

## SYSTEM DEFINITION, PURPOSE & BENEFIT

Sanitaire's patented HCl Gas Cleaning System works in-situ by injecting Anhydrous Hydrogen Chloride gas into the process air stream to clean fouled ceramic air diffusion elements.

Ceramic diffusers can become fouled over time as a result of biological growth, mineral salt deposits and oxidized metal deposits. Fouled or dirty diffusers result in an increase in operating pressure and a loss in oxygen transfer efficiency.

These two changes in the system operation will result in higher blower horsepower requirements. The operating cost of the system may significantly increase. The purpose of using the HCl Gas Cleaning System is to reduce the long term operating cost of the ceramic fine bubble aeration system by maintaining clean diffusers.

The benefits of using the SANITAIRE HCl Gas Cleaning System include:

- Works in process without de-watering the aeration tank
- Keeps the diffusers in a like-new condition, minimizing the operating costs
- Eliminates expensive manual cleaning of the diffusers
- Minimizes time and personnel requirements for cleaning

## ENGINEERS DESIGN CONSIDERATION

### AERATION GRID SIZE

The aeration grid is defined as a group of diffusers mounted on air distributors that are connected to a common manifold and dropleg. Typical aeration grid sizes range from one to several thousand diffusers.

For gas cleaning purposes there is no real minimum. The absolute maximum diffuser count per grid should not exceed 2000. The preferred design maximum is 1000 to 1500 diffusers per grid.

### HCl GAS CYLINDER SIZE

Anhydrous HCl gas cylinders are available with contents of 60# (27 kg) or 600# (271 kg) of liquid HCl. The combined cylinder and content weight is 182# (82 kg) or 1900 (860 kg).

The designer needs to have knowledge of what gas cylinder size is available to the plant as some locations may not have accessibility to the large 600# cylinders. The availability can be obtained from local gas suppliers.

The designer should also check local ordinances and DOT transport restrictions prior to selecting a cylinder size.

### HCl GAS CYLINDER SIZE IN RELATION TO AERATION GRID SIZE

The HCl system is designed to use 0.10# (45 gms) of liquid HCl (exits cylinder as a gas) per diffuser. Therefore, each

60# cylinder can theoretically clean 600 diffusers and each 600# cylinder can clean 6000 diffusers.

The following are recommendations with regard to HCl cylinder size and aeration grid size:

- If the total number of diffusers in the system is less than 5500, use 60# HCl cylinders.
- If the 60# HCl cylinders are used, the aeration grids should be sized as follows:
  - One 60# HCl cylinder up to 150 diffusers per grid and a system total of 500
  - Two parallel linked 60# HCl cylinders up to 400 diffusers per grid and a system total diffuser count of 500 to 5500
  - Three parallel linked 60# HCl cylinders up to 600 diffusers per grid and a system total diffuser count of 500 to 5500
- If the total number of diffusers is greater than 5500, the use of 600# cylinders will be more cost effective and require less handling.
- If the 600# cylinders are used, the diffuser grids should be sized up to 2000 diffusers. If the grids are sized greater than 1000 diffusers (2) parallel 600# cylinders should be used to maintain proper flow and air/gas mixture.

### CYLINDER HANDLING, SPARE REQUIREMENTS AND STORAGE

The storage, use and handling of HCl gas may be governed by Federal, State, County or other local jurisdiction codes that may have reporting and permit requirements.

60# HCl cylinders are usually transported with a dolly type cylinder cart. 600# cylinders will require a fork lift truck or overhead hoist crane to transport the cylinders.

The foot print slab dimensions for a multiple (up to 3) 60# cylinder system is 12' long x 5' wide (3.65 m x 1.52 m).

The foot print slab dimensions for a dual 600# cylinder system is 20' x 20' (6.1 m x 6.1 m).

Recommended open-air storage areas include:

- Slab
- Carport type covering at least 10'-0" (3.1 m) high
- Cyclone type surrounding fence 6'-8" (1.8 m x 2.4 m) high with a large gate for entry, exit and cylinder movement.
- Shade protection in the cyclone fence on the South and West sides or as required. It is important that the cylinders be protected from the direct sunlight to prevent excessive pressure build up.

- E. If 600# cylinders are used, the structure should be designed for and include an overhead hoisting device to move the cylinders into the set-up area from the unloading area.

### ELECTRICAL & POWER REQUIREMENTS

The automatic shut off feature requires a 115v, 15amp, 60Hz dedicated circuit to the HCl control panel. In addition, a 4 wire, 14-gauge control circuit will have to be provided from the HCl control panel to an air main mounted pressure switch.

### COMPONENT ITEMS REQUIRED WITH HCl GAS FEED SYSTEMS

- A. A pressure monitoring system should be provided for each grid. The monitoring system should be capable of measuring the headloss across the diffusers and estimating the airflow rate per diffusers.
- B. A nitrogen purge system should be located upstream of the HCl gas feed panel. The nitrogen purge system is used to pressure test the system prior to use and to evacuate the HCl from the transmission lines after use.
- C. A NEMA 4X enclosed HCl control panel should be provided to house a HCl regulator, solenoid valve, HCl flowmeter and isolation valves.

All components should be made from corrosion resistant materials such as 316L stainless steel and Monel.

All components should be rated at a minimum of 1500 psig.

All components should be interconnected with Monel tube and Monel fittings with a minimum pressure rating of 2000 psig.

The HCl control panel should also house a separate NEMA 4X electrical control panel with a clearly labeled terminal strip connection corresponding to the system electrical schematic.

- D. The HCl control panel should be connected to the HCl cylinders and nitrogen purge system with Monel tube and Monel tube fittings with a minimum pressure rating of 2000 psig  
  
Dual Monel check valves should be supplied at the HCl cylinder connection to allow the free flow of HCl or nitrogen to the HCl gas feed panel but prevent the backflow of HCl gas to the nitrogen regulator.
- E. The HCl control panel should be connected to the individual aeration grids using Monel tube, 316 stainless steel compression fittings and 316 stainless steel full ported, quick turn, removable ball valves.

Each grid should be isolated by a ball valve.

Other valves should be strategically placed to isolate and feed gas down multiple walkways.

All valves and tube fittings should be pressure rated at 2000 psig minimum.

- F. A fail-safe system should be included to electrically close the solenoid valve in the event of a power failure or blower shutdown.

Should the air pressure drop in the air main, a pressure switch should close the solenoid valve and stop the flow of HCl gas.

- G. Optional components may include:
  1. Cylinder scales
  2. Breathing apparatus
  3. Emergency shower and eye flush