The CONTACTOR™
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Stahl Columns

A piece of equipment called a Stahl column is sometimes used in glycol dehydration to produce a drier solvent than can be achieved by a simple still. It is the focus of this issue of The Contactor™. Additional water is removed from the glycol by using a stripping gas (usually dry nitrogen, natural gas, or fuel gas) as a carrier for water vapor. The purpose is to generate a super-dry glycol, capable of producing an even drier treated gas.

Stahl columns are usually packed and they have no reboiler—dry stripping gas replaces reboiler-generated steam (see Figure 1). The partially stripped solvent from the reboiler of the TEG-Still flows into the top of the Stahl column. Overhead vapor from the Stahl column may be sparged into the TEG-Still reboiler as in Figure 2, or it may pass directly to the base of the TEG-Still as in Figure 1. Both options are considered in this note.

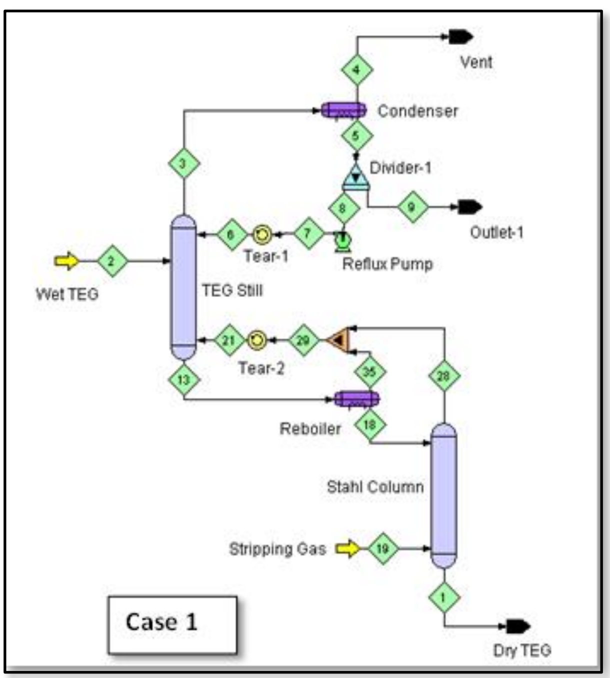

Figure 1 Stahl Gas Bypassing Reboiler

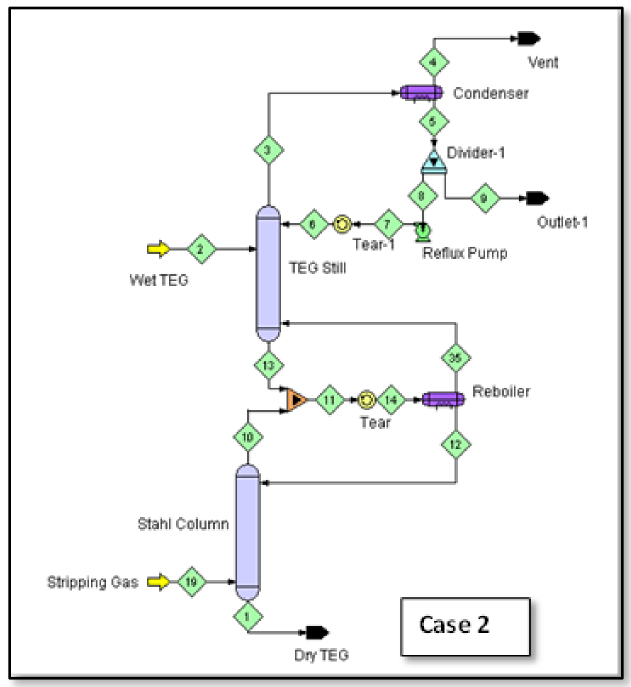

Figure 2 Stahl Gas Entering Reboiler

Case Studies

In this study, we will look at the effect on performance parameters of injecting the wet gas coming from the Stahl column directly into the TEG-Still versus routing it through the still reboiler. The TEG-Still contains from 2 to 10 bubble-cap trays with reflux to the top tray. Wet TEG is fed onto Tray 2 (from the top). Varying the tray count allows us to assess the effect of the number of trays on still performance. The reboiler operates at 400°F. The Stahl column contains 8-ft of a structured packing.

The wet TEG comes from a high pressure dehydration column via cross exchange where it has been heated to about 275°F. Its molar composition is 21% water and 76% TEG with the balance light hydrocarbons and BTEX components. The stripping gas is dry to 1 ppmv water and is mostly methane with minor amounts of other light hydrocarbons.

