

## **CUSTOM CONTAINMENT FILTRATION SYSTEMS**

Chemical - Biological - Radiological



### **Containment Filtration Systems for the Treatment of Contaminated Air Streams**

In 1960, Barnebey Cheney (now Barnebey Sutcliffe, a Division of Calgon Carbon Corporation), pioneered the use of special HVAC filter support systems for the nuclear power industry, now known as Containment Systems. They are installed wherever the air to be filtered contains the most hazardous contaminants. Containment Systems include special features for service and maintenance, which provide greater safety for the operator. These features prevent release of the contaminants into the air surrounding the containment system.

Systems manufactured by Calgon Carbon provide high-efficiency (>99.9% removal) air treatment with provisions for safety during service. These features satisfy current requirements for a wide range of applications.

Filter elements installed in Containment Systems include particulate High-Efficiency Particulate Air (HEPA), Ultra-Low Penetration Air (ULPA) filters, activated carbon High-Efficiency Gas Adsorbers (HEGA) filters, and associated prefilters installed to increase service life of downstream filters.

Containment Systems are supplied with one of two alternative filter clamping methods:

**Gasket Seal (CM Series).** A spring-loaded clamping mechanism that compresses a filter gasket providing a positive seal between the filter face and the sealing surface of the housing.

**Knife-Edge Seal (KE Series).** A clamping arm is designed to manually engage the filter element into a knife-edge flange. The seal is made when the knife-edge flange penetrates a gel-filled channel provided with the filter element.

A complete Containment System is constructed of modular sections that are factory assembled and tested to suit the demands of a specific application. A typical system consists of an inlet bubble-tight isolation damper (BTD), a prefilter with separate access, housing section to accommodate a standard HEPA or HEGA filter, and an outlet BTD with pressure gauge assemblies and welded transitions. Typically, the housing is combined with a skid, fan, controls, instrumentation, etc., to form a complete “drop-in” system. We also offer installation, start-up, and operator training services.

## Quality Design and Protection

### *Containment Systems Features*

- Time and application proven modular design.
- Safe and easy method to maintain filters without contaminating the area outside of the containment system.
- Available in two basic configurations: CM and KE series.
- Change up to three filters (placed in parallel) through a single access port.
- All housings are factory leak-tested to ASME N510 Testing of Nuclear Air Treatment Systems.
- Available for use in vertical or horizontal airflow applications.
- One-piece front panel and back panel construction of rugged 300 series stainless steel.
- Standard housings are designed to withstand 20" w.g. positive and negative pressures.

### *Gasket Seal (CM Series) Features*

- Accommodates standard gasketed HEPA or HEPA filters.
- A positive spring-loaded filter-locking mechanism that applies constant pressure on each filter.
- The mechanism is operated from outside of the housing using standard tools.
- No special filter clip is required for filter removal.
- Clean-up of seal surfaces not required during filter change-out.

### *Knife Edge Seal (KE Series) Features*

- Less clamping force required to maintain a proper seal.
- Filter access door cannot be reinstalled unless filter latch is properly engaged.

## Applications

### *Federal, State, and Embassies*

Government installations require the protection of the public from the discharge of chemical, biological, radioactive, and nuclear agents (CBRN).

### *Hospitals and Medical Research*

Exhaust air from laboratory hoods, hospitals, and/or prison isolation wards may contain radioactive and infectious particulates, and/or gaseous contaminants. Containment Systems safely exhaust filtered air from these facilities to the surrounding environment.

### *Chemical and Pharmaceutical Industry*

Control of air quality and protection of personnel working in the vicinity of lab hoods and research animals requires the use of HEPA filters and activated carbon filters. These filter elements are retained in a Containment System, which permits safe replacement of filter modules.

### *Military*

Government installations evaluating equipment and procedures require the protection of military personnel from the discharge of chemical, biological, and radioactive agents (CBR), or nuclear, biological, and chemical (NBC) warfare agents. Containment Systems are incorporated in the HVAC ventilation systems to prevent release of these agents to the atmosphere.

### *Schools and Public Buildings*

Air quality in schools and other public buildings that are vulnerable to toxic air requires control. Protection is provided by over-pressurizing the inhabited spaces with make-up air filtered through a Containment System.

