Hydrochloric Acid Recovery System

Immediately Available

This higher-alloy and graphite constructed hydrochloric acid (HCl) recovery system was designed by Sabic. It can handle up to 24 m³/hr of liquid feed and separate out the organics, water, and HCl in aqueous form. The system includes a main distillation column for HCl removal, four HCl absorbers, an HCl regeneration column, and an HCl water removal column.

The previous service was for the recovery of 3% HCl in a wet phenol stream.

In this design, the product feed enters the top of the acid removal column which operates at 133°C bottoms temperature and 0.17 bar of pressure. The column overheads leaves at 60°C and is partially condensed. The liquid from the condenser goes to an acid-organic separator where the organics float out the top and the aqueous HCl goes out the bottom. The vapors from the condenser proceed to four HCl vacuum absorbers.
The HCl streams from the acid-organic separator and the vacuum absorbers combine in an accumulator to feed the HCl regeneration column. This column operates at 130°C and 2.0 bar of pressure. The bottoms stream from this column feeds the water removal column which operates at 60°C and 0.17 bar of pressure. The aqueous HCl is concentrated to 23% in this particular operation, but this is adjustable.

This HCl recovery system includes the following major components:

- The acid removal column was built in 2001. The bottom section is 1.7 meters diameter and is constructed of Alloy 59 (60% nickel alloy). The top section is 1.35 meters diameter and is constructed of zirconium. The overall height of this packed column is 20.8 meters and the column is rated for 5 bars at 205°C.

- The acid removal column reboiler is rated for 2.0 MM kcal/hr with 90 m² of duplex stainless steel tubes. The shell and heads are also constructed of duplex stainless steel. The shell has an expansion bellows. The tube side is rated for 10.6 bars at 200°C and the shell side is rated for 12.8 bars at 200°C.

- The two acid removal column condensers are rated for 0.66 MM kcal/hr each with 354 m² of graphite tubes. The 1.14 meter diameter by 9.4 meters long shell is constructed of carbon steel and the exchanger was manufactured by SGL Carbon. The tube side is rated for 1.5 bars at 175°C and the shell side is rated for 7.0 bars at 175°C.

- The acid-organic separator was built in 2002. It is 1.2 meters diameter by 4.54 meters tall and is rated for 3.0 bars at 200°C. The separator is constructed of glass-lined carbon steel and was manufactured by Tycon.

- The two primary HCl vacuum absorbers were built in 1999. They are rated for 0.319 MM kcal/hr each with 71.7 m² of graphite tubes. The 0.7 meter diameter by 6.7 meters long shell is constructed of carbon steel and the exchanger was manufactured by Carbon Everflow. The tube side is rated for 1.8 bars at 165°C and the shell side is rated for 7.0 bars at 165°C.
• The two secondary HCl vacuum absorbers were built in 1999. They are rated for 0.047 MM kcal/hr each with 9.4 m² of graphite tubes. The 0.33 meter diameter by 4.2 meters long shell is constructed of carbon steel and the exchanger was manufactured by Carbon Everflow. The tube side is rated for 1.8 bars at 165°C and the shell side is rated for 6.4 bars at 165°C.

• The accumulator was built in 2001 by Tycon. It is 1.6 meters diameter by 2.7 meters tall and is constructed of glass-lined carbon steel. The tank is rated for 3.0 bars at 200°C.

• The HCl regeneration column was built in 2001. It is 0.578 meters diameter by 9.9 meters tall and is constructed of tantalum. The packed column is rated for 5.3 bars at 200°C.

• The HCl regeneration column condenser is rated for 0.417 MM kcal/hr with 18.5 m² of tantalum tubes and a carbon steel shell. The tube side is rated for 6.0 bars at 170°C and the shell side is rated for 7.0 bars at 170°C.

• The water removal column is 0.8 meters diameter by 9.6 meters tall and is constructed of graphite. The packed column is rated for 1.1 bars at 150°C and was manufactured by Le Carbonne Lorraine.

• The water removal column reboiler was constructed by Sigri in 1993. It is rated for 0.49 MM kcal/hr with 20.7 m² of graphite tubes. The carbon steel shell is 0.422 meters diameter by 5.1 meters long. The tube side is rated for 6.0 bars at 150°C and the shell side is rated for 10 bars at 150°C.

• The two water removal column condensers are rated for 0.5 MM kcal/hr each with 81 m² of vertical graphite tubes. The condensers were constructed by Sigri. The carbon steel shell is 0.9 meters diameter by 5.9 meters tall. The tube side is rated for 1.8 bars at 165°C and the shell side is rated for 7.0 bars at 165°C.