

VTT Rotor: Back EMF Test Fixture Midterm Presentation I

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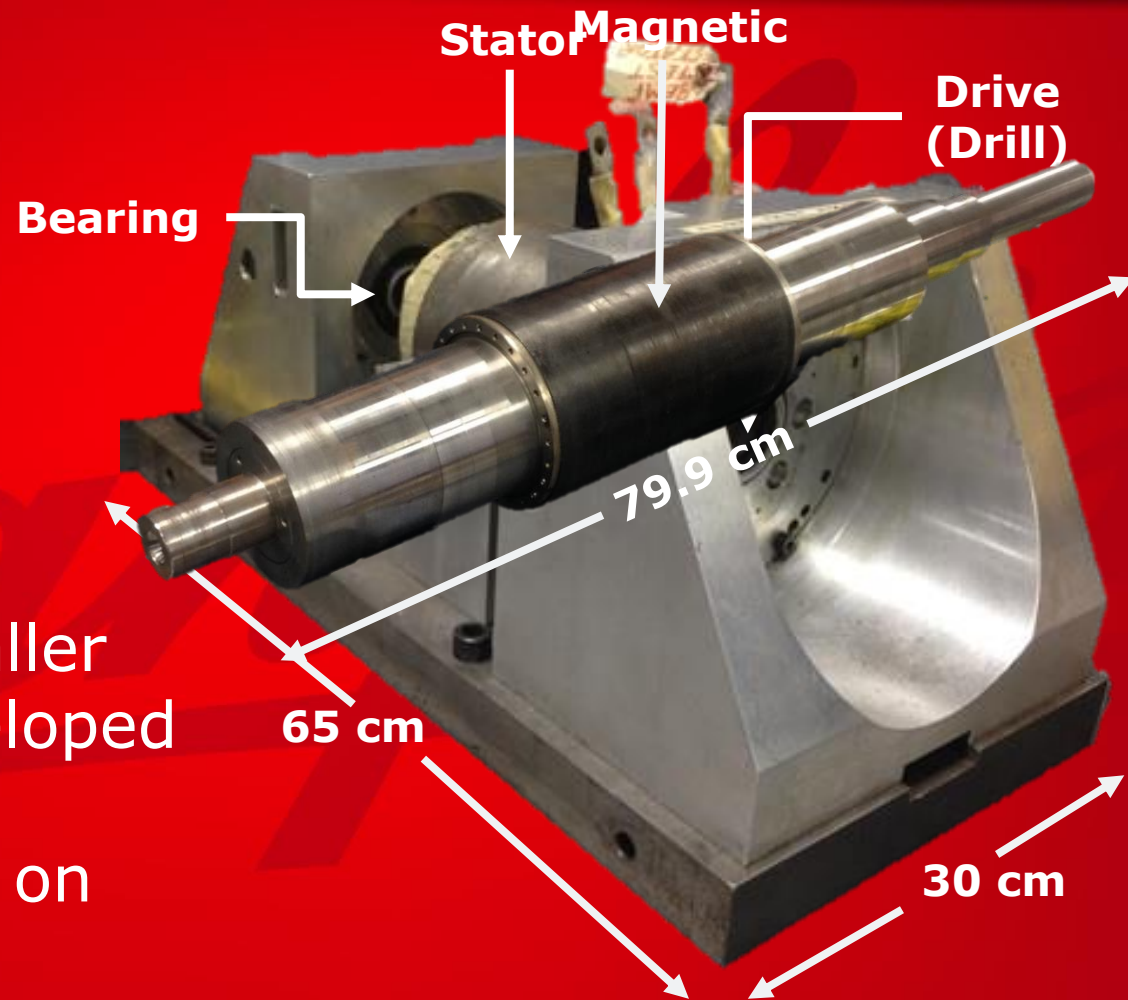
Date: 2/17/2015

Presentation Outline

- Background and Motivation
- Final Prototype
- Key Design Components:
 - Extruded Aluminum Baseplate
 - Ball Screw
 - Live Center Assembly
- Current Status
- Drawing Updates
- Gantt Chart
- Conclusion

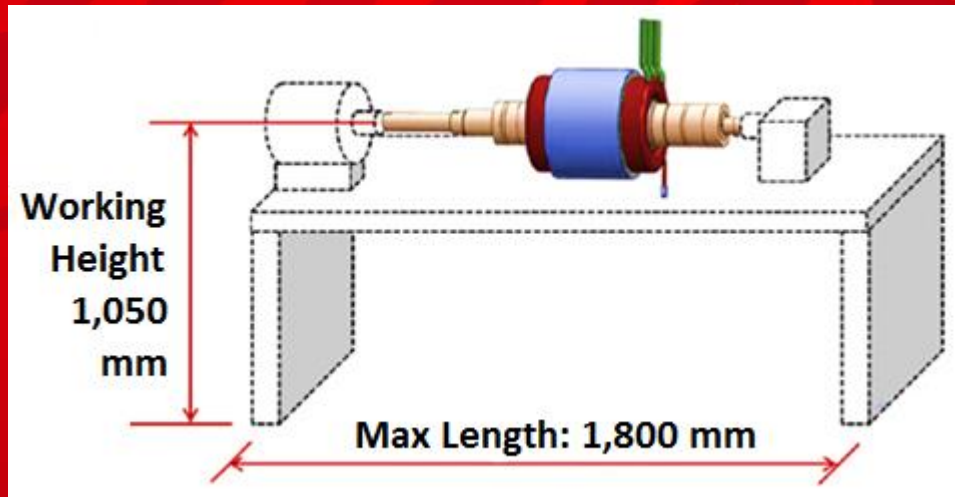
Motivation and Goal

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



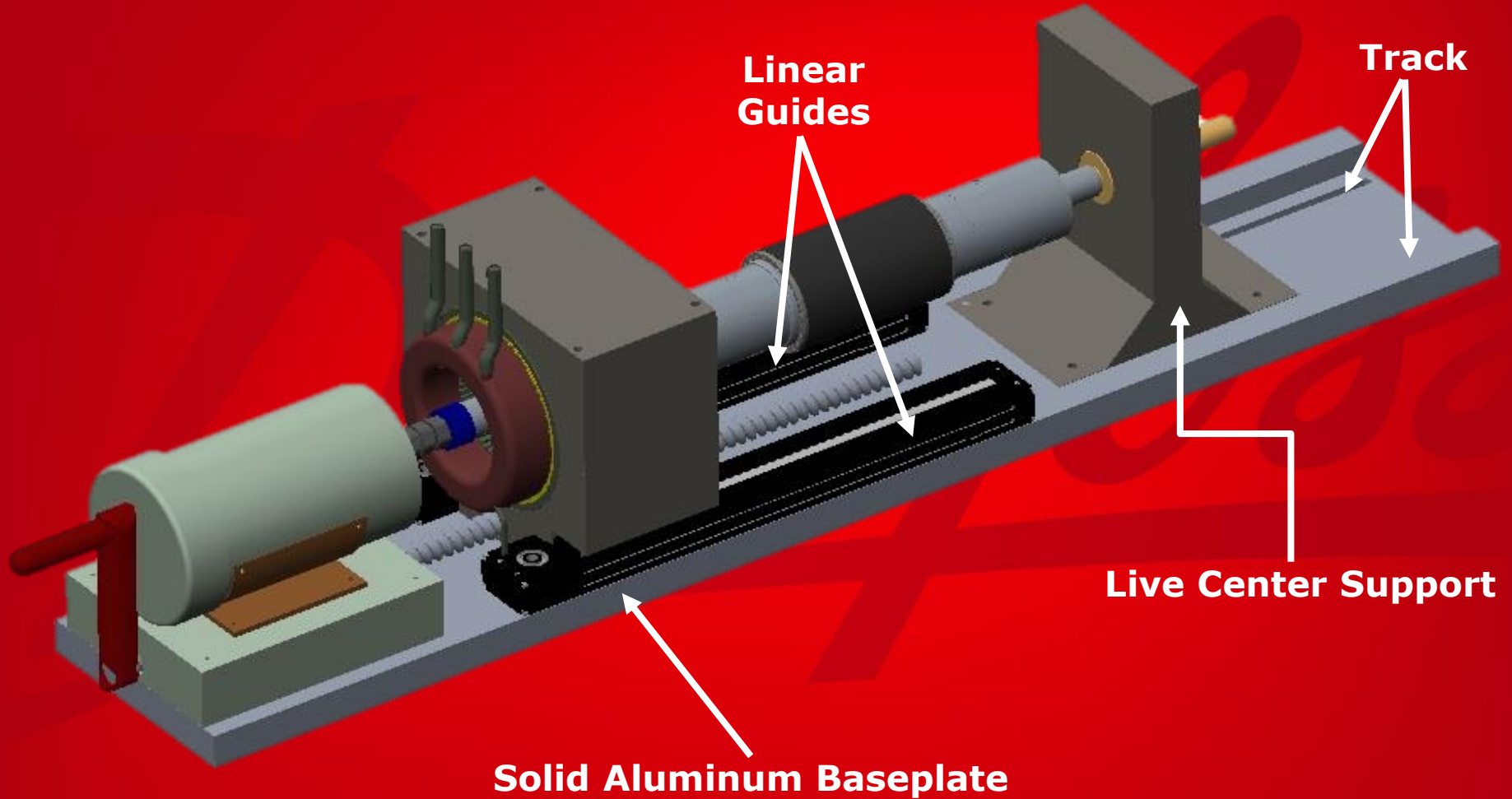
Design Challenges

- 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:

