



The CONTACTOR™

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Stahl Column Performance

Solvent regeneration controls the achievable moisture content of a gas being dehydrated using glycol. The final stage of regeneration takes place in the reboiler but unless a very high – expensive – reboiler duty is used it may not be possible to reach the desired treated-gas dryness. Rather than relying only on steam generated by a reboiler as the stripping medium, introducing a dry stripping gas can provide just that boost to stripping needed to lower the residual moisture content of the regenerated solvent to the desired level.

A Stahl column is a stripping column that uses a stripping gas rather than just heat to remove water from glycol, usually to a lower level than what can be easily achieved using a reboiler. The Stahl column itself is fed with semi-dry glycol coming from the reboiler of a conventional glycol stripper (Figure 1).

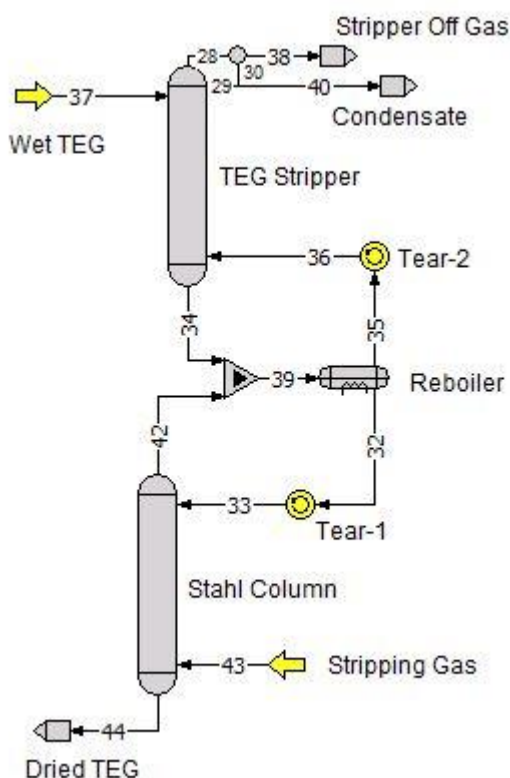


Figure 1 Typical Stahl Column Arrangement

Both the Stahl column and the conventional Stripper are usually packed (trays are no longer in vogue for this service).

Structured packing is the internal of choice. However, sometimes the stripping goal can be achieved by sparging the stripping gas directly into the reboiler of the stripping column, avoiding the expense of a Stahl column altogether. Figure 2 shows this configuration.

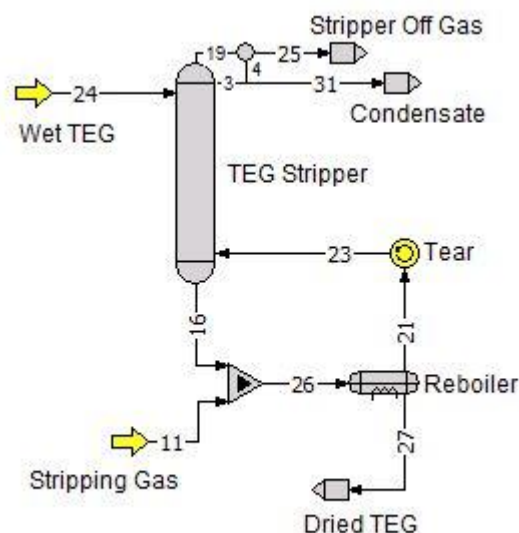


Figure 2 Direct Injection of Stripping Gas

In ProTreat® it is easy to set up a detailed and quite accurate rate-based model of a Stahl column, a model of the entire regeneration system, or a predictive model of the complete glycol dehydration unit. In this issue of The Contactor, we put a Stahl column under the microscope and use a Case Study to dissect its performance as a function of stripping gas flow and packing depth, leading to some real process insights. We also compare a Stahl column with direct injection (and use of no stripping gas at all) using the criterion of final lean glycol moisture level.

Case Study

The case study draws its data from an operating offshore platform that uses TEG to dehydrate methane prior to transferring the gas via undersea pipeline to an onshore LNG production facility. Rich glycol flows at 20,000 kg/h and has a TEG content of 95.4 wt% with 4.0 wt% water and 0.5 mol% CO₂ plus trace amounts of C₁ to C₆ hydrocarbons. The rich solvent enters at 170°C.

