Paper Machine Efficiency: Time, Broke and Overall

Time efficiency from downtime, material efficiency from broke and overall machine efficiency, with production lost to downtime (Smook ch. 21).

Method: Smook; Handbook for Pulp & Paper Technologists; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Calendar time in the period	720.00	h
Downtime (breaks, shuts, grade changes)	57.600	h
Reel production while running	49.000	t/h
Broke as a share of reel output	6.0000	%
Speed as a share of the design speed	97.000	%

Calculated results

Parameter	Value	Unit
Time efficiency	92.000	%
Material efficiency	94.000	%
Overall efficiency (time × speed × material)	83.886	%
Saleable production in the period	30,510	t
Production lost to downtime	2,822.4	t

Formula and method

$$\eta_t = \frac{T - T_d}{T}, \quad \eta_m = 1 - B, \quad \eta_o = \eta_t \, \eta_m \, P_s$$

Variables

T	Calendar time in the period	s
T_d	Downtime (breaks, shuts, grade changes)	s
P_r	Reel production while running	kg/s
B	Broke as a share of reel output	-
P_s	Speed as a share of the design speed	-
η_t	Time efficiency	-
η_m	Material efficiency	-
η_o	Overall efficiency (time × speed × material)	-
M	Saleable production in the period	kg
M_d	Production lost to downtime	kg

Method and standards

Efficiency definitions.

Assumptions and limits

- Constant running rate.
- With the speed above design speed (share over 100 %) the overall efficiency can exceed 100 %; the page flags it.

References

• Smook
• Handbook for Pulp & Paper Technologists
• 3rd ed. (Angus Wilde, 2002)

- ch. 21 (paper machine efficiency and broke)

Report details

Report reference	FCC-SRM7-9F83 (the same inputs always give the same reference)
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Calculator	Paper Machine Efficiency: Time, Broke and Overall
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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/pulp-paper/paper-machine-efficiency-oee

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.