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TECHNICAL **BULLETIN**

Supplemental HEGA Information

Plastic Frame
HEGA

Stainless Steel
Frame HEGA

HEGA
High Efficiency Gas Adsorber

Camfil, USA offers a comprehensive range of nuclear, biological and chemical High Efficiency Gas Adsorbers (HEGA) for removing gaseous contamination.

HEGA filters are factory tested to meet the requirements of IEST-RP-CC008.2 which covers design and testing of modular gas-phase adsorber. While HEGA filters are manufactured in different materials and sizes, this standard does not fully apply each time.

HEGA filters can be disposable, replaceable or refillable depending on the application for the control of dangerous gaseous contaminants.

HEGA frames are manufactured from either 304 stainless steel or high-impact plastic that is a cost-efficient alternative to metal-framed devices. The V-bed design channels air through multiple beds of adsorbent which reduces resistance to airflow. The HEGA filter may be changed using a bag-in/bag-out procedure to protect service personnel during changeout. Depending on the frame material and application, HEGA filters are available with high efficiency sorbent media in one or two inch bed depths to meet any gaseous filtration demand.

What is a HEGA?

HEGA filters are sometimes called by different names such as adsorber, carbon adsorber, charcoal adsorber, charcoal filter, carbon filter, gas filter, gas adsorber, etc. To be considered a High Efficiency Gas-Phase Adsorber (HEGA), the adsorber must exhibit a minimum mechanical efficiency of 99.9% when tested in accordance with the Institute of Environmental Sciences designation IEST-RP-CC008.2 which covers design and testing of modular gas-phase adsorbers. Also the adsorber cell must be designed, constructed, filled and packaged in accordance with the principal intentions of this standard.

It is the intent of the standard and the resulting performance of the HEGA filter that is important. These kind of filters are not utilized for odor control.

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Adsorption or Absorption?

Adsorption should not be confused with absorption.

- Adsorption is like water being adsorbed into a sponge. The water and sponge remain unchanged
- Absorption requires some type of chemical change. This is like mixing cream with coffee

Adsorption is the correct term when activated carbon remove gas phase contaminants from the air.

Design Considerations

A particulate prefilter should be considered before the HEGA to help protect the adsorber perforation in the V-bed from being blocked by particulates and possibly making the filter's pressure drop significantly increase. The pressure drop for HEGA filters should not increase. Some applications may require a particulate filter downstream of the filter to collect any carbon fines or carbon dust which might be hazardous.

Since media in the HEGA filter will adsorb anything that can be adsorbed, it can be spoiled by other materials and be unable to adsorb the material that it was intended to control. That is why a HEGA filter should always be protected from vapors that will damage it. This is especially true during jobsite storage.

Temperature and Humidity

The temperature of the vapor is important because the higher the temperature; the lower adsorption capacity will be especially for vapors with a low boiling point. Higher temperature can actually generate desorption which is a situation where the HEGA discharges previously adsorbed vapors. Gas vapor temperature should be kept below 140°F (40°C).

Relative humidity is a significant factor that can affect the efficiency of a HEGA filter. Molecules of gas vapor with low boiling points will reduce the amount of the target gas adsorbed. This is due to molecules of water vapor being adsorbed instead of the target gas which results in less free surface area in the carbon pores. When this occurs, gas vapors are unable to impact the carbon. To lessen this possibility, relative humidity should be kept below 60%.

Where HEGA filters are Used?

HEGA filters may be filled with a variety of adsorbents to focus on vaporized contaminants in the airstream in many different industries:

- Radiological laboratories
- Chemical and biological research facilities
- Medical facilities
- HVAC Systems
- Radiopharmaceutical facilities
- Chemical warfare agent applications
- Toxicology facilities
- Chemical Process Facilities
- Research facilities
- Universities

HEGA filters are used in applications to ensure containment of hazardous vapors or gaseous contaminants. Typically installed in a system that also includes prefiltration and HEPA filtration, HEGA filters are changed using a bag-in/bag-out process.

Camfil, USA produces several containment filtration housings designed to contain HEGA filters. These containment housings can be designed for either fluid or gasket seal style HEGA filters. In-place containment test housings are also available to assist in the owner in scheduling mechanical efficiency testing.

How Do HEGA Filters Work?

A HEGA filter removes vapors from the airstream by adsorbing the known contaminants. A system can be designed properly when given the correct carbon media, airflow, temperature, humidity and customer's required residence time.

The media in a HEGA is usually activated charcoal that is produced from either coal or coconut shells. Although elemental radioiodine is retained efficiently by activated carbon alone, the charcoal is often impregnated with additional chemicals to improve its retention of organic species (e.g. methyl iodide).

HEGA filters use different adsorbent media to remove vapors or gases from the exhaust air within various facilities.

