A Belt Press is a Belt Press?

NAWT 6th WASTE TREATMENT SYMPOSIUM
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What's the differences?

- Gravity Length
- Wedge Length
- Pressure Diameters
- Bearing / Journal Diameters
- Frame member sizes
- Overall length

Agenda

- Basics of Belt Press Design
- Factors to consider in evaluating Belt Presses
- Questions

Basics of Belt Press Operation:

- Three primary zones:
  - Gravity: A cake is formed from a dilute dispersion of solid particles on top of a filter cloth.
  - Wedge: Formed cake is sandwiched between two filter cloths and low squeeze pressure applied.
  - Pressure: High squeeze pressure applied by serpentine path of two belts around a series of rolls.

Gravity Zone Design

- Cake Formation
  - Even Feed Distribution
  - Initially no cake when the feed slurry is placed on the filter cloth.
  - As slurry flows through filter cloth, solids deposit on surface
  - Resistance to filtrate flow increases with time exponentially.
  - Increasing the belt speed improves the thickening by spreading the cake over more area, producing a thinner cake, and significantly reducing flow resistance.
  - Plows: Enhance filtrate flow by dislodging deposited solids, provide compression by kneading
Wedge Section Design

- Cake is formed and encapsulated between belts.
- Consolidate loosely packed solid particles so the potential for squeeze out in the pressure zone is reduced.
- Gradual increase in cake pressure from zero to pressure of first roll.

Pressure Zone

- Cake thickness is fixed, so the resistance to expressed filtrate is fixed.
- Longer time under pressure means more liquid is expressed.
- Slower belt speed enhances performance.
- Three Belt Design: high speed in gravity zone, low speed in pressure zone.

Pressure Section Design

\[
\text{Pressure} = \frac{2T*W}{D^2 + W + (R/360)}
\]

Where:
- \(T\) = Belt Tension
- \(W\) = Belt Width
- \(D\) = Roll Diameter
- \(R\) = Degrees of roll wrap

Notice outer belt has longer belt path than inside belt.

Factors to Consider:

1. Filtration Area:
   - Gravity: Length x Width
   - Wedge: Length x Width
   - Pressure: Contact area of filter cloth and Roll

2. Feed Distribution: Uniform thickness across width

3. Pressure Zone Configuration:
   - Number of Rolls
   - Roll diameters / Decreasing size
   - First Roll Perforated

4. Belt Tension Capability:
   - Cylinder size / Power Unit
   - Journal Bearing Size
   - Roll Shell Thickness
   - Frame Strength

Factors to Consider:

5. References:
   - Performance: Similar Process
   - Service
   - Parts

6. Belt Tracking Assembly

7. Accessibility: Operation Observation / Maintenance

8. Filtrate Collection Pans

9. Belt Wash Assembly

10. Materials of Construction
    - Member Size
    - Coating System

11. Bearings:
    - Type
    - Diameter

Factors to Consider:

11. Overall Layout:
    - Discharge Location
    - Feed Location

12. Financial Condition of Company
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FEED DISTRIBUTION

• Uneven distribution causes:
  – Premature clipper wire failure
  – Accelerated wear on roll coating
  – Cake solids concentration is lowered
  – Belt misalignment

Original Distributor

Poor Distribution: Clipper seam
Central Valley WWTP, Salt Lake City, Ut

Revised Distributor

Good Distribution: Clipper seam
Central Valley WWTP, Salt Lake City, Ut
**Distribution / Cake Solids**

- Uneven distribution “average” cake solids concentration: 18.7wt%
- Even distribution “average cake solids concentration: 22wt%
  - A gain of 3.3 percentage points.

**Roll Wear**

- Even cake = Even roll coating wear!!!!!!
- Uneven cake = Uneven roll coating wear:
  - Tracking misalignment
  - Lowers cloth life
  - Lowers cake solids

**Conventional Straight Wedge:**

- Upper Filter Belt
- Lower Filter Belt
- Filter cake
- First Pressure Section Roll

**Wedge Section Design**

- Curved Wedge Zone

**BDP Industries: Curved Wedge:**

**Pressure Section Design**

- Number of Rolls: more rolls, more time under pressure, higher shear and reduced belt life.
- Diameter of rolls, Decrease in diameter.
- Number of Perforated rolls
- Roll Construction, rigid
- Roll Coating, reduce wear on belt.
Pressure Section Design

**CONVENTIONAL HORIZONTAL PRESSURE SECTION**
- Re-absorption of filtrate.
  - Lowers discharge cake solids.
- Elevated belt press installation.
  - Higher installation cost.
- Operator platforms around belt press.
  - Hinders operator access.
- Structures that hinder maintenance.

**VERTICAL PRESSURE SECTION**
- Increased cake solids.
  - Collection pans eliminates re-wetting of cake.
- No platforms required for operator access.
  - Lower installation cost.
- No structures to hinder maintenance.

Belt Tension Assembly:
- Assembly must be capable of producing 70 pli belt tension. PE certified calculations must be provided.
- Assembly must provide the capability for setting the tension of each of the belts independently.
- Certified calculations of Roll Deflection at 70 pli belt tension
References

- Find similar process references
- Make sure it is the same model
- Similar Operational Frequency
- Questions:
  - Capacity: flow rate, feed solids – lb/hr per m
  - Cake Solids
  - Polymer Usage
  - Maintenance cost
  - Maintenance Frequency and Recent Repairs
  - Ease of maintenance
  - Responsiveness of Manufacturer
  - Sample Testing

Belt Tracking
Critical Design Factors

Belt Looping: caused from high belt tension or tracking issues

Accessibility

Filtrate Collection Pans

Belt Wash Assembly

- Wash belt prior to any cake side roll
- Self Cleaning Shower header
- Containment of wash spray on both side of the belt
- Some applications require washing both sides of the belt
Materials of Construction

- Frame must have a design safety factor of 10, actual stresses must be 1/10 the allowable member stress at 50 psi belt tension. Substantiate with PE Calcs.
- Frame must provide adequate spatial clearance between rolls for variations in operating cake thickness and access for cleanup and belt changing.
- Frame must have adequate width to mount bearing and keep it from rocking. On a 2 meter unit it must be 4”.
- Precision machined for mounting bearings.

Bearings

- Type: Split Case vs Pillow Block
- At a belt speed of 15 FPM and 70 PLI belt tension the L₁₀₀ bearing life must be a minimum of 1,000,000 hours.
- Bearing cannot be proprietary design that can only be purchased from the belt press manufacturer. Must procurable from USA bearing manufacturer such as Dodge.

Overall Layout

Financial Condition

- Dunn and Bradstreet Report
- Years in Business
- Number of units manufactured per year
- Shop size and manufacturing capabilities / equipment
- Service staff: education / experience / location / number of personnel.
- Performance Warranty

Questions???????