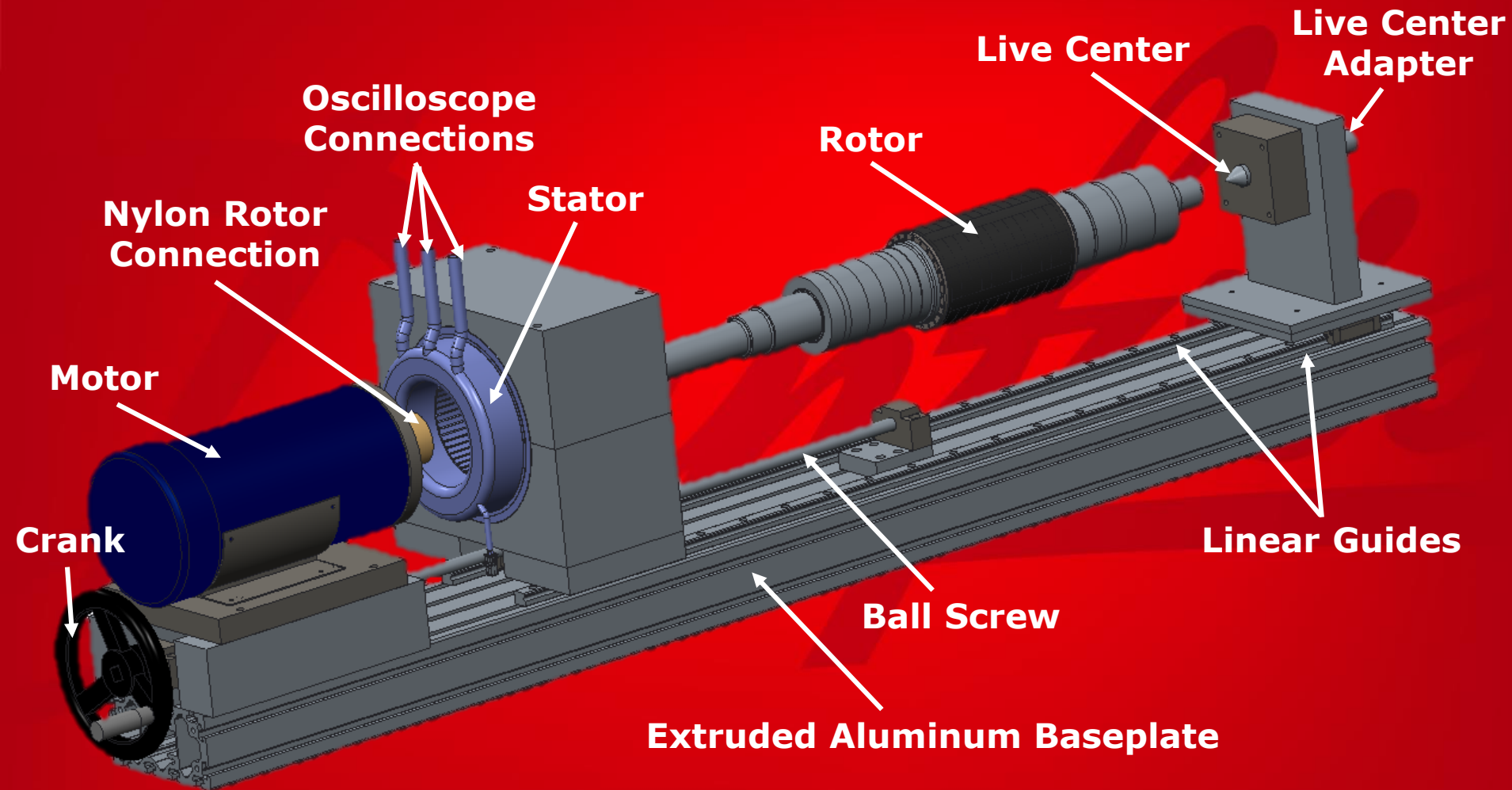


Initial Prototype

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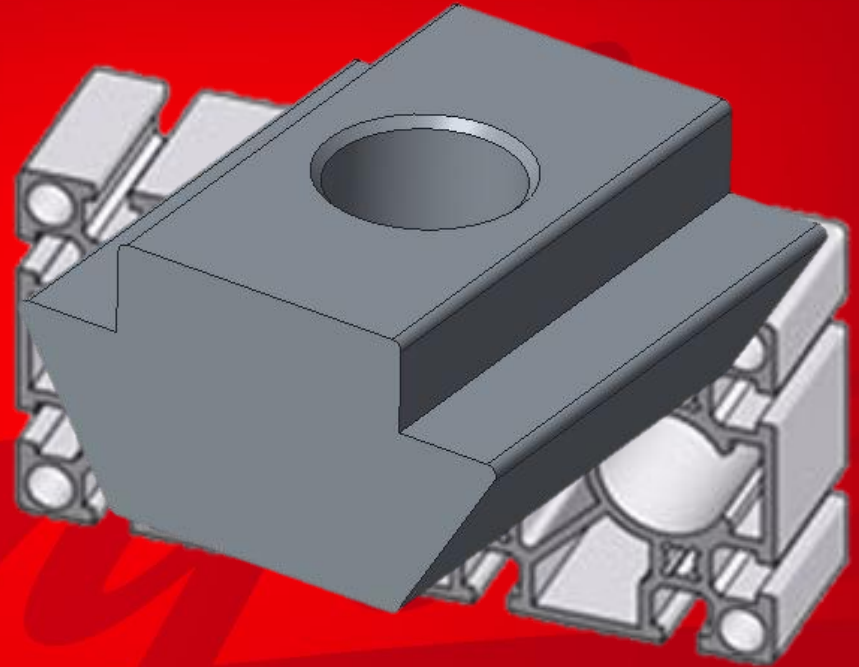


Final Prototype



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
 - 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**
 - Rated for 155 N-m, FOS of 4.4
 - Total Cost (Ball Screw, Guides, Clamps, Bearing Blocks):
\$1217.48



Misumi BSBR1510-1100 Ball Screw



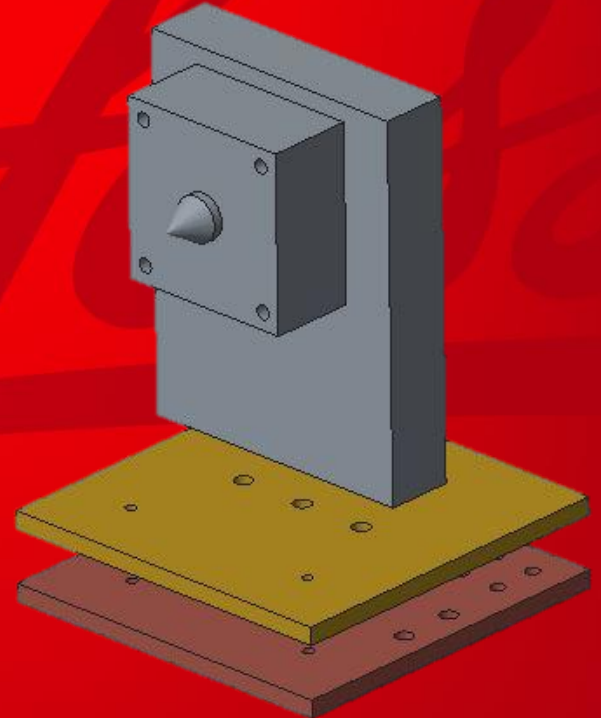
Misumi SX2R28-1240 Linear Guides

Live Center and Housing

- Live Center used to center the rotor
- Will be press fit into the support system
- 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

