Centrifugal Compressors 101
Part 1

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Product Line Management Single Shaft Compressors

DRESSER-RAND
A Siemens Business

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Who Are We???

- Jay Koch
- Graduate of Iowa State University (BS Aerospace Eng.)
- Joined Dresser-Rand in 1991
- Worked for Allied Signal Aerospace before joining D-R
- Aero Dynamics group, NPD team, Datum Development Team, Manager Aero/Thermo Design Engineering, R & D Manager, Principal Engineering Lead, Product Line Management Single Shaft Compressors

- Current Responsibilities include:
  - Development Portfolio management for centrifugal compressors
  - Interface between clients, sales, service and R&D organization

- Previous Responsibilities:
  - Design, development, analysis of aero components of centrifugal compressors
  - Development of software used to select and predict compressor performance.
Who Are We???

• Mark J. Kuzdzal
• 1988 Graduate of University of Buffalo (BSME)
• Joined Dresser-Rand in 1988
• Texas A&M Advisory Committee Member Since 2004
• Penn State Advisory Committee Member Since 2004
• RotorDynamics group, NPD team, Datum Development Team, Development Manager, Core Tech. Manager, Business Development Director, Head of Advanced Components and Methods organization

• Current Responsibilities include:
  – Development of Advanced Components and Methods to improve product portfolio
  – Favorite work-related topics: aero-mechanical excitation (SSV), & Acoustics
DISCLAIMER

The information contained in this short course, including concepts, factual data, technical interpretations, and opinions, which while believed to be accurate, are offered solely for informational purposes. No representation, guarantee or warranty is made concerning the accuracy of such data, interpretations, and opinions.

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Agenda

• Reciprocating and centrifugal compressor similarities/differences
• How do they work? (Potential Energy, Kinetic Energy, PE, KE, …)
• History of compressors
  – Timeline, major advances
  – Configurations, straight-through, back-to-back, compound, side streams, double-flow
• Markets served
• Pressure containment
  – Case
  – Nozzles and flanges
Agenda Continued

- Selection Process
  - Aerodynamic Selection
  - Mechanical Design
  - Rotordynamic Design
- Impellers
  - Design Basics
- Stationary Aero Components
  - Inlet, inlet guide
  - Diffuser, vaned and vaneless, LSD
  - Volute and collector
  - Return bend / Return channel
- Compressor Performance
  - Nomenclature
  - Impact of Operating Conditions
  - Internal Leakage
  - Surge Control
Agenda Continued

- Rotordynamics
  - Critical speed maps
  - Synchronous unbalance response
  - Stability, log decrement
  - Damper seals
  - Bearings, seals
  - TP, Sleeve, magnetic
  - Squeeze film damper
  - Steady state and transient torsional

- Stress analysis
  - Impeller dynamics

- Acoustics

- Seals
  - Gas seals
  - Oil film seals
  - Laby
Agenda Continued

- **Testing**
  - Type 2 and Type 1, Performance testing
  - Mechanical testing
- **Vibration signatures of classic problems**
  - Rotor Instability
  - Surge and stall - forced vibration
- **Materials considerations**
  - NACE
  - Typical compressor materials
  - Effects of blockage and fouling
- Adjourn