



Vapor Adsorption Cartridges

PRODUCT FEATURES / BENEFITS

- ◆ Desiccants For Moisture Removal Include Silica Gel, Molecular Sieves, and More
- ◆ Wide Range of Adsorbents For Vapor Removal
- ◆ Coconut Charcoal for Hydrocarbon Adsorption
- ◆ Purify Gas
- ◆ Analyzer Protection
- ◆ No Handling of Loose Media

We offer a complete line of disposable adsorption cartridges filled with desiccant media for moisture removal, as well as adsorbents designed for surface binding of contaminant gases within process streams. Vapor adsorption cartridges incorporate inner and outer filter elements rated 99.99% efficient at 0.01 micron. The adsorption media is securely sandwiched between these elements and fully encapsulated with bonded end caps to ensure zero media migration. Cartridges are designed to fit our standard housings for easy installation and replacement, providing a clean, disposable solution with no loose media handling.



Vapor adsorption cartridges are constructed with concentric inner and outer support tubes, forming a uniformly packed annular volume of adsorbent media. The assembly is sealed with bonded end caps and incorporates positive O-ring seals at both ends to prevent bypass, maintaining system integrity.

Nominal flow rates are equivalent to those of a disposable Grade 50 filter element of the same physical size. In adsorption applications, however, performance is governed primarily by adsorbent volume and contact (residence) time, rather than flow capacity alone.

For point-of-use, tube-connection applications, we also offer Disposable In-line Adsorbers (DIA), available with encapsulation in nylon or Kynar®.

Cartridges ⁽¹⁾ For Stainless Steel Housings	Cartridges ⁽¹⁾ For Aluminum & Plastics	Adsorbent Volume in Cubic Centimeters	Length (Inches)	End Caps/Seal	Flow at 100 PSIG
12-32-xx-TS	TRE12-32-XX	6	1.25"	Nylon/No Seal	5 SCFM
12-57-xx-TS	TRE12-57-XX	9	2.25"	Nylon/Buna-N	11 SCFM
25-64-xx-TS	TRE25-64-XX	20	2.50"	Nylon/Buna-N	15 SCFM
25-178-xx-TS	TRE25-178-XX	90	7.00"	Nylon/Buna-N	40 SCFM
38-152-xx-TS	TRE38-152-XX	130	6.00"	PVC/Buna-N	80 SCFM
51-230-xx-TS	TRE51-230-XX	220	9.00"	PVC/Buna-N	125 SCFM
51-476-xx-TS	TRE51-476-XX	530	18.75"	PVC/Buna-N	250 SCFM
63-762-xx-TS	63-762-xx-TS	1010	30.00"	PVC/Buna-N	560 SCFM

Notes: (1) Replace "xx" with adsorption required: CC, 4A, 13X, SG, DR, MB, PP, HO, SB, CS

Adsorbent	Code	Principles
Activated Carbon Cloth	CC*	Adsorption of hydrocarbons and other organic vapors Zero Air Calibration
Molecular Sieve 4A	4A	Adsorption of CO ₂ , NH ₃ , H ₂ S, SO _x
Molecular Sieve 13X	13X	Adsorption of CO ₂ , NH ₃ , H ₂ S, SO _x , aromatics, amines
Silica Gel	SG	Adsorption of water vapor
Drierite - Anhydrous Calcium Sulfate	DR	Adsorption of water vapor
Mixed Bases	MB	Removal of acidic gases, CO ₂ , SO _x , NO _x , HCl
Potassium Permanganate	PP	Removal of SO _x , Hg, and other acidic gases
Hopcalite	HO	Removal of CO by catalytic oxidation to CO ₂
Sodium Bicarbonate	SB	Acid Neutralizer
Copper Sulfate	CS	Removal of ammonia

Note: (*) Headline's **CC Adsorption Cartridges** are constructed entirely of highly adsorbent fibrous activated carbon formed into a strong, flexible cloth. This **carbon cloth** provides significantly greater dynamic adsorption capacity than granular carbon or carbon-impregnated media.