### *University and Industrial Research Facilities*

Many laboratories work with biological and chemical materials requiring special safety procedures such as BSL-3. Containment Systems supplied with appropriate filters are used in conjunction with fume hoods to contribute to the safety of operators, service personnel, and the environment.

### *Electronics and High Technology Industries*

The development of crystals and electronic chip production often require the application of chemicals that could be toxic. Air exhausted from these facilities is filtered in a Containment System prior to venting to the atmosphere.

### **Genetic Engineering**

Cultures are developed under controlled conditions with particulate and vapor phase filtration in exhaust and make-up air systems. These filter elements are contained in Containment Systems, assuring the controlled conditions in the lab are extended to other parts of the facility.

### **Standard Features**

Gasket Seal Design (CM series) and Knife Edge Seal Design (KE Series)

#### **Filter Locking Mechanism – CM Series**

- Commercial gasketed filters are clamped securely with 1,400 pounds of force per filter using a spring-loaded top and bottom clamping mechanism.
- 300 series stainless steel construction is used with the exception of brass travel nuts to prevent galling.
- The filter-locking mechanism is actuated from outside the housing using standard tools.

#### **Filter Locking Mechanism - KE Series**

- Sealing of the filter elements is provided by a 300 series stainless steel locking mechanism.
- The locking mechanisms press and align the  $\frac{3}{4}$ " wide fluid seal channel of the filter into a knife-edge seal that is welded to the containment housing.
- This mechanism does not allow access door reinstallation if the filters have been incorrectly installed.

#### **Bag Out Port**

- The change-out bag is safely secured around a porthole provided with smooth edges to prevent bag rupture.

#### **Removable Filter Access Door**

- Filters are easily accessed through a single neoprene gasketed door provided with four non-galling swing-away door clamps.

#### **Separate Prefilter Door**

- Separate openings are provided to accommodate 2", 4" or 6" prefilters, which permit changing of prefilters without disturbing the critical HEPA or HEGA seals.
- Downstream contamination of the housing is prevented by locating the sealing surfaces on the upstream side of the filter.

### **Construction**

- Stainless steel construction incorporating single piece front and back panels; limited number of seal welds means smooth internal surfaces to reduce the risk of leakage and accommodate decontamination.
- Welding is performed in accordance with Section IX of the ASME code.
- Housings are rated for 20" w.g. static pressure (both negative and positive).
- Filter removal rods are provided as standard on two- and three-filter-wide housings. The rods are at the top and bottom of the porthole and are accessed through the filter change-out bag. These rods are used to retrieve filter elements that cannot be easily reached.

#### **Filter Change-out Accessories**

- The bag-out bags themselves are of 8-mil. PVC construction and are factory pressure-tested.
- Clear section at bag neck enables technicians to view work.
- An elastic shock cord is hemmed into the mouth of the bag for a positive fit when stretched over the collar of the porthole.
- A special sleeve to remove the stump from the old bag generated during the change-out procedure is formed into each bag.
- A safety strap is provided for operator security. A cinch strap is installed on each bag to ensure that the bag is not drawn into the housing.

#### **Pressure Testing**

- Each filter housing is factory pressure tested to 20" w.g., the highest standard pressure rating in the industry per N510.
- The maximum permissible leak rate per this specification is 0.2% of the housing volume per hour.
- The filter element sealing surface is also factory tested by the pressure decay method.
- ASME-N510 testing is available.

**Available Options**

**Bagless housings** do not include the bag-in/bag-out feature, but retain all of the standard features and high quality of the CM Series (Gasket Seal) and the KE Series (Knife Edge Seal) housings that are designed to meet the requirements of ASME N509.

**Alternate door arrangements** allow for the locating of access doors on the right side, left side, or both sides of the housing. Door location is determined as right or left hand as viewed upstream of the housing and looking downstream. This permits access to filters and the filter removal rod from either side.

A **single-access door for the prefilter and primary filter** is available with a common door servicing the prefilter and the HEPA (or carbon) filters. While this is a more economical alternative, this arrangement does increase the potential risk of contamination by placing the sealing surface on the downstream side of the high-efficiency filter, thus exposing the entire filter element to the dirty air stream.

A **glass-beaded finish** is available as an alternative exterior finish.

