Amine Circulation Rate for Gas Sweetening (MEA, DEA, MDEA)

Amine solution circulation for acid gas removal from gas flow, acid gas fraction, amine strength, solution density and rich loading, with an excess margin.

Method: IUPAC standard atomic weights (amine molar masses)

Input parameters

Unit system: SI

Parameter	Value	Unit
Gas flow to the contactor	50.000	MMscfd
Acid gas (H_2S + CO_2) in the inlet gas	2.0000	%
Amine	MEA (monoethanolamine)	
Amine strength in the solution	20.000	%
Solution density at 60 °F	8.4100	lb/US gal
Acid gas loading (mol acid gas per mol amine)	0.33000	
Excess circulation margin	10.000	%

Calculated results

Parameter	Value	Unit
Solution circulation (no margin)	201.39	US gal/min
Design circulation with margin	221.53	US gal/min
Acid gas removed	49.804	kmol/h
Molar mass of the amine	61.084	kg/kmol
Amine circulated (100 % basis)	9,218.8	kg/h

Notes for this case

- (after Arnold and Stewart) recommends 10–15 % above the calculated circulation.

Formula and method

$$Q = \frac{\dot{n}_{AG} M / AG}{WF\rho}, \quad \dot{n}_{AG} = \frac{Q_G\, MF}{V_m}; \quad \text{field form } Q[\text{gpm}] = \frac{k\, Q_G[\text{MMscfd}]\, MF}{\rho[\text{lb/gal}]\, WF\, AG}, \; k = 112 \text{ (MEA)}, \; 192 \text{ (DEA)}$$

Variables

Q_G	Gas flow to the contactor	Nm³/s
MF	Acid gas (H_2S + CO_2) in the inlet gas	-
amine	Amine	-
WF	Amine strength in the solution	-
ρ	Solution density at 60 °F	kg/m³
AG	Acid gas loading (mol acid gas per mol amine)	-
excess	Excess circulation margin	-
Q	Solution circulation (no margin)	m³/s
Q_{design}	Design circulation with margin	m³/s
$\dot{n}_{AG}$	Acid gas removed	mol/s
M	Molar mass of the amine	kg/kmol
$\dot{m}_{amine}$	Amine circulated (100 % basis)	kg/s

Method and standards

Acid-gas mole balance (Arnold and Stewart).

Assumptions and limits

- Lean loading taken as zero; all acid gas absorbed.

References

IUPAC standard atomic weights (amine molar masses)

Report details

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

This calculator online

https://calc.firecad.com/chemical/oil-gas/amine-circulation-rate

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Reopens the calculator with the inputs of this report.