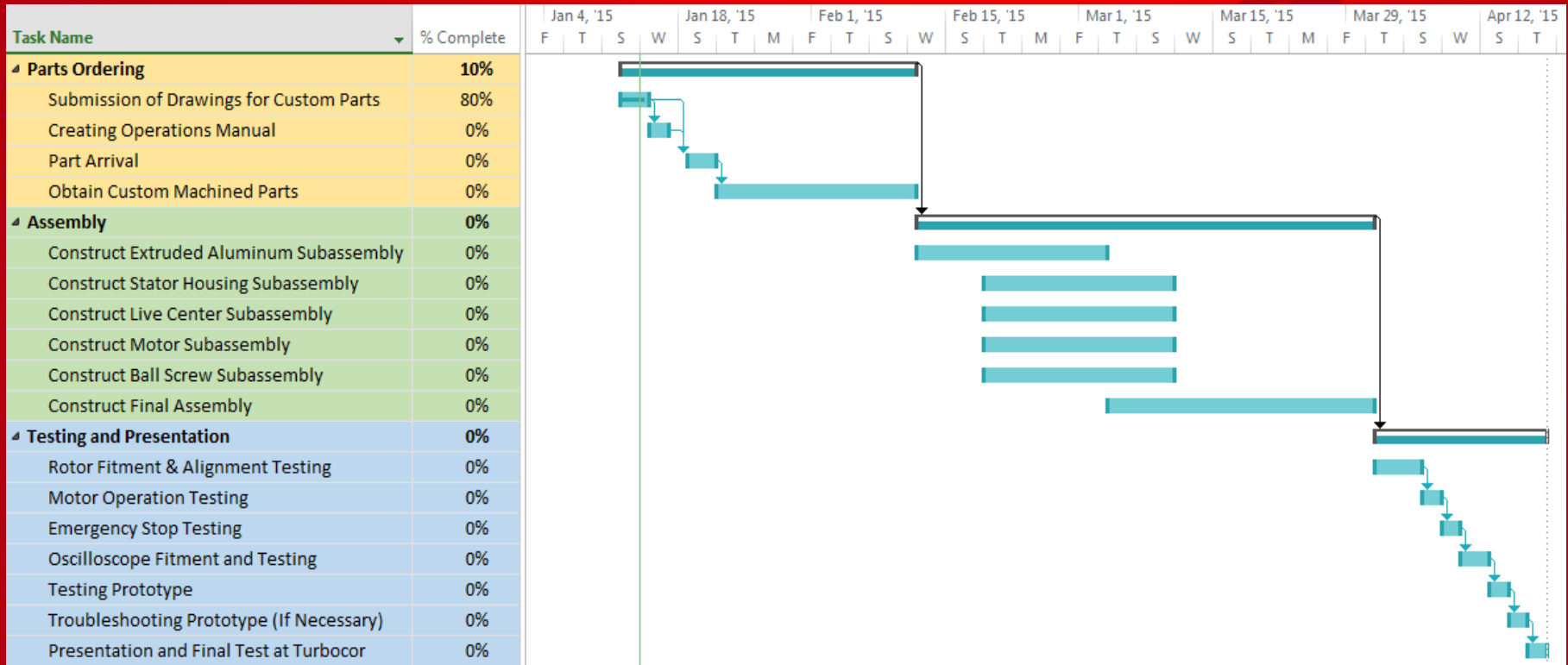


Live Center Housing

Current Project Status

- Final Design Review was held at Turbocor at the end of the Fall 2014 semester
 - Design approved
 - Purchase orders for individual parts submitted
- Spring Turbocor Meetings
 - Drawings for custom parts finalized
 - Purchase orders for aluminum submitted
- Next Step: Manufacturing Stage
 - As parts arrive from suppliers and custom made parts are machined, assembly of test fixture will begin

Gantt Chart



Conclusion & Future Work

- Drawings for custom made parts finalized.
- Once drawings are approved and parts start arriving, assembly may begin
- Participating in the ASEE Poster Competition and the ASME's SPDC Poster Competition.
- After assembly, several tests need to be performed
- Final goal: Implementation ready by April 14th, 2015

Questions or Comments?

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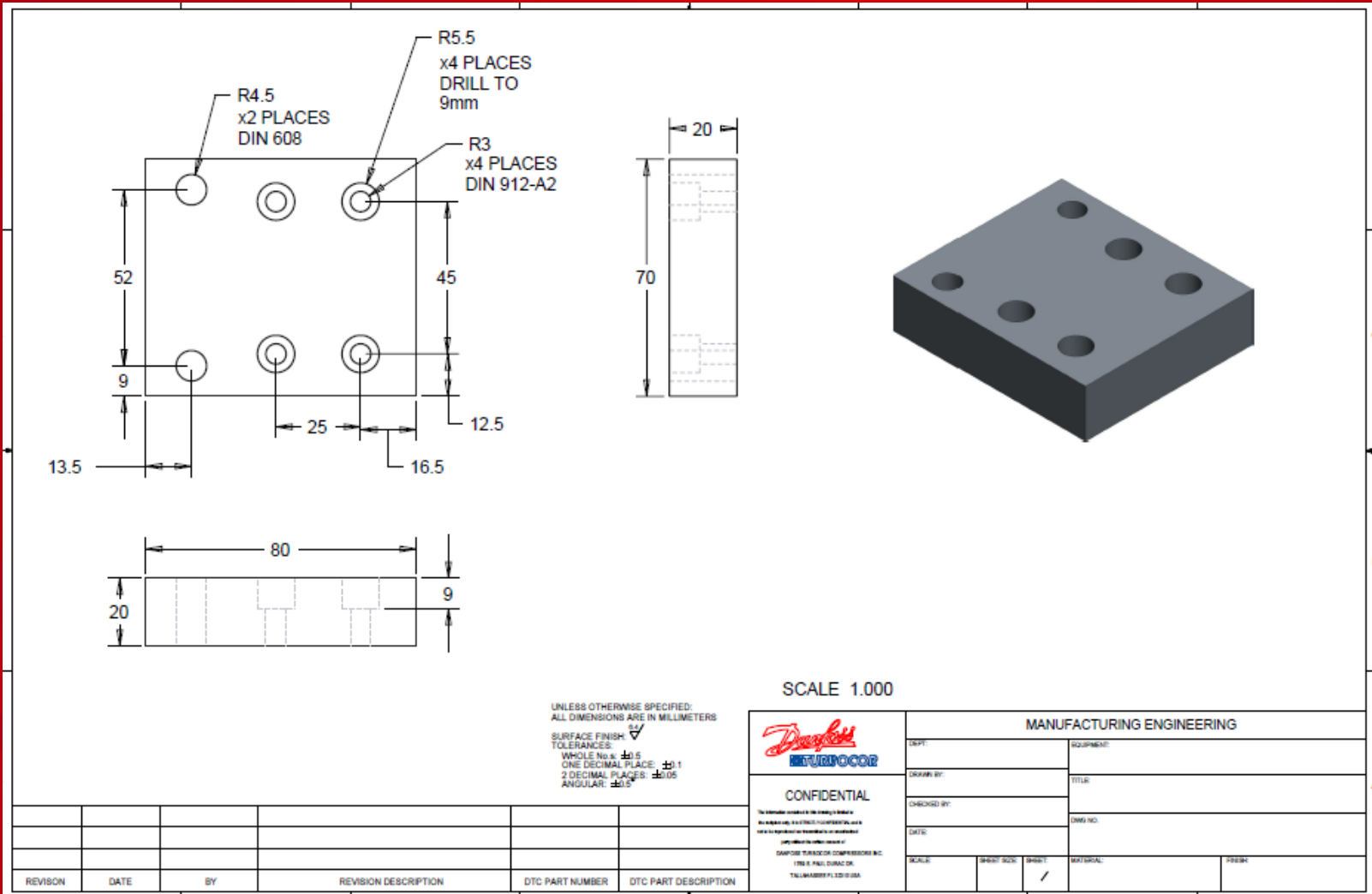


- For more information, see our website:
http://eng.fsu.edu/me/senior_design/2015/team04/

