Supercalender Performance Improvement by Process Optimization

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Conventional Supercalender

- Type: Typical 12 roll Supercalender
- Make: ECK Haubold
- Unwind: Single flat disc water cooled
- 11 intermediate paper rolls
- Dyno-drive center winder
All chilled rolls were hard chrome plated and superfinished.

- **Hard chrome plating:**
  - No specific benefit in terms of roll hardness
  - Chemical properties of surface greatly altered
  - No development of a thin layer of corrosion products on roll surface
  - No corrosion during a shut for a couple of days
  - Better surface finish possible after hard chrome plating.
Upgrades During Installation

- Installation of hydraulic accumulator.

- Hydraulic Accumulator:
  - Basically a pressurized variable volume storage device
  - Stores hydraulic oil at desired pressure
  - Reduced electricity consumption
  - Low hydraulic oil temperature
  - Better hydraulic cylinder life
Chilled Roll Superfinishing

- Done by Modinagar Rolls Ltd., by their specially developed method (Mod-Finish) for hard chrome rolls.
- Surface smoothness achieved: approx. 0.25Ra.
Initial Problems

- Low speed: 60-70 mpm
- Low production capacity
- Frequent joints
- Unstable gloss
- Time consuming reel change
- Time consuming tail feeding
Installation of Proximity Sensor

- A proximity sensor was mounted on to the shaft of a paper roll near key
- The reset button of the counter was deactivated.
- The difference between shift readings indicated roll revolutions
- More difference ~ More paper length
Installation of Proximity Sensor

- A healthy competition started between operators
- Within a few of weeks, production increased by 2.5 times

* This technique works well if the operators are too cautious to speedup the machine.
On-machine Gloss Indication

- Variation in gloss in machine direction.
- Inconsistent nip loading.
- Analog pressure gauges difficult to read accurately
- Due to manual control of loading.
- It takes time to draw a sample and check for gloss.
Lighting System Improvement

- Tubelights were fitted
- Operators can see the reflection
- Visual information about the gloss.
Unwind

- Original: Disk brake, water cooled.
- Larger brake area, low air pressure for braking, poor control.
- Poor response at low speeds, particularly at startup.
Unwind Modification

- Disk brake was replaced with a locally fabricated drum brake.
- Optimized diameter pneumatic cylinder for better breaking control.
Winder

- Original Winder-
  - Center winder
  - Dyno-drives based tension control
  - Paper slippage between layers
  - Poor winding
  - Frequent breaks
Winder Modification

- Modified Winder-
  - Surface winder
  - Gear coupled DC Motor
  - DC motor was replaced by AC motor later on.
  - Gear box was replaced by V-Belt drive
  - Main calender drive and pope reel drive synchronized.
Winder Modification

- **Results:**
  - Excellent winding
  - No joints at winder
  - Uniform tension profile
  - Reduced side trimings
Removal of Paper Rolls

- Normal Operation Schematic
  - Paper rolls used for web cooling
  - Soft rolls life improvement

- Problems Faced:
  - Time consuming reel change
  - Time consuming tail feeding
  - Increased tail feeding losses
Removal of Paper Rolls

- Advantages:
  - Reduced reel changing time
  - Reduced tail feeding time
  - Reduced tail feeding losses
  - Improved runnability
Soft Roll Performance

- Problems:
  - Frequent failures immediately after a startup.
  - Roll slicing ▶ Roll became unusable
  - Often a deep cut desirable.
  - Roll life was very low.
  - Uneven nip profile.
Improving in Soft Roll Performance

- Warming up before startup
- Installation of in-house grinder
- Uni-run operation
- Frequent sponge humidification
- Climatic improvements
## Roll Material