The 900-mm diameter TEG stripper contains 3.2 meters of 1-inch Pall Rings and 45% of the condensate is returned to the column as reflux. The reboiler consumes 1.2 MW of energy and the stripper overhead is at 1.05 bara. The 400-mm diameter Stahl column is packed with Mellapak™ M250.X structured packing. Stripping gas is methane with a moisture level of 8 gm/Nm³ (475 lb/MMscf). The high pressure dehydrated gas has a water content of around 1.5 lb/MMscf but it's unnecessary to expend such dry material for stripping gas. Stripping gas rate was varied over the range 100–300 Nm³/h and packed bed depths of 0–8 m were considered.

How Effective Is Stripping Gas?

For the specific case of a 3.2-m (10-ft) packed bed and a stripping gas rate of 150 Nm³/h, Table 1 compares (1) lean solvent dryness using a Stahl column, (2) direct injection into the reboiler, and (3) using no stripping gas at all. Differences between process configurations are much more apparent when results are considered in terms of water content rather than wt% TEG.

Table 1 Wt% H₂O in Lean Solvent for Three Cases

Stahl Column with 3.2-m Bed of Sulzer M250.X	0.213
Stripping Gas Fed Directly into Reboiler	0.814
No Stripping Gas at All	0.971

Table 1 shows that even a short Stahl column produces lean solvent 3.8 times drier than obtained by injection of the same stripping gas directly into the reboiler and more than four times drier than without stripping gas. Using stripping gas can improve lean solvent quality (dryness) to some extent, but a Stahl column can produce a much drier lean solvent, hence a much drier product gas.

Effect of Stripping Gas Flow Rate

Simulations were run at five stripping gas rates between 100 and 300 Nm³/h to expose the dependence of lean solvent moisture content on this parameter. Table 2 shows the results.

Table 2 Effect of Stripping Gas Rate on Residual Moisture in Lean Solvent

Gas Rate (Nm ³ /h)	Wt% Water in Lean Solvent	
	Stahl Column	Direct Injection
100	0.300	0.860
150	0.214	0.815
200	0.156	0.772
250	0.116	0.731
300	0.088	0.692

Residual moisture responds readily to changing stripping gas rate. This is potentially a useful way to control lean solvent quality and ultimately the treated gas dryness.

Effect of Packing Height

Table 3 shows that even a *very short* (2.5 ft) packed bed will halve residual moisture over gas injection into the reboiler. Returns from bed depths over 20 feet

though are increasingly marginal—there are better ways to get more performance, such as a slightly higher stripping gas rate.

Table 3 Effect of Packing Height on Residual Moisture (wt% H₂O) in Lean Solvent

Packed Depth (ft)	Wt% Water in Lean Solvent
2.5	0.416
5	0.319
10	0.213
15	0.172
20	0.152

Solvent Stripping in a Reboiled vs. a Stahl Column

Figure 3 compares the solvent moisture profile in the reboiled column with how the profile looks in the Stahl column. *A reboiled stripper does almost all its work near the very top of the column and in the reboiler. ProTreat® simulation clearly shows that a Stahl column strips quite effectively throughout its entire packed height.*

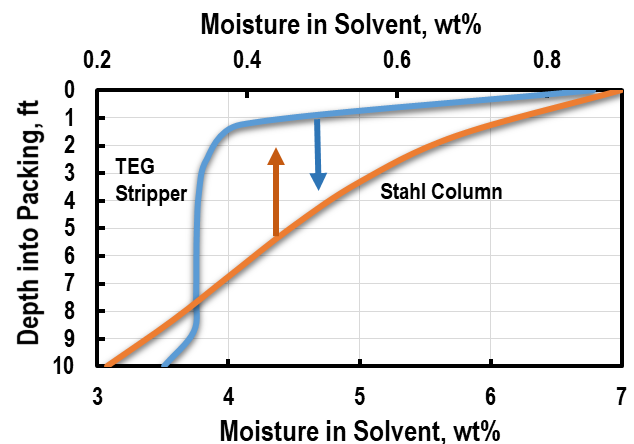


Figure 3 Solvent Moisture Profiles for TEG Stripper (—) and Stahl Column (—)

Summary

A Stahl column is vastly superior to a reboiled stripper alone or simple gas injection into a reboiler. The operating cost is just relatively wet stripping gas, which can later be used as fuel.

To learn more about this and other aspects of gas treating, plan to attend one of our training seminars. For details visit www.oqtr.com/seminars.

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