**Modular Base Design**

*CM Housing Standard Feature  
(Shown with optional change out table)*

A **removable and fully gasketed weather cap** protects the entire top of the housing from accumulation of debris and water in outdoor installations. The material and finish are the same as the housing.

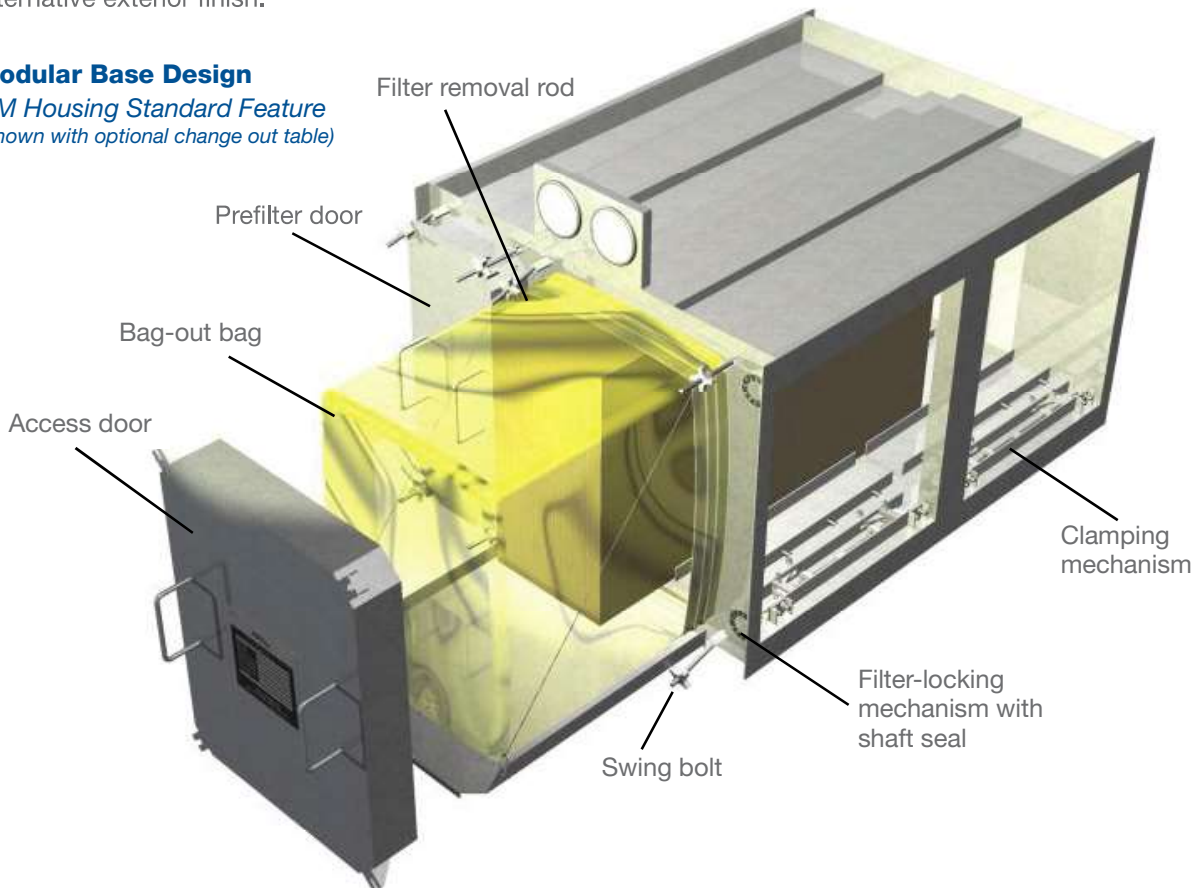
**Lifting lugs** can be attached to the top of each housing or bank of housings for ease of installation.

**Differential pressure gauges** can be installed at each stage of filtration to monitor the pressure drop across particulate filters. They are also available with analog transmitters and adjustable pressure switches.

**Static pressure taps** can be provided across each stage of filtration for customer-supplied gauges or manometers.

**Seismic testing**, analysis, and documentation per N510 are available.

**System Integration** Containment Systems can be combined with air handlers fitted with heating/cooling coils.



Fully welded inlet and outlet transitions can be provided with flanges to attach directly to the customer's ducting. Transitions are tested as part of the leak test.