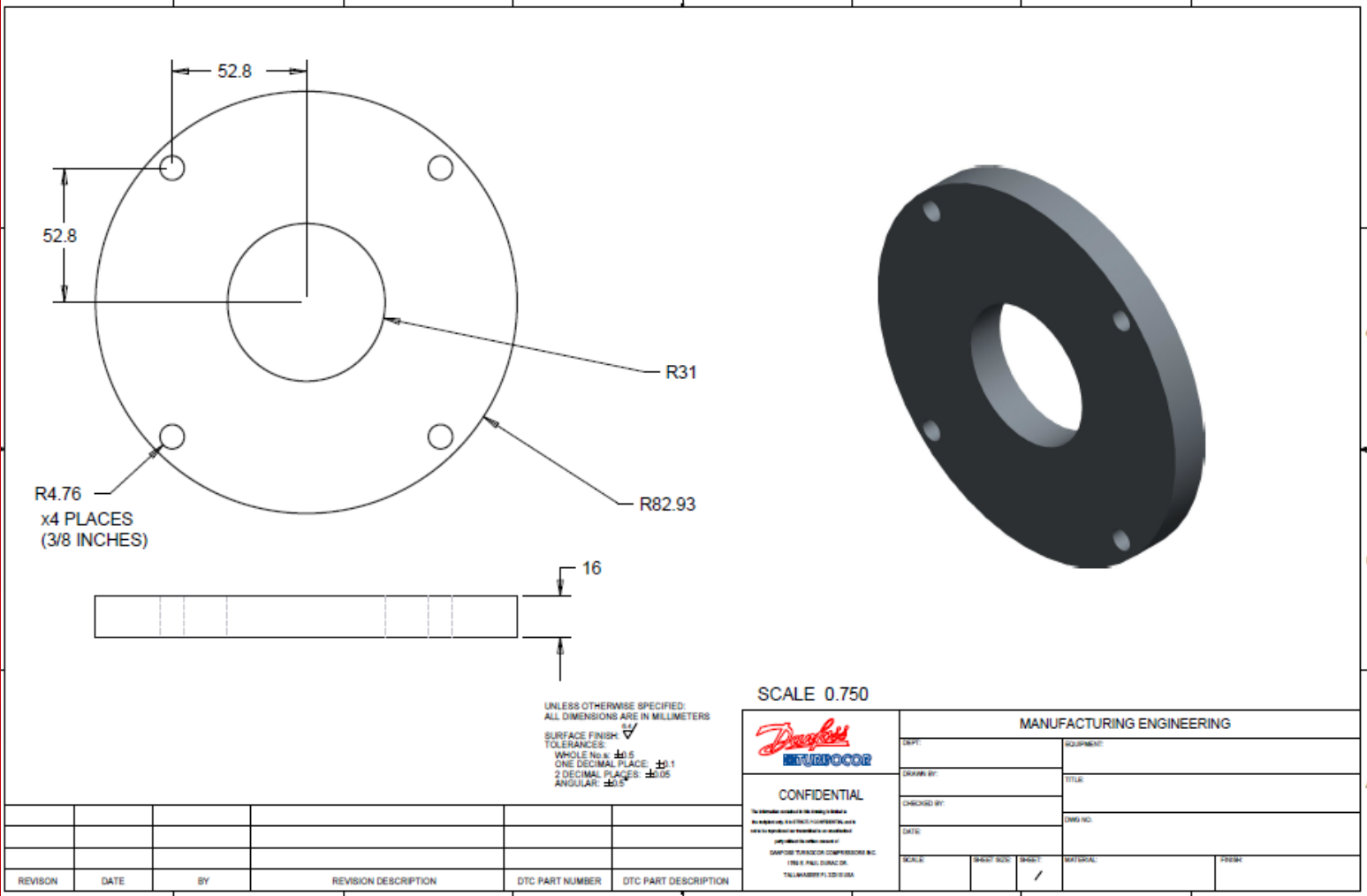


Bearing Block Support

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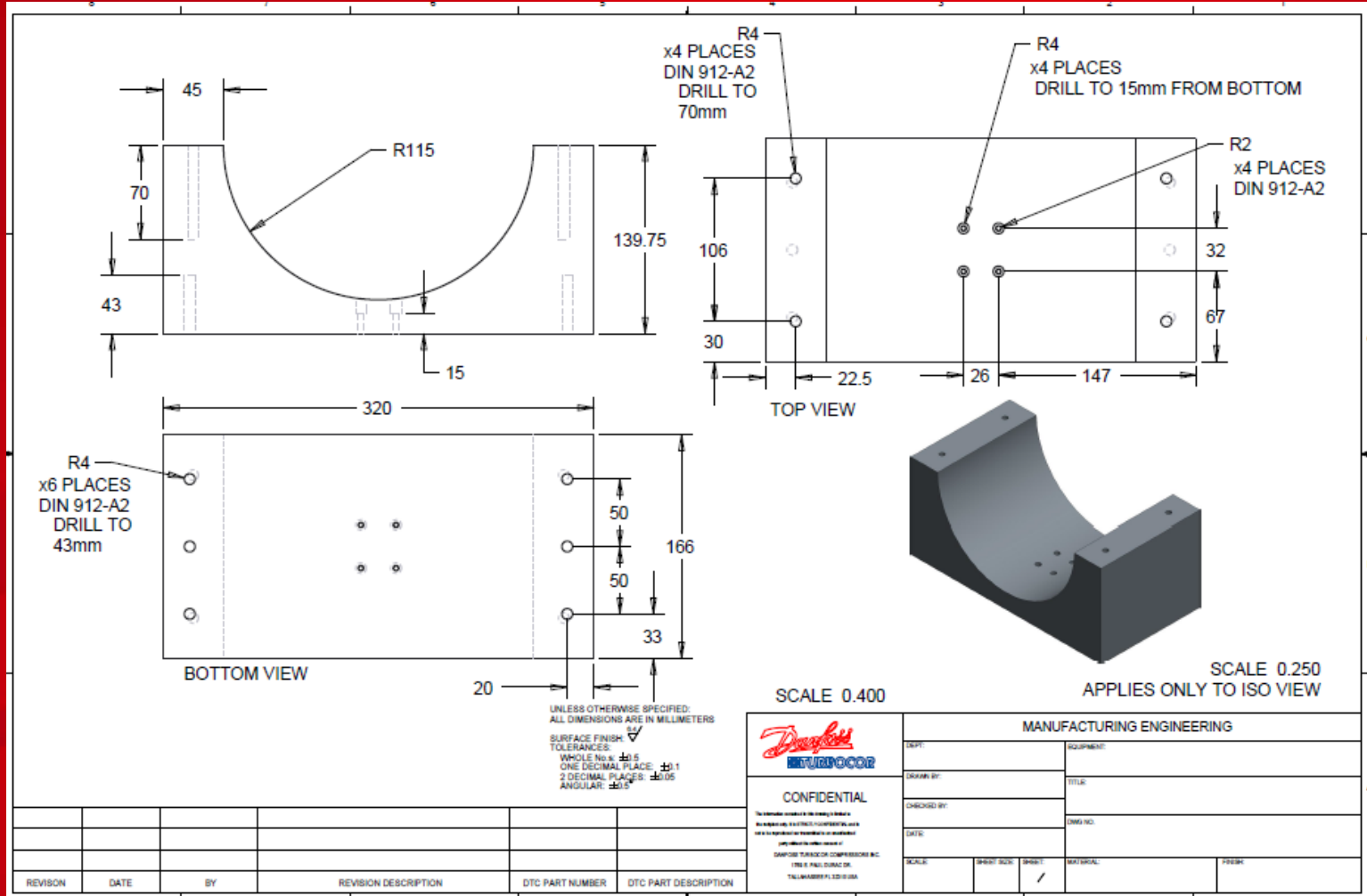


