

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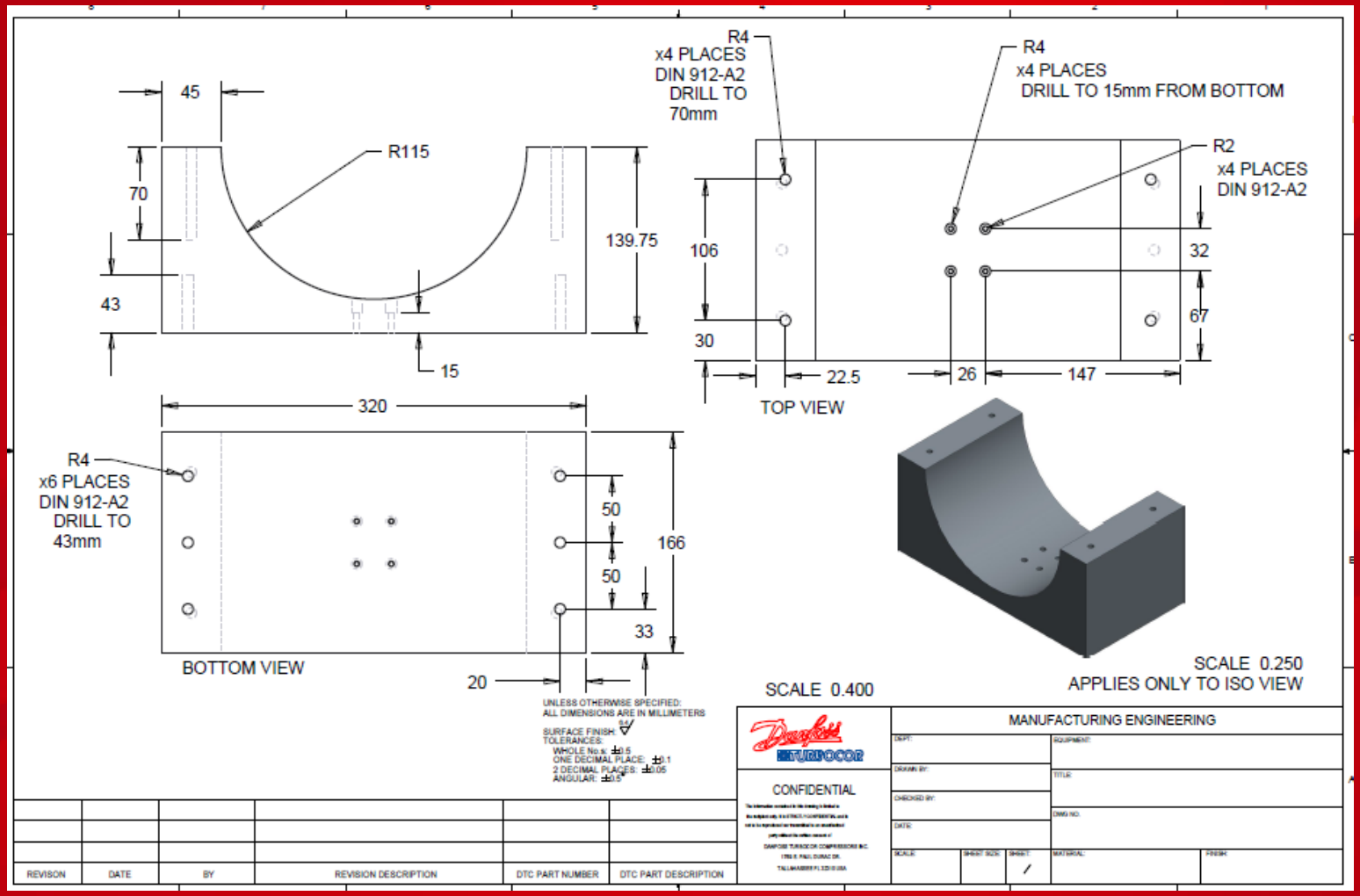

