

Questions & Answers

Hydrochloric Acid Recovery System



Q. What does the system do?

A. The system continuously recovers "free" acid for re-use in your production operation while concentrating the iron as ferrous chloride. The system does not manufacture HCl like a roaster; it recovers the acid that is unused in the process. The system re-concentrates the HCl, removes the iron chloride, and also recovers the excess water. This reduces the purchase of fresh acid, eliminates neutralization or disposal, and provides high quality water that can be reused.

Q. How does the system work?

A. Spent acid is processed into three parts: recovered acid, recovered water, and a FeCl_2 solution. The system uses heat to vaporize the water and hydrochloric acid from the iron chloride solution. The iron chloride becomes a super-concentrated solution that can be recovered as a concentrated liquid used as a feed stock for municipal water treatment.

Q. In what concentration is the acid returned?

A. The grade of the HCl acid being returned is a function of the feed supply but is generally in the range between 16 and 20%. Fresh, virgin acid must be added to the process tank to replenish the acid consumed in the pickling process.

Q. Will the system consume hydrochloric acid, returning less to the process tanks? Will the system add additional water to the process tanks?

A. The system itself does not consume HCl. The metal finishing process does. The system will return 99.5% of the available free acid, with 0.5% remaining in the ferrous chloride concentrate. Since the vapor is recovered using condensers (cooling supplied by an external cooling tower), no additional water is added to the process.

Q. What happens to the recovered water?

A. The recovered water can be returned to a process tank, storage tank, or discharged to the sewer after a minimal pH adjustment before discharge. Since it has no metals, it will not create sludge. Most customers use it to replenish rinse tanks or to fill the cooling tower to make up for water lost to evaporation.

Q. What markets are available for the ferrous chloride concentrated solution?

A. Municipal wastewater treatment is the principal market. Other large markets include mining and circuit board etching.

Q: How do you control the output acid concentration and the FeCl₂ concentration?

A: We use a process known as rectification. HCl concentration is temperature dependant so we use a reflux of water dripping through a contact media to control the temperature and produce a separate HCl concentrate. The water vapor passes through the contact column, but the HCl is captured from the rectification column.

Q: Does the remaining FeCl₂ solution contain a certain level of HCl?

A: Essentially not, i.e. the remaining HCl level is very low, most often below 1%.

Q. What type of heating system is necessary to operate the system?

A. The system requires a steam boiler capable of producing 60 - 85 psi (4 - 6 bar) dry, saturated steam. ≥97% steam quality at the steam delivery point

Q. Are storage tanks necessary?

A. A storage tank is necessary for the ferrous chloride. Storage tanks for the feed supply and recovered acid are optional and dependent upon the individual site conditions. Many of our customers draw the process solution directly from the tank and return the recovered acid to the same tank so they do not use intermediate storage.

Q. What does installation cost?

A. Installation costs vary from site to site. Some plants have space close to the process line; others construct a small building. When the system arrives at the plant, it takes about a week to assemble a small system. Beta supplies its equipment ready to be connected to the local plumbing and utility connections provided by the customer. The connection of the steam, compressed air, water, and cooling tower can be completed in 1 - 2 weeks (depending upon system size) by an electrician and pipe fitter.

Q: What are the on-going operational costs?

A: The main costs are steam, electricity, and filters. Beta has a simple calculator to estimate your actual costs based on local energy rates. As a quick rule of thumb, the steam and electrical cost usually run between \$10 per ton and \$15 per ton of spent acid processed.

Q. Is operation of the system difficult to learn or time consuming?

A. The system is fully automated. An operator is expected to walk by periodically to check on conditions, to respond to alarms when indicated, and to change filters when the system alerts the operator to the need.

Q. How many maintenance personnel are required to manage the system?

A. No additional people are required beyond your existing staff. Beta supplies a preventative maintenance list, the implementation of which would require two man-days per quarter to accomplish. Further, there is not much work to do when the system is running either. For example, about an hour per shift is usually sufficient.

Q: What are the operation and maintenance duties are involved?

A: The operation and maintenance items are listed below.

Daily Operation

Confirm boiler is operating and compressed air is on. Water should be available at all times.

Check liquid levels of both spent and recovered tanks. Check level of concentrate tank.

Check that all lines into and out of the system are open and ready.

Press the start button from the Initial screen. The system is now operating automatically.

An audible alarm issued by the PLC will alert the operator to any problems.

Daily Maintenance

Perform a visual check of the plant every hour.

Look for leaks in pumps, spools, tank lines, or tanks and any unusual pump motor sounds.

Inspect iron chloride storage tank and water tank.

Weekly or As Needed Maintenance

Inspect seals of pumps

Grease motor seals and bearings

Inspect exchangers

Inspect temperature probes

Inspect compressed air line

Clean flow meters and level sensors

Check liquid levels in pumps

Recalibrate probes, sensors, and flow meters

Annual Maintenance

Contact a local boiler maintenance company for the annual maintenance of the boiler.

Wash and polish the system's exterior. Paint any chips or scratches in framework.

Inspect inside of Separator and Crystal Reactor.

Tune feed valve and concentrate valve.

Clean carbon block heat exchangers

Q: What is the average maintenance cost?

A: About US\$5000 per year (max) for a Model 25KL.

Q: How often does the filter need to be changed?

A: Once per week for clean solutions, twice or more times per week for very dirty solutions.

The need for a change is indicated by a drop in pressure. It takes about 30 minutes to change a filter.

Q: Does the system need to be shut down for the filter replacement?

A: Systems equipped with a pre-filter feed station. It take about 30 minutes to change filters.

Q: What is the life span of the system?

A: 10+ years. But we have systems in operation for almost 20 years. It is more likely that components will be replaced rather than the system itself.

Q: During the first 4 years, what are the main items that need replacement or attention?

A: The pump seal will have to be replaced every year or so. Heat exchangers need to be cleaned from time to time depending on the amount of oil in the bath. A few valve actuators may need to be repaired or replaced. The major components, however, tend to last for quite a long time and require little attention. We proved a spare parts list that is more specific.



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