Motor Bearing Support



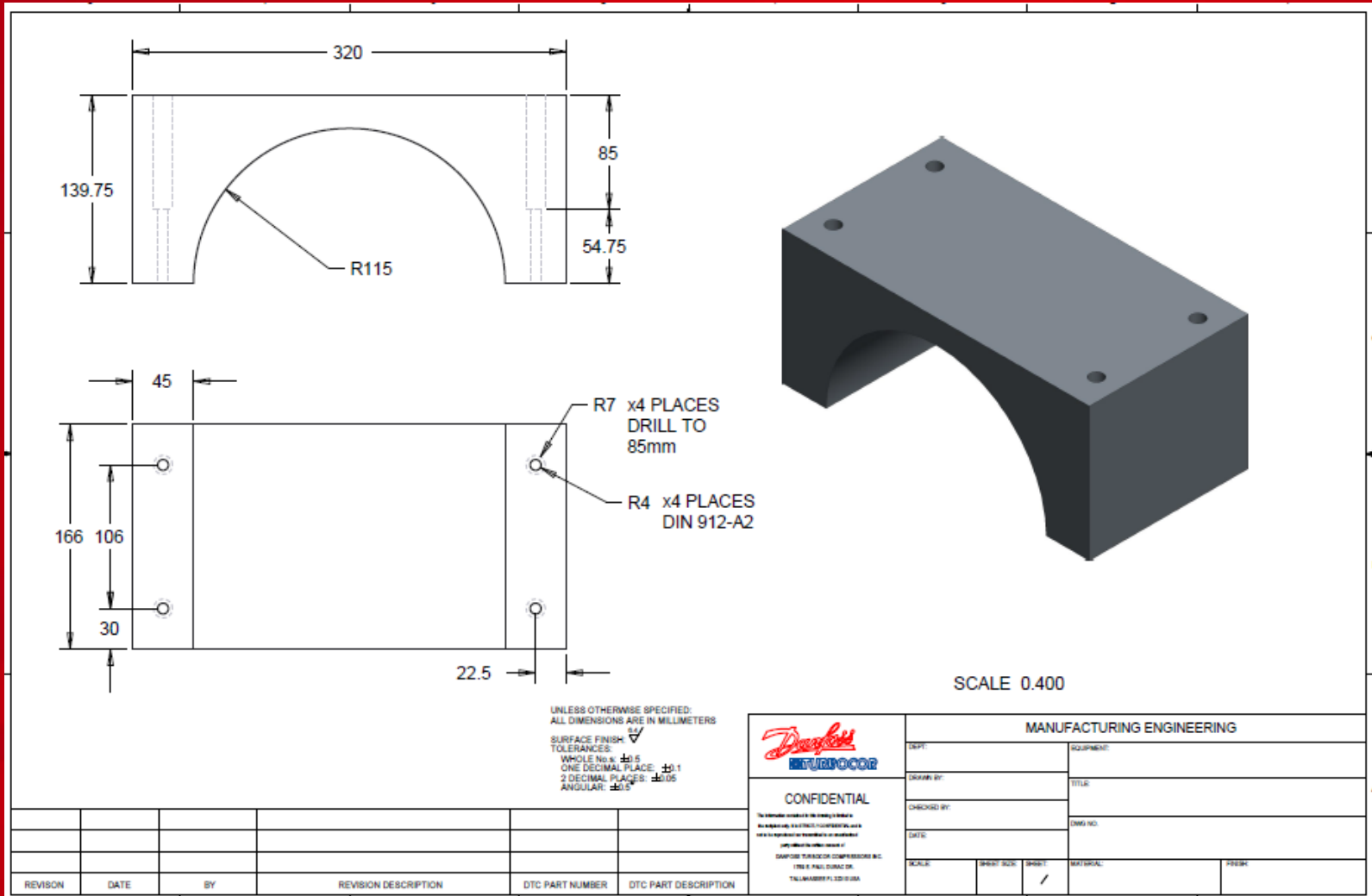
Bottom of Stator Housing

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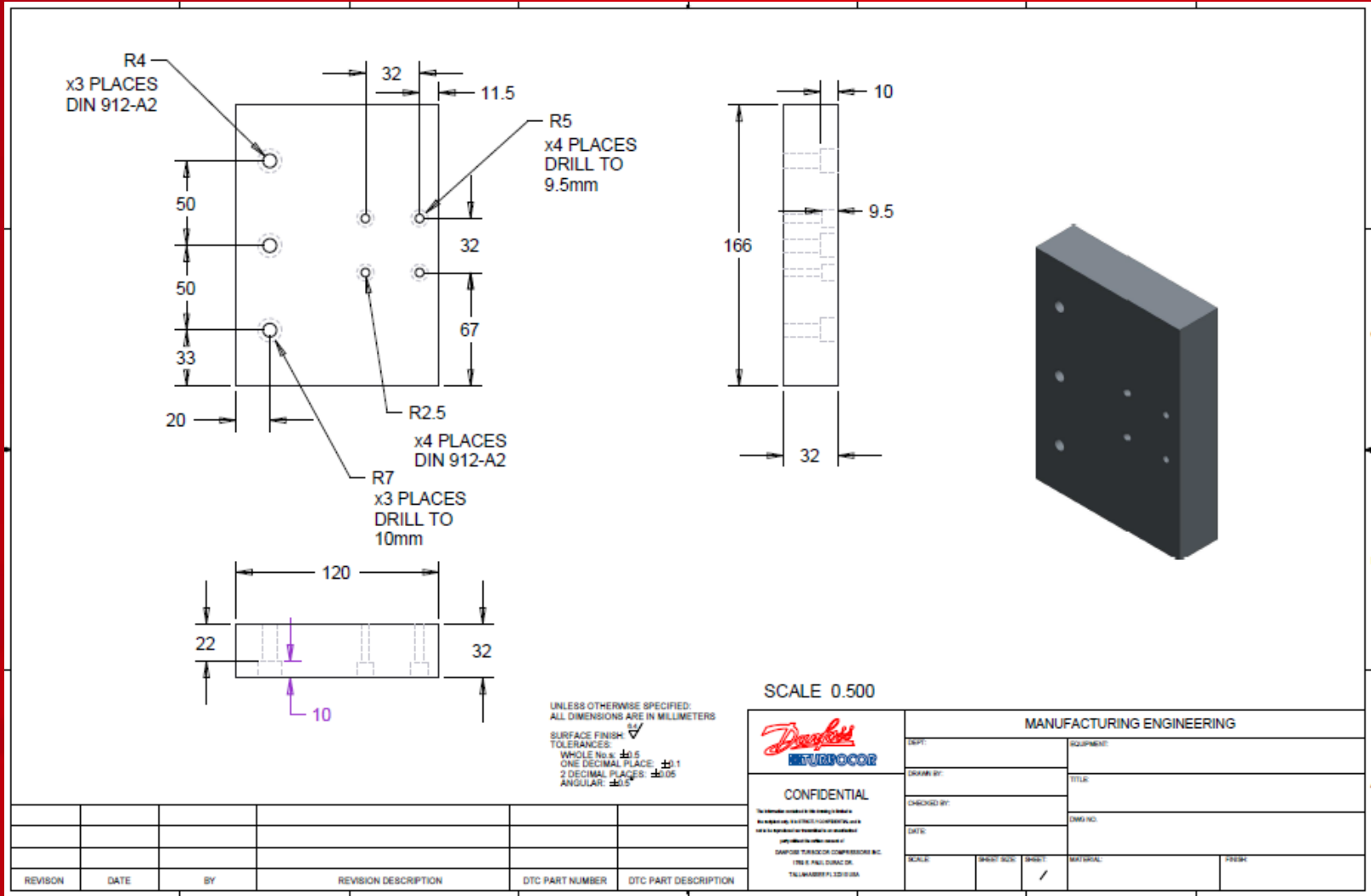
Top of Stator Housing

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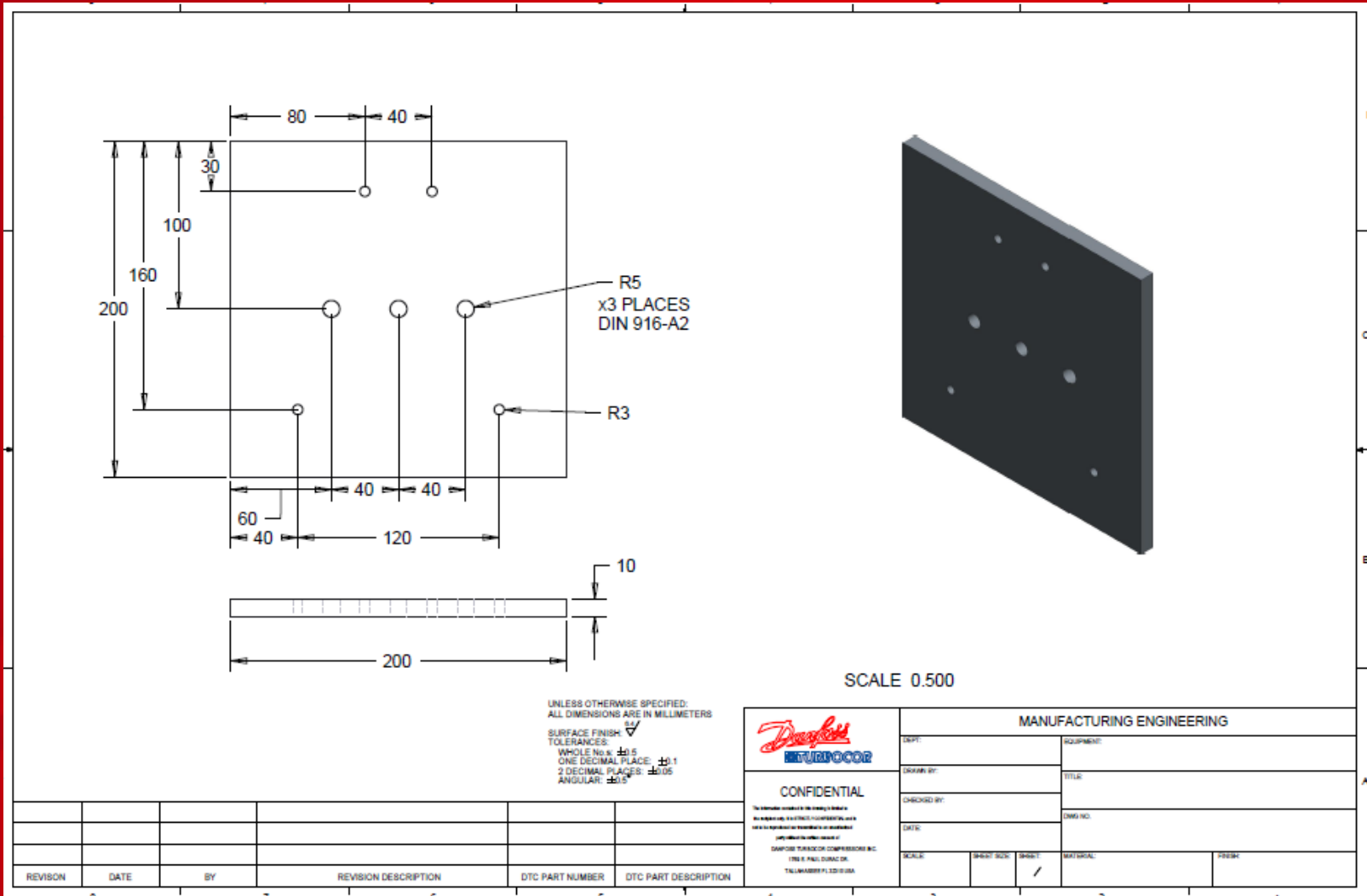
Linear Guide Spacer

