

- Self supporting ductwork, mild steel construction, on the suction side of the hot air supply fan. Includes (1) 90 degree elbow and up to 25 linear feet of duct. Transition piece to fan inlet included.

MONROE WET SCRUBBER SYSTEM

Benefits of Utilizing "The Monroe Method"

- In-House Engineering & Fabrication Capabilities
- Shop Assembly Capabilities & Fit-Up as Required
- Dedicated Parts & Service Departments for Ongoing Support
- Experienced & Responsive Project Management Team
- Registered ISO 9001 & ISO 14001 Quality Systems
- 40+ Years of Experience Manufacturing Pollution Control Systems

I. Design Criteria

Monroe Dual Throat Venturi Scrubber	
Capacity	23,000 ACFM @ 150°F
Efficiency	95%+ Removal of Particulate >2.5µm
Required Static Pressure	18" W.C.
Approx. Dimensions	6'-6" W x 16'-0" H x 20'-0" L
Pump & Motor Assembly	Up to 15 HP, 1800 RPM, TEFC, 3/60/230-460
Conveyor Motor Assembly	Up to 1 HP, 1800 RPM, 143 TC-Frame, TEFC, 3/60/230-460
Shell Construction	316 Stainless Steel
Internal Construction	316 Stainless Steel, HD Polyethylene
Mist Eliminator Material	High Density Polyethylene

Monroe Packed Tower Scrubbing System	
Design Capacity	Up to 22,800 ACFM @ 142°F @ 100% RH
Efficiency	95%+ of HCl at 36.6 lb/hr maximum inlet loading (chemical use required) 95%+ of SO ₂ at 17.1 lb/hr maximum inlet loading (chemical use required) 95%+ of H ₂ SO ₄ at 2.24 lb/hr maximum inlet loading (chemical use required)
Required Static Pressure	Up to 5" W.C. Total Static Pressure
Approx. Height	Up to 20'-0"
Tower Diameter	Up to 8'-0"
Packing	6' of Loose Fill Polypropylene Media
Shell Construction	FRP
Internal Construction	FRP, PVC, Polypropylene
Piping Material	PVC
Mist Eliminator Material	Polypropylene Mesh
Pump Motor	Up to 15 HP, 1800 RPM, T-Frame, TEFC, 3/60/460V

II. System Description

The Monroe Environmental Dual Throat Venturi Scrubber is designed to efficiently remove airborne particulate and uses a unique non-plugging, manually adjustable scrubbing throat in which high velocity water droplet atomization takes place. The small water droplets created by the venturi contact the airborne particulate creating a heavier mass to be centrifugally removed by the dropout and mist eliminator section. The system must be shut down for throat adjustment. Solids that readily settle during operation will be continuously removed by the integral drag conveyor. Shut down may be required to allow all settle-able solids to be removed. Floating and suspended solids will be removed via blowdown from the recirculation pump/piping at an estimated rate of 3 GPM based on 35.2 lb/hr PM loading to the system. Theoretically, this will achieve approx. 3% solids in the blowdown stream.

The Vertical Packed Tower Unit is designed to efficiently remove airborne fumes and odor from an airstream. The vertical assembly is a counter-flow design with contaminated gas flowing upwards and recirculated liquid flowing downward onto the packing media. The contaminant is absorbed in the recirculating liquid and periodically bled from the system reservoir at an estimated rate of 2 gpm, bringing the total system blowdown to 5 gpm. 5 gpm of make-up water will therefore be required.

Operating values are subject to change upon actual conditions. The pH controls monitor and adjust the pH as necessary to achieve constant high removal efficiency by neutralizing the incoming contaminant. pH and liquid level instrumentation provide signals to solenoid valves to remove and replace liquid in the system reservoir. Chemicals are not included in our scope of supply. All chemicals used in the system must be aqueous with any solids completely dissolved. A 3,000 gallon chemical storage tank is optioned below. We have also included optional heating cable and insulation to keep a 50% sodium hydroxide solution above its freezing point of 60°F. The heat cable is sized for a maximum temperature differential of 40°F. The scrubbing system will include a control panel.

