Langley Separation & Process
Belt Press 101
Mechanical Training

Applying 40-Years of Experience and Process Knowledge
Mechanics

.........Building It Right
Mechanical Components of a Belt Filter Press

- Frame
- Rollers
- Drives
- Tensioning
- Tracking System
- Belt Washing
- Media
Defining Roller Forces

\[ F = (f_1 + f_2 + f_3 + f_4) \times \text{Belt Width} \]
= 200 lbs./in. x 88 in. = 17,600 lbs.

Bearing 1
8,800 lbs

Bearing 2
8,800 lbs
Roller Deflection

F

D

D = at the maximum working load (50 PLI) the roller deflection is lower than 0.025 inches per meter

Negative effects of roller deflection:

- Increase in mechanical stress
- Decrease in life cycle
- Deformation of belts
- Irregular surface pressures and decrease in dryness

Maintenance cost

Hauling Costs
4 Bolt Base

- Longer Distance from Bearing CL to roll face
- Higher Deflection
- Higher Shaft stress
2 Bolt Base

- Heavier Frame
- Shorter Distance from Bearing CL to roll face
- Lower Deflection
- Lower Shaft stress
Effect of Drive Torque

50-lbs.

50-lbs.
1. After machining, roller is shot blasted to improve rubber adhesion

2. Rubber is hot extruded to the point of bearing insertion

3. Rubber is machined to the same tolerance as the cylinder
Mechanics: Frame Design

Corrosion Protection

- Painting
- Flame spray
- Hot dip galvanizing
- Duplex
- Stainless steel
Galvanic Series of Metals

Magnesium
Zinc
Aluminum
Cadmium
Steel
Lead
Tin
Nickel
Brass
Bronzes
Copper
Nickel-Copper Alloys
Stainless Steels (passive)
Silver
Gold
Platinum

ZINC
Steel
Hot Dip Galvanizing After Fabrication
Spangled Galvanized Coating
Effect of pH

Relative Loss Rate

pH of Contact Material

Belt Press 101

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Components

- Housing
- Bearing
- Seals
- Spacer Ring
- Mounting Hardware
Spherical Roller Bearing

- High angular tolerance
- High radial loads
- Always metric
- SKF / FAG
- Designation 22x E
Housings

- Split case
- Rilsan nylon coating
- 2 / 4 bolt base
- Cast closed end
- Six month lubrication cycle
Direct mount bearing

- Designation 222x
- Shaft is full diameter
- Fixed position
- No Adapter
- Interference fit
Nomenclature

22218E =

- 222 = Spherical, Double Roller, Straight Bore
- 18 = Size (ID = (n X10) / 2) = 90mm
- E = Class load rating
Calculating the L10 Rating

- **C** = Dynamic Load Rating (lbs.)
- **P** = Equivalent Radial Load (lbs.)
- **N** = Roller Speed (rpm)

\[
L10 = \frac{(C/P)^{10/3} \times (16,667 / N)}{}
\]
Bearing Protection in High Moisture/Wet Environments

Cast Closed Housing
Seals

- **Double labyrinth seal**
- **Triple Labyrinth Seal**

Mounting types

- **Direct Mount**
- **Adapter Mount**
Non-Metallic Combination - Triple Seal
Top Five Ways To Destroy a Bearing

- Steam Cleaning
- Improper lubricant type
- Contaminated lubricant
- Skip lubrication cycle
- Blow out seal by excessive purging
Factors Affecting Belt Life

- Factory Machine Alignment
- Tracking
- Tension
- Distribution
- Seam Strength
- Foreign Objects
- Running Speed
Components of a Tracking System

- Sensor Paddle
- Actuator
- Pneumatic
- Hydraulic
- Tracking roller
- Must be rubber
Factors Affecting Tracking

- Sensor Setting
- Factory Machine Alignment
- Tension
- Distribution
Defining Roller Forces

\[ F = (\sum f_1 + f_2 + f_3 + f_4) \times \text{Belt Width} \]
\( = 200 \text{ lbs./in.} \times 88 \text{ in.} = 17,600 \text{ lbs.} \)

- Bearing 1: 8,800 lbs
- Bearing 2: 8,800 lbs
Static / Dynamic Loads

100 lbs.

50 lbs.

50 PLI

50 PLI

X

Belt Press 101
Bearing Nomenclature

- Bearing Cartridge
- Seal Kit
- Roller Shaft
- Lower Casting / Foot
- Upper Casting
- Snap Ring
- Lubricant
- Grease
- Zerk Fitting

LS&P BFP Mechanical Training 101
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Belt Tracking Device

- Simple adjustment
- Proportional correction
- Low air consumption
- Minimal maintenance cost
- Low friction and accurate positioning
Brush Cleaning

Shower header Cut-a-way
Tracking Device Location

Control valve

Pneumatic guide

Paddle

Control valve

Paddle

Adjustable supporting arms

upper belt

lower belt
Jud Tracking Actuator
Components of Tensioning System

- Tension Roller
- Actuators
- Thrust Rods
- Rack and Pinion System
The rack and pinion system ensures parallel movement of the roll during operation of the two air bellows.
- Non-Linear Curve
- Compact
- No Sliding O-Rings
- Corrosion Resistant
- 20 Year Life
Tension measurement with Air Bellows

Belt Press 101

Gauge Pressure (PSIG)

Belt Tension (PLI)

H=7”
H=9”
H=12”
H=14”

PSIG

H=9”
Top 5 Ways to Destroy a Belt

- Improper Distribution
- High / Low Pressure Setting
- Failure to provide protection from oversize material
- Operation with wrinkles
- Do not repair holes / tears
Newly installed – No Load
Seam Deviation 4” is marginal
High Load - Poor distribution

Diagonal Seam Deviation >10” Is Dangerous

Imminent Failure

Seam Deviation Causes diagonal Wrinkling

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Broken CLipper – High Load
Belt Cleaning System
Belt wash water would have the following characteristics

- **PRESSURE** > 100 PSIG
- **TSS** < 50 mg /L
- **Debris Size** < 1.0 mm
- **Alkalinity** < 100 mg / L
Spray Pipe Detail

Cleaning handwheel

Purge valve assembly

Purge discharge nozzle 2" NPT F

Wire brush

Gasket

Nozzle

Lock nut

Snap ring
Shower header Cut-a-way
Scouring

• Requires high water velocity

Brushing

• Frequent cleaning causes nozzle abrasion
Scouring

Water Flow
Assembly

Belt Press 101
New Drive System

Upper belt drive

Lower belt drive

Belt speed 3 - 30 fpm (8 - 80 Hz)
DRIVES and MOTORS

- Types of Reducers
- Mounting
- VFD Applications
AC Electric Motors

- Stator
- Rotor
- Bearings
- Insulation
- Cooling Fan
- Conduit Box
Variable Frequency Applications

Low Frequency
• Low Motor Speed
• Overheating
• Stalling

High Frequency
• High Motor Speed
• Motor Damage
• Torque Loss
Low Frequency Operation

- Oversized Machines
- Under-loaded Machines

Low Frequency Precautions
- Increase Gear Ratio
- Constant Speed Cooling Fan
- De-rate Motor Frame
- Increase Insulation Class (H)
- Frequency Limit ( >8 Hz)
CAUTION WHEN CLEANING MACHINE!

- **NEVER** stand on side beams when operating
- **NEVER** place hands inside operating machine
- Verify Function of Tag Lines
- **NEVER** WORK ON ACTIVE MACHINE!