Labyrinth Seal Test Rig

Sponsored by Danfoss –Turbocor

Spring 2009 Project Update Presentation

Group 1

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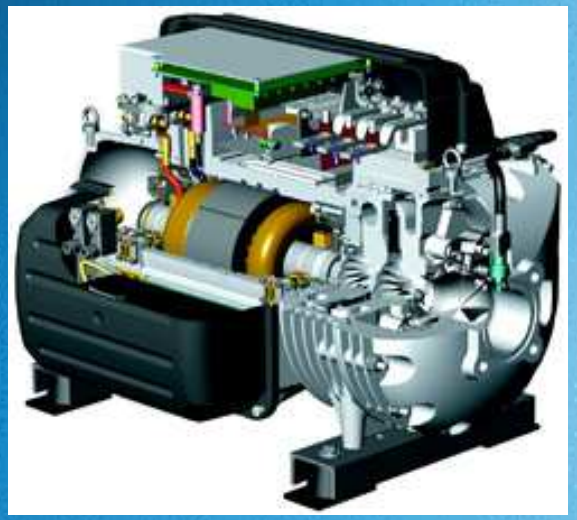
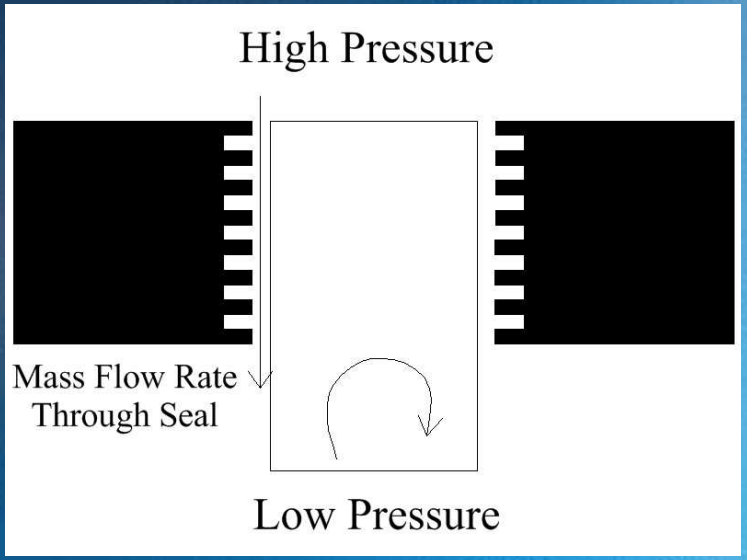
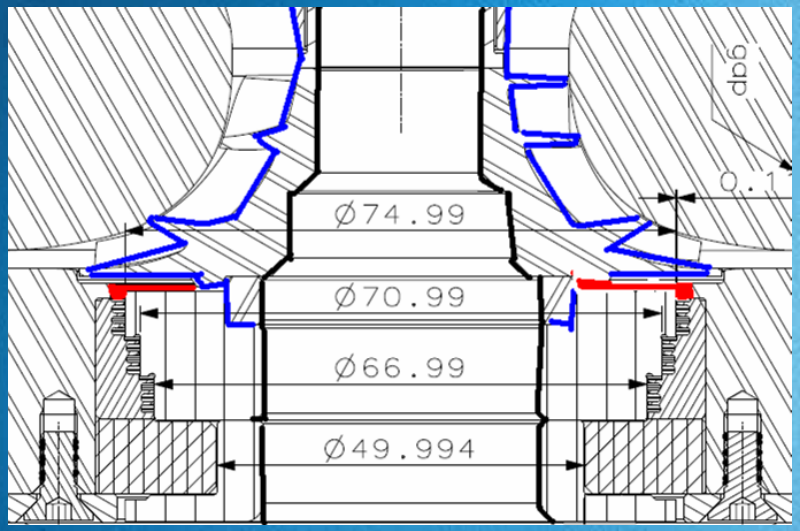


Problem Definition

- Design and build a test rig which measures flow rates through a Danfoss – Turbocor labyrinth seal
- The measured flow rates will be used to analyze which seal design is superior
- The rig will allow for testing of multiple seals of various sizes
- At least two different concentricity positions must be tested

