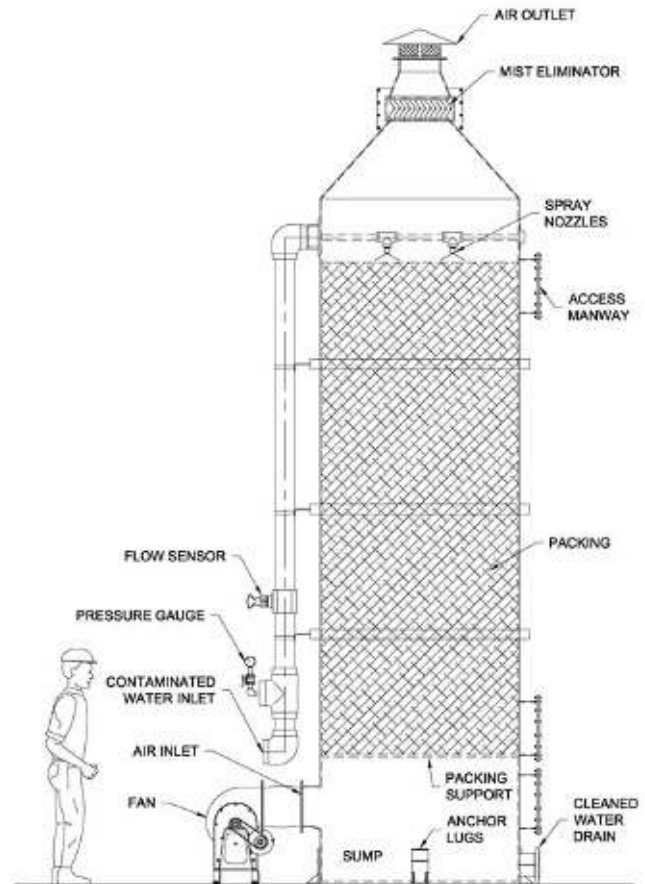# Air Stripped Tower Model HAST

- Efficient Contaminant Removal from Water
- Removal of VOC's from Water
- Capacity up to 7,000 gpm
- Towers Up to 16 foot Diameter
- Low Pressure Drop
- Custom Designed for Your Application
- Corrosion Resistant Construction
- PE Stamped Structural and Chemical Calcs

INTRODUCTION

HEE Environmental Engineering provides an economical and innovative air stripping solution for removal of organic chemical contaminants from water. The Air Stripper Tower Model HAST is the most cost effective solution when considering the initial capital equipment cost, installation, operation and maintenance.

HEE's Air Stripper Towers Model HAST are complete cylindrical towers filled with a high efficiency packing, mist eliminator, liquid distribution system, access man ways, an integral sump with a flat bottom, and a blower. The Air Stripper Tower Model HAST can accommodate a wide range of contaminant concentrations and liquid flow rates. The towers and internal components are fabricated using corrosion resistant materials such as fiberglass reinforced plastic (FRP), polypropylene, and PVC.

APPLICATIONS

Some of the more common applications are listed below.

- Groundwater and Wastewater Treatment
- Treating Contaminated Well Water
- Removal of Dissolved Volatile Organic Compounds (VOC's) from Water
- Removal of Dissolved Chlorinated Organic Compounds
- Groundwater Contaminated from Leaking Gasoline Tanks
- Contaminated Groundwater by Dry-Cleaning Solvents
- Removing Methane from Groundwater Near Leaking Gas Wells
- Well Water Treatment for Hydrogen Sulfide Removal
- Stripping Ammonia from Waste Using Air Recycled Through a Scrubber

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A partial list of common chemical contaminants are shown below.

1,1,1-Trichloroethane	Methylene Chloride
1,1-Dichloroethane	MTBE
Ammonia (NH3)	Perchloroethylene (PCE)
Benzene	Phenol
BTEX (Gasoline Range Organics)	Radon and other Dissolved Gases
Carbon Dioxide (CO2)	Tetrachloroethylene
Carbon Tetrachloride	Toluene
Chloroform	Trichloroethylene (TCE)
Hydrogen Sulfide (H2S)	Vinyl Chloride
Methane	

AIR STRIPPER SYSTEM DESCRIPTION

HEE's Air Stripper Towers Model HAST are designed and manufactured for your specific application to treat the contaminated water. Air enters at the bottom of the tower, flows through a packed bed section of a high efficiency Lantec packing and through a second stage mist eliminator. The air is discharged through the top. The contaminated water is introduced at the top of the packing column and flows downward by gravity.