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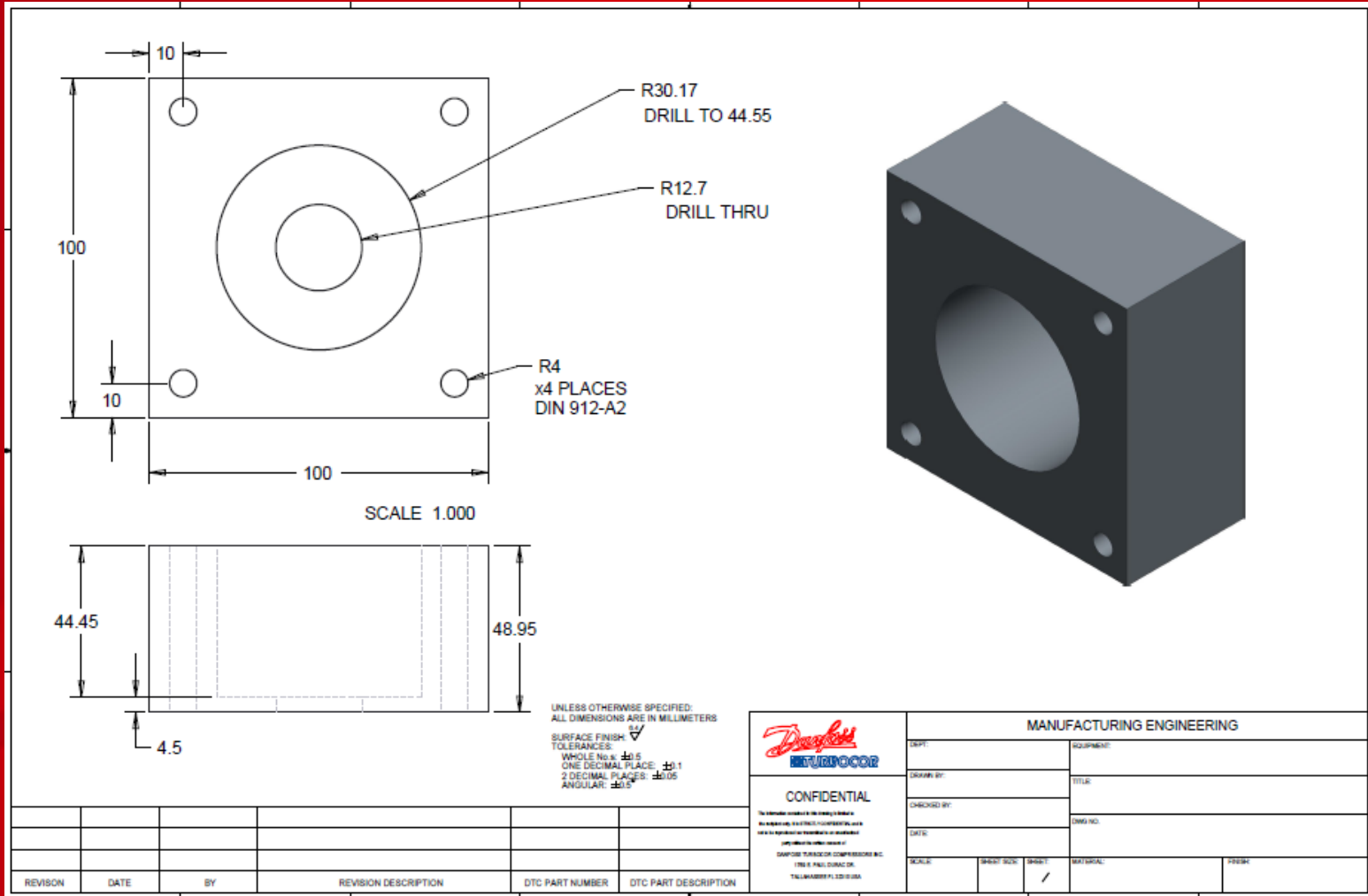
Live Center Baseplate

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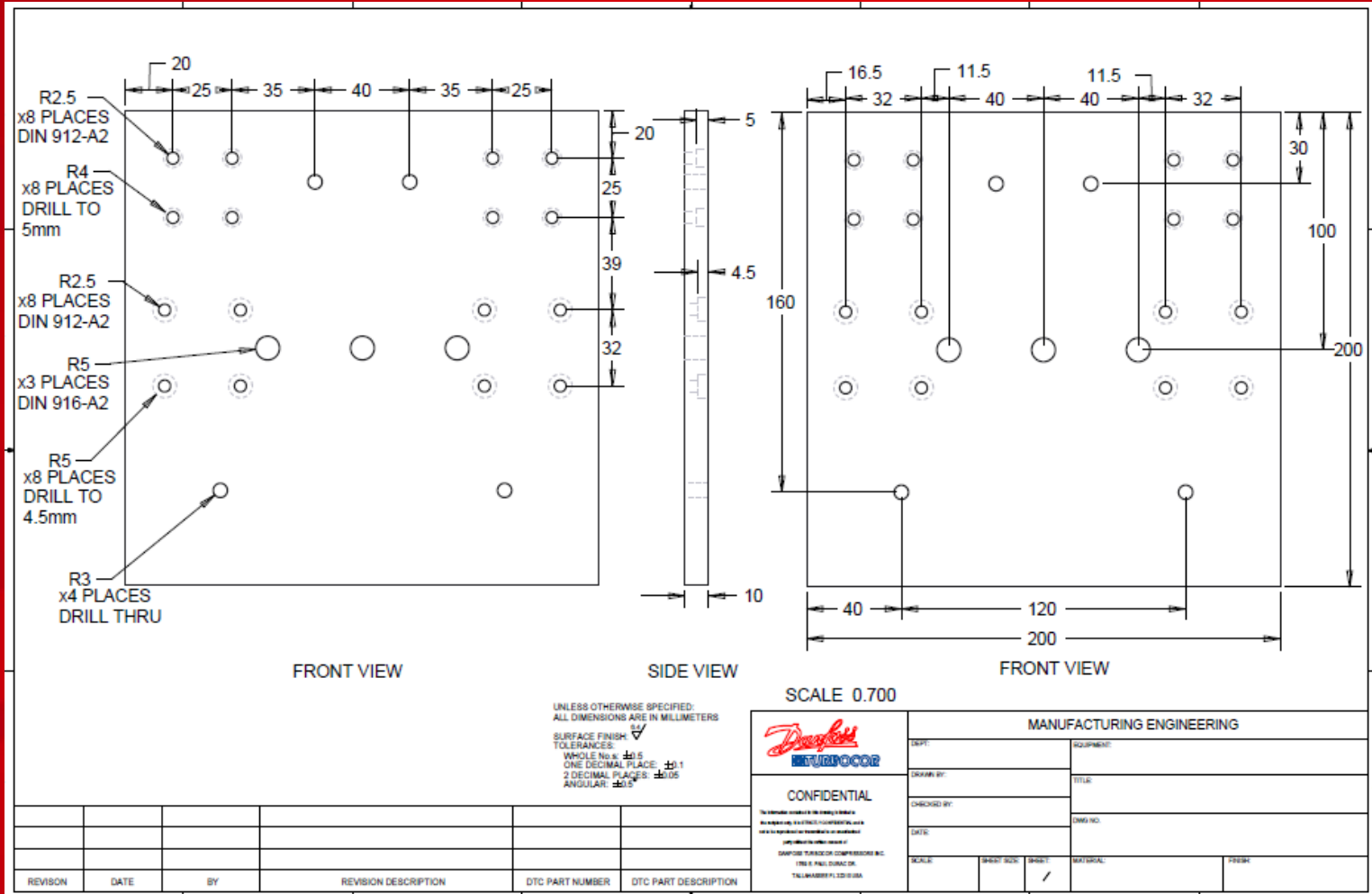
Live Center Frontplate

