

## Powell Scrubber System



# Room Scrubbers

## Sentry 2000 Chlorine/Sulfur Dioxide Scrubber System

The Powell Sentry 2000 Chlorine/Sulfur Dioxide Scrubber System is one of the most advanced emergency scrubber systems available today. The horizontal packed bed scrubber was designed by the world's foremost expert on gas scrubbing technology, Ralph Strigle, Jr.

The Powell Sentry 2000 incorporates today's most advanced design and performance features. A patented 4-stage, single-pass scrubber system with a horizontal packed bed of high efficiency packing material. Predictable, scalable technology, based on extensive tests with full scale 3000 ACFM testing and large release rates, the Powell Sentry 2000 Scrubber can achieve virtually any stack emission performance desired. Thus, it is possible to control performance of the Sentry 2000 based on any inlet and outlet concentrations and flow rates.

## Performance Proven in Rigorous Testing

The Powell Sentry 2000 has been subjected to the most demanding testing of any scrubber on the market. In rigorous testing, the Powell Sentry 2000 surpassed the requirements of Uniform Fire Code Section 80. The Powell Sentry 2000 is the only scrubber tested in accordance with US EPA Reference Test Methods, which are more accurate than continuous chlorine detector tests.

- Performance tested by the nation's leading air emissions testing organization at full scale 3,000 ACFM air flow rate with 2,000 lb. releases of both chlorine and sulfur dioxide.
- Performance tests witnessed by an independent firm specializing in the application of fluid dynamics to industrial flow problems.
- The Powell Sentry 2000 demonstrated better performance than the 5 ppm stack discharge limit set by UFC specifications.
- Complete test data and informative videotape showing actual test available upon request.
- The only chlorine scrubber also subjected to sulfur dioxide testing.



## Sentry 150 Chlorine/Sulfur Dioxide Room Scrubber

The Powell Sentry 150 Chlorine/Sulfur Dioxide Room Scrubber is a scaled down version of the advanced Powell Sentry 2000 Chlorine/Sulfur Dioxide Room Scrubber. The Powell Sentry 150 uses the innovative packed bed scrubber design Ralph Strigle, Jr. developed for the Powell Sentry 2000 Scrubber, the only room scrubber tested with EPA Reference Methods. The Powell Sentry 150 is capable of 500 ACFM. Features include:



- Unique 4-stage, single-pass scrubber with horizontal packed bed
- High efficiency packing material
- Technology tested and certified by the nation's leading air emissions testing organization
- Lowest caustic pressure of any scrubber, providing greater safety of operation
- Low profile especially suitable for low ceilings
- Engineering specifications and drawings produced using ACAD are available

## Guardian 150 Venturi Chlorine/Sulfur Dioxide Room Scrubber

The Powell Guardian 150 Single Pass Venturi Chlorine/Sulfur Dioxide Room Scrubber is designed for emergency scrubbing of accidental chlorine releases from cylinders stored in containment rooms. The single pass Venturi design safely and effectively neutralizes chlorine releases using a caustic soda solution. The Powell Guardian 150 can be custom designed and built for your specific needs.

The Powell Guardian 150 Single Pass Venturi Chlorine/Sulfur Dioxide Room Scrubber safely and effectively neutralizes chlorine releases from cylinders stored in containment rooms. The unit is field tested and proven to meet all Uniform Fire Code Section 80 Guidelines. The Powell Guardian 150 can be sized to accommodate various flow rates and quantities of chlorine. The Powell Guardian 150 provides reliable performance and added safety. Features include the following:

- Configured for 150-lb cylinder capacity
- Field tested and proven to meet all Uniform Fire Code Section 80 Guidelines
- Maintains negative pressure in the containment room during accidental release and scrubbing period, providing added safety
- Can be sized to accommodate various flow rates and chlorine quantities. Standard configuration achieves a 150-CFM flow rate.
- Compact design permits passage through standard size door.
- Fully compatible with sulfur dioxide
- Complete test data and informative free videotape, showing actual test, are available upon request.