The proposed system will include access doors and fill/drain connections. The equipment will be assembled at our facility prior to shipment. Breakdown will be only as necessary for shipment. Scrubber to include necessary internal piping, fasteners and other internal appurtenances required for correct operation.

III. Components and Features

Monroe Dual Throat Venturi Scrubber		
Dual Throat Vessel	- Spray Headers	- Access doors
	- Piping from pump to spray headers	- Differential pressure gauge
	- Flanged inlet/outlet connections	
Scrubber Reservoir	- Drain/fill connections	- Float Valve
Mist Eliminator	- Two Stage Chevron type	
Recirculation Pump Assembly	- Stainless steel construction	- Centrifugal, vertical type
	- Mounted on scrubber reservoir	
pH Control System	- pH probe	- pH analyzer/ controller
	- Chemical feed pump	
Bottom Drag Flight Conveyor	- Mild steel construction	- Shear pin sprocket
	- Gear reducer with C-Face motor and OSHA guard	
System Control Panel (For Dual Throat and Packed Tower Scrubbers)	- NEMA 4 enclosure	- Drag conveyer motor starter
	- pH controls mounted in panel	- Pump motor starters
	- Disconnects, fuses, start/stop pushbuttons, push-test pilot lights	

Monroe Packed Tower Scrubbing System	
Scrubbing Tower	<ul style="list-style-type: none"> - High Efficiency Packing Media - Spray Headers - Piping from pump to spray headers - Flanged inlet/outlet connections - Packing, mist pad, and spray header access flanges - Nozzles - Access doors - FRP Packing Supports
Piping	<ul style="list-style-type: none"> - Sch. 80 PVC and associated fittings - Check & Ball Valves - Liquid Pressure Gauge - Static Mixer
Scrubber Reservoir	<ul style="list-style-type: none"> - Level switches for liquid level monitoring - Valves for liquid blowdown and freshwater makeup - Drain/fill connections - Overflow Connection
Mist Eliminator	<ul style="list-style-type: none"> - Single stage polypropylene mesh
Recirculation Pump Assembly	<ul style="list-style-type: none"> - Polypropylene construction - Mounted next to scrubber reservoir - Up to 400 GPM - Centrifugal, horizontal type
pH Control System	<ul style="list-style-type: none"> - pH probe - Chemical feed pump - (1) pH analyzer/controller
Optional On-Site Assistance (both units)	<ul style="list-style-type: none"> - On-site assistance and/or training by a Monroe factory trained technician - Excludes all mechanical labor, tools, parts, and equipment

- **OPTIONAL**

Packed Tower Scrubber vessel upgrade to be suitable in operation at pressures up to 42" W.C.

Dual Throat Scrubber height increase including additional 304 stainless steel plate and structural steel to accommodate the new liquid levels in the tank caused by the fan suction.

- **OPTIONAL**

FRP stack up to 65 ft. tall with 45 degree inlet and top velocity cone. The stack will be supported inside the building and free standing up to 13 ft. above the roof line. Foundation and mounting hardware by others.

FRP duct to connect packed tower #1 outlet to packed tower #2 inlet and from packed tower #2 outlet to fan inlet. Includes (6) 90 degree elbows and up to 30 lineal feet of duct. Suitable for pressures up to 42" W.C. Transition piece to fan inlet included.

IV. Exclusions

Chemicals are not included in our scope of supply. Chemical usage is estimated to be approximately 10 GPH of 50% NaOH solution, but is subject to change upon actual operating conditions. A collection bin to receive solids removed by the drag conveyor is not included. Due to uncertainties in the particle size distribution, Monroe can only guarantee removal of particulate greater than 2.5 micron. Once data on the PM2.5 is acquired, total removal efficiency can be approximated.

