Bed Depth

Ion exchange units typically have bed depths between two and six feet. A 2-foot bed is usually the minimum height needed to achieve efficient distribution. The maximum is normally 6 feet because of pressure drop considerations.

Bed heights should be carefully measured when a new system is installed and after it has been re-bedded with new resin. It is a good idea to mark the bed height on the outside of the tank with the date and the form the resin was measured in, i.e. the exhausted form (the salt form) or the regenerated form. This mark can be used to compare the bed height months or years later. Knowing the ionic form limits the error due to volume changes between ionic forms, which can be significant.

On multiple train systems, it is important that the units have the same bed depth and physical layout on each train. Differences in bed heights between parallel trains can lead to flow rate differences. If, in a multiple train system, one train has bed depths lower than the other(s), that train will receive more flow because water follows the path of least resistance and the lower bed height translates to a lower pressure drop which allows more flow to get through. The flow will cause that train to exhaust first and make the service runs appear shorter. Bed heights should be checked at least annually. For systems with unequal trains, a flow rate controller is recommended to keep the trains' capacities and flow rates balanced.

Vessel design and bed heights should take into account the space needed for the entire regeneration procedure. The backwash step requires the greatest amount of freeboard above the top of the bed. Typically, a strong acid cation unit needs between 50 and 75% freeboard.

A strong base anion unit will need 50 to 100% freeboard and mixed bed units 100%. If the unit is one in which backwash takes place externally from the vessel, it must also be able to accommodate the resin in its regenerated form, which is usually swollen. Strong acid cation resins swell between 5 to 7% from the exhausted to the hydrogen form. A strong base anion resin can swell between 15 to 22% from the exhausted to the hydroxide form. Weak acid cation resins can almost double in size from the hydrogen to the exhausted sodium form.

A small, gradual decrease in bed height over time is normal from attrition. Sudden or more substantial decreases in bed height may be from improper backwashing or an underdrain failure that has allowed resin to escape from the bottom of the vessel. Sometimes bed heights can increase due to oxidation and clumping.

Oxidation of the bead can lower the crosslinking of the resin. This causes the resin to swell by increasing its water retention. When this occurs, the resin will show an increased water retention, decreased volumetric capacity and increased shrink/swell characteristics during changes in ionic form. It will also become weaker and physically less stable.

Clumping is caused by external foulants in single bed resins. When a resin clumps, it increases the void volume and the bed swells. Fouling causes poor operating characteristics. (New mixed beds clump due to electrostatic attraction but that disappears after a few cycles.)

Deeper beds are always better! Compared to a 36" bed, 48" bed has 5% extra capacity, 60" bed has 8% extra capacity and 72" bed has 10% extra capacity.

ResinTech® Inc.
INNOVATIONS IN ION EXCHANGE

CORPORATE HEADQUARTERS 1801 Federal Street Camden, NJ 08105 USA PHONE 856.768.9600 FAX 856.768.9601 EMAIL info@resintech.com WEB resintech.com