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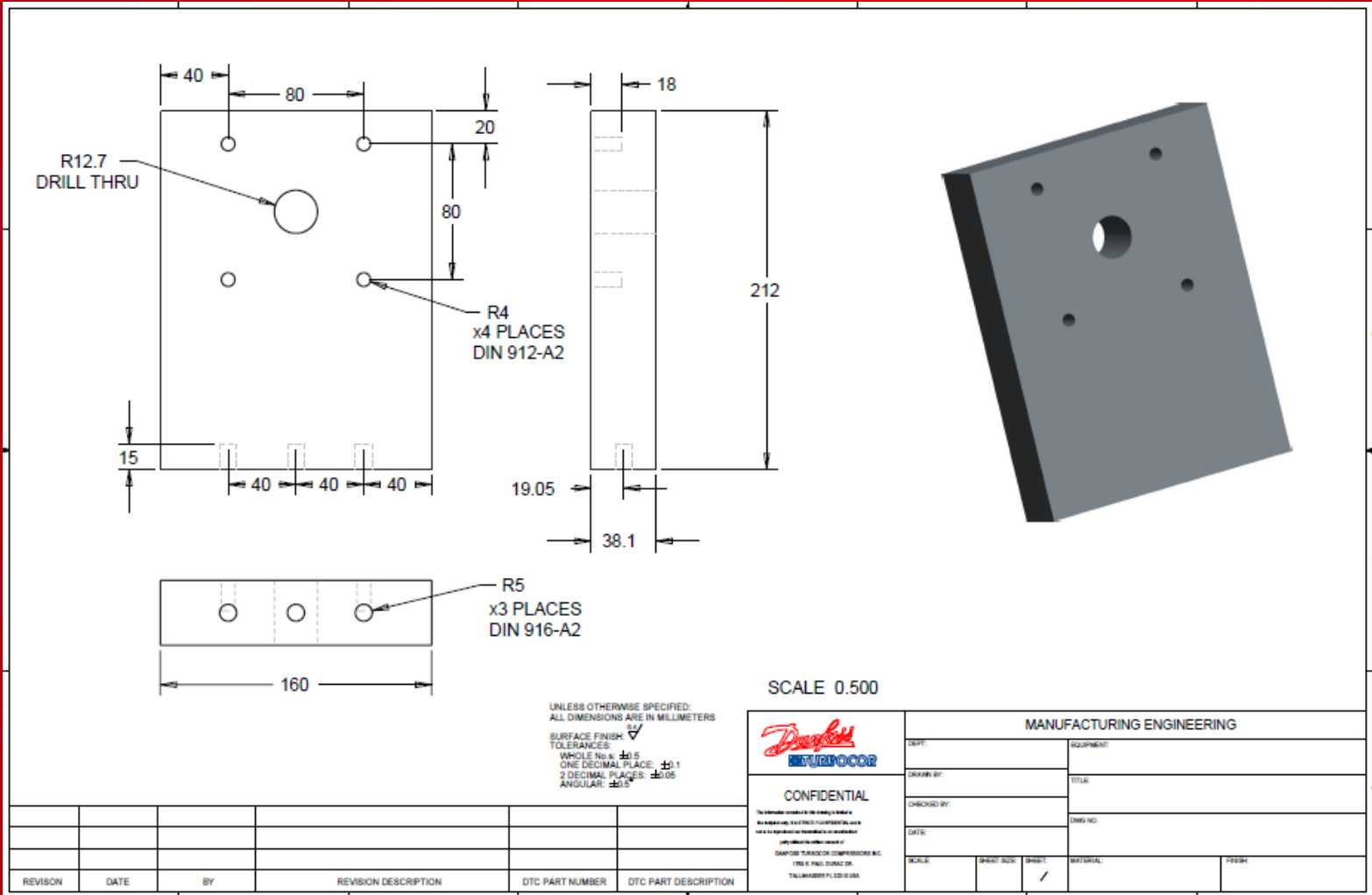
Linear Guide Connector

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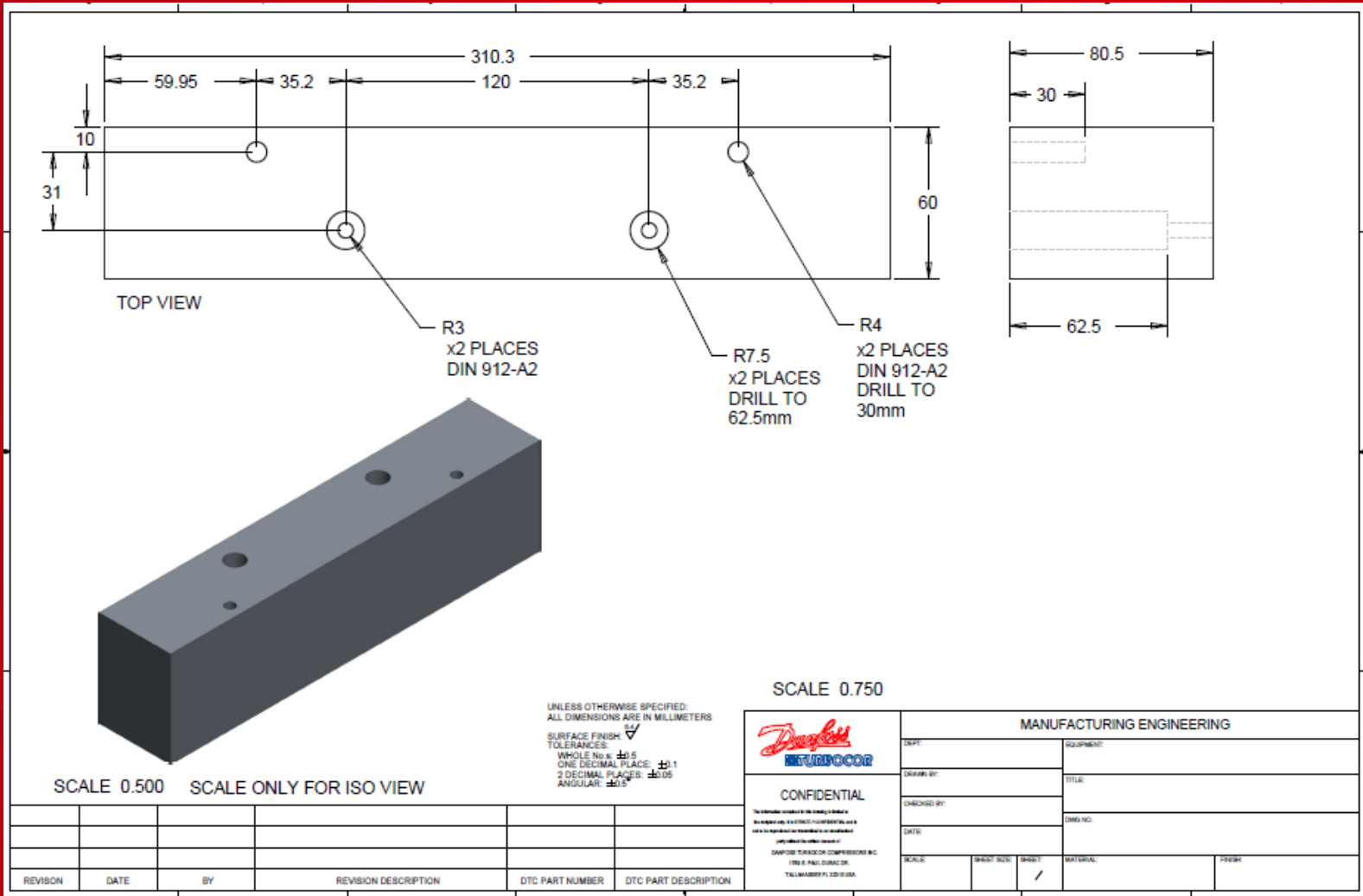
Live Center Upright Support

