Ozone Dose, Transfer Efficiency and Off-Gas Concentration

Applied and transferred ozone dose from feed-gas flow and concentration, the off-gas ozone concentration and the destruct efficiency needed for a vent limit.

Method: Ozone mass balance between feed gas; water and off-gas

Input parameters

Unit system: SI

Parameter	Value	Unit
Feed gas flow (normal)	60.000	Nm³/h
Ozone in the feed gas, by volume	10.000	%
Water flow	1,800.0	m³/h
Transfer efficiency	95.000	%
Vent limit for ozone, ppmv	0.10000	

Calculated results

Parameter	Value	Unit
Ozone generated	12.849	kg/h
Applied ozone dose	7.1381	mg/L
Transferred ozone dose	6.7812	mg/L
Off-gas ozone, ppmv	5,524.9	
Off-gas ozone, mass per normal volume	11.831	g/m³
Destruct efficiency for the vent limit	99.998	%

Notes for this case

• Normal conditions 0 °C and 101.325 kPa. The off-gas concentration allows for the gas volume lost with the transferred ozone. Ambient limits are about 0.1 ppmv (OSHA 8-hour), so off-gas always needs thermal or catalytic destruct.

Formula and method

$$\dot{m}_{O_3} = \frac{Q_g\, y_{O_3}}{V_m} M_{O_3}, \quad D_{applied} = \frac{\dot{m}_{O_3}}{Q_w}, \quad D_{transferred} = TE \cdot D_{applied}$$

$$C_{off} = \frac{y_{O_3}(1 - TE)}{1 - y_{O_3} TE}, \quad \eta_{destruct} = 1 - \frac{C_{vent}}{C_{off}}$$

Variables

Q_g	Feed gas flow (normal)	Nm³/s
y_{O_3}	Ozone in the feed gas, by volume	-
Q_w	Water flow	m³/s
TE	Transfer efficiency	-
C_{vent}	Vent limit for ozone, ppmv	-
$\dot{m}_{O_3}$	Ozone generated	kg/s
$D_{applied}$	Applied ozone dose	kg/m³
$D_{transferred}$	Transferred ozone dose	kg/m³
C_{off}	Off-gas ozone, ppmv	-

$\eta_{destruct}$	Destruct efficiency for the vent limit	-

Method and standards

Gas-phase mass balance on an ozone contactor.

Assumptions and limits

- Steady state; normal gas volumes.

References

Ozone mass balance between feed gas, water and off-gas

Report details

Report reference	FCC-E2MA-EJPX (the same inputs always give the same reference)
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Calculator	Ozone Dose, Transfer Efficiency and Off-Gas Concentration
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Release checks	3 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/environmental/drinking-water/ozone-dose-offgas

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.