TECHNICAL ARTICLE SERIES

Big Scrubber, Big Pump, Big Emergency

ARTICLE # TL-128

INDUSTRY: Pollution control

ENTITY:

SOLUTION(S) PUMPED: Hydrochloric acid, Zinc ammonia, Zinc chloride solution

PUMP TYPE(S): CHEM-GARD Horizontal Centrifugal Pump

Vanton Pump & Equipment Corp.
201 Sweetland Avenue
Hillside, NJ 07205 USA
Telephone: 908-688-4216
Fax: 908-686-9314
E-Mail: mkt@vanton.com
www.vanton.com

Vanton Pumps (Europe) Ltd
Unit 4, Royle Park
Royle Street
Congleton, Cheshire, UK CW12 1JJ
Telephone: 01260 277040
Fax: 01260 280605
www.vantonpump.com

Flow diagram of heavy duty scrubbing system

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Reprinted from Pumps and Systems
By Thomas L. O'Connor

Our company has been designing, fabricating and installing air cleaning and fume scrubbing systems since 1972. Every once in a great while, we run into an emergency that demands beyond the call of duty activity from other designers, construction crews and suppliers.

In October 1991, I received a call from an engineer who was in charge of overseeing the start-up of a galvanizing process and its heavy-duty scrubbing system. About 10 months before that, an air pollution "expert" had designed and installed a ventilation system in this plant to ventilate the hydrochloric acid tank and the flux tank with its zinc ammonia/zinc chloride solution. The company had received a construction permit from the state that was effective for one year —at which time they were required to apply for an operation permit.

In evaluating the effectiveness of the ventilation system, the engineer was dismayed to find that it didn't come close to meeting the 99.5% removal efficiencies required to obtain the permit needed for the plant to continue operating. He asked me to fly down and observe the problems firsthand. Here's what I found:

• The ventilation on the tanks had been inadequately designed and was now exposing the plant workers to toxic fumes.

• Equipment near the stacks was being severely damaged by the improperly "scrubbed" airborne particles coming from the facility.

• The company had six weeks left on its temporary permit to design, fabricate and install a system that would meet state standards... failure would mean the plant would have to close down.

After a series of urgent phone calls to our component suppliers and a review by our plant personnel, we agreed to accept the challenge. Our company designed two systems —each requiring a 40,000 CFM scrubber, and fabrication was begun almost immediately. The difficulty in scrubbing hydrochloric acid in this application is that it requires chemically inert thermoplastic centrifugal pumps, each able to pump 600 gpm to provide the liquid loading of eight gallons per square foot of surface area needed for adequate entrainment of the hydrochloric chemistry.

Our check of the existing installation had revealed that the pumps selected were
recirculating only 120 gpm of the scrubbing solution. This was not enough to achieve and maintain the heavy liquid loading on the packed beds required to fully entrain the corrosive and noxious HC1 fumes. As a result, a noticeable fog of acid was polluting the atmosphere and corroding metal structures.

In addition to the systems design and installation, we had to guarantee delivery and successful operation in six weeks. Since design and

fabrication of scrubbing systems is our business, we knew we could handle that commitment. Our component manufacturers were tuned into the emergency. The one problem we faced involved the pump. When we discussed with various pump manufacturers the critical nature of pumping as related to performance, chemical inertness and unusually short delivery we got negative answers. But we persevered and came up with a thermoplastic pump manufacturer that promised to deliver the pumps we needed to withstand the chemistries, within the limited lead time and at a competitive price. These pump specifications were agreed upon:

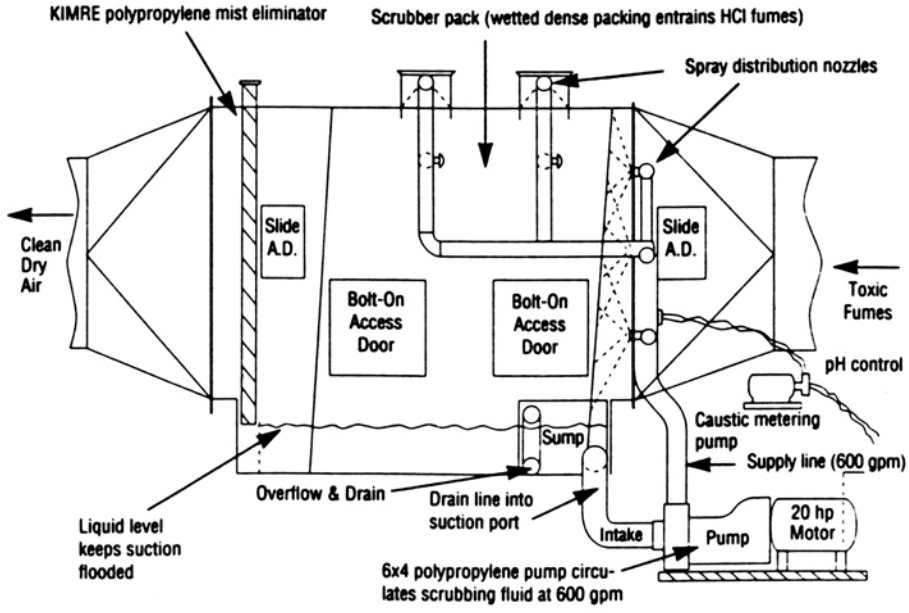
1. The pump casing, suction cover and impeller were to be molded of solid, homogeneous virgin polypropylene.
2. The wetted end of the large diameter stainless steel shafts was to be sheathed in thick-sectioned PVDF, a fluoropolymer thermoplastic.
3. The mechanical seal was to be reverse mounted to avoid metal contact with fluid.
4. The design was to incorporate a retractable front bearing on heavy sliding bars to minimize shaft overhang.
5. Back pull-out and wide open seal area was required to facilitate servicing.
6. The pumps were to have direct water flush to cool the seal and extend service life.
7. The rugged, heavy duty pumps were to be rated for flows to 1,000 gpm, discharge heads to 240 ft and temperatures to 275° F
8. Epoxy coated cast iron armor was required to protect the thermoplastic casing against accidental damage from material handling equipment.

To assure system reliability, we incorporated dependable pH monitoring instrumentation so that the recirculating scrubbing fluid would always be neutral or slightly alkaline. The pH probe was set to energize a small metering pump to deliver caustic solution automatically when the pH rating dropped to 8.

Not only did our fabricated scrubbers and the related instrumentation arrive on schedule, but the two heavy duty 6x4 polypropylene pumps arrived on location
the very day promised. It was just what we needed to appease anxious plant engineers, who had become skeptical about the American work ethic and quoted promises. Extensive pump downtime, primarily due to seal failure, coupled with inadequate capacity had left their plant manager in a "show me" mood.

Both scrubbers were turned on, and to the amazement of the customer the "fog" was gone, and the effluent was clear and neutral. The new system operated on time and within regulations so that the company received the required EPA Clean Air Act operating permits. One year later, we double checked the ventilation system and found everything, including the heavy-duty pumps, still operating perfectly.

Who says the "extra effort and quality emphasis" has gone out of America!



One of the two 6 x 4 Vanton polypropylene centrifugal pumps that recirculate the scrubbing liquid.