Types of standard carbon media

Camfil USA's 8x16 USS mesh, activated carbon has an adsorptive capacity towards a very wide range of volatile organic gases contaminants, odors and some chemical warfare nerve agents.

The activated carbon base material shall be coconut shell. The carbon tetrachloride activity shall be a minimum of 60% when tested in accordance with ASTM D3467.

Camfil USA's 8x16 USS mesh, activated nuclear grade carbon is for the removal of radioisotopes and shall meet the requirements of US NRC Regulatory Guide 1.52 and/or 1.140 requirements and ASME AG-1.

The carbon is manufactured from virgin coconut-shell material and impregnate content shall not exceed 5% by weight. Moisture content of product shall not exceed 8.0%. Carbon to be co-impregnated with potassium iodide (KI) and triethylenediamine (TEDA).

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The carbon is qualified in accordance with ASME AG-1 Article FF-5210 (Qualification Tests) and to have met the requirements of Article FF-5211 (methyl iodide removal - low temperature), Article FF-5212 (elemental iodine removal), and Article FF-5213 (methyl iodide removal - high temperature).

Camfil USA's 12x30 USS mesh, ASZM-TEDA grade carbon is used to adsorb toxic warfare gases. This carbon meets the requirements of MIL-DTL-32101, 19, September 2002.

The carbon is impregnated with copper, silver, zinc and molybdenum salts and triethylenediamine (TEDA) for use as a sorbent for known and suspected military chemical weapons agents.

This carbon has not had the optional toxic gas-life testing that may be required for some applications.

Residence Time

ASME AG-1 Describes the calculation of residence time of HEGA cells below.

Residence time is the theoretical time that the gas remains within the bed of the adsorber cell at a specified airflow by remaining in contact with the adsorbent and is calculated from the following equation:

(U.S. Customary Units)

$$T = \frac{t(A - B)}{28.8Q}$$

(SI Units)

$$T = 3.6 \times 10^{-3} \frac{t(A - B)}{Q}$$

Where 3.6 = product of 3,600 s/h and 10−3 m/mm
28.8 = product of 1,728 in.3/ft3 and 1/60 min/sec
A = gross screen area of all screens on inlet side or
outlet side, whichever is smaller, in.2 (cm2)
B = total area of baffles, blanks, margins of all screens, in.2 (cm2)
Q = total cell volumetric airflow, cfm (m3/h)
T = resident time, sec
t = thickness of bed, in (cm)

Types of Adsorption

Kinetic: Is physical adsorption by electrostatic force dependent on the carbon's pore structure.

Isotopic Exchange: Molecular exchange of iodine in KI impregnated carbon where a bad molecule will interchange with a safe molecule that is then released in the system.

Chemisorption: Chemical Adsorption (TEDA) where the carbon is impregnated (coated) and the bad molecules bond to the impregnate material.

Available Options

Carbon Sampling Canisters

Other medias available to meet design requirements.

Type II HEGA Filters

The Type II (flat-bed or tray-type) cell is two parallel media beds separated by an air space and filled with 8x16 USS mesh nuclear grade carbon media.

Type III Deep Bed Adsorbers

The Type III Deep Bed adsorber is designed to allow the replacement of spent carbon without replacing the adsorber frame. It is constructed of stainless steel and can be designed and built for almost any airflow. It is most often used for systems requiring large volumes of air and/or high residence times.

DMMP - Qualified Adsorbers

These HEGA filters are tested and certified for DMMP Qualification. Test reports are to be furnished certifying the adsorber design has been successfully DMMP life tested, minimum 35 minutes.

Toxic Gas-Life Testing

Certification that the ASZM-TEDA carbon has been successfully Toxic Gas Life Tested are furnished.

Example of containment housing for HEGA filters.

Camfil – a global leader in air filters and clean air solutions.

For more than half a century, Camfil has been helping people breathe cleaner air. As a leading manufacturer of premium clean air solutions, we provide commercial and industrial systems for air filtration and air pollution control that improve worker and equipment productivity, minimize energy use, and benefit human health and the environment.

We firmly believe that the best solutions for our customers are the best solutions for our planet, too. That's why every step of the way – from design to delivery and across the product life cycle – we consider the impact of what we do on people and on the world around us. Through a fresh approach to problem-solving, innovative design, precise process control and a strong customer focus we aim to conserve more, use less and find better ways – so we can all breathe easier.

The Camfil Group is headquartered in Stockholm, Sweden, and has 33 manufacturing sites, six R&D centers, local sales offices in 30 countries, and about 4,800 employees and growing. We proudly serve and support customers in a wide variety of industries and in communities across the world. To discover how Camfil can help you to protect people, processes and the environment, visit us at www.camfil.com.

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