Setting up an effective in-mill Machine Alignment Program

Overview

- Understand misalignment in your mill
  - Rapid and gradual alignment change
  - Combined and compounded misalignment
- Static alignment survey
- Trouble-shooting example and static and dynamic relationships
- Establishing alignment control between surveys
Supreme alignment confidence

- Goal is alignment control
- Hit and miss approach is risky
- No rocket science
- Grow confidence through sound understanding and proven techniques

Why monitor alignment?

- Monitor product quality
- Monitor saw performance
- Monitor vibration
- Monitor setworks
- Monitor Alignment

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### ‘Events’ that cause misalignment

- Rapid component failure
- Maintenance change-out e.g. replaced bearing
- Localized adjustments e.g. stops
- Incorrectly setup saw guide
- Air / hydraulic leak e.g. centering roll
- Unusual impact or jam up
- Electronic fault e.g. timing delay
- Speed of feed changes = different load condition
- Got the re-alignment wrong

### Keep track of *gradual* alignment change

*Caused by:*
- Wear e.g. slides, bushes, rails, bunks, knees
- Slow air / hydraulic pressure change
- Environment change
- Foundation settling
- Many small localized adjustments

1. Regular alignment checks to establish trends
2. Base your service intervals on trend
3. Improve the cycle
Combined misalignments

- Misalignments can combine to either compound or counteract effects
- A misalignment related problem can be ‘improved’ by introducing or increasing another misalignment.
- One day a small change can produce serious problems due to compounded misalignment

Accumulated misalignment   (ARI SKR/KS)

1. An air line begins leaking to one infeed centering tire ram. The tire loses centering pressure.
2. A dive in the cut is noted over the first 1.5m.
3. It’s decided that it is probably a saw guide issue.
4. Saw guides are adjusted and a noticeable improvement is gained… but some diving is still occurring.
5. The chipper heads are then adjusted because back cutting is now occurring. Back cutting is fixed, cut is reasonable but saw life has worsened ….
6. Back at Alignment Engineering’s office, the phone rings.
## Sawmill alignment specialist

- **specialist experience**
  - timber mill knowledge
- **technical competence**
  - precision geometry measurement equipment and skill to apply it properly
  
  (Experts often possess more data than judgment)
- **practical suitability**
  - resource proximity & availability

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## Survey from infeed thru out feed

- Start by surveying alignment right through from the infeed to out feed of the machine centre before making any changes.
- Identify from survey what repairs / realignments will likely have biggest influence and deal with them first.
- Correct all misalignment conditions if time permits and create a benchmark alignment record for future reference.
  
  Tolerances are critical.
  
  **If the plant runs well, this might become your alignment specification record.**
## Parameters and tolerances

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Typical target / range</th>
<th>Preferred Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chipper anvils to c/u saw</td>
<td>0.20 to 0.50mm</td>
<td>straight edge and feelers</td>
</tr>
<tr>
<td>Chipper lead to log travel</td>
<td>0.50mm/m saw diameter</td>
<td>theodolite / scale</td>
</tr>
<tr>
<td>Anvil flatness</td>
<td>0 to 0.10mm</td>
<td>straight edge and feelers</td>
</tr>
<tr>
<td>Circular saw camber (pair)</td>
<td>0 to 0.3mm/m gap diff.</td>
<td>inclinometer 0.01mm/m</td>
</tr>
<tr>
<td>Straightness sharp chain</td>
<td>0.2mm/m</td>
<td>theodolite / scale</td>
</tr>
<tr>
<td>Carriage knees plumb</td>
<td>0.2mm/m max.</td>
<td>inclinometer 0.01mm/m</td>
</tr>
<tr>
<td>Flat rail – v rail elevation</td>
<td>+/- 1.0mm max</td>
<td>laser / detector</td>
</tr>
<tr>
<td>Straightness of v-rail</td>
<td>within 0.25mm/3m</td>
<td>laser / detector</td>
</tr>
<tr>
<td>Set works repeatability</td>
<td>+/- 0.025mm</td>
<td>optical level</td>
</tr>
<tr>
<td>Bed roll elevation</td>
<td>+/- 0.5mm</td>
<td>inclinometer 0.01mm/m</td>
</tr>
<tr>
<td>Plumb of band sawguides</td>
<td>0.15mm/m</td>
<td>custom setting tool</td>
</tr>
<tr>
<td>Band saw guide twist</td>
<td>0.05mm/m over guide lgth</td>
<td></td>
</tr>
</tbody>
</table>