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Top of Stator Housing

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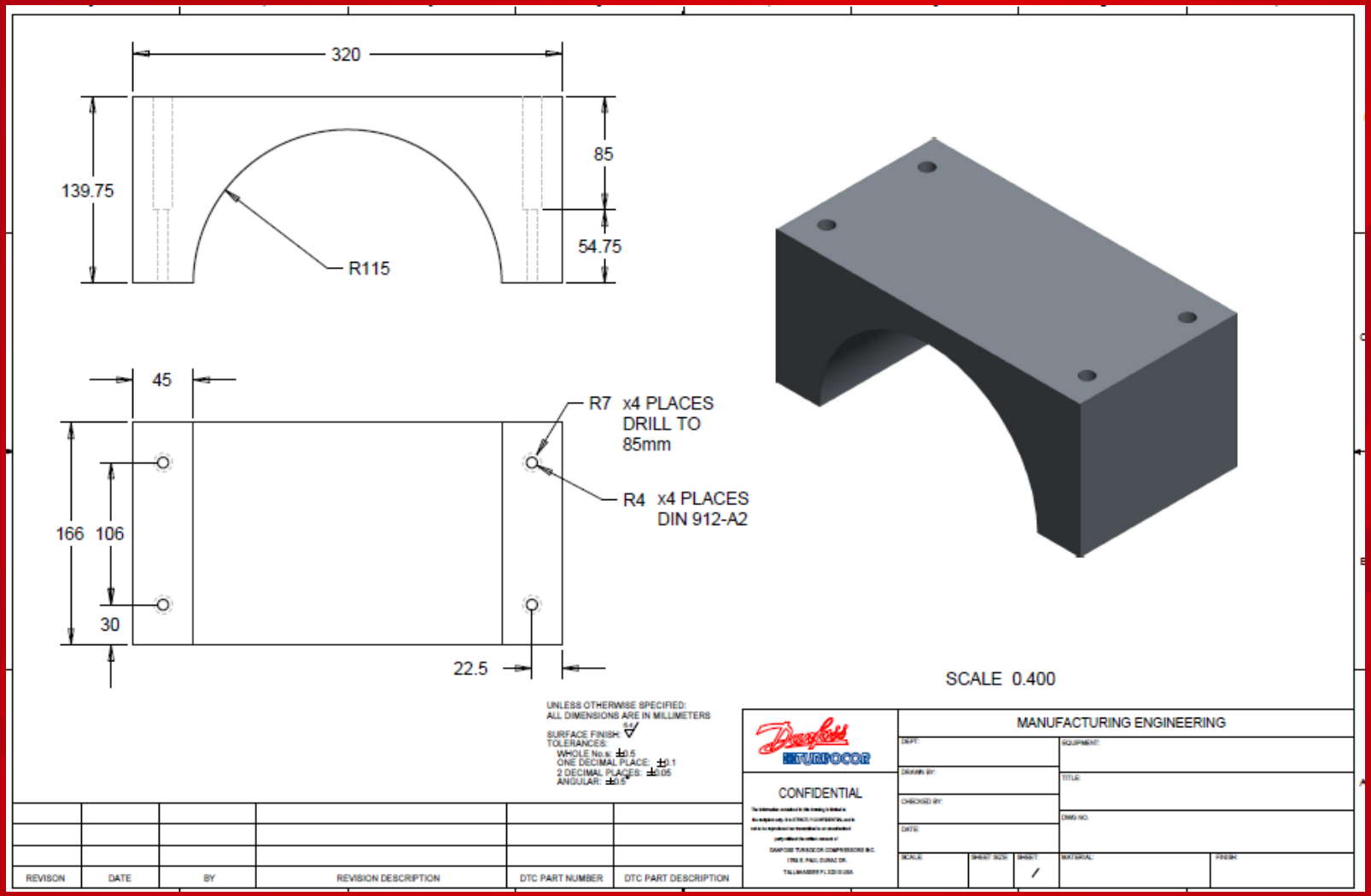

