Measuring Paper Machine Performance

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Paper Machine Performance Systems

- General standards associations
  - VDI (German)
  - SSG (Swedish-Standard Solutions Group)
  - SFS (Swedish)

- Paper producer associations
  - TAPPI
  - Pulp & Paper Products Council (PPPC) Was CPPA
  - Zellcheming (Finnish/German)

- Machine builders
  - Metso
  - Voith/PTS

- Unique paper company systems
Paper Machine Performance Guidelines TIP 0404-47

- Has 15-20 good performance guidelines for linerboard, corrugating medium, fine paper, newsprint, Kraft paper, bleached board, and recycled paperboard.
- Explains the guidelines and provides suggestions for application.
- Issued 1997, revised 2001 and 2006
Paper Machine Performance Guidelines TIP 0404-47

- Uptime
- Salable Product
- Overall Machine Efficiency
- Headbox Consistency
- Steam Box Steam Consumption
- Flatbox Vacuum
- Couch Consistency
- Consistency After Last Press
- Steam Consumption
- TAPPI Drying Rate
- Basis Weight Profile Variation
- Moisture Profile variation
- Water Consumption
Paper Machine Uptime

Uptime = Annual Hours Sheet On Reel X 100%

Annual Available Hours

- Excludes Scheduled Outages >24 Hours
- Other Mill Services Affect
- No Factor For Machine Speed
- Highest Observed 97% on Liner Machine
- Lowest Observed 58% on Coated Machine
<table>
<thead>
<tr>
<th>Category</th>
<th>Units</th>
<th>% of Available Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaks</td>
<td>%</td>
<td>&lt;3.0</td>
</tr>
<tr>
<td>Scheduled Maintenance</td>
<td>%</td>
<td>1.5</td>
</tr>
<tr>
<td>Unscheduled Maintenance</td>
<td>%</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>Process</td>
<td>%</td>
<td>1.0</td>
</tr>
<tr>
<td>Grade Changes</td>
<td>%</td>
<td>0 to 4</td>
</tr>
<tr>
<td>Other Departments</td>
<td>%</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Total</td>
<td>%</td>
<td>&lt;7.0</td>
</tr>
</tbody>
</table>
Percent First Quality

Percent Salable = \( \frac{\text{Salable Tonnage}}{\text{Reel Tonnage}} \times 100\% \)

- Net Tons Off Winder
- Losses Include Trim, Slabs, and Off-Quality
- Seconds Should be < 5%
Overall Machine Efficiency

OME = \frac{\text{Annual Hours (Sheet on Reel Annual Available Hours)}}{\text{Salable Tonnage Reel Tonnage}} \times 100\%
Zellcheming Production Indices-Revised 2005

- Very similar to TAPPI TIP 0404-47.
- Major difference is scheduled outages are excluded if they exceed 48 hours instead of 24 hours for TAPPI.
- Provides more detail than 0404-47 and includes some additional indices.
- Guidelines include:
  - Time definitions
  - Time related efficiencies
  - Product definitions
  - Area efficiency
  - Overall efficiency
  - Production capability
Long term goal is to have all paper mills in the world use the same performance reporting system.

This is a great goal but it will take time to gain acceptance.

It is widely used in Europe and has been adopted by Metso and Voith.
Pulp and Paper Products Council (CPPA) Reporting

- Newsprint Producers Association
- Market Pulp Association
- Printing and Writing Papers Association
- Paper Recycling Association
PPRC (CPPA) Newsprint Machine Comparison

- Machine speed
- Average trim
- Average basis weight
- Production per operating day
- Operating efficiency
- Production per operating day
- Percent maximum trim
- Moisture percentage
- Drying steam
- Furnish
- Percent loss-non-controllable
- Percent loss-sheet off wire
- Percent loss-sheet on wire
- Percent loss dry end
- Percent loss miscellaneous
PPPC(CPPA) Reporting

- Most productive newsprint machine (1109.7 kg/cm/day for 2008)
- Operating efficiency
- Absolute efficiency
- Average trim width
- Average speed
- Tons per day
- Average basis weight
- Break information
- Former type
Valmet/Metso Paper has conducted surveys annually since 1988

Major paper and board grades reported globally
- News, SC, LWC, WFU, WFC, Liner and Medium