Unlike conventional charcoal materials, the **carbon cloth** maintains performance in moist conditions, exhibiting far less degradation when exposed to humidity. To prevent carbon dust carryover, the carbon cloth is fully encapsulated on both the upstream and downstream sides with a high-efficiency borosilicate glass microfiber layer.

For optimal performance and service life, carbon cloth adsorbers should be protected by **70C and 50C coalescing prefilters**. Under typical operating conditions, activated carbon can adsorb approximately **20–30% of its own weight** in contaminants.

The following factors should be considered when designing a system that incorporates vapor adsorption cartridges:

1. **Phase Compatibility (Vapor vs. Liquid)**

Adsorbents are effective only for vapor-phase contaminants. Exposure to liquids will damage or deactivate most solid adsorbents. Therefore, adsorption cartridges or DIAs must be protected upstream by an efficient coalescing filter (e.g., Grade 70C or 50C) to remove entrained liquids and aerosols.

2. **Finite Adsorption Capacity and Breakthrough Behavior**

Unlike microfiber filters, which operate at essentially constant efficiency throughout their service life, adsorption cartridges have a finite holding capacity. Once this capacity is reached, additional adsorption does not occur. The limiting capacity, commonly referred to as the *breakthrough point*, is not sharply defined; instead, outlet vapor concentration rises rapidly as saturation is approached.

To prevent downstream contamination, adsorption cartridges must be replaced well before reaching full saturation. Determining the appropriate change-out point is application-specific and depends on multiple variables. As a general rule of thumb, many adsorbents can retain approximately 20% of their own weight in adsorbed vapor (see Item 3).

3. **Adsorption Efficiency and Operating Conditions**

The adsorption efficiency of a given adsorbent for a specific vapor is highly dependent on operating conditions. Consequently, unlike filtration, adsorption media cannot be assigned a single, fixed efficiency rating. In addition to the intrinsic affinity between the adsorbent and the target vapor, key influencing factors include:

- **Temperature** – Adsorption efficiency generally increases as temperature decreases and decreases at elevated temperatures.
- **Vapor Concentration** – Percentage removal efficiency is typically higher at low inlet vapor concentrations, whereas total adsorption capacity increases at higher vapor concentrations.
- **Contact Time (Residence Time)** – Adsorption efficiency improves with increased contact time; therefore, the lowest practical flow rate should be maintained for optimal performance.
- **Presence of Competing Vapors** – Adsorption of a target vapor is reduced in the presence of other vapors with affinity for the same adsorbent. For example, high concentrations of water vapor significantly reduce the adsorption of other vapors on carbon, silica gel, or molecular sieves.

4. **Reversibility and Desorption Effects**

Adsorption is generally a reversible process. Changes in operating conditions may cause desorption rather than adsorption. This reversibility is intentionally exploited during adsorbent regeneration via heating, vacuum application, or purging with a low-contaminant gas stream. However, inadvertent desorption can also occur during normal operation. For example, a temporary increase in inlet vapor concentration may result in significant adsorption, followed by desorption if the inlet concentration subsequently decreases.

While adsorption efficiency cannot be precisely predicted or guaranteed for all operating conditions, system performance can be optimized by maximizing conditions favorable to adsorption and minimizing factors that inhibit or reverse the adsorption process.