### Measure all relevant components (ARI KS)

- Guides and spacers assembled and clamped onto shaft
- The quality of table surface, guide and spacer thickness is crucial here

**PLAN VIEW OF GUIDE ARRANGEMENT**
Circular saw problem (ARI KS)

PLAN VIEW OF INNER GUIDES

Relate static alignment and dynamic response

<table>
<thead>
<tr>
<th>Roll</th>
<th>Sharp chain guided along a rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitch / Roll</td>
<td>Carriage traversing thru the cut area</td>
</tr>
<tr>
<td>Yaw</td>
<td>Cant released from infeed centering rolls</td>
</tr>
<tr>
<td>Twisting</td>
<td>Circular saw tables traversing in and out</td>
</tr>
</tbody>
</table>

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Example - Chipper / Canter slant rig

1. Attitude of chipper at different traverse positions
2. Wear on bunks and knees
3. Straightness of v-rail and wear on rails
4. Attitude of saw guides for different sizing

Rail relationships

V to Flat Rail in Vertical plane

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Alignment Engineering Group
Carriage Rolling

Carriage Attitude - 12.4 metre traverse

<table>
<thead>
<tr>
<th>Length</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>12400.8 mm</td>
<td>1538.0 mm</td>
</tr>
</tbody>
</table>

Saw

Cut area

Flat rail

Maximum error: 4017.1 μ

How the machine & product moves in horizontal

Horizontal Movement of Bunk 1A - positions 3 & 7 set to zero

1 m traverse steps

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How the machine / product moves in vertical

Alignment example - Bunks and Knees
example - Bunks

Each bunk has A & B top surfaces

Relative level of each bunk top

<table>
<thead>
<tr>
<th>BUNK #1 (South)</th>
<th>BUNK #2</th>
<th>BUNK #3 (North)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>-0.88</td>
<td>-1.58</td>
</tr>
<tr>
<td>2</td>
<td>-0.50</td>
<td>-0.06</td>
</tr>
<tr>
<td>3</td>
<td>-0.30</td>
<td>-0.54</td>
</tr>
<tr>
<td>4</td>
<td>-0.14</td>
<td>-0.20</td>
</tr>
</tbody>
</table>

Solution: machine bunk tops

Maximum wear
2.1mm at outer end of bunk #3

125mm Steps
The localized quick check / fix

- Establish quick checks based on item reliability and criticality
- Reliable if alignment survey is recent or adjacent components known to be reliable
- Create best practice SOPS, define tolerances
- Record all changes identifying:
  - The problem
  - Changes made
  - Result

General alignment equipment

- Theodolite and scales (requires good lighting)
- Levels – bubble & electronic (smart level or inclinometer)
- Dumpy or laser machine level
- Straight edge, machinists square, calipers, feeler gauges
Ideal attributes for the alignment person

- Affinity for the type of work
- Thorough, not given to short cuts
- Resists pressure to compromise
- Methodical but not dogmatic
- Records all relevant information
- Lateral thinker
- Precise where appropriate
- Verifies rather than assumes

Decide on site alignment conventions

- Terminology
- Units of measurement
- Orientation
- Sign convention
Summary

- Assess all potential sources of misalignment
- Consider static alignment vs dynamic response
- Survey all relevant mill alignments
- Equip well for in-house alignment measurement and control
- Appoint suitable people and train in-house best practice

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