



Custom Engineered Systems

*Filtration Products and Services
for Control of Gaseous and Particulate Contaminants*

A Wholly Owned Subsidiary of Flanders Corporation

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What does CBR mean? CB? NBC?

CBR stands for Chemical, Biological, Radiological. So, a CBR filter is one that can filter those contaminants. CB stands for Chemical, Biological. NBC stands for Nuclear Biological, Chemical.

What are the specific contaminants?

A CBR filter was originally intended to control those contaminants that would likely come from an enemy attack:

- Chemical contaminants would be mustard gas, phosgene or other forms of chemicals designed to cause bodily harm.
- Biological contaminants would include virus and other microorganisms that would cause sickness or death to any exposed persons.
- Radiological would include any radioactive material that would be in the air as a result of a nuclear blast.

A CBR filter is intended to control these three classes of dangerous contaminants by filtering them out. CBR units can be used in fallout shelters, civil defense control centers and others.

Where did the CBR concept come from?

The CBR concept is much older than we may realize. It was initially begun during World War I. The *doughboy's* gas mask was one of the first CBR units. In fact, the carbon developed for use in those early gas masks is still the type of carbon used in today's CBR units.

What are the essential elements of the CBR?

The CBR has three essential elements. First, it has a HEPA filter to control particulate contaminants such as microorganisms and viruses, and it also controls radioactive particles. Second, the CBR has a carbon filter to control the gas and vapor phase contaminants. Third, a high quality containment housing to contain these filters is required.

Does the combination of the HEPA and the carbon give complete protection to personnel by supplying clean air to their living environment?

Yes. Clean air is supplied to the environment if two other essential elements are supplied: (1) If the closure that houses the filters is a good high quality closure, which will have no air leakage, all of the contaminated air will be forced to go through the filters, cleaning it. (2) If the blower that forces the air through the system is properly sized, contaminated air will be forced through the filters appropriately.

Is the HEPA special?

The HEPA is a standard military-type HEPA, built to specification ASME, AG-1, Section FC.

Is the carbon special?

The carbon filter is a holding frame designed to hold a special carbon called Whetlerite. This carbon has been specially impregnated with salts and metals so that the carbon can react with the known gas contaminants--such as chlorine, phosgene, mustard gas, or other military-type gases. Of course, as an adsorber, it will control all other types of adsorbable gases, such as radioactive species of iodine, solvents and such.

What does a CBR look like?

A CBR looks like any other type of filter. First, a prefilter is installed to take out the large particles that could plug up the HEPA filter. Next, a HEPA is installed to remove submicrometer particles. Then, a carbon filter with V-Bed arrangements of the whetlerized carbon in them is installed in the system. Most of the time, when two such filters are installed, the first is to act as primary filter and the second is to act as the backup filter. Such an arrangement also gives the filter additional capacity to hold gas contaminants; and, it also allows for the capture of some of the more difficult to adsorb gases by giving additional time in the carbon bed to react with the impregnates. Most of the time a downstream HEPA is installed to catch "fines" generated by

the carbon, and serve as a backup filter.

How long will the carbon be good?

There is no way to give an exact answer to this question. However, there are a couple methods to determine the effectiveness of the carbon:

- First, the air stream can be sampled between the filters to determine if any of the known contaminants are going through the first carbon filter. If they can be detected by any detecting method, the carbon should be changed.
- Second, a sample of the carbon can be taken and subjected to a challenge by the contaminants in a lab to determine efficiency for a specific contaminant.

How can I be sure of getting a good system?

The following design considerations should be addressed when specifying a system.