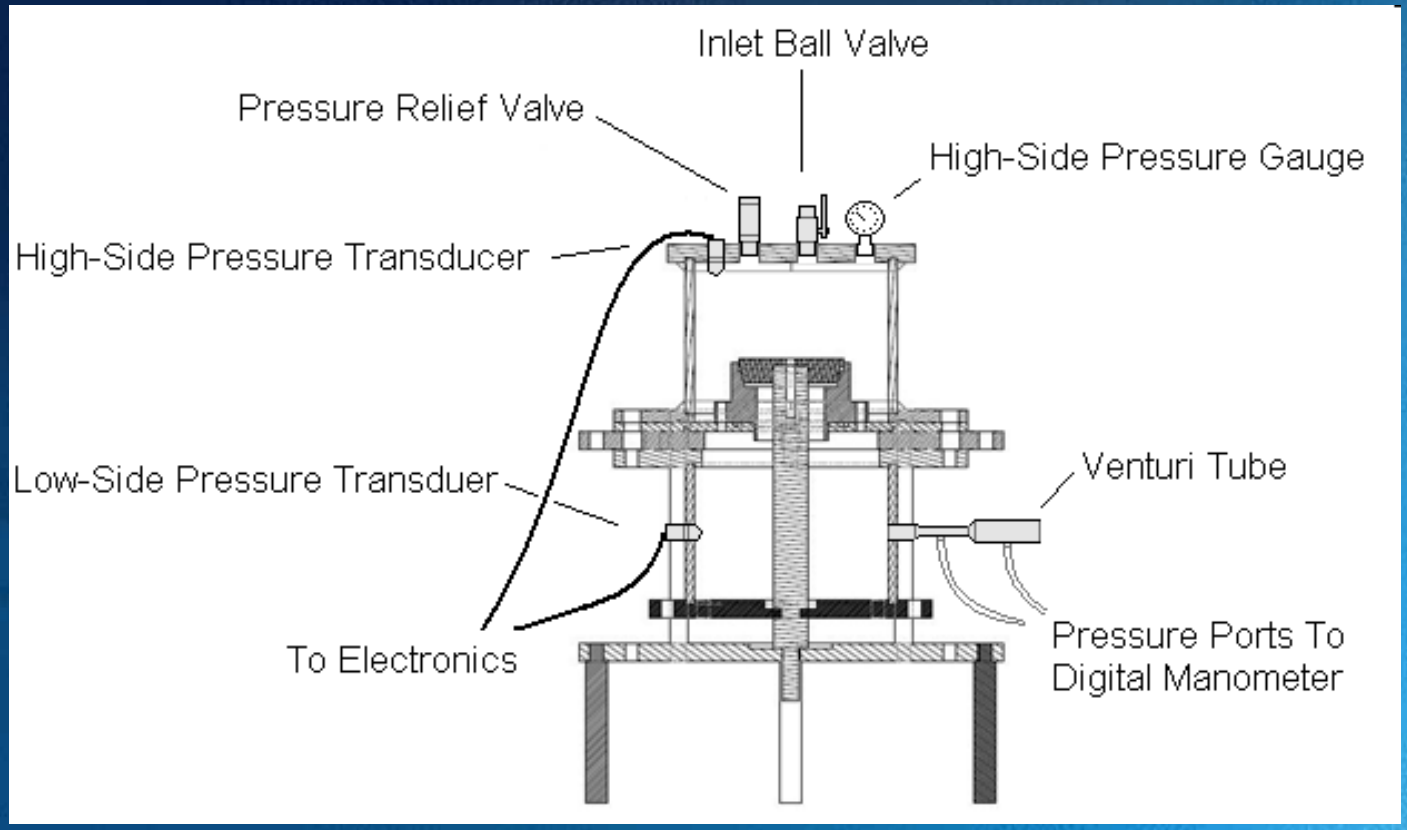




Detailed Design

- Utilized shop air to achieve 60 PSI within the high pressure Cylinder
- Test one location with a 120 micron gap between the seal
- Test another with the balancing piston making contact with the seal
- Measure flow rates through use of Venturi tube and manometer
- Bushings used to support the shaft, and allow for rotation.
  - A dial gauge will verify the position of the seal

