

# ...Providing State-of-the-Art Fine Particulate Control Through Advanced High Energy Ionization

## Advanced Operating Features That Deliver Performance Benefits You Can Count On

- **Proprietary HEI™ (High Energy Ionizer) WESP Technology**—Greatly reduces Precipitator Size as much as 200% and Increases Collection Efficiency
- **Modular Design and Fabrication**—Facilitates Quicker On-Site Installation and Startup
- **Flexible Discharge Electrode/Collection Tube Design**—Allows Size and Configuration Changes to Meet Application-Specific Requirements
- **Durable Rigid Mast Discharge Electrodes**—Replace Flimsy Electrode Wires or Rods that can Warp or Break
- **Robust Discharge Electrode Mast Supports**—Reduce Misalignment due to Mechanical Stress or Heat Distortion and Prevent Waste of Energy and Low Collection Efficiency due to Corona Discharge Arcing
- **High Voltage Insulators Located Out of Gas Stream**—Eliminate a Common Source of Premature and Costly Insulator Failure
- **Large Open Area Gas Inlet Distribution Devices**—Eliminate Packing or Marble Bed Components that can Plug or Foul
- **Unique Top-Mounted EZ Align™ Electrode System**—Reduces Setup Time and Eliminates Need for Bottom Alignment Devices
- **Simple and Effective Irrigation and Particulate Collection System**—Uses no Weirs or Piping Networks and Promotes Low Water Consumption
- **Choice of Upflow or Downflow Configurations**—Permits More Economic use of the HEI WESP to Accommodate a Wide Range of Applications and System Layouts
- **PLC-Based Voltage and Spark Controls**—Provide Maximum Control to Maintain Electric Field Stability



Hardware Improvements for Enhanced Reliability

HEI™ DISCHARGE  
ELECTRODE  
HIGH ENERGY  
IONIZATION

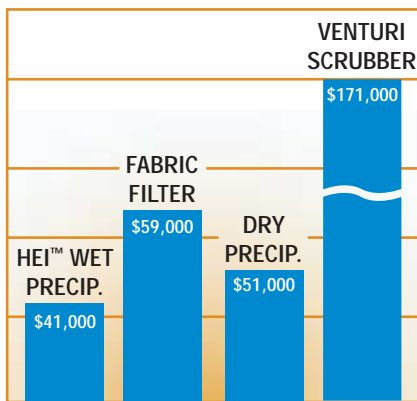
# Bionomic HEI™ (High Energy Ionizer) Wet Electrostatic Precipitator Technology at a Glance

## HEI WESP vs. Traditional Gas Cleaning Devices

	Scrubber	Fabric Filter	Dry ESP	HEI WESP
Extremely fine solid particle removal		X	X	X
Aerosols and acid mists				X
Low gas temp/high dew point	X			X
Sticky particulate	X			X
Gas absorption required	X			X
High resistivity particles	X	X		X

## Energy Consumption of HEI WESP vs. Other APC Devices

The Bionomic HEI WESP System operates at lower pressure drops than scrubbers or fabric filters and provides the lowest energy consumption costs compared to other air pollution control devices.



### ANNUAL ENERGY COSTS

The Annual Estimated Costs were based on the following:

1. Gas volume treated: 40,000 to 45,000 SCFM
2. Pressure drop: HEI™ WESP–2"WG; Baghouse–8"-12"WG; Dry ESP–1"WG; and, Wet Scrubber–35"-45"WG
3. Electricity cost: \$0.06 per KWH
4. Daily operation: 24 hours/day
5. Operating hours/days per year: 350 days or 8,400 hours per year
6. Items considered for each device as it may apply: H.V. power supplies, utility/power, pressure drop/loss, pumps, purge air blowers, insulator compartment heaters, controls, cleaning, pulsing, valves, etc.



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RotaBed™ is a trademark of Bionomic Industries, Inc. Patent No. 6,007,005



# HEI™ (High Energy Ionizer) Wet Electrostatic Precipitator System

For Low-Energy Collection of Fine or Submicron Particles in Gas Streams



# Bionomic HEI™ Wet Electrostatic Precipitator System

Superior  
Technology  
Made Even  
Better  
Through  
Design

The Bionomic HEI Wet Electrostatic Precipitator System represents a major breakthrough in the advancement of state-of-the-art fine particulate control. Centered around precipitator hardware improvements that deliver high reliability and outstanding collection performance, the HEI WESP System incorporates a unique discharge electrode technology that can be sized to specific applications. The system's electrode geometry concentrates a high intensity ionizing corona in strategic areas within the collecting tubes instead of distributing it along the entire length of the tube's treatment area. This high intensity corona provides particle charging fields that are two to three times stronger than those of conventional precipitators—resulting in higher particulate charges, higher migration velocities, and smaller precipitator size.

The Bionomic HEI WESP System also offers the user maximum flexibility through a choice of two innovative, adaptable designs that can meet any application or system layout requirement. Depending upon the particular contaminant properties and gas stream contents, the HEI WESP System can be configured in either a gas upflow or downflow configuration.

