Motor Test Rig

Group 5:
Jack Pullo
Alex Jurko
Jonathan De La Rosa
Fehintoluwa Aponinuola

William Sun – Sponsor
Patrick Hollis – Staff Advisor

02/23/2017

OUTLINE

- Project overview
- Approved design
- Design progress
- Schedule
- Conclusion

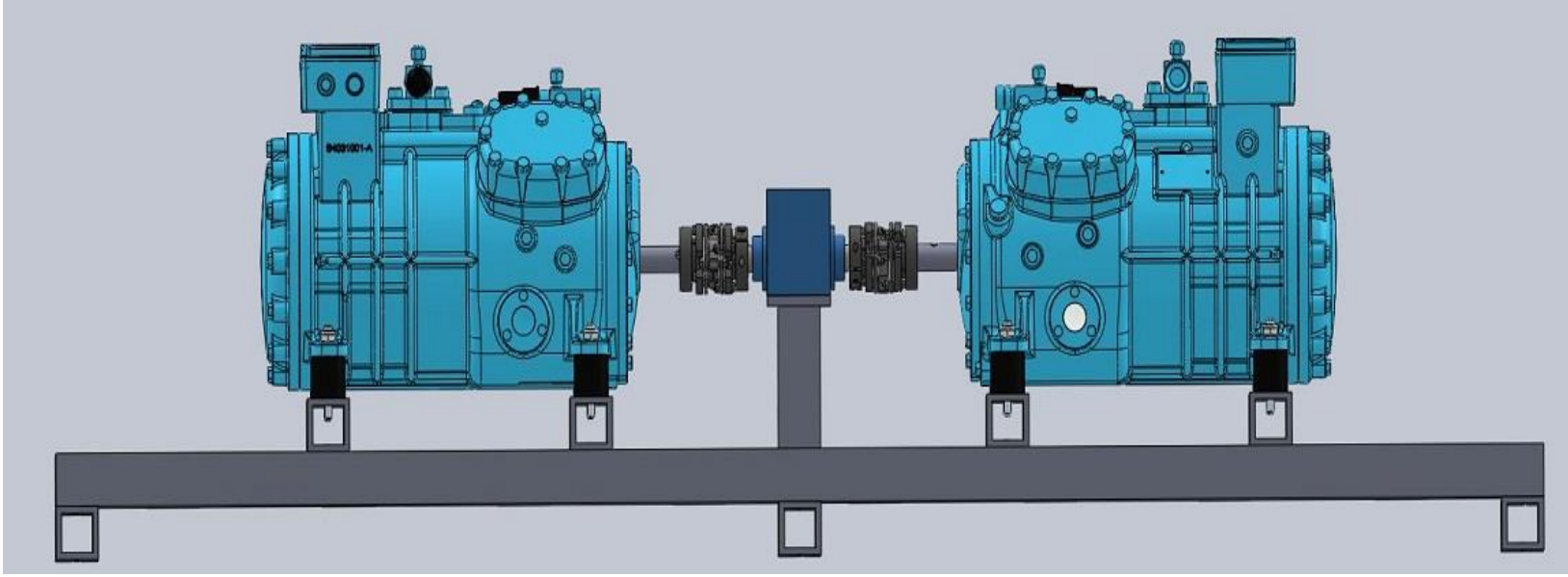


Fig. 1. Motor Test Rig

PROJECT OVERVIEW

THE PROBLEM

- Danfoss Turbocor manufactures compressors but don't have a mechanism to determine the torque load and power efficiency of the compressors.

GOAL STATEMENT

- To improve on the design of a motor test rig to determine the torque load and power efficiency of Danfoss Turbocor's compressors.

PROJECT OVERVIEW

WHAT IS A MOTOR TEST RIG?

- Treating one compressor as a motor and the other as a generator.
- In this case, we'll be using two compressors provided by Danfoss Turbocor.
- A transducer placed between will measure the axial loads and determine the power efficiency.

