

# gb housing

## Gasket Seal Bag-In/Bag-Out Air Filter Housing



1400 pounds of gasket-sealing integrity to ensure complete capture of airborne contaminants



The highest level of personnel protection.

Camfil Farr GB Series Housings are designed for use in critical processes where hazardous airborne materials must be prevented from escaping to the atmosphere. Air filters may be replaced using a control barrier to protect change-out personnel from contaminants within the housing or contaminants captured by the filters.

The Camfil Farr GB Housing minimizes exposure to harmful contaminants during filter service through the use of a PVC bag enclosure system. The entire filter changing process isolates personnel from the hazardous materials.

Although the Camfil Farr GB Housing is available in a basic configuration various options specific to the application are available.

These housings are typically used in facilities that incorporate hazardous materials in their processes. These contaminants may include biomedical, radiological, carcinogenic or other materials of concern. Some specific applications include:

- Chemical manufacturing facilities
- Food processing
- Genetic research and biotechnology facilities
- Hospital Isolation Suites to prevent the spread of infectious diseases
- Industrial processes exhaust
- Microelectronic and semiconductor facilities
- Nuclear power plants
- Pharmaceutical facilities
- Radioisotope handling facilities
- University research laboratories
- US Department of Energy Facilities
- Veterinary research and animal disease laboratories
- Specific United States Government facilities including military and the Department of State.



|                                 |                  |
|---------------------------------|------------------|
| Camfil Farr                     | Product bulletin |
| GB Housing                      | 3402 – 0606      |
| Camfil Farr—clean air solutions |                  |

# Containment Train Components

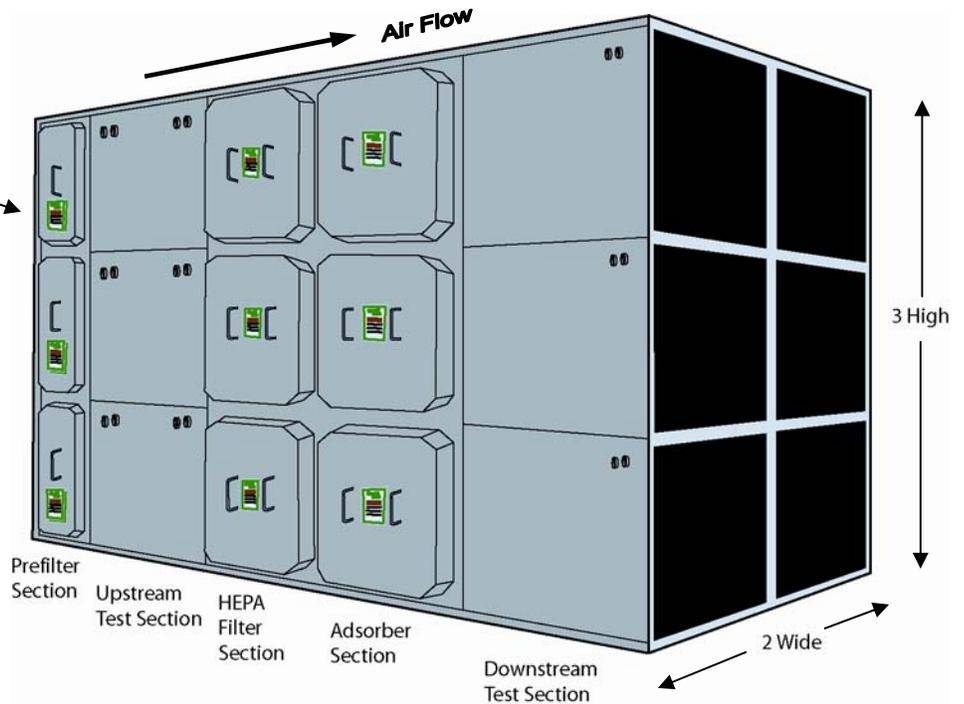
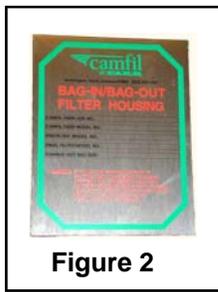


Figure 1

Camfil Farr GB Housings are available in configurations from  $\frac{1}{2} \times \frac{1}{2}$  (that include the installation of one filter 12" by 12" size) to configurations that are 1 x 3 that allow the service of up to three 24" by 24" filters from a single service door.

