Question 69: What do you see as the critical considerations for wash bed design in high C-factor vacuum columns? How does one determine bed type, depth, and appropriate wash oil distributor design?

Ralph Goodrich (KBC Advanced Technologies, Inc.)

A new vacuum column will typically be designed for a C-factor of 0.36 ft/sec above the wash zone which is normally the section with the highest vapor velocity. A high C-factor situation (say above 0.43) would then involve an existing unit operating well above its original design point. So, these questions apparently refer to a possible revamp of an existing vacuum column.

The wash zone performance is ultimately a function of a number of factors including:

•Column diameter

•Transfer line configuration

•Feed inlet design

•Type of feed distributor

•Collectors pan design

•Wash bed packing type(s) and depth

•Wash oil distributor design

•Wash rate

Normally modifications to the column diameter, transfer line, and inlet nozzle(s) cannot be justified so for this case we will focus only on discussing the tower internals themselves.

Ideally, recent test run information should be obtained to determine the current performance of the flash zone and wash bed. If significant entrainment is involved, modifications to the feed inlet distributor device should be considered. The overflash collector pan should also be designed such that it provides adequate pressure drop to help evenly distribute the vapor and any entrained liquid into the wash bed above.

Today’s wash bed design normally consists of a single bed containing either 100% open-grid type packing or a combination of open-grid packing supporting several layers of large capacity structured packing. The choice of one configuration over the other will depend on the primary objectives of the revamp design, the type of crude being processed, and the disposition of the HVGO.

For example, in a situation where reliability, run-length, and deep-cut are highly desired, a 3-to-5-foot (900 to 1500 mm) bed of open-grid may be the optimal choice. For a more moderate cut point with the HVGO being processed in a hydrocracker and minimizing contaminants in the feed is a priority, a more efficient wash bed using a combination bed may be the better design choice.

Assuming adequate column straight-side is available, care should also be taken to limit the wash bed height to reduce the potential for coking. This must be balanced with the benefits of the improved fractionation for the deeper and more efficient bed. (More is not always better!)

KBC prefer a pressurized spray system over gravity flow types for liquid distribution onto the top of the wash bed. It minimizes residence time, has a large open area for vapor to pass through to minimize pressure drop, is not as susceptible to out of levelness, and wash oil flow can be checked against the spray pressure drop.

Typically, the sprays are designed for 200 to 300% overlap in coverage while providing 0.2 gpm/ft2 of “true” overflash at the bottom of the bed. Proper anchoring of the main and sub-headers is required to ensure the distributor remains perpendicular to the vapor flow. Flanges should be minimized, and seal welded after installation and all screwed connections should be tack welded to help ensure the spray system integrity.

Print as PDF:

Year

2010

Submitter

Licensor

Operator

Vendor