PROJECT OVERVIEW

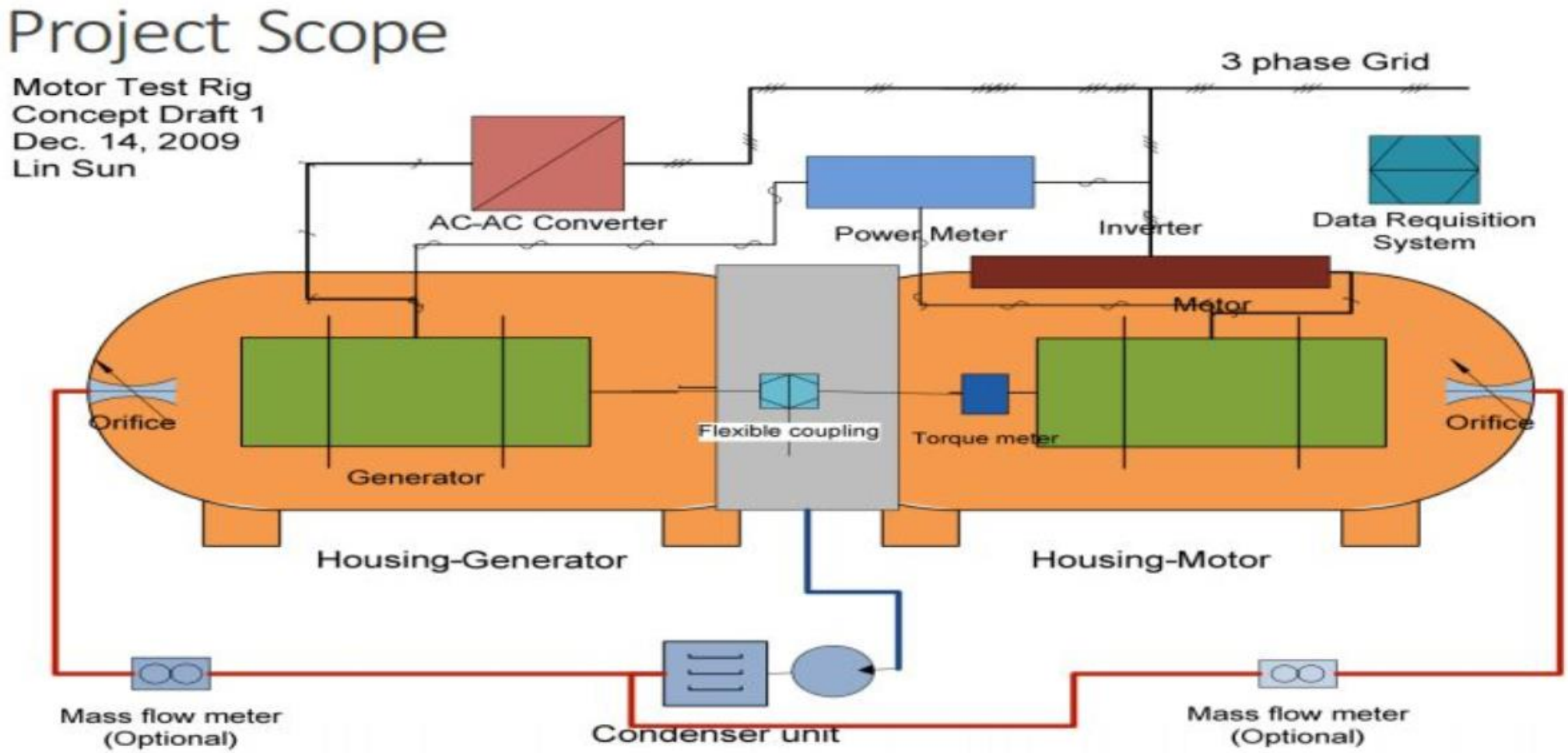


Fig. 2. Motor Test Rig

PROJECT OVERVIEW

OUR OBJECTIVES

1. Incorporating an adjustable stand in the base frame for a torque transducer
2. Purchasing appropriate couplings, torque transducer and alignment tool for the system
3. Aligning the compressors and the components between them
4. Achieving levitation of the compressors' shafts
5. Achieving up to 10,000 rpm speed (limited for safety)