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Linear Guide Spacer

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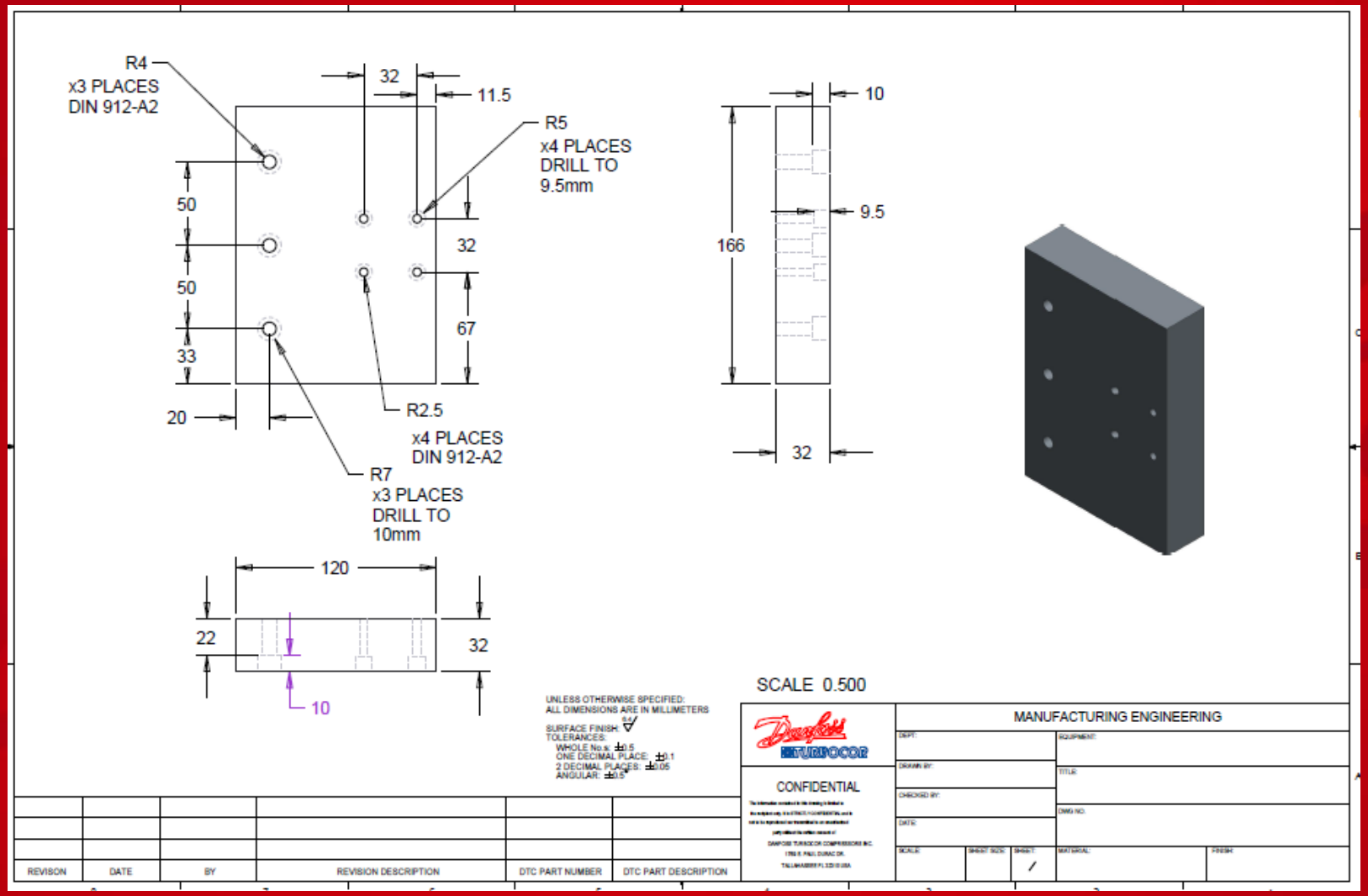