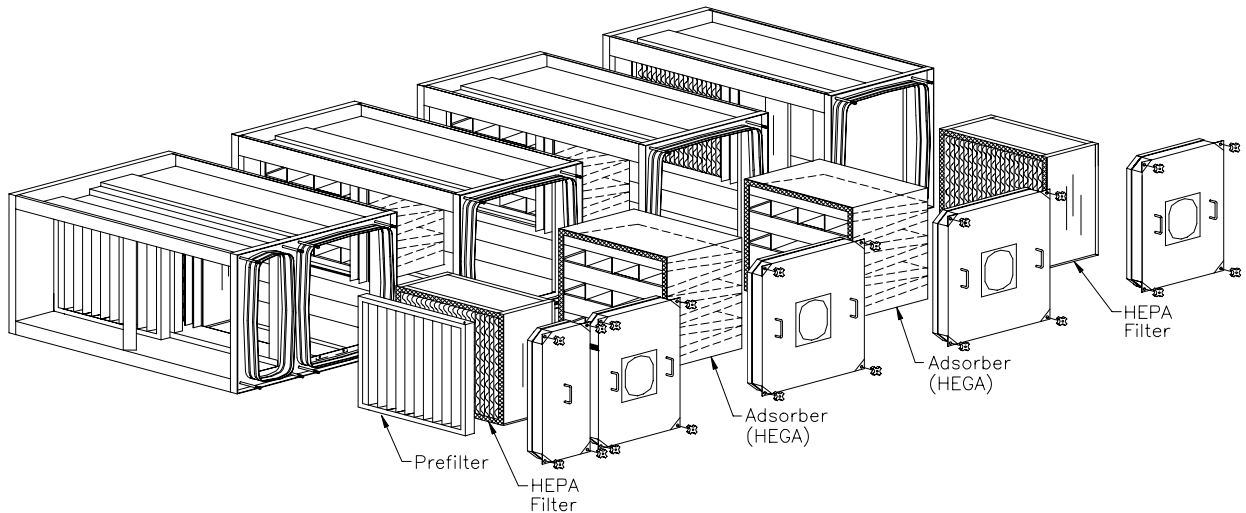
- Closure (i.e. housings) for the filters should be a high quality Bag-In/Bag-Out type that is guaranteed to pass in-place DOP and Freon tests. These housings will protect maintenance personnel and the immediate environs during the changing of contaminated filters.
- The latest information from the US Army indicates that the total residence time for the carbon section of a CBR unit should be 0.30 seconds. This is usually achieved by having two carbon banks in series, each with a residence time of 0.15 seconds.
- The CBR filter system should have filters in the following order: Prefilter/HEPA/Carbon/Carbon/HEPA
- Provisions to allow for in-place testing should be considered.
- Copies of factory leak test reports for the HEPA filters, carbon filters and filter

housings should be supplied to the purchaser.

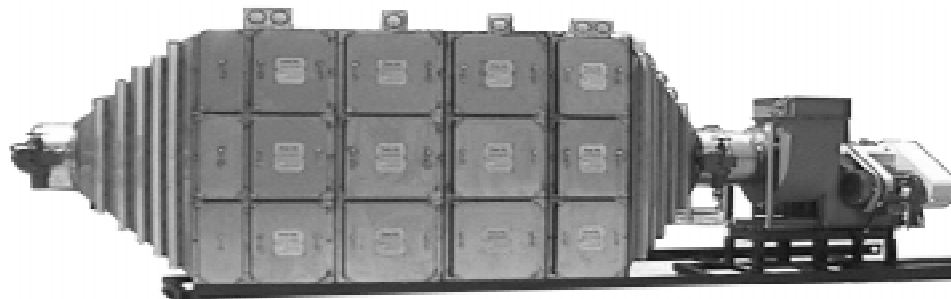
- The carbon filters must:
 1. exhibit a minimum mechanical efficiency of 99.9% (i.e. HEGA type)
 2. have frames constructed of T-304 stainless steel — or plastic, if disposal by incineration is desired
 3. be properly filled with whetlerite-type ASC 12 x 30 mesh carbon that meets the requirements of MIL-C-13724C, as amended October 13, 1976.
 4. not weigh over 200 pounds each
- The CBR filtration system design should have provisions for pulling samples of air or carbon for laboratory analysis — to assist in determining when carbon adsorbers need changing.
- The CBR filtration system should be in-place DOP and Freon tested in accordance with ANSI/ASME N510-1980, when field installation is complete. The HEPA filters, adsorbers and housings are factory tested before shipping. The in-place test assures that these components are functioning properly after being integrated into a complete filtration system.