APPROVED DESIGN

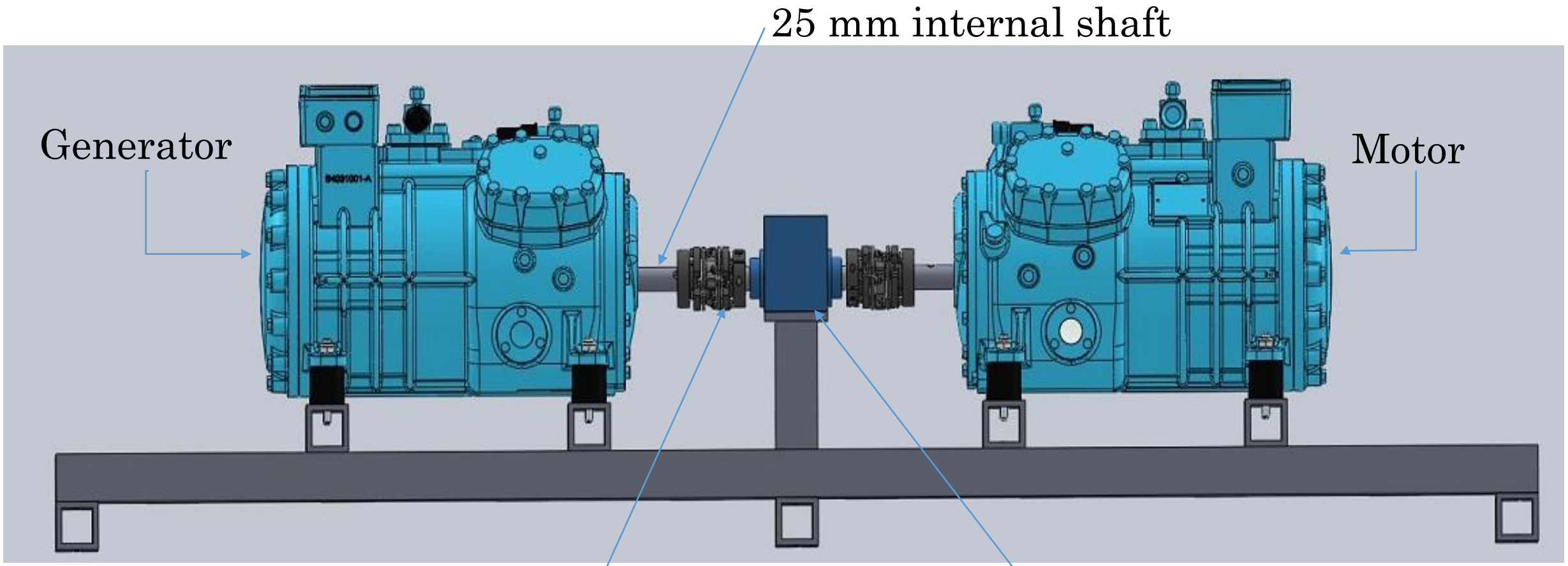


Fig. 3. Motor Test Rig

APPROVED DESIGN

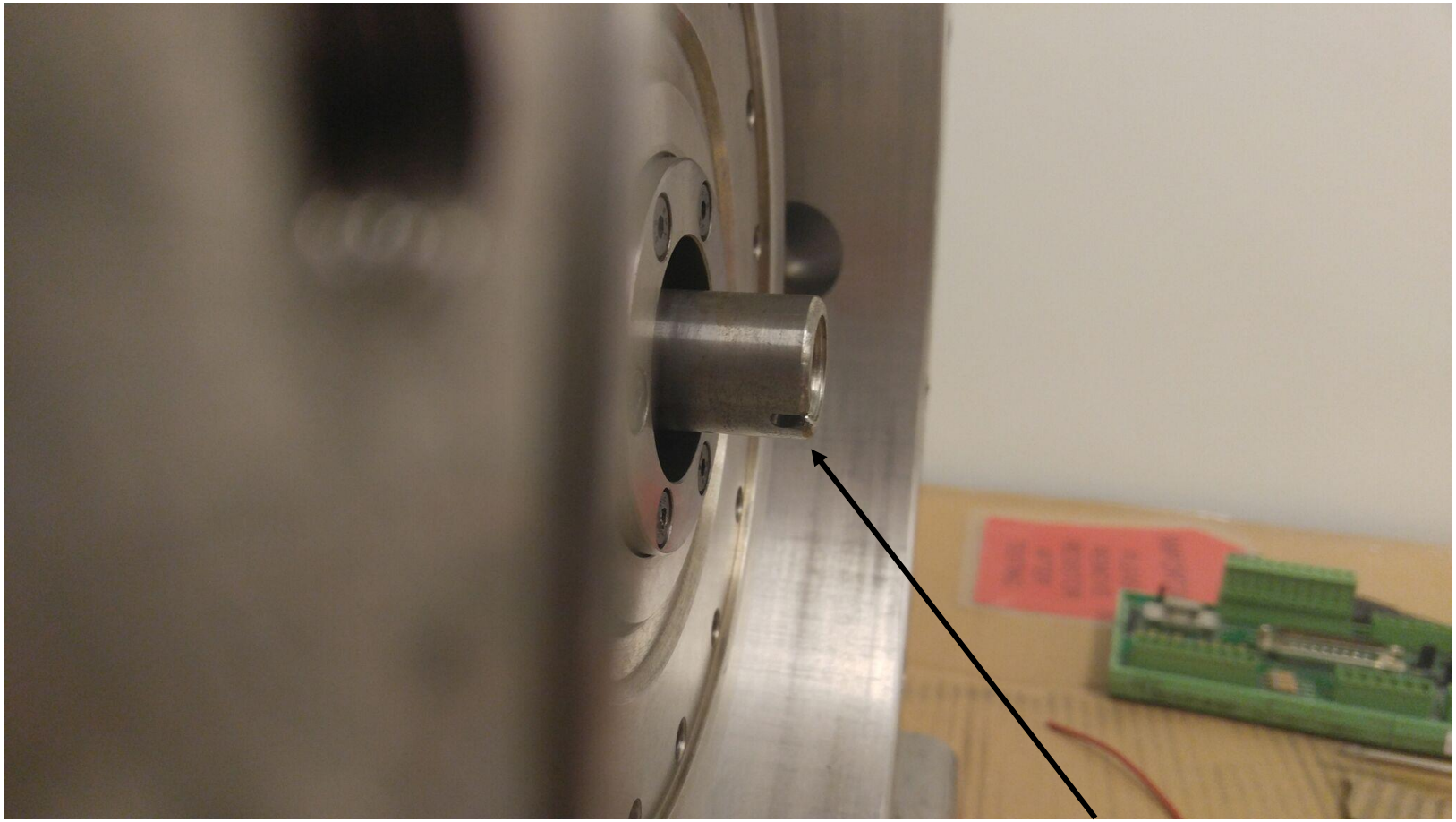


Fig. 4. Compressor Internal Shaft

DESIGN PROGRESS

DOUBLE-FLEX DISC COUPLINGS

Fig. 5. Zero-Max double-flex disc coupling

- Price: Approximately $400 a piece (not including tax/shipping)
- Quantity: 2
- Adjustable Collar (not keyway)
- 25mm shaft connecting to 20h6 mm shaft
- Up to 9,500 rpm
- **Status: Has been purchased and is being delivered**

