Toluene Recovery System

Immediately Available

This all stainless steel, dual-column distillation system was designed by Sabic to separate and purify up to 18 mt/hr of toluene from a complex mixture including isomers, Bisphenol-A, and water. The system consists of a feed tank, vaporizer, pre-flash vessel, upper column, lower column, two column reboilers, and two overhead condensers with vacuum jets.

![Toluene Recovery System Process Flow Diagram](image)

In this design, up to 20 mt/hr of crude toluene enters the feed tank at 60°C and 1.0 barabsolute. There is a low-pressure steam coil in the 304 stainless steel feed tank. The crude toluene is then pumped through the vaporizer rated for 2.0 MM kcal/hr where the temperature is increased to 120°C. After the crude toluene is vaporized, it enters the pre-flash vessel operated at 120°C and 1.1 bar-absolute. The bottoms from the pre-flash vessel enter the middle section of the 304 stainless steel upper toluene column. This column is 1 meter diameter by 8.3 meters tall with two packed sections and operates at 111°C and 1.02 bar-absolute in the top section and 177°C and 1.04 bar-absolute in the bottom section.
The overheads from both the pre-flash vessel and the upper toluene column combine and flow to the overhead condenser which is rated for 1.6 MM kcal/hr and then to the secondary condenser which is rated for 1.4 MM kcal/hr. The bottoms from the upper toluene column circulate through a reboiler rated for 1.4 MM kcal/hr. The final product flow from the secondary condenser is up to 18 mt/hr of pure toluene.

A side-stream from the upper toluene column reboiler loop feeds the lower toluene column. This column is 0.3 meters diameter by 6.5 meters tall and operates at 166°C and 1.04 bar-absolute in the top section and 195°C and 1.08 bar-absolute in the bottom section. The overheads from the lower toluene column go back to the upper toluene column. The bottoms from the lower toluene column circulate through a reboiler rated for 0.05 MM kcal/hr with a small side-stream returning the separated BPA back to the process.

This toluene recovery system includes the following major components:

- The 304 stainless steel feed tank is 2.4 meters diameter by 2.5 meters tall. The tank is rated for 1.1 bars at 115°C. There is a low-pressure steam coil in the bottom of this tank.

- The crude toluene feed vaporizer is rated for 2.0 MM kcal/hr with 115 m² of 316 stainless steel tubes. The shell is constructed of carbon steel. The tube side is rated for 6 bars at 180°C and the shell side is rated for 8.7 bars at 180°C.

- The 304L stainless steel pre-flash vessel is 1.5 meters diameter by 2.5 meters tall. The drum is rated for 3.8 bars at 180°C.

- The 304 stainless steel upper toluene column is 1 meters diameter by 8.3 meters tall with two packed sections. The column is rated for 2.7 bars at 186°C.

- The upper toluene column overhead condenser is rated for 1.6 MM kcal/hr with 214 m² of duplex stainless steel tubes. It weighs 6,200 kg. The shell is constructed of carbon steel. The tube side is rated for 10.5 bars at 180°C and the shell side is rated for 5.3 bars at 180°C.
• The upper toluene column secondary overhead condenser is rated for 1.4 MM kcal/hr with 94.8 m² of duplex stainless steel tubes. It weighs 1,820 kg. The shell is constructed of 316L stainless steel. The tube side is rated for 10.5 bars at 150°C and the shell side is rated for 5.3 bars at 150°C.

• The upper toluene column reboiler is rated for 1.4 MM kcal/hr with 60 m² of 304 stainless steel tubes. The shell is constructed of carbon steel. The tube side is rated for 5.3 bars at 232°C and the shell side is rated for 12.8 bars at 232°C.

• The lower toluene column is 0.3 meters diameter by 6.5 meters tall with one packed section.

• The lower toluene column reboiler is rated for 0.05 MM kcal/hr with 11.4 m² of 304 stainless steel tubes. The shell is constructed of carbon steel. The tube side is rated for 5 bars at 250°C and the shell side is rated for 20 bars at 250°C.