Molecular Sieve Dehydration: Water Removed

Water removed in a molecular sieve dehydration unit from the anhydrous ethanol rate and the water contents (by mass) of feed and product, with regeneration recycle.

Method: Ethanol and water mass balance; strengths by mass (convert % v/v with the strength calculator)

Input parameters

Unit system: SI

Parameter	Value	Unit
Anhydrous product	78.924	t/d
Water in feed (% w/w)	7.0000	%
Water in product (% w/w)	0.40000	%
Regeneration recycle (share of feed returned)	15.000	%

Calculated results

Parameter	Value	Unit
Fresh feed (rectified spirit)	84.525	t/d
Water removed	5.6011	t/d
Total feed through the beds	99.441	t/d

Notes for this case

- Rectified spirit at about 94.5 % v/v holds roughly 7 % water by mass.
- The water removed is the net balance on fresh feed; the beds also handle the water in the regeneration recycle, so their water load is higher.

Formula and method

$$\dot{m}_f = \frac{\dot{m}_p(1 - w_p)}{1 - w_f}, \quad \dot{m}_w = \dot{m}_f - \dot{m}_p$$

Variables

$\dot{m}_p$	Anhydrous product	kg/s
w_f	Water in feed (% w/w)	-
w_p	Water in product (% w/w)	-
r	Regeneration recycle (share of feed returned)	-
$\dot{m}_f$	Fresh feed (rectified spirit)	kg/s
$\dot{m}_w$	Water removed	kg/s
$\dot{m}_t$	Total feed through the beds	kg/s

Method and standards

Mass balance.

Assumptions and limits

- Ethanol not lost.
- The water removed is the net balance on the fresh feed. The beds also adsorb water from the regeneration recycle, which returns to distillation, so the water load on the beds is higher than the net water removed; size the beds on the total feed through them.

References

- Ethanol and water mass balance; strengths by mass (convert % v/v with the strength calculator)

Report details

Report reference	FCC-NQAJ-318Q (the same inputs always give the same reference)
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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/sugar-ethanol/ethanol-distillation/molecular-sieve-water-removal

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.