DESIGN PROGRESS

LASER ALIGNMENT TOOL

Fig. 6. SKF Shaft Alignment Tool TKSA 31

- Price: Approximately $4,192
- Quantity: 1
- Accurate up to 5 microns
- Live position correction feed
- **Status: Has been purchased and is being delivered**

DESIGN PROGRESS

TORQUE TRANSDUCER

Fig. 7. Magtrol TMHS 310 Torque Transducer

- Total Price: $10,861
  - Transducer: $8,250
  - Power Supply: $2,380
  - ER 113 Signal Cable: $231
- Quantity: 1
- Torque Rating: 50Nm nominal; 100Nm over range
- High Speed Applications: up to 32,000 rpm
- Stainless Steel Shaft Diameter: 20h6 mm
- **Status: Denied due to price and lead time**

APPROVED DESIGN

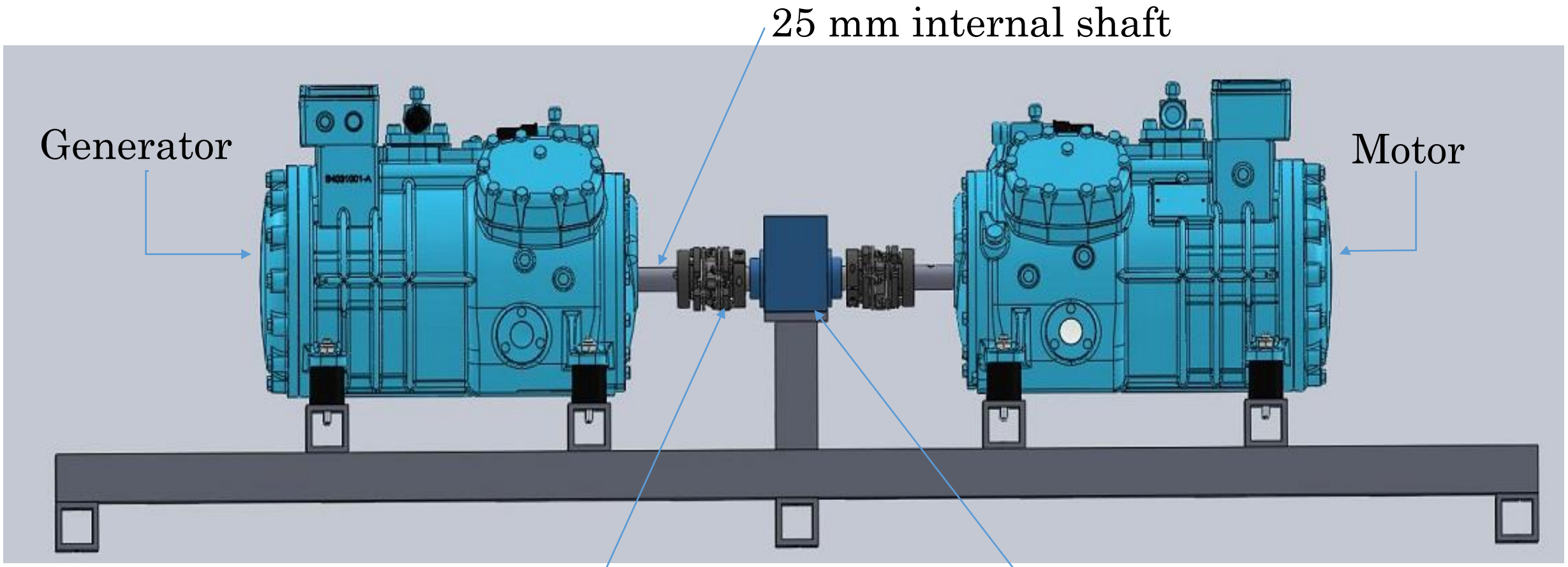


Fig. 8. Motor Test Rig

DESIGN PROGRESS

MOCK TRANSDUCER (BEARING HOUSING)