Air Stripper towers are available from 12 inch up to 16 foot diameter with liquid flow rates from 1 to 7,100 gpm.

THEORY OF OPERATION

Air strippers force air through contaminated or polluted water and work best on chemicals that evaporate easily. The polluted water is pumped in the tower and sprayed over a packing material. As the water trickles down through the packing material to the bottom of the tower, a fan at the bottom blows air upwards. The chemicals change from a liquid to a gas phase (evaporate) as the air passes through the trickling water. The air carries the removed chemical gases to the tower outlet into the atmosphere or can be treated by activated carbon or thermal destruction systems. The clean water trickles to the bottom sump.

The efficiency of removing contaminants from the water in an air stripper tower depends on several important factors:

1. Water temperature
2. Packing height
3. Tower diameter
4. Air to water ratio

The removal efficiency is highly dependent on temperature and we need to know the coldest expected water temperature. For most contaminants, elevated water temperatures will improve the removal efficiency.
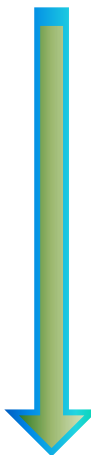
The required removal efficiency is directly related to the packing height and will result in a taller tower. If higher removal efficiency is required, more packing height will be required. If structural stability or site restrictions prevent a taller tower, the packing height can be reduced by increasing the tower diameter and maintain the same removal efficiency.

The open face area or tower diameter is also a function of the water flow rate and loading rate. In general, the liquid loading rate can range from 1 to 35 gpm/Sq Ft.

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Finally, the air to water ratio can vary from 10:1 to 200:1. The volatility of a contaminant will determine the required air to water ratio. A smaller air to water ratio is needed for contaminants that are more volatile.

Air strippers cannot remove chemicals that do not evaporate, but works best on chemicals that evaporate easily. The key variable in the design equations for air stripping systems is Henry's law constant **H**, and the contaminant diffusivity in water. Table 1.1 below list common compounds and the easiness to strip by air based on Henry's law constant. The constant **H** will determine how appropriate air stripping can be as a remedial option.

Table 1.1 List of Selected Contaminants and Removal Based on Henry's Law Constant

Compound	Henry's Constant*	
Vinyl Chloride	50	**Easiest to remove**
Tetrachloroethylene	1	
Carbon Tetrachloride	1	
1,1-Dichloroethane	0.6	
Trichloroethylene (TCE)	0.5	
Toluene	0.3	
Benzene	0.2	
1,1,1-Trichloroethane	0.2	
Chloroform	0.1	
Methylene Chloride	0.1	
Heptachlor	0.06	
Nitrobenzene	0.001	
Ammonia	0.0006	
Phenol	0.000005	**Hardest to remove**

* mg/L in air per mg/L at 25°C

Air strippers are custom designed and fabricated for specific site requirements. Table 1.2 below provides a summary example of several air stripper systems.

Table 1.2 Summary Example of Air Stripper Systems

Contaminants	MTBE	TCE	Methane	Radon	H$_2$S	NH$_3$
Water flow, gpm	150	250	200	1000	600	130
Concentration	1.0 mg/L	0.300 mg/L	15 mg/L	35 Bq/L	400 ppm$_v$	19 ppm$_v$
Liquid temp,°F	70	70	60	70	54	90
Removal Efficiency	98%	98.50%	99%	99%	90%	90%
Tower Diameter, Ft	4.0	3.5	3	6	6	9
Packing Height, Ft	18.0	16.0	8.5	10.5	10	20.5
Air Flow Rate, ACFM	4,000	1,000	600	4,000	800	27,000

The minimum application details required to design an air stripper tower are as follows:

Chemical Contaminant
Water flow rate, gpm
Influent Concentration
Liquid temperature range, °F

Desired removal efficiency, %
Water Analysis
Available space

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MATERIAL OF CONSTRUCTION AND SYSTEM COMPONENTS

Material of Construction

Fiberglass reinforced plastic (FRP) is the suitable and most common material used to fabricated air stripper towers because of excellent corrosion resistance to the chemical environment. Even tall air stripper towers can be designed for high wind loads. Other materials could be used such as stainless steel and coated carbon steel and may offer good corrosion resistance, but are two the three times higher in cost than fiberglass.

The packing material and the mist eliminator are plastic such as polypropylene.