Instrumentation Diagram



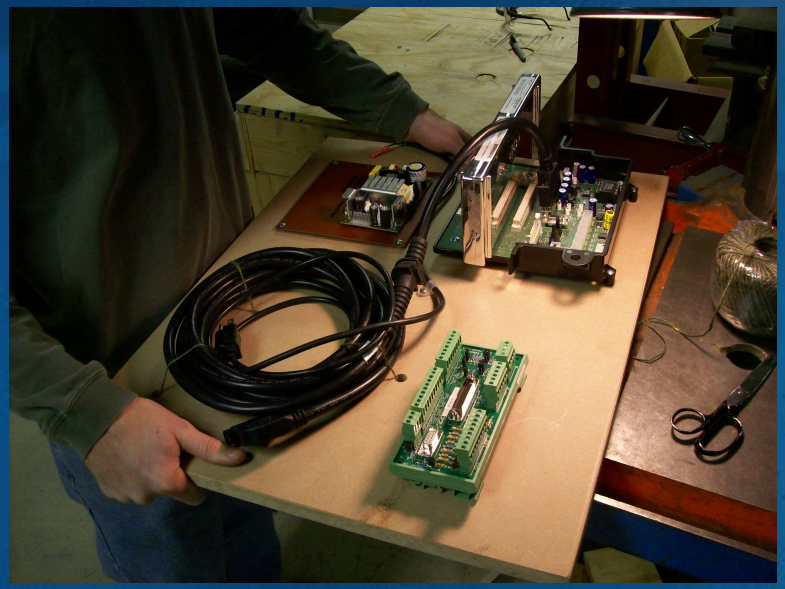
- Figure details the location on the test rig of each measurement device

Design Changes

- **Bearings to bushings**
  - Increases tolerance and decreases price
  - Increased distance between bushings to increase shaft support
- **Flow meter: Venturi tube & digital manometer**
  - More precise for relative cost
- **DTM vs. pin fitting alignment**
  - Pin fitting less complex, reduces parts and machining
  - Reduce testing time
- **Reduced Number of Legs & Spacers**

Progress to Date

- Received ordered materials
- Preliminary machining completed



- Electronics mounted to platform
- Identified manufacturers and welders

Cost Analysis

Item	Cost
Raw Materials	$333.24
Measurement Equipment	$341.00
Welding	$210.00
Misc.	$185.00
Total	**$1069.70**

- Does not include machining costs aside from the cost of welding
- A Venturi tube still needs to be purchased

Future Work

- Order remaining parts
  - Hardware & O-Rings
- Finish machining and welding
  - Turbocor & Tallahassee Welding
- Assemble

- Perform leak test & seal testing
- Analyze data

Conclusion

- Major Design Changes
  - Bushings will replace bearing
  - Venturi Meter will replace flow meter
  - Implementing pin alignment
- Progress is on schedule
- Project is expected to be at the budget limit

Thanks to

- **Danfoss – Turbocor Staff:**
  - **Jesper Nielsen**
  - **Marius Dragut**
  - **Lin Sun**
  - **Joost Brasz**

- **FAMU-FSU College of Engineering Faculty**
  - **Dr. Chiang Shih**
  - **Dr. Daudi Waryoba**
  - **Mr. Bill Starch , Shop Supervisor at ASC, NHMFL**

References

- **Sources**
  - Author Unknown "Centrifugal Compressors" Chapter 4: Pg 62-66
  - Childs, Peter R. Mechanical Design Pg 184. Arnold Publishers © 1998
  - Classical Concepts and Papers by Egli 1935
  - Piotrowski, John. Shaft Alignment Handbook. Danbury: NetLibrary, Incorporated, 1995.
- **Vendors:**
  - www.Metalsdepot.com
  - www.Omega.com

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? Questions ?