Fig. 9. SNL 505 bearing housing

- Total Price: Roughly $200-300
- Quantity: 1
- Roller Bearing in Housing
- High Speed Applications: up to 17,000 rpm
- Diameter: 31.5 mm (Compatible with desired bearing)

DESIGN PROGRESS

MOCK TRANSDUCER (BEARING AND ADAPTER SLEEVE)

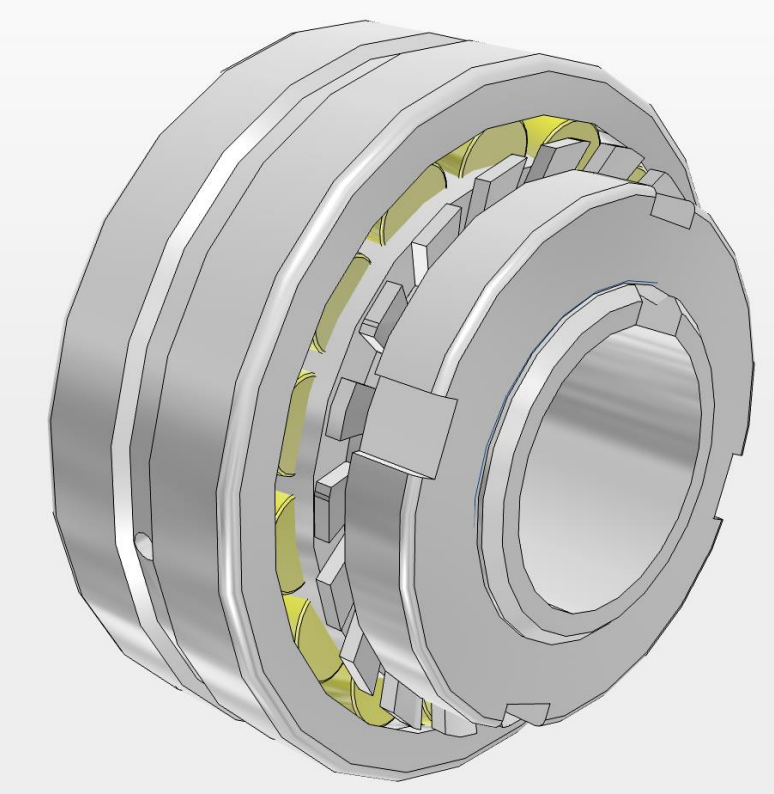


Fig. 10. 22205 EK bearing + H 305 adapter sleeve

- Total Price: Roughly $50
- Quantity: 1
- Roller bearing
- 2 x FRB 6/62 Locating rings
- High Speed Applications: up to 17,000 rpm
- Bearing outer diameter: 31.3 mm
- Stainless Steel Shaft Diameter: 20 mm (Compatible with couplings ordered)