System Components

Single piece tower construction
Fiberglass reinforced plastic construction – filament wound
Exterior coat UV resistant
Anchor lugs design for seismic and wind load as required
Lifting lugs
Guy wire lugs (if required)
PE Stamped structural and chemical design calculations
Water inlet connections
Water outlet connection
Sump drain valve on sump bottom
Flanged air inlet
Flanged air outlet
Fan Inlet and Outlet screens
Liquid supply piping with support brackets
Liquid distribution system
Packing by Lantec Products
Packing support for low pressure drop
Mist Eliminator
Access manways for sump, packing and liquid distribution
Centrifugal fan for forced or induced draft

DESIGN FEATURES

To simplify shipping and field assembly, air stripper towers can be fabricated in flanged sections that will also simplify future maintenance.

Liquid distribution can use 120-degree full cone spray nozzles for constant liquid flow rates. For systems with wide fluctuations in flow rates, a distribution tray and manifold will provide an even distribution.

The standard chevron shaped mist eliminator is capable of removing liquid droplets in the 25 micron range. The limit of visibility to the human eye is +50 microns. If mist droplets of less than 10 microns must be captured, a high efficiency composite mesh pad can be used. These mesh pads however require a higher pressure drop and will be more prone to plugging.

AVAILABLE OPTIONS

Free standing or guy wire design	NSF certified resins for potable water service
Flanged body sections	Integrated control and instrumentation panels
ANSI flanged connections	OSHA ladder and work platform
Sump level sight gauge	Pump out or gravity drain sump discharge

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Sump heater
Choice of exterior colors
Instrumentation and control
- Differential pressure gauges
- Water flow meter

- Level
- Temperature
- Transmitters for remote monitoring

PACKING FOR AIR STRIPPERS
The packing is the most important component of an air stripper tower and works by providing the maximum surface area for efficient air and water interaction. Plastic packing is chemically inert to most contaminants and will not degrade when exposed to various chemicals encountered in air stripper applications. The packing support is fiberglass grating which is mounted on fiberglass beams and column supports. The grating support is designed for the dry weight of the plastic packing, liquid holdup in the packing and the additional weight due to collection of debris over time.

HEE uses plastic packing exclusively designed and manufacture by Lantec Products. Lantec' s packing products work by creating millions of droplets inside the tower and increases the removal of chemicals from the water droplets by greatly increasing the mass transfer activity in the airborne droplets. Lantec Products have also shown excellent resistant to plugging and fouling thereby reducing maintenance and downtime.

MODEL SUMMARY
The Table 1.3 below is a summary of the model HAST based on 15 feet of packing height and shows a minimum and maximum liquid flow range in gallons per minute. The actual data on the HEE Air Stripper Tower Model HAST will be determined per application.

Table 1.3 Air Stripper Tower Model HAST Summary

Model Number	Water Flow Range, gpm	Stripper Diameter		Typical Height, Ft	Packing Volume, Cu Ft	Sump Capacity, gpm	Dry Weight, Lbs	Operating Weight, Lbs
		Feet	Inches					
HAST-1.5	1 - 60	1.5	18	25	26	65	540	1,300
HASTT-2	6 - 110	2	24	26	47	116	810	2,190
HAST-3	15 - 250	3	36	29	106	261	1,500	4,600
HAST-3.5	20 - 340	3.5	42	30	144	356	2,180	6,400
HAST-4	25 - 440	4	48	31	188	465	2,600	8,200
HAST-5	40 - 690	5	60	34	294	726	4,200	12,900
HAST-6	55 - 1,000	6	72	37	424	1,046	5,660	18,100
HAST-8	100 - 1,700	8	96	42	754	1,859	9,200	31,400
HAST-10	160 - 2,700	10	120	47	1,178	2,905	13,600	48,300
HAST-11	190 - 3,300	11	132	50	1,425	3,514	17,100	59,100
HAST-12	230 - 4,000	12	144	52	1,696	4,182	19,900	69,800
HAST-13	270 - 4,700	13	156	55	1,990	4,909	24,200	82,900
HAST-14	310 - 5,400	14	168	57	2,308	5,693	27,700	92,600
HAST-15	350 - 6,200	15	180	60	2,649	6,535	31,300	109,320
HAST-16	400 - 7,100	16	192	63	3,014	7,436	35,000	124,100

1. Water flow range based on 2 to 35 gpm per Sq Ft face area
2. Typical height and packing volume assumes 15 foot height
3. Actual tower diameter and packing height is determined by the application

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