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Live Center Baseplate

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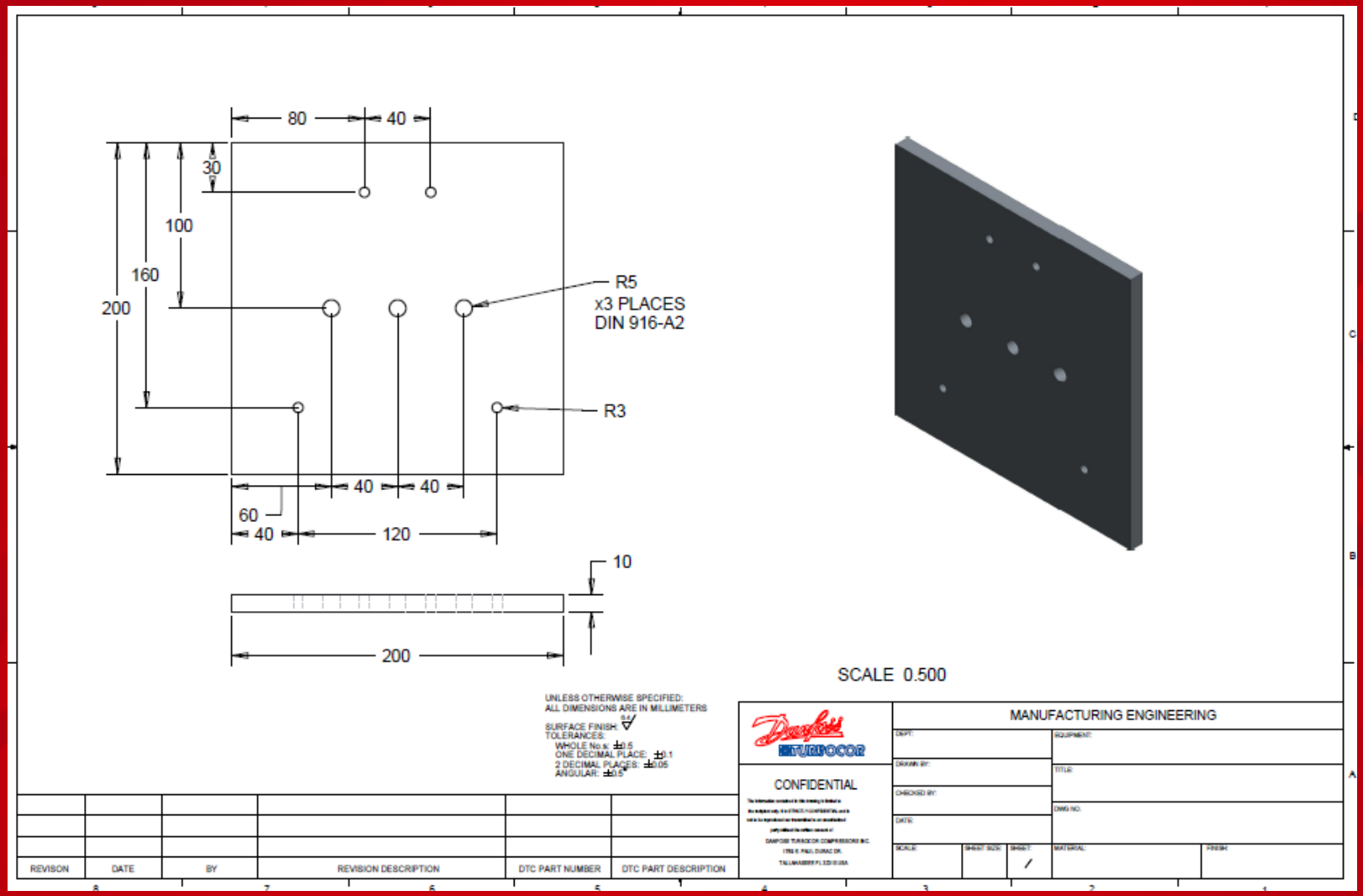

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Live Center Frontplate

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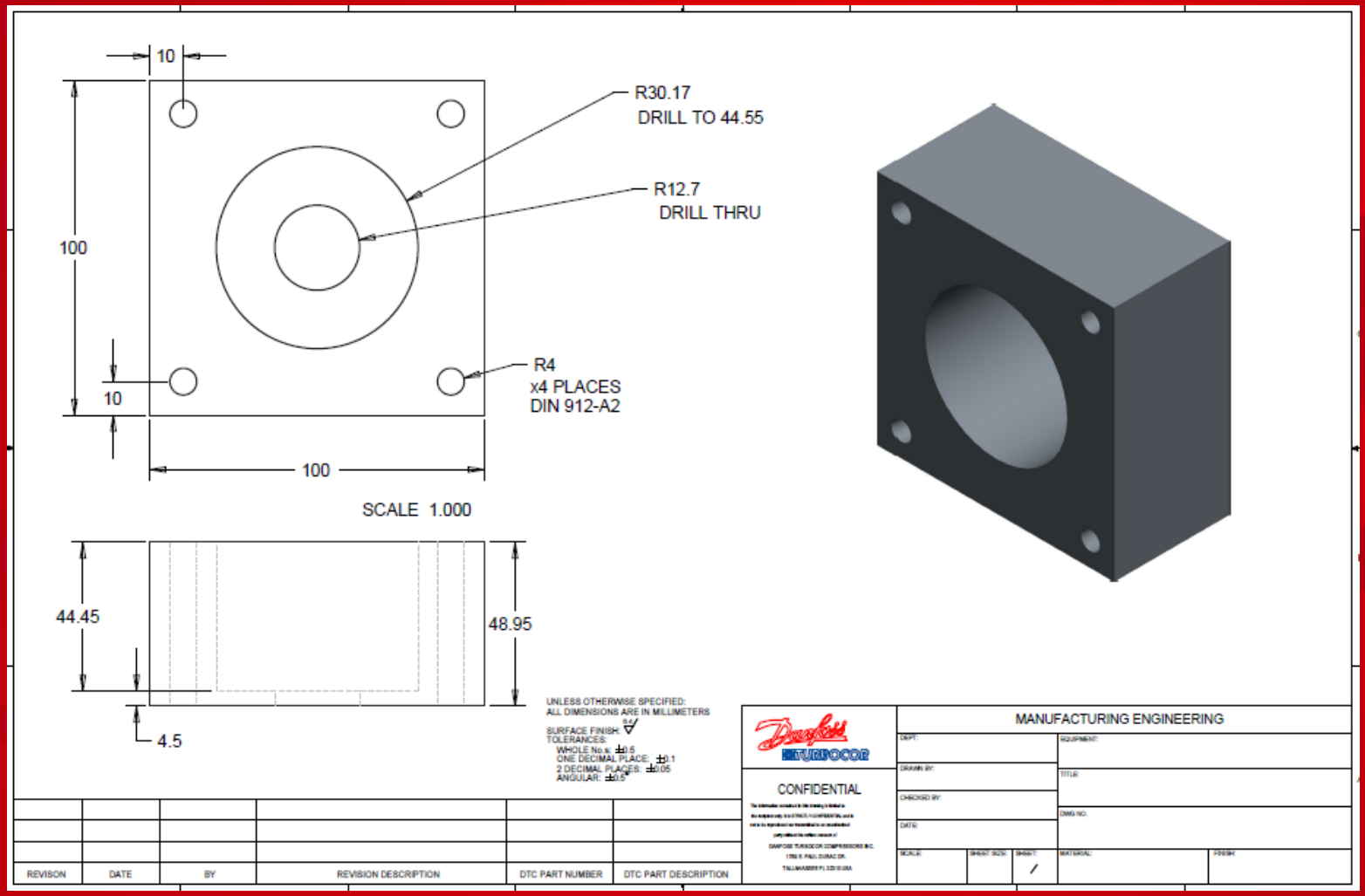