All equipment, components, services, testing, certifications, guarantees, and inspections not specifically called out or identified in this proposal are not included in Monroe Environmental's scope of supply. Storage of completed equipment is excluded. You will be contacted when your equipment is complete and ready for shipment. If your equipment has not shipped within two weeks of completion, it will be moved to storage and a monthly storage fee will be applied after notification to the purchaser. Please refer to the Terms & Conditions for a complete list of exclusions.

Optional Chemical Storage Tank	
Chemical Storage Tank	<ul style="list-style-type: none">- 3,000 gallon capacity- HDPE construction- Primary and secondary containment- Top mounted tank vent- Piping from tank to chemical metering pump- Optional heat trace cable and 2" polyurethane foam insulation on tank sides- Up to 100 gpm inlet feed pump- Rated for 50% NaOH- Level monitor and audible alarm- Drain connection

OPTIONAL SECOND SCRUBBER PACKAGE FOR AMMONIA MITIGATION

I. Design Criteria

Monroe Packed Tower Scrubbing System	
Design Capacity	Up to 22,800 ACFM @ 142°F @ 100% RH
Efficiency	98.6%+ of NH ₃ at 200 lb/hr maximum inlet loading (chemical use required)
Required Static Pressure	Up to 5" W.C. Total Static Pressure
Approx. Height	Up to 21'-6"
Tower Diameter	Up to 7'-6"
Packing	6' of Loose Fill Polypropylene Media
Shell Construction	FRP
Internal Construction	FRP, PVC, Polypropylene
Piping Material	PVC
Mist Eliminator Material	Polypropylene Mesh
Pump Motor	Up to 15 HP, 1800 RPM, T-Frame, TEFC, 3/60/460V

II. System Description

The Vertical Packed Tower is designed to efficiently remove airborne fumes and odor from an airstream. The vertical assembly is a counter-flow design with contaminated gas flowing upwards and

recirculated liquid flowing downward onto the packing media. The contaminant is absorbed in the recirculating liquid and periodically bled from the system reservoir.

The pH controls monitor and adjust the pH as necessary to achieve constant high removal efficiency by neutralizing the incoming contaminant. pH, conductivity, and liquid level instrumentation provide signals to solenoid valves to remove and replace liquid in the system reservoir. Efficient removal of ammonia requires the addition of 96% H₂SO₄ for neutralization. Chemicals are not included in our scope of supply. The ammonia scrubber controls will be included in the existing system enclosure (QN10255R3) or as a standalone panel.

The proposed system will include access doors, fill/drain connections, internal piping, fasteners and other internal appurtenances required for correct operation.

III. Components and Features

Monroe Packed Tower Scrubbing System	
Scrubbing Tower	<ul style="list-style-type: none"> - High Efficiency Packing Media - Rated up to 42" W.C. - Spray Headers - Nozzles - Piping from pump to spray headers - Access doors - Flanged inlet/outlet connections - FRP packing supports - Packing, mist pad, and spray header access flanges - Includes duct from scrubber outlet to ground level
Piping	<ul style="list-style-type: none"> - Sch. 80 PVC and associated fittings - Liquid pressure gauge - Check & ball valves - Static mixer
Scrubber Reservoir	<ul style="list-style-type: none"> - Level switches for liquid level monitoring - Valves for liquid blowdown and freshwater makeup - Drain/fill connections - Overflow Connection
Mist Eliminator	<ul style="list-style-type: none"> - Single stage polypropylene mesh
Recirculation Pump Assembly	<ul style="list-style-type: none"> - Thermoplastic construction - Up to 350 GPM - Mounted next to scrubber reservoir - Centrifugal, horizontal type
pH Control System	<ul style="list-style-type: none"> - NEMA 4 enclosure (existing or standalone) - Pump motor starter - pH/Conductivity controls - Liquid level and automated valve control
Optional On-Site Assistance (both units)	<ul style="list-style-type: none"> - On-site assistance and/or training by a Monroe factory trained technician - Excludes all mechanical labor, tools, parts, and equipment

- Chemical storage tank design still being determined. We will provide pricing for this at a later date.