Hydrate Inhibitor Dose: Hammerschmidt and Nielsen–Bucklin

Inhibitor concentration in the water phase to lower the hydrate temperature below the line temperature (Hammerschmidt, Nielsen–Bucklin) and the inhibitor rate.

Method: Mokhatab; Poe and Speight; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Hydrate formation temperature without inhibitor	29.158	°C
Lowest line temperature	9.4000	°C
Inhibitor	Methanol	
Free water in the line	100.00	kg/h

Calculated results

Parameter	Value	Unit
Hydrate depression needed	19.758	K
Inhibitor in the water phase (Hammerschmidt)	32.796	%
Inhibitor in the water phase (Nielsen–Bucklin)	35.963	%
Inhibitor rate to the water phase (Hammerschmidt)	48.801	kg/h

Notes for this case

- Inhibitor in the water phase only: methanol also vaporises into the gas and dissolves in condensate, so the injected rate is higher. Hammerschmidt suits up to about 20–25 % methanol or 60–70 % glycol by weight; Nielsen–Bucklin is recommended for 25–50 % methanol.
- The methanol concentration is above the Hammerschmidt range: use the Nielsen–Bucklin result.

Formula and method

$$W = \frac{100\,M\Delta T}{K + M\Delta T}\ (\Delta T \text{ in } °\text{F}), \quad \Delta T = -129.6 \ln x_{H_2O}$$

Variables

T_h	Hydrate formation temperature without inhibitor	K
T_l	Lowest line temperature	K
$\mathrm{inhibitor}$	Inhibitor	-
$\dot{m}_w$	Free water in the line	kg/s
ΔT	Hydrate depression needed	K
W	Inhibitor in the water phase (Hammerschmidt)	-
W_{NB}	Inhibitor in the water phase (Nielsen–Bucklin)	-
$\dot{m}_i$	Inhibitor rate to the water phase (Hammerschmidt)	kg/s

Method and standards

Hammerschmidt (1934) and Nielsen–Bucklin (1983).

Assumptions and limits

- Water-phase concentration only.

References

- Mokhatab
- Poe and Speight
- Handbook of Natural Gas Transmission and Processing (Gulf Professional Publishing, 2006)
- ch. 3

- eqs. 3-54 and 3-55
- Table 3-6
- Example 3-3

Report details

Report reference	FCC-QVSY-FSAH (the same inputs always give the same reference)
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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/chemical/oil-gas/hydrate-inhibitor-hammerschmidt

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.