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Linear Guide Connector

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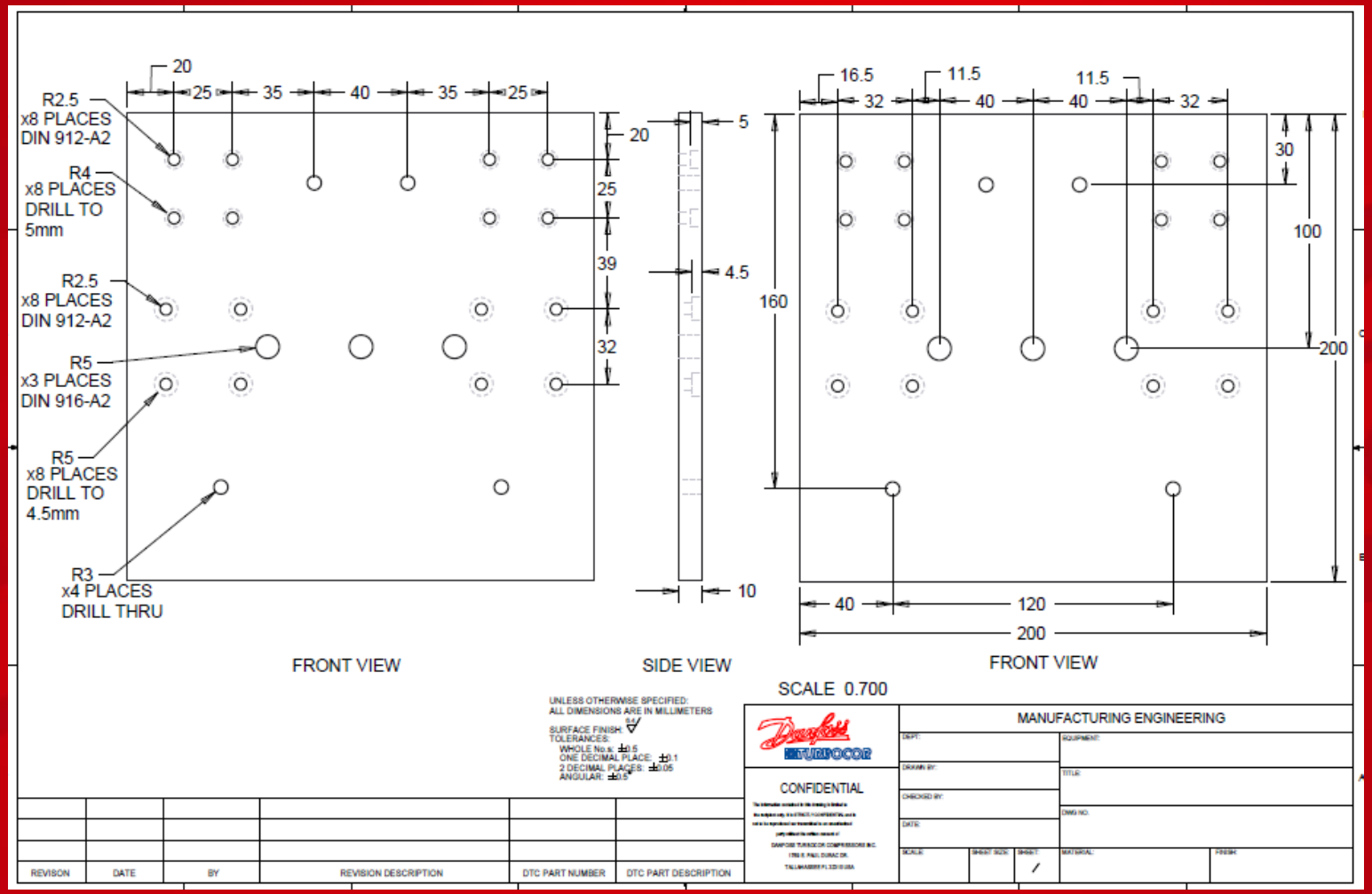