**Test sections** are available. The filtration aerosol test housings offered are model TI (inlet), TC (combination), and TO (outlet). The test housings are designed and constructed to allow HEPA filter efficiency testing of each element per ASME N510. We can provide a certified test report from an independent testing organization that states our test housings perform in accordance with customer-generated requirements.

**Venting filters** can be specified when the housing is supplied with isolation dampers. A small HEPA filter cartridge is used to equalize the pressure inside the housing with the ambient air during filter change-out.

**High-pressure housing designs** are available to withstand greater than 20" w.g. positive and negative pressures.

**Low-leakage or Bubble-tight isolation (BTD) and/or control dampers** can be provided both upstream and downstream of the housing as part of a factory-installed and pressure-tested assembly.

**A filter change-out table** is available to expedite filter changing. The removable filter change-out table is designed to conveniently handle heavy carbon filters.

**Activated carbon adsorbers** are fabricated by the only manufacturer of containment systems with 80+ years of carbon filtration experience. We have the technical staff to properly assess your application and apply the most cost-effective solution. We are uniquely qualified to offer this level of carbon application experience.

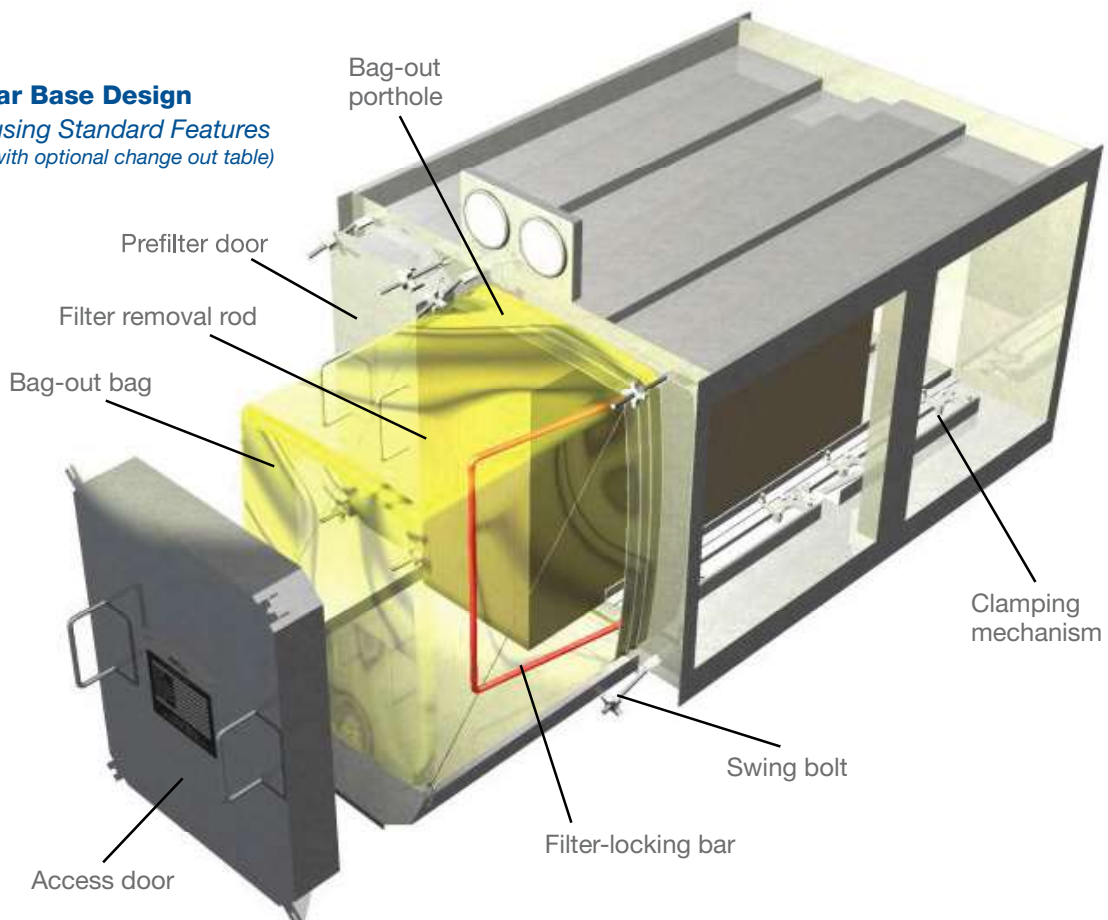
**DMMP qualified adsorber** filters are specifically designed for critical applications where Best Available Control Technology (BACT) is required.