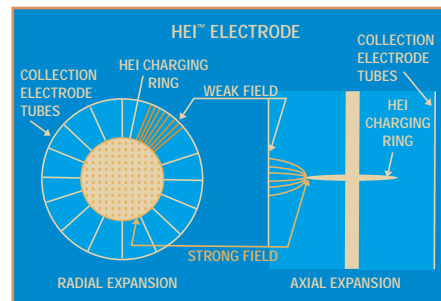
Rigid, large diameter mast-supported EZ Align<sup>SM</sup> Charging Electrodes add to the simple yet robust construction, and low maintenance of the HEI WESP System. Available Unagon<sup>SM</sup> Extended Area Collecting Electrode Tubes extend system capabilities with increased efficiency and elimination of tube sheets that need to be cleaned due to sticky or scale forming particulates.

Other key features of the HEI WESP System are the available methods for collection tube cleaning, gas precleaning, and conditioning. Unlike other precipitator designs that utilize sprays, overflow weirs or packed marble beds, the HEI WESP System is the only design that can incorporate the Ultimix<sup>TM</sup> Conditioning System for gas saturation and collection tube cleaning, and the patented, nonfouling RotaBed<sup>TM</sup> Pre-Scrubber for acid gas removal and particulate loading reduction.

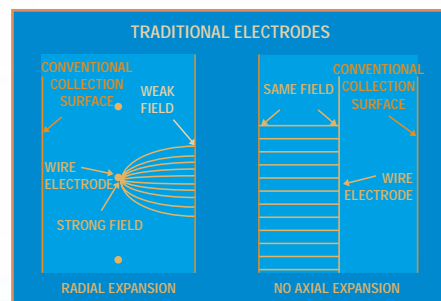
PLC-based voltage and spark controls to maintain maximum electric field stability, nonfouling insulator locations, and new, improved materials of construction that provide longer life and more resistance to corrosive gases complete the advanced yet economical HEI WESP System.

