First-Pass (Single-Pass) and Overall Retention

Single-pass retention on the forming fabric from headbox and white water consistencies (total and ash), and overall retention of furnish added (Smook ch. 15).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Headbox consistency	0.80000	%
White water (tray) consistency	0.25000	%
Headbox ash consistency	0.16000	%
White water ash consistency	0.10000	%
Furnish retained in the sheet	800.00	t/d
Furnish added with the stock	830.00	t/d

Calculated results

Parameter	Value	Unit
First-pass retention (total)	68.750	%
First-pass ash retention	37.500	%
Overall retention	96.386	%

Notes for this case

- Low first-pass retention loads the white water loop with fines and filler; retention aids raise it.

Formula and method

$$FPR = \frac{C_{hb} - C_{ww}}{C_{hb}}, \quad FPAR = \frac{A_{hb} - A_{ww}}{A_{hb}}, \quad R_o = \frac{m_{sheet}}{m_{add}}$$

Variables

C_{hb}	Headbox consistency	-
C_{ww}	White water (tray) consistency	-
A_{hb}	Headbox ash consistency	-
A_{ww}	White water ash consistency	-
m_{sheet}	Furnish retained in the sheet	kg/s
m_{add}	Furnish added with the stock	kg/s
FPR	First-pass retention (total)	-
$FPAR$	First-pass ash retention	-
R_o	Overall retention	-

Method and standards

Smook's retention definitions.

Assumptions and limits

- Simultaneous samples.
- Retentions that cannot be formed (no headbox ash, no furnish added) are not shown; negative ash retention and overall retention above 100 % are flagged.

References

- Smook
- Handbook for Pulp & Paper Technologists

- 3rd ed. (Angus Wilde, 2002)
- ch. 15 (retention: % single-pass and % overall retention)

Report details

Report reference	FCC-MKV7-XFBS (the same inputs always give the same reference)
Generated	17 November 2026, 19:48 UTC
Calculator	First-Pass (Single-Pass) and Overall Retention
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/first-pass-retention

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.