**Drilled and reinforced flanges** for bolted duct connections.

**Mounting bases and skids** are available.

### Modular Base Design

*KE Housing Standard Features  
(Shown with optional change out table)*



## Containment Systems



**Application:**

War gas destruction off-gas treatment

**Location:**

Arkansas, USA

**Equipment:**

Blower, prefilter, HEPA, DMMP carbon tray, test section, transitions



**Application:**

Biotechnology research laboratory facility

**Location:**

Virginia, USA

**Equipment:**

Bubble-tight damper, prefilter, test section, refillable carbon tray, transitions



**Application:**

Prison collective protection

**Location:**

Indiana, USA

**Equipment:**

Blower, prefilter, HEPA, DMMP carbon tray, test section, transitions



**Application:**

Collective protection system

**Location:**

Maryland, USA

**Equipment:**

Blower, prefilter, refillable DMMP carbon tray, test section, transitions



**Application:**  
Hospital lab hood exhausts

**Location:**  
Texas, USA

**Equipment:**  
Prefilter, HEPA filter, and HEGA filter with type 787 carbon for control of radioactive isotopes

### Radial Flow (Round) Military NBC Filtration



18,000 cfm

**Application:**  
Military war gas air filtration

**Location:**  
Kentucky, USA

**Equipment:**  
Radial flow DMMP air filtration system combined with an air handler and blower sections



24,000 cfm



Control panel

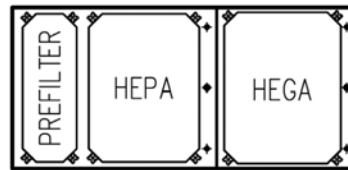
### Containment Systems Custom Engineered From Modular Design

Containment system configurations can be customized to meet customer requirements. Below are typical configurations as they apply to several types of filtration applications.

Direction of Airflow 



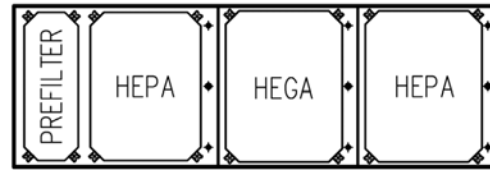
Hood or process streams containing particles only



In exhaust applications where both particulates and vapor phase contaminants are to be removed, the HEGA is placed last to protect the carbon from particulates



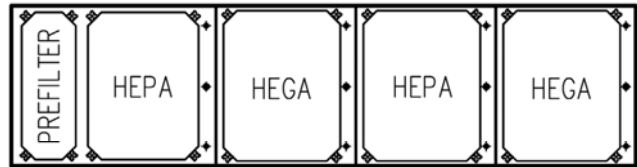
Exhaust stream with vapor phase contaminants only



Removal of particulates and vapor phase contaminants from intake air when recirculating into a controlled space



Intake and recirculating applications where both particulates and vapor phase contaminants are to be removed



Removal of particulates and vapor phase contaminants from intake air; when recirculating into a controlled space in critical situations and a redundant HEGA is required