The water and TEG content of certain key streams are shown in Table 1 for Case 1 and in Table 2 for Case 2.

Table 1 Summary of Stream Results for Case 1

Total Trays	From Still Strm 13 H_2O (wt%)	To Stahl Strm 18 H_2O (wt%)	Dry TEG Strm 1 H_2O (wt%)	From Still Strm 13 TEG (wt%)	To Stahl Strm 18 TEG (wt%)	Dry TEG Strm 1 TEG (wt%)
2	5.128	0.869	0.103	94.593	99.092	99.88
5	5.058	0.878	0.103	94.923	99.120	99.88
9	5.095	0.878	0.103	94.898	99.122	99.88
10	5.104	0.878	0.103	94.889	99.122	99.88

Table 2 Summary of Stream Results for Case 2

Total Trays	From Still Strm 13 H_2O (wt%)	To Stahl Strm 12 H_2O (wt%)	Dry TEG Strm 1 H_2O (wt%)	From Still Strm 13 TEG (wt%)	To Stahl Strm 12 TEG (wt%)	Dry TEG Strm 1 TEG (wt%)
2	5.124	0.611	0.103	94.597	99.357	99.88
10	5.098	0.613	0.103	94.895	99.381	99.88

From a process standpoint, the critical stream of interest is Stream 1, the final Dry TEG whose water content will determine the dryness of the final gas coming from the dehydration unit. These tables indicate that it doesn't matter how many trays there are in the TEG Still, the dry solvent will have a purity of 99.88 wt% TEG. Nor does the moisture content of the semi-stripped stream matter (Streams 18 and 12 in Cases 1 and 2, respectively) — final TEG dryness is unchanged.

For the conditions of this study, feeding the vapors from the Stahl column into the reboiler of the TEG Still (Case 2) results in a slightly drier solvent from the reboiler. This is as one should expect—the reboiler is an additional unit of contact and passing even saturated stripping gas through it should evaporate more water because the reboiler is hotter (400°F) than the vapor from the Stahl column. Additionally, the flow of total carrier (steam plus stripping gas) is higher than steam alone. But what determines the dryness level in the final stripped solvent?

Figure 3 shows the wt% water in the TEG as a function of position within the structured packing bed measured from the top of the bed. Evidently, eight feet of packing in the Stahl column is sufficient for the solvent to come into equilibrium with the stripping gas and its 1 ppmv water content. Although the stripping gas flow is low (just 3% by mass of the solvent flow rate) and the Stahl column does not remove a large amount of water, it removes enough water to push the dryness from 99.1 to 99.9 wt% TEG. This is enough to have a very large impact of the water content of any treated gas.

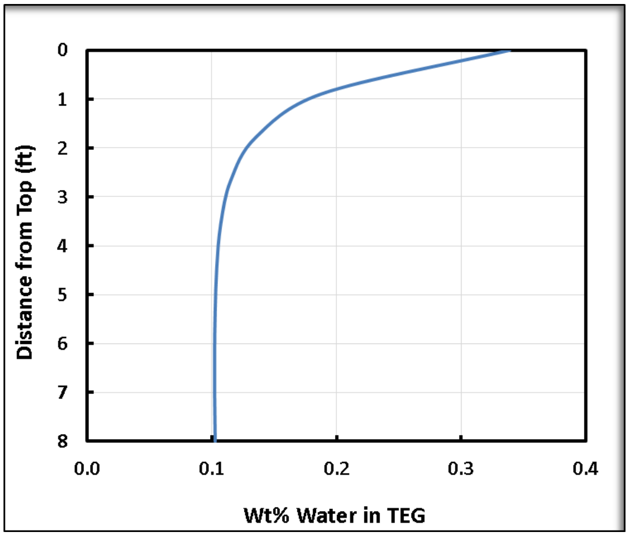

Figure 3 How wt% Water in TEG Varies with Distance along the Packing in the Stahl Column

It is also worth noting that as far as the TEG Still is concerned, except for the very bottom tray which is removing roughly 400 lb/h of water, the remaining eight trays in a nine-tray TEG-Still remove an additional 500 lb/h *combined*, only slightly more than the bottom tray *alone*. The reboiler, on the other hand, removes over 3,000 lb/h water. The Still might almost be replaceable by a single heated flash, i.e., a one stage evaporator, especially if it is followed by a Stahl column.

These results were obtained using the mass transfer rate-based ProTreat® simulator. ProTreat, does not just *predict* the correct answers. It also is able to explain the real mechanistic reasons for the behaviors one sees. Deeper understanding allows one to develop better processing schemes and to move operating parameters in the right directions to achieve desired goals.

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