Complimentary service

Electronic survey form

Absolute confidentiality

Statistical reports for benchmarking
Paper Machine Productivity Survey

- Scheduled downtime %
- Unscheduled downtime %
- Total downtime %
- Broke %
- Breaks %
- Breaks per day, number
- Time efficiency %
- Total efficiency %
- Shrinkage %
- Productivity in tons/day/inch
- Area efficiency
Paper Machine Productivity
Survey - Energy Consumption

- Starting with 2008 survey will collect consumption for:
  - Water
  - Steam
  - Gas
  - Electricity
Linerboard machines 2006
TOTAL EFFICIENCY (Metso)

(*): Not included in the average value.

machines with size press in use

Average (all) without size press size press
Paper Machine Productivity Survey - Production Trends

Average of Five Best PMs Production

Year


Average Production, sh tons/in/d

1.0 1.5 2.0 2.5 3.0 3.5 4.0

NEWS

SC

LWC

FINE
Paper Machine Productivity Survey - Broke Trends

Average of Five Best PMs Broke

Year

Broke, %


NEWS SC LWC FINE
Paper Machine Productivity Survey—Break Trends

Average of Five Best PMs Breaks

![Graph showing the average of five best PMs breaks over the years 1985 to 2010. The graph includes lines for NEWS, SC, LWC, and FINE, with a trend of decreasing breaks over time.]
What is World Class PM OME Performance?

<table>
<thead>
<tr>
<th>Grade</th>
<th>Average-</th>
<th>Top 10%</th>
<th>TIP 0404-47 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newsprint</td>
<td>86</td>
<td>92+</td>
<td>90</td>
</tr>
<tr>
<td>SC</td>
<td>81</td>
<td>88+</td>
<td></td>
</tr>
<tr>
<td>LWC &amp; MWC</td>
<td>81</td>
<td>88+</td>
<td></td>
</tr>
<tr>
<td>Woodfree Uncoated</td>
<td>86</td>
<td>92+</td>
<td>89</td>
</tr>
<tr>
<td>Woodfree Coated</td>
<td>79</td>
<td>86+</td>
<td></td>
</tr>
<tr>
<td>Liner &amp; Medium</td>
<td>86</td>
<td>93+</td>
<td>92</td>
</tr>
<tr>
<td>Carton Board</td>
<td>82</td>
<td>88+</td>
<td>84</td>
</tr>
</tbody>
</table>
OME = (100 - (Total % PM Shutdown + % Breaks at PM)) \times (100 - % Production Line Total Broke) / 100
## Great Paper Machine Uptime - Liner Example

<table>
<thead>
<tr>
<th>Lost Time Cause</th>
<th>Lost Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaks</td>
<td>1.84%</td>
</tr>
<tr>
<td>Scheduled Maintenance</td>
<td>0.61%</td>
</tr>
<tr>
<td>Unscheduled Maintenance</td>
<td></td>
</tr>
<tr>
<td>- Electrical and Instrumentation</td>
<td>0.38%</td>
</tr>
<tr>
<td>- Mechanical</td>
<td>0.23%</td>
</tr>
<tr>
<td>Process</td>
<td>0.29%</td>
</tr>
<tr>
<td>Other Departments</td>
<td>0.13%</td>
</tr>
<tr>
<td>Total</td>
<td>3.25%</td>
</tr>
</tbody>
</table>
Downtime Comments

1. Maintenance outages of 10-12 hours are scheduled every 10-12 weeks.
2. Maintenance workers on field days include 46-50 mechanics, 28-30 E&I, and 80-100 contractors.
3. There are three mechanical supervisors, three E&I supervisors, and four maintenance planners.
4. Extending time between outages has not hurt runnability or increased downtime due to mechanical or E & I breakdowns.
5. If any bearing is noisy, it is changed on the next outage.
6. There are few short outages for fabric changes, etc.
7. Overall, it seems best to do repairs, change clothing, etc., on long outages every 10 weeks than to have more frequent shorter outages. (It is also easier on superintendents!)
8. There have been minor issues with motor brushes. Brushes are now checked before all shutdowns.
Average production should be within 10% of record production.
What Does it Take to Achieve World Class Performance?

- Attention to:
  - Details, details, details, details, details, details, etc.