## Containment Systems Model Nomenclature

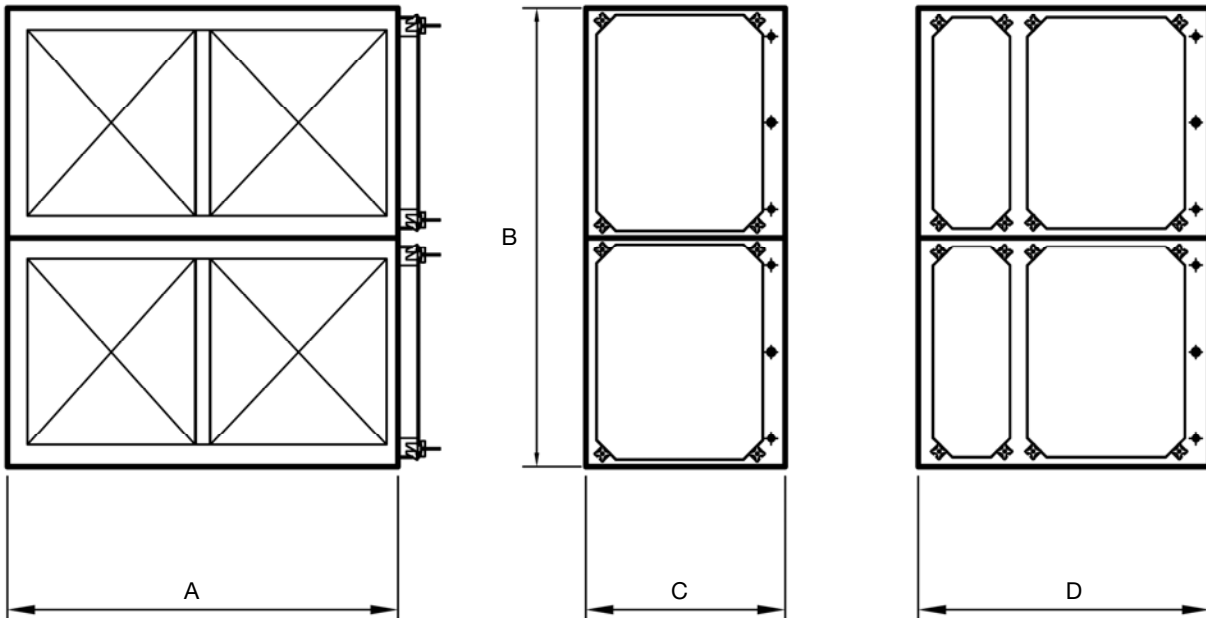
**CMP 3S - 2 - 1 x 1 - R - P2 - H12 - C12**

**A B C D E F G H**

<b>A</b>	
<b>CM</b>	gasket seal – no prefilter
<b>CMP</b>	gasket seal with separate prefilter door
<b>KE</b>	fluid seal – no prefilter
<b>KEP</b>	fluid seal with separate prefilter door
<b>SS</b>	gasket seal side service – no prefilter
<b>SSP</b>	gasket seal side service with separate prefilter opening
<b>SK</b>	fluid seal side service – no prefilter
<b>SKP</b>	fluid seal side service with separate prefilter opening
<b>B</b>	
<b>3S</b>	type 304 stainless steel
<b>3L</b>	type 304L stainless steel
<b>6S</b>	type 316 stainless steel
<b>6L</b>	type 316L stainless steel
<b>C</b>	
Number of modules in entire series (1 and higher)	
<b>D</b>	
Number of modules high (1 and higher)	
<b>E</b>	
Number of modules wide (1 through 6)	
<b>F</b>	
Right-or left-hand orientation. More than three wide housings will have access doors on both sides.	
<b>G</b>	
<b>P2</b>	2" prefilter
<b>P4</b>	4" prefilter
<b>P6</b>	6" prefilter
<b>H</b>	
<b>H12</b>	12" deep filter section HEPA
<b>HC12</b>	12" deep filter section High Capacity HEPA
<b>C12</b>	12" deep filter section carbon
<b>C16</b>	16" deep filter section carbon
<b>C18</b>	18" deep filter section carbon
<b>TS</b>	test section
<b>SC</b>	scan section

**Dimension Table**  
*CM and KE – Standard Housing*

Filter Arrangement HxW	A	B	C – CM/KE			D – With Prefilter		Approximate Shipping Weights (lbs.)				
			11 1/2" Filter	16 - 18" Filter	Test Section	11 1/2" Filter	16 - 18" Filter	11 1/2" Filter	16 - 18" Filter	Test Section	11 1/2" Filter	16 - 18" Filter
1 x 1	27"	30"	CM	CM	26"	CM	CM	150	170	186	206	130
1 x 2	51"							235	255	285	305	215
1 x 3	75"							320	340	382	402	295
2 x 1	27"	60"	26"	32"	26"	38"	44"	300	340	372	312	260
2 x 2	51"							470	510	570	610	430
2 x 3	75"							640	680	764	804	590
3 x 1	27"	90"	KE	KE	26"	KE	KE	450	510	558	618	390
3 x 2	51"							705	765	855	915	645
3 x 3	75"							960	1,020	1,146	1,206	885
4 x 1	27"	120"	26"	32"	26"	38"	44"	600	680	744	824	520
4 x 2	51"							940	1,020	1,140	1,220	860
4 x 3	75"							1,280	1,360	1,528	1,608	1,180