DESIGN PROGRESS

ADJUSTABLE STAND

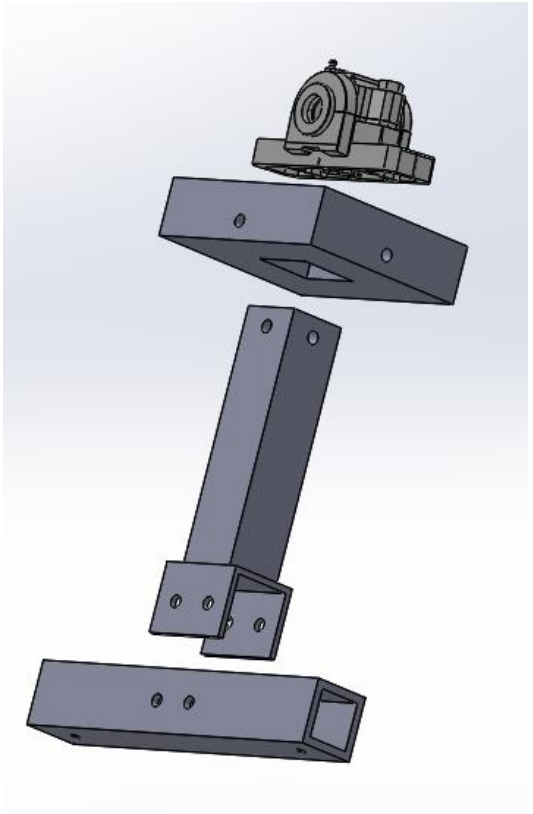


Fig. 11. Adjustable stand

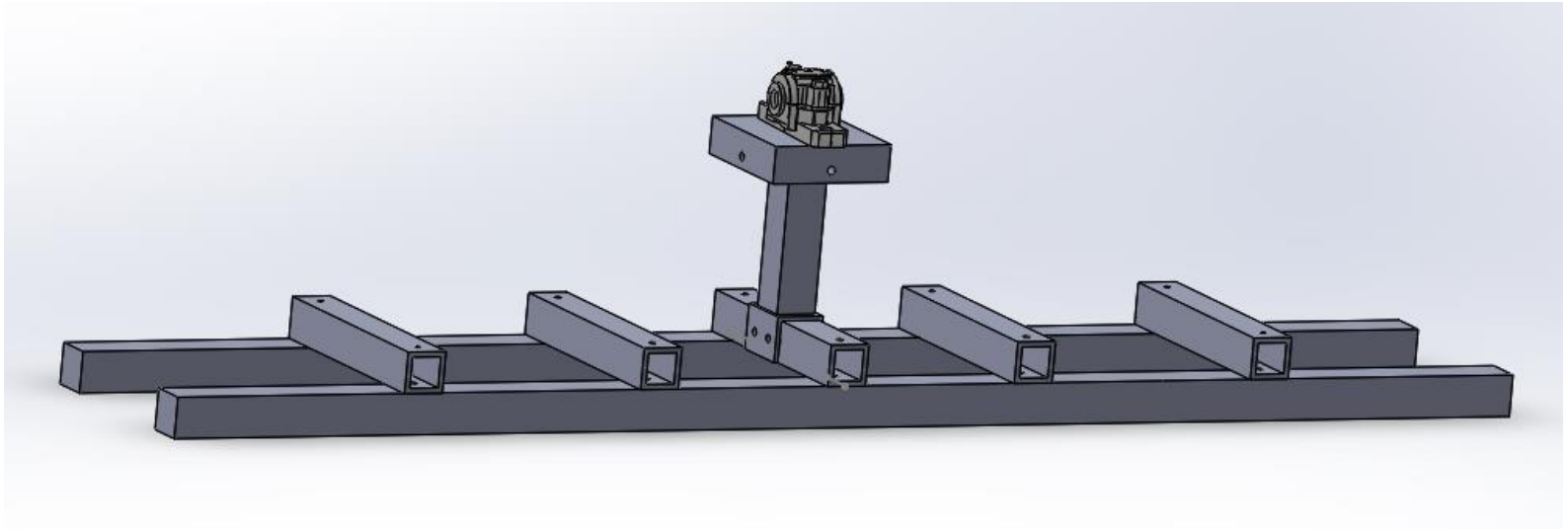
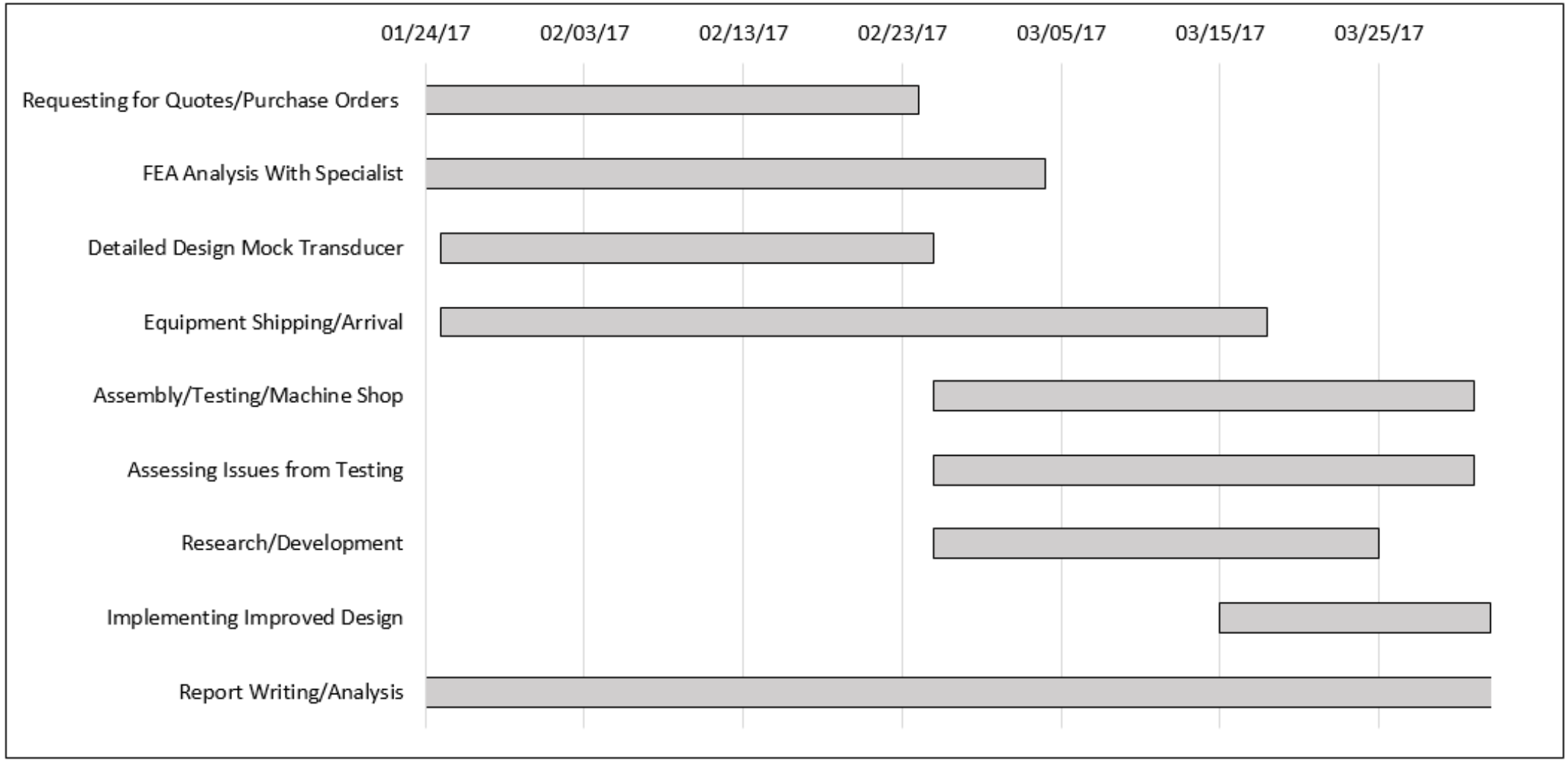


Fig. 12. Adjustable stand on base frame

SCHEDULE

Table 1. Gantt Chart



CONCLUSION

FURTHER WORK

- Machining attachment for mock transducer
- Aligning the compressors and the components between them
- Achieving levitation of the compressors' shafts
- Achieving up to 10,000 rpm speed

REFERENCES

- http://www.lovejoy-inc.com/content.aspx?id=544
- http://www.agroengineers.com/bearings/types-of-couplings-2.shtml
- http://www.rw-america.com/products/precision-couplings/metal-bellows-couplings/bk2.html
- http://eng.fsu.edu/me/senior_design/2016/team04/finalreport.pdf
- http://3.imimg.com/data3/FW/MO/MY-5715853/bearing-housing-500x500.jpg

QUESTIONS?