Note: An in-place test housing is usually required between the banks of carbon in order to properly perform these tests. Flanders/CSC can provide the in-place test housing when it is required.
- Provisions for the in-place testing must be made during the design stage.
- The CBR filtration system should be manufactured under a quality assurance program that addresses the requirements of ANSI N45.2 **Quality Assurance Program Requirements for Nuclear Power Plants.**

Filter Arrangement of a Typical CBR Filtration System



Filter Arrangement of a Typical CBR Filtration System

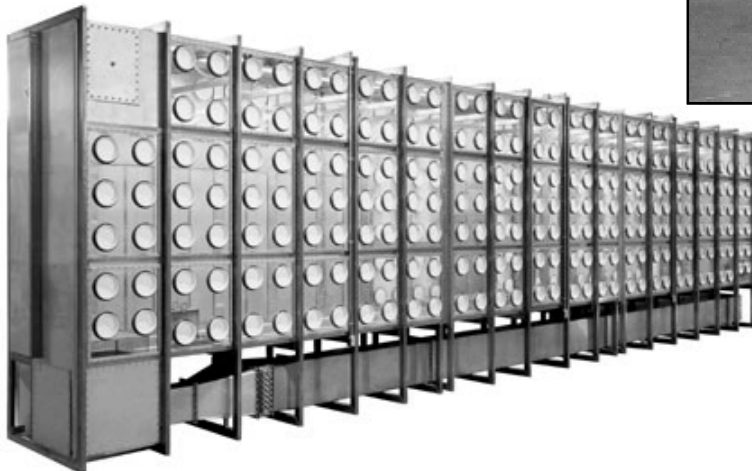


Self-Contained, 9000 CFM, BF-Series, Bag-In/Bag-Out filter train to contain Prefilters, 1st stage HEPA, 1st stage Carbon, 2nd stage Carbon and 2nd stage HEPA filters. This system includes lifting lugs, weathercaps, test ports, Magnehelic gages, inlet and outlet transitions, inlet and outlet bubble tight isolation dampers with electric actuators, electrical switchgear and a complete fan/motor assembly.