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Live Center Upright Support

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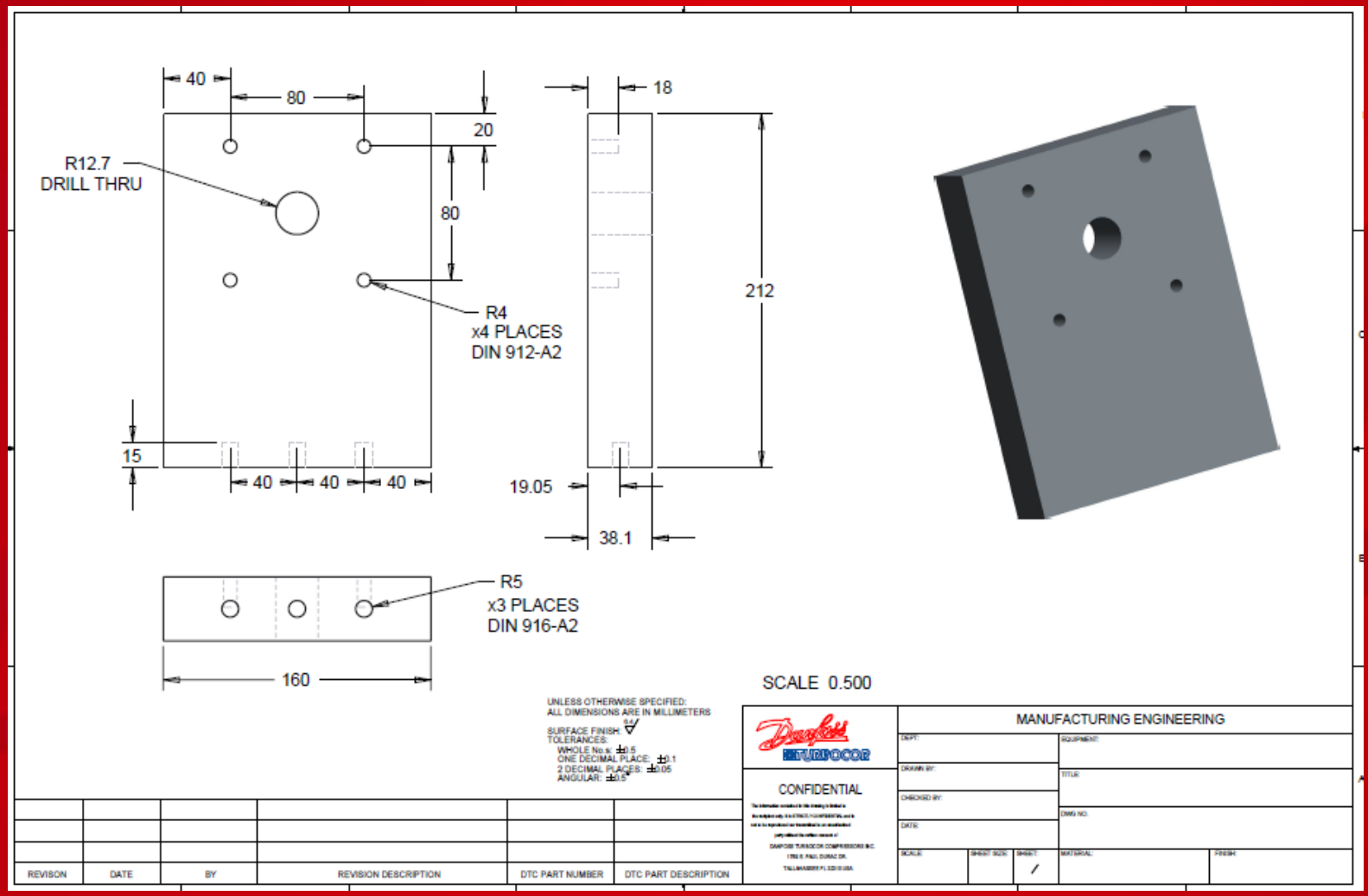

