Chlorine Dioxide as Active Chlorine and Kappa Factor

Converts a ClO_2 charge to active chlorine (2.63 × by electron transfer) and computes the kappa factor of a D_0 stage from the entering kappa number.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
ClO_2 charge on OD pulp	0.90000	%
Elemental chlorine charge on OD pulp	0	%
Kappa number entering the stage	14.000	
Pulp production (oven-dry)	500.00	t/d

Calculated results

Parameter	Value	Unit
Active chlorine per kg ClO_2	2.6280	
Active chlorine charge	2.3652	%
Kappa factor	0.16894	
ClO_2 used	187.50	kg/h

Notes for this case

- ClO_2 takes 5 electrons per molecule against 2 for Cl_2: one kg of ClO_2 oxidises like 2.63 kg of chlorine.

Formula and method

$$f = \frac{5 M_{Cl}}{M_{ClO_2}} \approx 2.63, \quad c_{aCl} = f\, c_{ClO_2} + c_{Cl_2}, \quad KF = \frac{c_{aCl}(\%)}{\kappa}$$

Variables

c_{ClO_2}	ClO_2 charge on OD pulp	-
c_{Cl_2}	Elemental chlorine charge on OD pulp	-
κ	Kappa number entering the stage	-
$\dot{m}_{OD}$	Pulp production (oven-dry)	kg/s
f	Active chlorine per kg ClO_2	-
c_{aCl}	Active chlorine charge	-
KF	Kappa factor	-
$\dot{m}_{ClO_2}$	ClO_2 used	kg/s

Method and standards

Electron-transfer equivalence and kappa factor definition.

Assumptions and limits

- Charges on OD pulp.

References

- Smook
- Handbook for Pulp & Paper Technologists
- 3rd ed. (Angus Wilde, 2002)
- ch. 11 (bleaching with chlorine dioxide)
- Active chlorine equivalence from electron transfer: ClO_2 ($5\ e^-$) against Cl_2 ($2\ e^-$)

Report details

Report reference	FCC-MMJA-B9M3 (the same inputs always give the same reference)
Generated	17 November 2026, 19:45 UTC
Calculator	Chlorine Dioxide as Active Chlorine and Kappa Factor
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/clo2-active-chlorine-equivalent

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.