## Suggested Specifications for CM/KE Containment Housings

The filter housing shall be model CM or KE. The top and bottom panels shall be manufactured from a minimum 14-gauge type 304 stainless steel. The front and back panels shall be each constructed from a single sheet of 11-gauge type 304 stainless steel. (Type 304L, 316, 316L and other stainless steels are also available.) All stainless steel sheet products shall have a 2-B mill finish. Each housing shall be a side-service, bank-type arrangement. Welding shall be in accordance with applicable criteria of Section IX of the ASME Boiler and Pressure Vessel Code. The filter housings shall be designed in accordance with applicable sections of ASME AG-1 and ASME N509, and to withstand an internal and external differential pressure of 20" w.g.

The filter housing pressure boundary shall undergo factory testing per ASME-N510 to a minimum of 20" w.g., as specified in Table 4.5 of ERDA 76-21, Nuclear Air Cleaning Handbook. The maximum permissible leak rate per this specification is 0.2% of the housing volume per hour. The filter element sealing surface shall also be factory-tested by the pressure decay method as specified in ASME-N510.

### CM Series

The sealing action for the filter elements shall be provided by top-and bottom-locking mechanisms. The locking mechanisms shall be spring-loaded to exert a minimum sealing force of 1,400 lbs. per filter over a minimum of 80% of the gasket surface filter element. The mechanism shall apply an even, uniform load along at least 80% of the top and bottom of each filter frame. The locking mechanism shall be located downstream of the filter elements and operated from the outside of the housing. All mechanical components of the filter-locking mechanism shall be stainless steel except for the brass travel nut.

The housing shall have a removable access door for each tier and filtration stage. The housing shall have a separate access door for the prefilter. There shall be four access door retainers that secure each door in place. The door retainers shall swing away from the access door to allow for easy removal of the access door. All parts of the door retainer mechanism shall remain attached to the housing when the access doors are removed. The access door seal shall be a continuous extruded neoprene gasket securely attached to the door lip. The neoprene access door gasket shall seal against the front panel of the containment housing.

Housings with two or more filter elements per tier or stage shall have a filter removal rod that will allow the operator to draw the filters toward the opening to facilitate bagging-out. The filter removal rod shall be designed so that the containment is maintained while the filters are being drawn toward the opening.

The proper size bag-out bag shall be provided for each access door. Each bag shall be 0.008" thick polyvinyl chloride plastic with an elastic retaining cord located at the mouth. Glove sleeves shall be incorporated into the bag to facilitate filter element removal. Each bag shall be provided with a nylon safety strap and a separate cinch strap. Each bag shall be individually tested and clearly marked with the bag stock number.

### KE Series

The sealing action for the filter elements shall be provided by top-and bottom-locking mechanisms operated from a single handle. The locking mechanisms shall displace the filters toward a knife-edge attached to the containment housing. The mechanism shall provide uniform displacement that will ensure alignment of the filter gel seal and the housing knife-edge. The locking mechanism bar shall also provide a device that will not allow the door to be installed on the containment housing unless the filters have been correctly installed and the gel seal initiated. The locking mechanism shall be located downstream of the filter elements. All mechanical components of the filter-locking mechanism shall be stainless steel and removable.

### Go Green – Activated Carbon Reactivation

With its spent carbon reactivation program, Calgon Carbon has been a green company for years. After an activated carbon's adsorptive capacity has been exhausted, it can be returned to Calgon Carbon for thermal reactivation. In the reactivation process, the spent activated carbon is heated in furnaces devoid of oxygen, using steam as a selective oxidant. The adsorbed organics are either volatilized from the activated carbon or pyrolyzed to a carbon char. The volatile organics are destroyed in the furnace's afterburner and acid gases are removed by means of a chemical scrubber. The high-temperature reaction with steam serves to restore the adsorptive capacity of the activated carbon. The reactivated product is packaged and recycled for reuse.

Reactivation and recycling eliminate the cost and long-term liability associated with disposal of spent activated carbon. In addition to being efficient and cost-effective, reactivated carbon also represents an environmentally friendly, cradle-to-grave alternative to virgin carbon. Calgon Carbon has safely reactivated well over one hundred billion pounds of spent carbon, making us the world's leader in activated carbon recycling.