<table>
<thead>
<tr>
<th>Feature</th>
<th>Paper Rolls</th>
<th>Glosvax (Cotton) Rolls</th>
<th>Effect</th>
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<tbody>
<tr>
<td>Composition</td>
<td>Cotton / Wool / Linen</td>
<td>Cotton + Wool</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Die Cutting / Pressing</td>
<td>Carding / Caking</td>
<td>Better interlocking and hence low possibility of slicing.</td>
</tr>
<tr>
<td>Assembly</td>
<td>Fast Pressing</td>
<td>Slow Pressing</td>
<td>Better interlocking and hence low possibility of slicing.</td>
</tr>
<tr>
<td>Finishing</td>
<td>Turning / Grinding</td>
<td>Turning / Polishing</td>
<td>Better surface of roll and hence better gloss.</td>
</tr>
<tr>
<td>Hardness</td>
<td>80-92 Shore D</td>
<td>72-82 Shore D</td>
<td>Increased nip width resulting in better results even at high speed operation.</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Low</td>
<td>High</td>
<td>Better resistance to score marks</td>
</tr>
<tr>
<td>Mark Resistance</td>
<td>Moderate / Low</td>
<td>Excellent / Moderate</td>
<td>Frequent grinding is avoided.</td>
</tr>
<tr>
<td>Cut Depth</td>
<td>Low Depth</td>
<td>Deep Cut</td>
<td>Grinding time is reduced significantly.</td>
</tr>
<tr>
<td>Grinding Frequency</td>
<td>Very High</td>
<td>Moderate / Low</td>
<td>Lesser downtime for fewer roll changes.</td>
</tr>
<tr>
<td>Costing</td>
<td>Moderate</td>
<td>Economical</td>
<td></td>
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Installation of In-house Grinder

- Roll grinding done at a local workshop.
- Grinding cost- not a big issue.
- Transit in tractor trolley, prone to roll damage.
- A new grinder (double chuck type) was purchased & installed.
- Quality of grinding was also improved significantly.
Slicing

- Cotton rolls rotation in clockwise or anticlockwise possible.
- In case roll position change, sometimes direction of rotation reverses.
- Reverse rotation
  - Slicing.
Uni-run Operation

- To avoid slicing, rolls were marked for Uni-run operation.
- Slicing problem eliminated.
Roll Cotton Behaviour

- **Cotton:**
  - Absorbs moisture in high humidity environment and vice versa.
  - Around roll area, temperature is higher, and so relative humidity is lower.
  - So, cotton rolls tend to release moisture during operation.
  - Deterioration of cotton rolls speeds up if the moisture is lower than a critical level.
  - This results in roll failure (burn out).
Frequent Sponge Humidification

- Frequent wetting the roll surface, particularly in the dry weather (RH< 50%) helps a lot by-
  - Maintaining desired moisture in the roll cotton.
  - Lowering down the temperature of roll.
  - Improving the flexibility of roll, thus better nip.
  - Reduced CD caliper variation.
  - Increase roll life between grindings.
Frequent Sponge Humidification

- Initial trials of sponge humidification used water along with detergents e.g. Nirma, Wheel, Ezee and shampoos like sunsilk etc.
- Use of **Techzyme** was found very useful.
Frequent Sponge Humidification

- Advantages:
  - Grinding to grinding span improved.
  - CD caliper variation reduced significantly.
  - Much better reel winding.
  - Improvement in roll life.
Localized Roll Burn Out

- More roll failures during dry weather rather than during summer.
- Often, such failures required deep cuts.
Climatic Improvements

- Sponge humidification is good technique, but, it needs loss of production for 4-5 minutes after say every reel.
- Sometimes, operators may tend to skip it a couple of times.
- So, we needed to have a better solution.
Climatic Improvements

- Use of air cooler was planned.
- Three coolers were installed at one side of supercalendar.
- Objects were:
  - To increase the humidity.
  - To reduce the climatic temperature.
  - To reduce the dependency on sponge humidification.
Climatic Improvements

- Definite advantages were observed.
- Over a period of 4 months, there were at least 6 incidences when no roll had been changed during 7 consecutive days.
- Reel winding improved further.
- Physical work (sponge humidification) by operators was reduced.
Overall Results

- Better runnability
- Better reel winding
- Reduced trim losses
- Reduced joints
- Reduced gloss variation
- Reduced caliper variation
- Reduced grindings per ton of paper
- Improved roll life
Overall Results

- And of course-
- Happier Customers…..!!
- Happier Operators……!!
- Happier Mill…………!!!
Any Questions?
Thank You.