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Rotary Valve Applications in Ash Handling Systems

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Rotary Valve Basics

Common design elements:

- **A rotor with multiple pockets turning inside a housing/body**
- **Both ends of the housing/body closed up with endbells**
- **Bearings in the endbells**
- **Bi-Directional Rotation is typical**
- **Round, rectangular, or square inlet and discharge openings**

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Ash Handling Systems

- Throughput varies from system to system
  - Depends on boiler size, type of fuel, and other factors
- Unique challenges:
  - High temperatures
    - Fly ash = ambient to roughly 300^{o} F depending on system
    - Bottom Ash = 600-700^{o} F
  - Variable temperatures
  - Very abrasive…particularly if it gets wet

Ash Handling Systems

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Rotary Valve Sizing

- **Understanding throughput & bulk density are the keys to proper sizing**
  - **Typical bulk densities**
    - **Fly ash = 40 lbs/ft^3**
    - **Bottom ash = 50 lbs/ft^3**
- **Like most other rotary valve applications, *slower speeds are better***
  - **Typical would be 8 to 15 RPM**
  - **Slower speeds generally correlate to longer life and lower total-cost-of-ownership**

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Rotary Valve Sizing

- Sizing is a math problem…
- Control-fed or flood-fed?

A. Expected throughput per unit of time / bulk density = volume of material per unit of time

B. Valve capacity x RPM x assumed pocket fill = valve volume per minute

→ *Find a combination of B that balances with A*

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Rotary Valve Sizing

- **Beware of the "Dimension vs. Volumetric Capacity" Trap**
  - **The only size that matters is volume**
    - **Expressed as cubic feet per revolution or CFR**
  - **A "ten inch rotary valve" can mean many things…**
    - **10" rotor diameter**
    - **10" round inlet opening**
    - **10" overall height**

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Design Features to Consider

Outboard Bearings

- Use of “stand-offs” to move bearings away from the body of the rotary valve
- Helps to isolate the bearings from dust or other contamination
- Helps to isolate the bearings from the high temperatures

Design Features to Consider

Rotor-to-Barrel Clearance

- The tighter, the better
- Must take into account the operating temperature
  - Every rotary valve is subject to some thermal expansion
  - To avoid lock-up or rotor-on-barrel scraping, manufacturers will machine the rotor OD for the expected temperature

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Design Features to Consider

Abrasion-Resistant Materials

- **Abrasion most often attacks the *barrel***
  - **Can be prevented by investing in an upgraded barrel material**
  - **Most barrels are industrial hard-chromed as well**
- **Surprisingly, the rotors are normally less susceptible to abrasive wear**
- **HardOx, Tri-Braze, or other materials in the range of 500 Brinnell or 50 Rockwell C are reliable choices – balancing cost with durability**
- **Ceramic or other ultra-hard liners don't generally justify the investment and are susceptible to cracking or shattering on impact**

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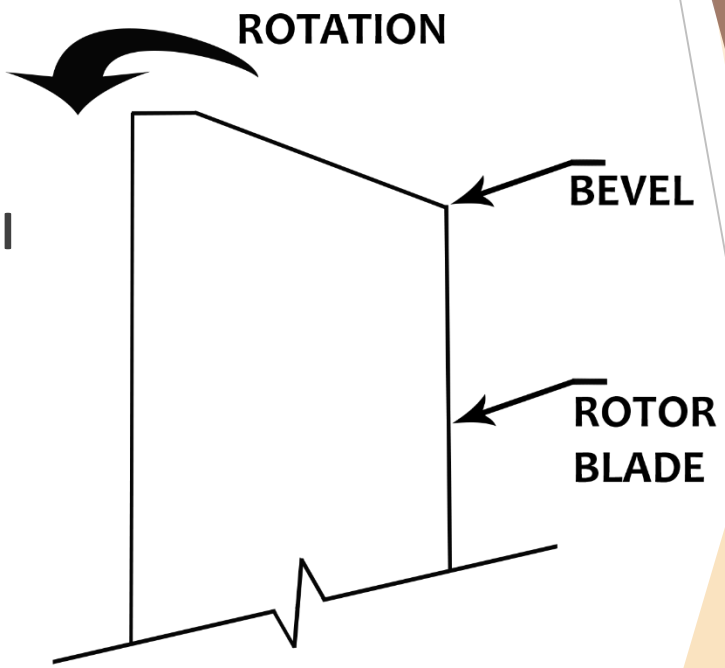
Design Features to Consider

Optional: Beveled Rotor Vanes

- Commonly used in valves handling a material that can smear and buildup on the barrel
- Not always required in ash applications



Design Features to Consider

Optional: Air Purge Systems

- Using compressed air to flush the shaft seal area and to flush the space between the rotor ends and the endbells
- Fairly common on valves discharging into pneumatic conveying lines
- Usually not necessary on valves discharging into bins, screws, etc.

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Operations

- For the most part, rotary valves in ash systems are a "set it and forget it" application
  - Not typically tied into plant-wide control systems
  - Not typically equipped with zero-speed sensors
  - Usually not equipped with variable frequency drives to control the RPM

Maintenance

- Ash is a tough application…the rotary valve will need attention
- Maintenance keys:
  - Weekly inspection
    - Signs of ash leaking around the shaft
    - Listen for any scraping or squealing noises
  - Regular maintenance (frequency depends your application)
    - Grease bearings
    - Adjust/tighten shaft seals and/or packing
    - Check for loose fasteners
  - Annual maintenance
    - Replace shaft seals and/or packing

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Rebuilding / Refurbishment

- Most rotary valves can be rebuilt
- Symptoms that it is time:
  - Increased or excessive ash leakage
  - Bearing failure
- Typical scope of work:
  - Bore out housing to a new diameter
  - Rebuild rotor with new material to match housing diameter
  - Replace shaft seals and bearings

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Questions?

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Thank You