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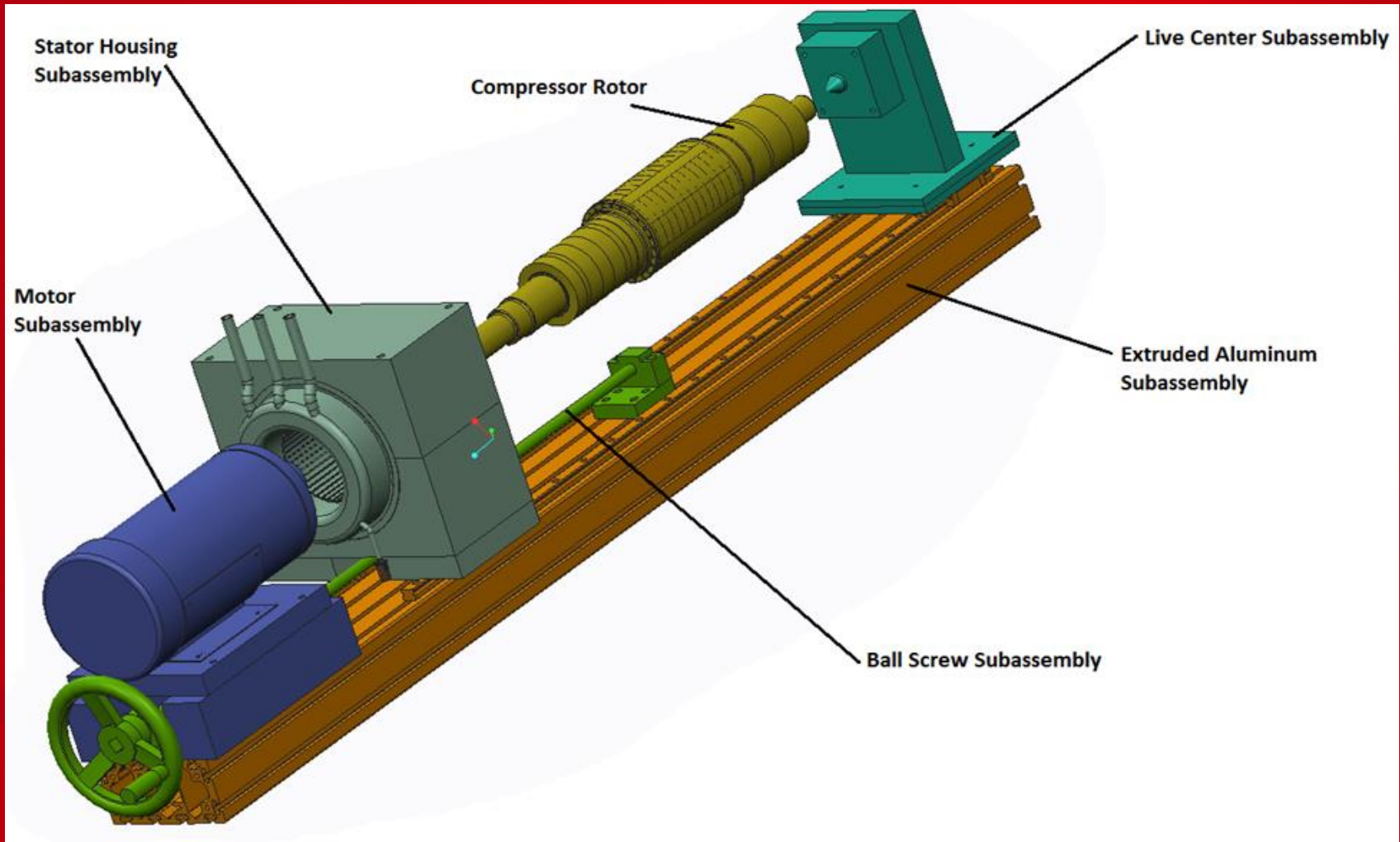


Motor Base Support

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Prototype Subassemblies



FEM: Rotor Connection

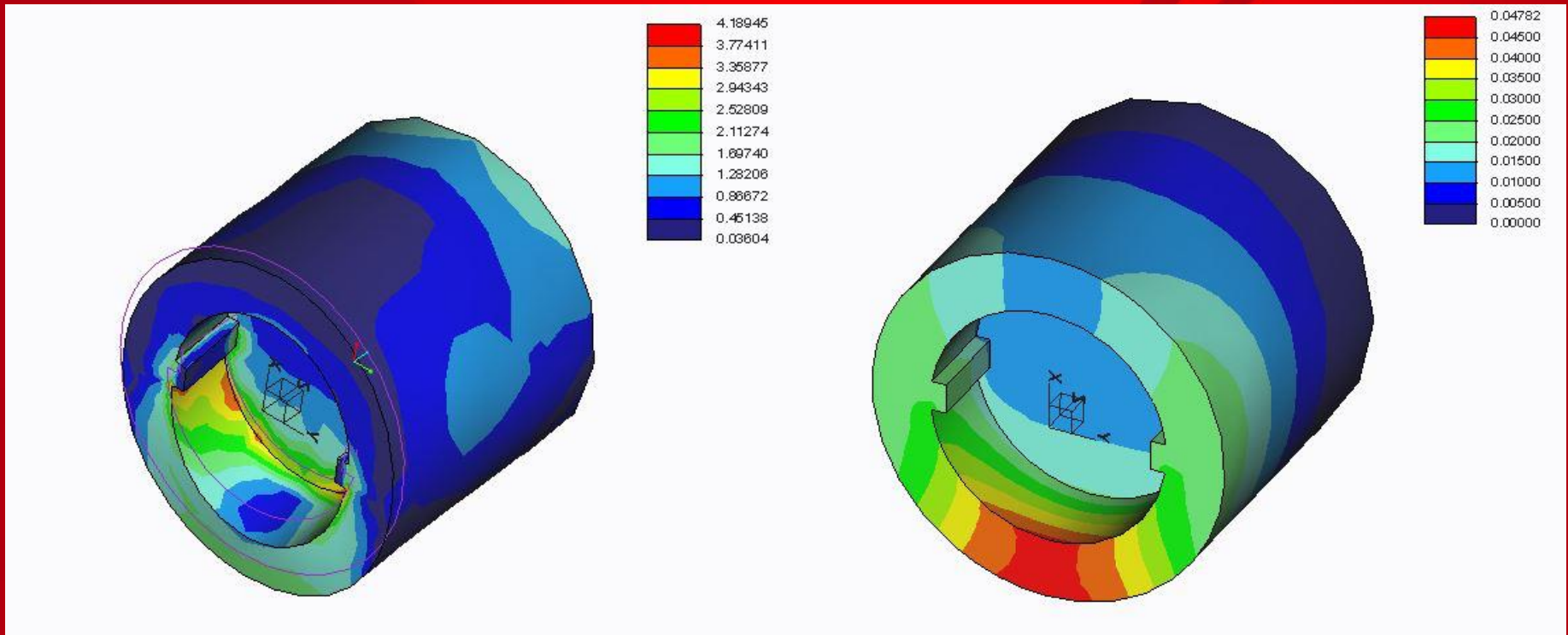
Stress in MPa

Max Stress: 4.19 MPa

Nylon Tensile Strength: 76 MPa

Displacement in mm

Max: 0.048 mm

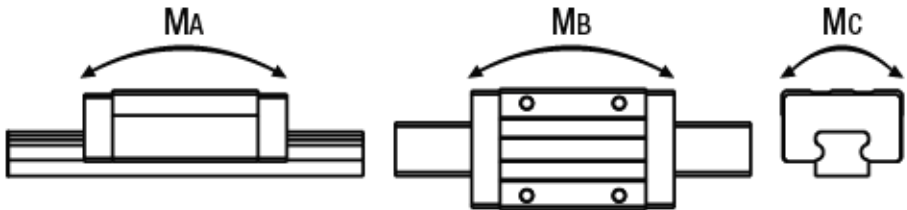


Linear Guides

- Vendor: Misumi
- Part Number: SX2R28-1240
- Unit Height: 1240 mm
- Moment due to Magnetic Force:
 - 35 N-m
- Allowable Moment:
 - 155 N-m
- Factor of Safety:
 - 4.4

kgf=Nx0.101972

H	Basic Load Rating		Allowable Static Moment		Mass		
	C (Dynamic) kN	Co (Static) kN	MA, MB N·m	Mc N·m	Block kg		Guide Rail kg/m
					Standard	Wide	
24	8.6	14.2	69	98	0.20	0.25	1.5
28	12.5	21.3	155	232	0.30	0.35	2.4
33	20.2	34.5	275	393	0.45	0.60	3.4



The diagrams illustrate the application of moments MA, MB, and MC. MA is shown as a moment applied to the top of the guide block. MB is shown as a moment applied to the side of the guide block. MC is shown as a moment applied to the bottom of the guide block.

Motor and Motor Drive

- Vendor: Automation Direct
- Motor: E2007A AC Motor, 2 HP, 1800 RPM, 3 phase
- 24 ft-lb start up torque, 11 ft-lb needed
- Factor of Safety: 2.2
- Drive: GS1 2 HP AC Drive, 3 phase



E2007A AC Motor



GS1 AC Drive