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Motor Base Support

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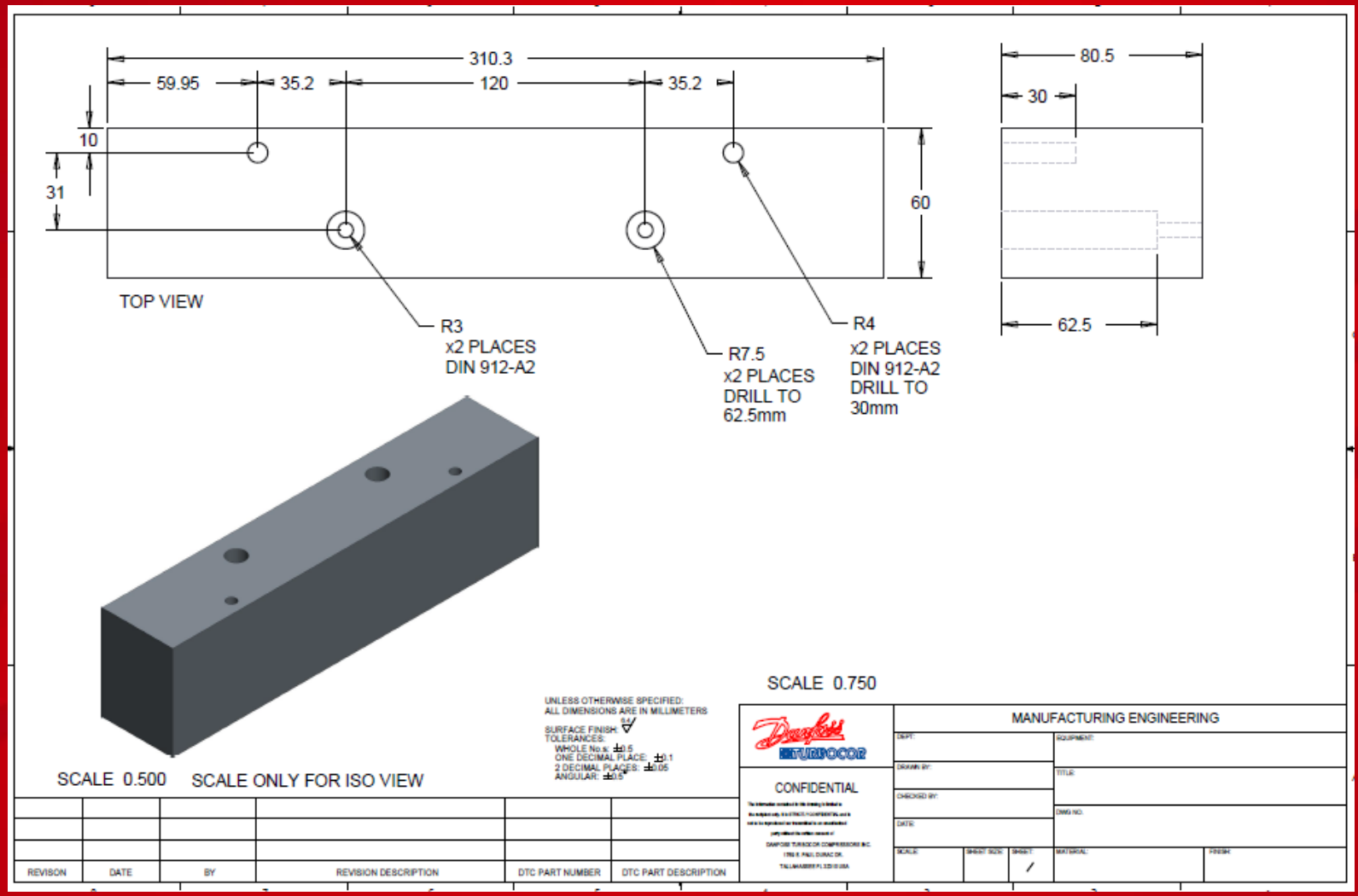