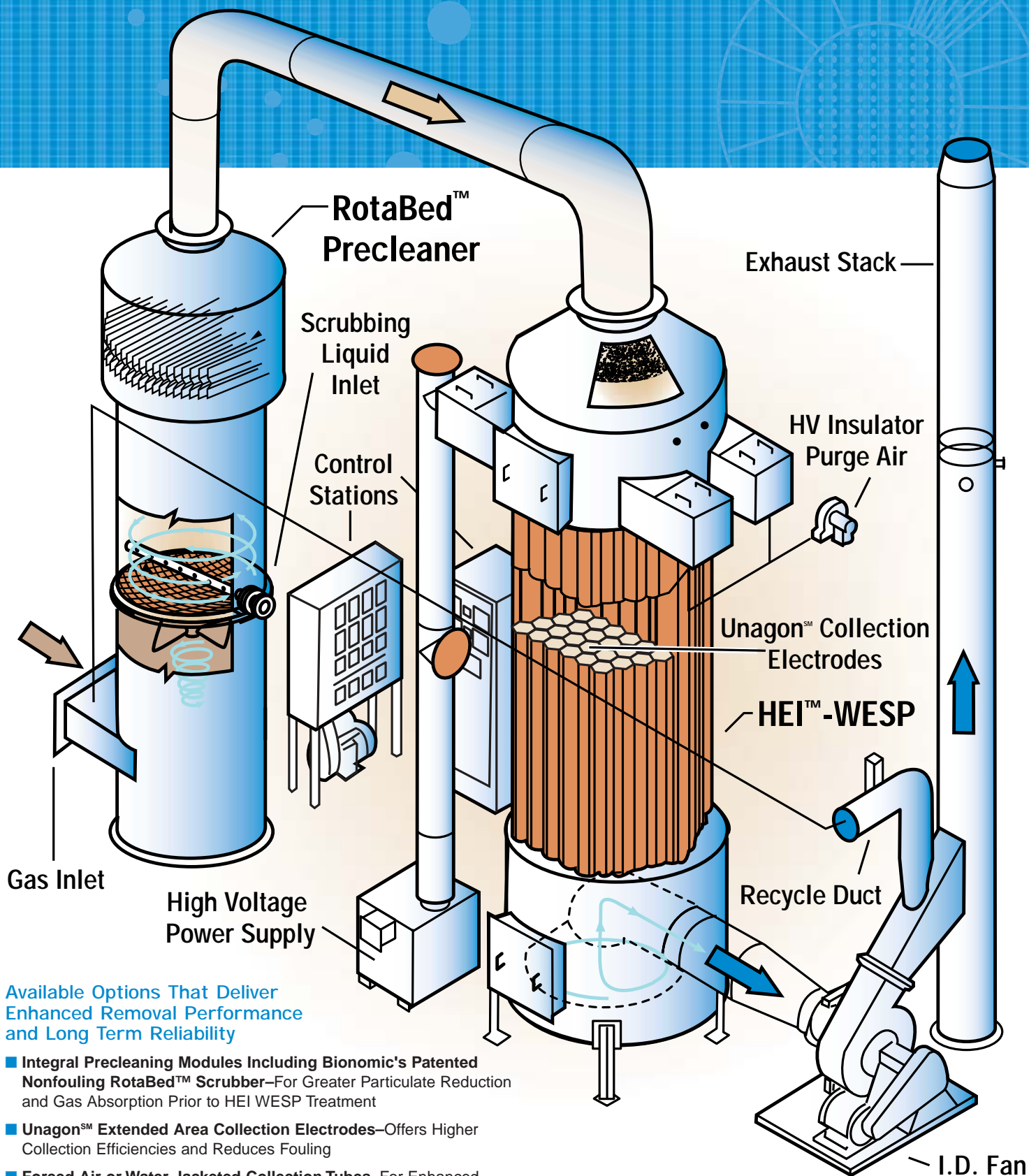


Improved Configurations and Geometry of HEI™ Fields



Improved HEI™ Electrode vs. Traditional Electrodes





**Available Options That Deliver Enhanced Removal Performance and Long Term Reliability**

- **Integral Precleaning Modules Including Bionomic's Patented Nonfouling RotaBed™ Scrubber**—For Greater Particulate Reduction and Gas Absorption Prior to HEI WESP Treatment
- **Unagon™ Extended Area Collection Electrodes**—Offers Higher Collection Efficiencies and Reduces Fouling
- **Forced Air or Water Jacketed Collection Tubes**—For Enhanced Condensation-Forced Washing and Particle Collection
- **Improved Corrosion-Resistant Materials of Construction**—Including FRP (Fiberglass Reinforced Polyester) Collection Electrodes and Upper and Lower Housing Compartments
- **Complete Air Pollution Control System Components**—Ductwork, Stack, Fan, Chemical Feed Systems, Water and Effluent Treatment Systems, Instrumentation and Controls, and Other Required Options
- **Complete HEI WESP System Engineering Support Services**—Erection Supervision, Startup Assistance, and Operator Training



Better voltage and spark controls for maximum electrical field stability

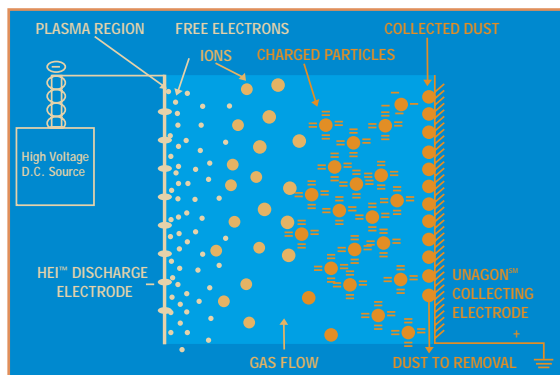


Rigid EZ Align™ discharge electrodes with tube type collecting electrodes

## A Simple Yet Highly Effective Operating Principle

The Bionomic HEI Wet Electrostatic Precipitator offers one of the most effective techniques available for low-energy collection of fine or submicron particles in gas streams.

During operation, acid and/or particulate laden gas enters the patented RotaBed Pre-Scrubber for pretreatment to remove acid gas and/or reduce heavy particulate loading. Further gas saturation and pretreatment takes place in the Ultimix Conditioning System prior to remaining particulate laden gas flow into the region between HEI WESP's discharge electrodes and collecting tubes. Particles are continuously charged by the system's high intensity ionizing corona and, as gas flows through the collection area, the highly charged particles are electrostatically driven to the grounded collecting tube electrodes. The highly conductive fog or water droplets that result from Ultimix pretreatment or conditioning process also become charged and migrate onto the collecting tubes. Entrained pollutant particles are then removed by a continuous, stable, irrigating film of water or conductive flushing liquid and drained from the unit.



In the WESP Avalanche Process, the Corona Discharge Generates Ions that Electrically Charge and Collect Suspended Particles.

## Adaptability to a Wide Variety of Gas Cleaning Applications and Conditions

Bionomic HEI WESP Systems can be applied to virtually any emission source and provide far superior gas stream cleaning over other methods such as dry precipitation, bag houses or wet scrubbing. They are particularly effective when the gas stream profile or operational requirements meet one or more of the following criteria:

- High Moisture Content Gas Stream
- High Concentration of Submicron Particulate and/or High Opacity
- Aerosol Removal
- Sticky or Tenacious Particulate in Gas Stream
- Gas Stream is Already Condensed to, or Below, Adiabatic Saturation Temperature in a Wet Quench/Scrubber System
- Gas Absorption Plus Particulate Collection is Required

The Bionomic HEI WESP System offers the best possible solution for applications involving "Blue Haze" emissions—a condition caused by a large percentage of submicron dust or liquid particles that are not easily collected by any other air pollution control device. Typical examples include condensed organic vapors, salt fume, metal oxides, fine ash and other emissions found in chemical, plastics, fertilizer, mining, ferrous and nonferrous metal, hazardous and municipal waste treatment, pulp & paper, wood products, textile, food products, electronic, semiconductor, fiber optic, glass and power industries.

Bionomic HEI WESP's can also be used as "polishing", final cleanup or mist elimination devices behind, and in combination with, other air pollution control devices.