# Equipment Scrubbers for Chlorine/Sulfur Dioxide

## ProVent Chlorine/Sulfur Dioxide Equipment Scrubber



The Powell ProVent Chlorine/Sulfur Dioxide Equipment Scrubber is designed to evacuate transfer hoses, piping, and vaporizers used for chlorine process systems. The Powell ProVent, which can be sized for your specific needs, recirculates a caustic soda solution through an eductor to safely neutralize any chlorine remaining in the hoses or piping. In case of power failure, the scrubber can still neutralize chlorine sulfur dioxide under pressure. Other features of the Powell ProVent include:

- PFA lined magnetic drive pump or optional titanium pump
- Fiberglass or chlorobutyl rubber-lined tank
- Tefzel®-lined steel eductor and Tefzel®-lined steel pipe and fittings
- Optional oxidation-reduction potential (ORP) or pH alarm system

## Portable Chlorine/Sulfur Dioxide Equipment Scrubber



The Powell Portable Chlorine/Sulfur Dioxide Scrubber is designed for evacuation of components such as transfer hoses, piping, and vaporizers in the event of leaks or during servicing of equipment. The unit is completely self-contained and can be safely carried by fork truck. The standard design is able to neutralize 400 pounds of chlorine or sulfur dioxide. The compact Powell Portable Scrubber is able to obtain 25" of mercury vacuum at shutoff and 2 SCFM flow at 5" of mercury vacuum. The unit typically uses 20% weight sodium hydroxide. Standard materials of construction include:

- 2-hp Tefzel® magnetic drive pump
- 1/2" by 25' hose for chlorine connection and CPVC Schedule 80 pipe fittings
- Motor starter/disconnect and 50' extension cord for power welding outlet
- Optional ORP monitoring system

## Chlorine/Sulfur Dioxide Eductor



The Powell Chlorine/Sulfur Dioxide Eductor is suitable for use in liquid and gas applications and was developed to safely evacuate chlorine or sulfur dioxide cylinders, tankers, railcars, and piping systems. The unit is based on a unique manufacturing concept, and is custom sized for each application. Sodium hydroxide is typically used for the motive liquid. An optional cross design with gauge is also available. The Powell Chlorine/Sulfur Dioxide Eductor features include:

- Kynar® eductors encased in Tefzel®-lined steel tees
- Structural integrity to prevent failure during turbulent gas/liquid chlorine interface
- 20" or more of mercury vacuum

# Equipment Scrubbers for Chlorine/Sulfur Dioxide

## Titan 90-ton Chlorine/Sulfur Dioxide Tank Car Scrubber



The Powell Titan 90-ton Chlorine/Sulfur Dioxide Tank Car Scrubber is designed to safely and efficiently evacuate chlorine or sulfur dioxide residue from 90-ton rail tank cars or 18-ton tank trucks. Using a continuous scrubbing process that combines both caustic dilution and chlorine or sulfur dioxide scrubbing systems, the Powell Titan produces commercial quality bleach or sodium bisulfite and inert gases that can be harmlessly vented to the atmosphere. Features include:

- A typical flow rate of 1,500 lb. per hour for injection of vapor or liquid chlorine into the eductor unit. Larger flow rates are available.
- The system uses a continuous scrubbing process that combines both caustic dilution and chlorine or sulfur dioxide scrubbing systems.
- The evacuation system converts a gas residue into bleach or sodium bisulfite gases.

The Powell Titan is manufactured to withstand the most demanding conditions and provides such value-added features as:

- Vacuum scrubbing by a large capacity eductor system
- PTFE-lined steel pipe and fittings
- Titanium pump with mill and chemical duty motor
- ORP or pH control systems

## Air Padding System



When chlorine tank cars are unloaded at production facilities, frequently additional pressure is required. Clean, oil free air, dried to an atmospheric dew point of -40°F or below is the preferred way to achieve pressurization of tank cars. The use of high quality air results in decreased tank car corrosion and decreased maintenance of the pipeline, chlorine vaporizers, and control valves for the chemical producer.

The Powell's Air Padding System for air or nitrogen is designed to eliminate field fabrication and high maintenance, reduce corrosion, and prevent chlorine back flow. The system is available as a complete packaged drying system and offers numerous advantages:

- Decreased potential for corrosion of tank cars, piping, vaporizers, and control valves
- Decreased maintenance costs
- No vapor backflow to damage drying equipment
- Reduced personnel hazards and increased safety
- Industrial quality components for long service life

The standard unit is designed to provide 14 SCFM of clean, dry, oil free air with a dew point of -40°F or below at line pressure with a maximum outlet pressure of 130 psi. The unit automatically fills tank cars in an on-off mode with a minimum of 5 psi differential (i.e. 115 - 120 pounds). The typical 10-hp system is skid mounted and has approximate dimensions of 5 feet long by 6 feet wide by 6 feet high. The unit includes 3 subassemblies — the air equipment, the dryer equipment, and the safety section. The Tank Car Padding System can be customized to your operation with any of the several options available. These include custom designs, higher or lower flow rates, higher output pressures, and individual components. Oil free compressors can also be provided.