Prototype Subassemblies

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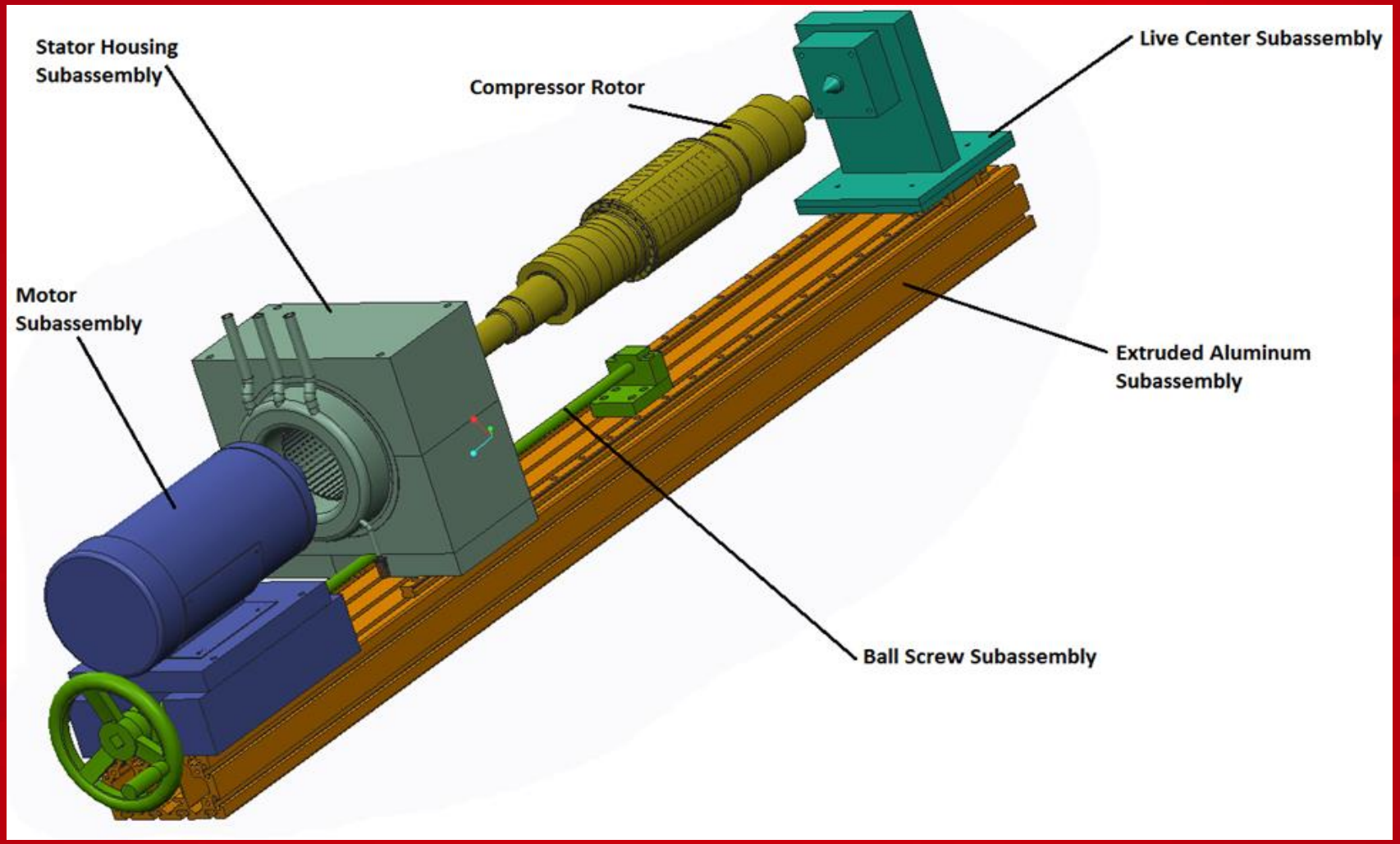

FEM: Rotor Connection

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

Displacement in mm
Max: 0.048 mm