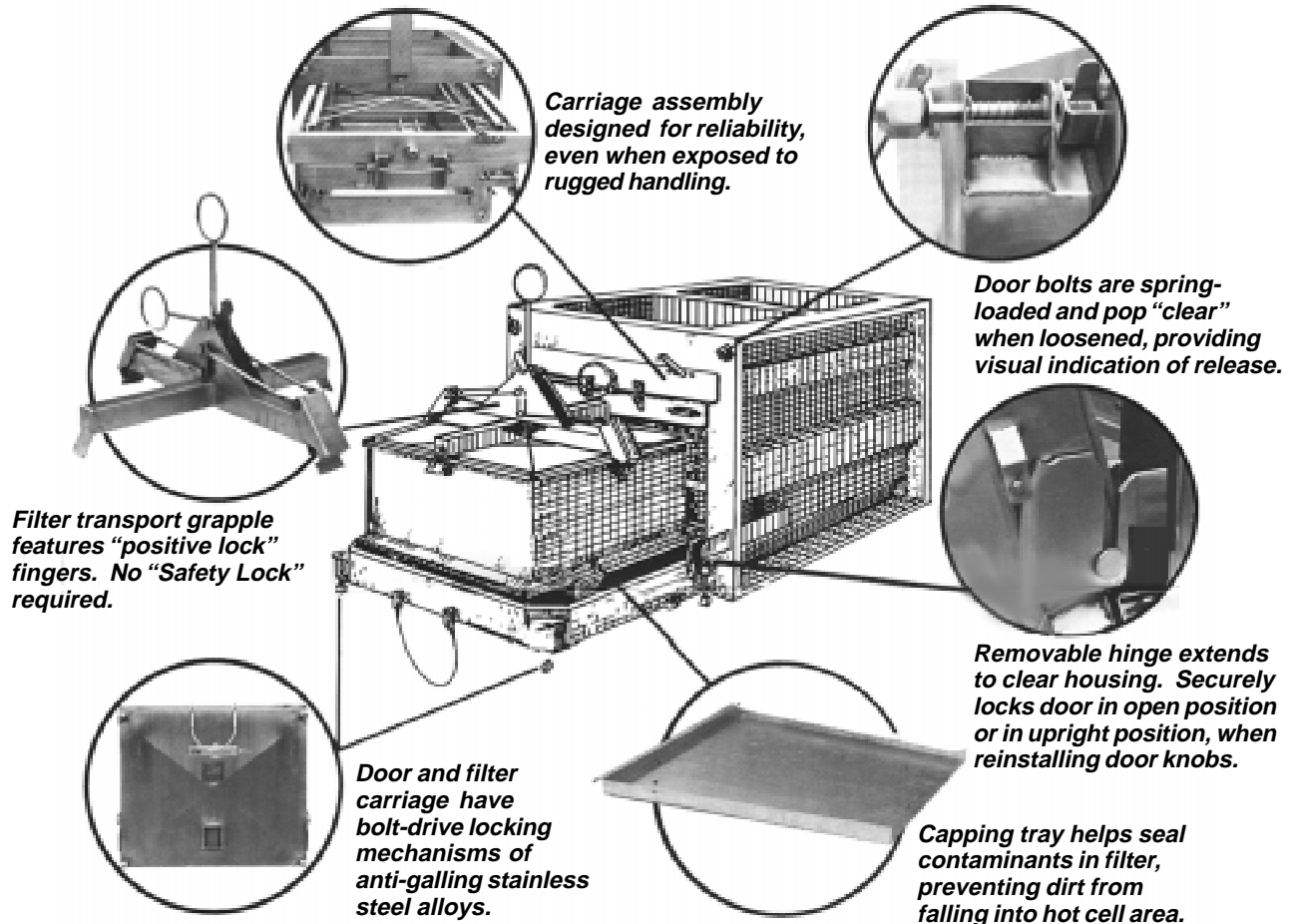
Custom Engineered Systems: *Gloveboxes*



For the United States Department of Energy, these custom engineered gloveboxes for hazardous material handling, included cooling arrangement, airlocks, transportation devices, and over pressure systems. The unit also includes an air hood, lifting lugs, external lighting with access panels and penetration plates. Laminated safety glass and glove ports were installed on both sides to facilitate work within the glovebox from either side. This system was too large to ship as one unit and had to be constructed in two (2) sections, assembled and tested at the factory, then shipped to the end user, reassembled, retested and certified at the jobsite.



Advanced “Hot Cell” Design Can Reduce Costs, Simplify Maintenance Procedures and Improve Compatibility with Robots



Minimize Filter Costs and Worker Exposure

The ROH-1 is a remotely operated up-flow filter housing specifically designed for “hot cell” applications. Utilizing HEPA filters, it operates as a prefilter, removing the bulk of toxic radiation from the air flow and greatly reducing change-out frequency requirements of downstream Bag-In/Bag-Out filter banks. Filter maintenance costs are lowered and the possibility of worker exposure is minimized.

Simplify Maintenance Procedures

“Fail-safe” engineered to simplify filter change-out and assembly/disassembly procedures, the ROH-1 works efficiently with either PAR or Master/slave manipulators and can “recover” from common operator error without damage. All parts are replaceable, making it possible to totally rebuild the housing within the hot cell.

Special design considerations allow for limitations of the PAR manipulator, including the replacement of rigidly attached handles with flexible “wire rope” handles. Wire ropes offer a spring action to protect parts against sudden jolts. Since PAR manipulators do not offer feedback to operators, the flexible wire handles allow “play” and give a visual indication of improper loading, which the operator can then correct.