# Chlorine Process Scrubbers

## Multi-Feature Chlorine Process Scrubber

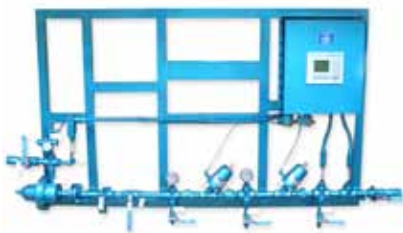


The Powell Multi-Feature Chlorine Process Scrubber is a single pass Venturi scrubber designed for emergency scrubbing of major chlorine releases in containment rooms.

Flow rates for the Powell Multi-Feature Chlorine Process Scrubber are determined by computerized numerical modeling. The unit features lined steel pipe and fittings, titanium pump with mill and chemical duty motor, custom scrubber tanks, optional chlorine eductor systems for liquid chlorine, and optional chlorine sparger for evaporator safeties. Other features include:

- No recycle of vent gas containing sodium hydroxide and sodium hypochlorite, eliminating equipment damage during testing and actual releases.
- No fans or blowers to maintain
- No build up of chlorine pressure in containment room

## Safety Section



The Powell Safety Section — a subassembly in the Powell Air Padding System — is designed to prevent the back flow of chlorine from the tank car to the air drying system and to automatically fill the tank car. Redundant features are built in to maintain equipment protection in the event of power loss, compressor failure, or failure of individual components.

Two differential pressure transmitters are located across the inlet and outlet of the safety section. If the upstream pressure is greater than the downstream pressure, the transmitter sends a signal to the PLC, allowing the first air driven automatic ball valve to open. These transmitters provide the necessary redundancy to make the system reliable. An on/off pressure transmitter is installed on the outlet of the safety section. The pressure transmitter opens and closes as required to pressurize the car when both differential pressure set points are satisfied. The on/off transmitter can be adjusted for 5 psig differential and may be set within approximately 15 psig of the dryer operating pressure. Ball valves and gauges are located at various locations on the safety section to enable each component to be individually tested and calibrated for the desired ranges. Panel View screen display will provide display of inlet and outlet pressure, display alarm banner, and allow set up for pressure set points.

## Chlorine Unloading System



Powell can supply the required components for a complete chlorine unloading system designed in accordance with The Chlorine Institute, Inc. Pamphlet 57 guidelines. The system could include chlorine transfer hoses, chlorine pressure gauges, automatic and manual ball or plug valves of Monel® or Hastelloy®, expansion tanks, and required accessories.

# Instrumentation and Controls for Chlorine

## Gas Detection Equipment



Controller: The gas detection system listed below consists of an 8 to 16-channel controller, universal transmitters, individual gas sensors and the equipment required to calibrate the system. The controller is wall-mounted in a NEMA 4X enclosure, which can be centrally located. The controller features include:

- 3 independent alarm levels per channel
- Graphic LCD readout displays monitored data as trends, bar graphs and engineering units
- Common SPST relays for horn, high alarm level, warning alarm level, and system fault alarm
- Dual Modbus RS-485 serial ports
- Expandable architecture allows for monitoring up to 16 channels



Universal Transmitter: The universal transmitter is mounted in the area to be monitored. It is connected to and powered by the controller. Features include the following:

- Capable of monitoring over 200 different gases, as well as oxygen
- Self-diagnostic transmitter
- 4-20mA outputs and digital HART communication
- LCD display
- Order one sensor for each transmitter in service



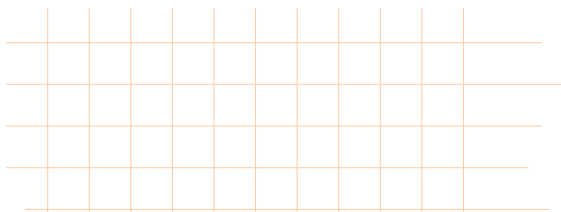
Gas Sensors: The gas sensors for the system are installed in the universal transmitters and include the following features:

- High sensitivity
- Longer sensor life (up to five years)
- 2 year sensor warranty
- Wide temperature range -40°F to +150°F



Electrochemical Gas Generator: The Cal 2000 provides unmatched versatility and accuracy in corrosive calibration gases. Field replaceable electro-chemical generating cells provide a calibration standard for accurately testing chlorine, chlorine dioxide, hydrogen, hydrogen cyanide and hydrogen sulfide gas sensors.

- Microprocessor controlled
- LCD display
- Field adjustable ppm and flow rate
- Interchangeable generating cells



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