With a full line of products and services, including carbon reactivation, Calgon Carbon makes it easy to go green!

#### Limitation of Liability

Notwithstanding any provision to the contrary herein, in no event shall Supplier or its contractors or suppliers of any tier be liable to Purchaser for any indirect, special, consequential, incidental or punitive damages as a result of a breach of any provision hereunder or for any other claim of any kind arising out of or relating to this document, whether in contract, in tort (including without limitation, negligence or strict liability), indemnification or otherwise. Notwithstanding any provision to the contrary herein, for all losses, damages, liabilities or expenses (including attorney's fees and costs), whether for indemnity or negligence, including errors, omissions or other acts, or willful misconduct, or based in contract, warranty (including any costs and fees for repairing, replacing or re-performing services or curing a breach hereof), or for any other cause of action (individually, a "Claim"; collectively, "Claims"), Supplier's liability, including the liability of its insurers, employees, agents, directors, and officers and all other persons for whom Supplier is legally responsible, shall not, to the maximum extent permitted by law, exceed in the cumulative aggregate with respect to all Claims arising out of or related to this document, the total amount of compensation paid to Supplier hereunder. All Claims of whatsoever nature shall be deemed waived unless made in writing within forty-five (45) days of the occurrence giving rise to the Claim.

### One Source. Many Services-Field Services

Calgon Carbon, the world's leading supplier of activated carbon products and technologies, offers a complete range of services, each designed to make the job of selecting, installing and managing your treatment systems easier than ever. Calgon Carbon Field Service provides total on-site service and solutions support for all of your air, water and chemical process units. Our standard services include:

- Filter Removal and Replacement
- BIBO housing and indoor air filter replacement
- 24/7 emergency response capabilities
- Vessel lease and purchase programs
- System automation with programmable logic controls
- Installation, start-up and operator training services
- System inspection and maintenance programs
- Media, technology and equipment selection assistance
- Vacuum, slurry, and eduction transfer capabilities
- On-site exchange of modular vessels
- Vessel and media disinfection
- Pilot and field testing
- Process optimization and troubleshooting

#### Warranty Disclaimer

Calgon Carbon Corporation warrants that the Custom Containment Filtration Systems will be free from defects in materials and workmanship for a period of 90 days following the date of purchase. In the event of a breach of this warranty, Calgon Carbon Corporation will, in its discretion, repair or replace any defective parts or the complete unit during the warranty period. This warranty does not apply to defects caused by (i) normal wear and tear, (ii) accident, disaster or event of force majeure, (iii) misuse, fault or negligence of or by Buyer, (iv) use of Custom Containment Filtration Systems in a manner for which it is not designed, (v) external causes such as, but not limited to, power failure or electrical power surges, or (vi) improper storage and handling of the Custom Containment Filtration Systems. EXCEPT AS EXPRESSLY PROVIDED IN THIS WARRANTY STATEMENT, CALGON CARBON CORPORATION DISCLAIMS ALL OTHER WARRANTIES, WHETHER STATUTORY, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CALGON CARBON CORPORATION DOES NOT WARRANT THAT THE CUSTOM CONTAINMENT FILTRATION SYSTEMS ARE ERROR-FREE OR WILL ACCOMPLISH ANY PARTICULAR RESULT. ANY ADVICE OR ASSISTANCE FURNISHED BY CALGON CARBON CORPORATION IN RELATION TO THE CUSTOM CONTAINMENT FILTRATION SYSTEMS PROVIDED FOR HEREUNDER SHALL NOT GIVE RISE TO ANY WARRANTY OR GUARANTEE OF ANY KIND. THIS WARRANTY WILL TAKE PRECEDENCE OVER ANY AND ALL OTHER WARRANTIES UNLESS SPECIFICALLY DISCLAIMED AND REFERENCED BY CALGON CARBON CORPORATION.

Calgon Carbon Corporation is constantly striving to improve its products and capabilities and to provide the best product to its customers.

Calgon Carbon Corporation may from time to time develop product improvements or alterations (including, without limitation, revisions to product specifications), and may implement such Product Improvements without notice to the Buyer.

MAKING AIR SAFER AND CLEANER

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