Built for “Hot Cell” Quality

The ROH-1 has been designed and constructed for one purpose: use in hot cell applications. It features all stainless steel construction, highest quality workmanship, and testability. (ANSI 509 and 510)

Flanders/CSC welcomes the opportunity to bid on your next filtration project. We will custom fabricate to meet your special requirements.

Model TB - 1000 SC and Model TB - 500 SC

There has been a tremendous increase in the incidence of tuberculosis in the United States. Because much of the transmission can be attributed to the close proximity between patient and hospital staff, the Centers for Disease Control (CDC) have issued guidelines [Morbidity and Mortality Weekly Report (CDC) Oct. 28, 1994] for ventilation of isolation rooms and intensive care units (ICUs). The guidelines recommend that isolation rooms and ICUs have at least six air changes per hour and that both be maintained under negative pressure.

Isolation room air should be exhausted to the outdoors in a way that minimizes any possible exposure to the public. To safely exhaust the air, it should first be properly filtered.

Air in ICUs may be recirculated after it has been passed through a properly designed and maintained HEPA filter system.

The guidelines also provide procedures for the safe removal and disposal of the contaminated HEPA filters to prevent further infection.

The proper means of providing ventilation for the isolation rooms and ICUs is to furnish a dedicated filtration system for each room.

Flanders/CSC's self-contained TB systems are designed to address the CDC's guidelines by providing small, high-efficiency filtration systems that provide for the safe change-out of filters by using bag-in/bag-out housings.

The Flanders/CSC TB systems are perfectly suited for removal of the infectious airborne particles including multidrug-resistant (MDR) organisms and other viral and bacterial pathogens.

Typical Applications

- hospital isolation suites
- asbestos abatement
- localized clean-air supply
- exhaust of dirty air from contaminated or hazardous areas and processes
- operating rooms
- autopsy rooms
- laboratories
- emergency medical services
- hospices
- correctional facilities
- long-term care facilities
- home health care settings
- dental settings
- medical offices



***BG-Series, Gasket Seal TB Unit
with prefilter behind door with primary filter***



***BF-Series, Gel Seal TB Unit
with optional separate prefilter access door***

Analytical Process Isolator



This unit is a PTH (Potent Toxic, Hazardous) Hardwall Isolator. This isolator is used for laboratory prep and analysis in a pharmaceutical environment. It utilizes a PLC, allowing safe and reliable control of the various features on this unit and reducing the need for stringent SOPs. This unit features a nitrogen purge and oxygen analyzer. It has an automatic wash-out airlock for easy washdown, a hydraulic lift for easy adjustable height and a window hatch for easy removal of equipment from inside the isolator.

Potent, Toxic, Hazardous Isolator

This unit is a PTH (Potent, Toxic, Hazardous) Isolator constructed of 316L stainless steel. The isolator base is constructed of 304 stainless steel. The purpose of this isolator is to provide containment and is a self-contained glovebox system to be used in the GMP manufacture of a licensed biological product. It is PLC controlled and utilizes temperature and humidity monitoring. This system has magnetic stirrers welded in the bottom of the isolator. It has a bolt-on airlock and a product airlock for introducing items into the isolator.



Assembly Line Isolator

Each of these isolator units almost forms a laboratory “assembly line.” These chambers house many different pieces of laboratory equipment, i.e. stirrers, micro balances, printers, hardness testers, chillers, pumps, etc. It utilizes a PLC, allowing safe and reliable control of the various features on this unit and reducing the need for stringent SOPs. 316L stainless steel construction, No 4 finish, laminated safety glass, integration to customer’s equipment and complete integration to their (in-house) computer system, air-tight cabinets with separate ventilation system, fabricated sink, fabricated oven and a carousel with washdown (three vertical doors).



Security Test Isolator

Unit offers state-of-the-art technology designed to remedy problems associated with VHP as a biodecontamination agent. Features include automatic operation of VHP cycles, elimination of transfer isolators, aeration cycle of less than 70 minutes, rotary carousels for storing samples, media testing, 316L stainless steel construction, No. 4 finish, lift-up window to remove samples from the isolator and a biodecontamination chamber for introducing material during operation.