Adsorbent	Final Numbers In Designation	Vapor Adsorption Activity	
		Good To Excellent Adsorption	Little Or No Absorption
Carbon	CC	Most C ₄ and heavier hydrocarbons, ketones, alcohols, esters, ethers, organic acids, chlorinated organic, Freons, all aromatic hydrocarbons, carbon disulfide	Carbon monoxide, carbon dioxide, amines, ammonia, acetylene, most C ₃ and lighter hydrocarbons, sulfur dioxide
Silica Gel	SG	Water vapor	Recommended only for water vapor adsorption
Molecular Sieve Type 4A	4A	Carbon Dioxide Ammonia Sulfur Dioxide Hydrogen Sulfide Acetylene Propylene Methane Ethane Water Vapor Ethylene Ethylene Oxide Carbon Disulfide	Organic compounds C ₄ or larger, carbon monoxide
Molecular Sieve Type 13X	13X	All materials adsorbed by Type 4A Sieve plus: Methanol Straight Chain Mercaptans Freon 11 Freon 12 Freon 114 Sulfur Hexafluoride Straight Chain Hydrocarbons to C ₂₂ Cyclohexane Diphenyl Butene-1 Isopentane Benzene, Toluene, Xylene Boron Trifluoride Triethylamine and Smaller Amines	Organic Compounds C ₇ Or larger, Carbon Monoxide
Calgon Type HGR Sulfur –Impregnated Carbon	CC-RD	Mercury Vapor	Recommended only for mercury vapor adsorption
Mixed Sodium and Calcium Hydroxides	MB	All acidic gases, including: Sulfur Trioxide, Sulfur Dioxide, Nitrogen Dioxide, Carbon Dioxide, Hydrogen Sulfide, Hydrogen Chloride, Chloride, Phosphorus Chlorides	Inert and non-acidic gases
Potassium Permanganate Impregnated Aluminum	PP	Removal of SO _x in stack gas	

TABLE

Y Denotes that chemical is Adsorb
 N Denotes No Adsorption
 MB Represents Mixed Bases
 PP Represents Potassium Permanganate

Chemical Substance	Formula	PP	MB	TLV (ppm)
Acetic Acid	CH ₃ COOH	Y	Y	10
Acetone	CH ₃ CO CH ₃	Y	N	750
Acrylic Acid	H ₂ C CH COOH	Y	Y	
Alcohols	ROH (General)	Y	N	
Aldehydes	RCHO (General)	Y	N	
Allychloride	H ₂ C CHCH ₂ Cl	Y	N	1
Ammonia	NH ₃	Y	N	25
Arsine	AsH ₃	N	Y	0.05
Bromoform	CHBr ₃	Y	N	0.05
Butyl Alcohol	CH ₃ (CH ₂) ₂ CH ₂ OH	Y	N	50
Carbon Dioxide	CO ₂	N	Y	5000
Carbon Oxysulphide	COS	N	Y	
Chloroform	CHCl ₃	Y	N	10
Diacetone Alcohol	CH ₃ COCH ₂ C(CH ₃) ₂ OH	Y	N	50
Diesel Fuel	General Hydrocarbons	Y	N	
Esters	General	Y	N	
Ethers	ROR (General)	Y	N	
Ethyl Acetate	CH ₃ COOC ₂ H ₅	Y	N	400
Ethyl Alcohol	C ₂ H ₅ OH	Y	N	1000
Ethyl Benzene	C ₆ H ₅ C ₂ H ₅	Y	N	100
Ethylene	C ₂ H ₄	Y	N	
Formaldehyde	HCHO	Y	N	1
Formic Acid	HCOOH	Y	Y	5
Gasoline	Hydrocarbon Mixture	Y	N	100
Hydrogen Chloride	HCl	N	Y	5
Hydrogen Cyanide	HCN	N	Y	10
Hydrogen Sulphide	H ₂ S	Y	Y	10
Ketones	R ₁ COR ₂ (General)	Y	N	
Mercaptans	RSH (General)	Y	Y	
Methyl Alcohol	CH ₃ OH	Y	N	200
Methyl Chloroform	CH ₃ C Cl ₃	Y	N	
Methyl Ethyl Ketone	CH ₃ COC ₂ H ₅	Y	N	
Nitrogen Oxides	NO _x (NO+NO ₂)	NO oxidized	N	
Ozone	O ₃	Decomposed	N	0.1
Petrols	Hydrocarbon Mixtures	Y	N	
Phenol	C ₆ H ₅ OH	Y	N	5
Phosphine	PH ₃	Y	N	0.3
Pyridine	C ₅ H ₅ N	Y	N	5
Stibine	SbH ₃	Y	N	
Sulphur Dioxide	SO ₂	Y	Y	2
Toluene	C ₆ H ₅ CH ₃	Y	N	100
Vinyl Acetate	CH ₃ COOCHCH ₂	Y	N	10
Vinyl Chloride	CH ₂ CHCl	Y	N	5
Xylene	C ₆ H ₄ CH ₃ CH ₃	Y	N	