Units may be stacked or connected in series dependent upon the airflow requirements and contaminants of concern. The housing in Figure 1 shows a stacked unit that is 3 filters high by 2 filters wide and includes 3 stages of air filtration. Personnel in critical applications need an extra level of protection during filter service and maintenance. In many cases containment measures are required by Federal or State mandates or by recommended practices by other cognizant authorities. The details of each enclosure are clearly identified on a stainless steel label (Figure 2). The following components assure compliance with these mandates.

## Prefiltration

Camfil Farr GB Housings can incorporate a prefilter track to extend the life of the primary filters. Tracks may accommodate 2", 4", or 6" deep prefilters. Access to prefiltration may be through the same door as the final filter without disturbing final filter integrity. A separate door may also be provided for prefilter access only. Prefiltration efficiency typically ranges from a MERV 7 to a MERV 14 when evaluated under *ASHRAE Filter Testing Standard 52.2-1999*.

## Particulate Filters

Typically the primary filter in a containment system is a high efficiency particulate arrestor (HEPA). Camfil Farr HEPA filters are manufactured under strict quality control guidelines. Every filter is tested to ensure that the particulate efficiency meets or exceeds the requirements of the application. Particulate filters are available from 99.97% on particles 0.3 micron in size to 99.9995% on particles 0.12 micron in size. All Camfil Farr HEPA filters include a unique poured-in-place seamless gasket for superior filter sealing integrity. Conventional closed-cell neoprene gaskets are also available.

## Molecular Filtration

Hazardous gases may be removed from the airstream through the application of various configurations of adsorbers. Adsorbers should be selected for their affinity to the hazardous gas contaminant of concern or combination of gases involved. In some cases multiple stages of adsorbers should be applied, and in all cases adsorbers should be prefiltered. An additional stage of prefiltration may be required downstream of the adsorber to capture any particulate that may be generated by the adsorber. Consult Camfil Farr Bulletin 3431.

## Test Sections

Most installations will require an in-place filter efficiency evaluation to ensure that the system is performing to specifications. Applications that should incorporate test sections include any system where access to upstream and downstream ductwork may be restricted. In-place test sections minimize system train distance requirements that are typical for proper mixing of challenge aerosol. In most cases the entire bank of air filters is evaluated for overall efficiency. Scan test sections are also available that allow individual filter scanning for leaks. Consult Camfil Bulletin 3407.

## CBR Systems (Special)

A CBR system is a single filter system designed to control chemical, biological and radiological contaminants that may be generated by wartime, terrorist or industrial accident. The system usually includes prefiltration, gaseous adsorbers and post filters for particulate removal in one certified leak free module. Contact factory for assistance with CBR units.

## Standard Component Construction

### 8-Mil Change-out Bag

Each Camfil Farr Housing includes a translucent poly vinyl chloride bag mounted behind each access door. Standard bags include three glove sleeves to facilitate handling of the filter (s) and an elastic shock cord to seal internal components from the atmosphere during a change. Bag replacement data is engraved on the label of each housing as well as identified with a label on the shock cord supplied with the bag. Consult Camfil Bulletin 3410.



### Stainless Steel Construction

Camfil Farr GB Housings are completely factory assembled and constructed of 304 stainless steel sheet metal. There are no painted surfaces, nor cross-contamination from the use of carbon/mild steel materials. Each housing is warranted to withstand 15" w.g. positive or negative pressure without failure of the housing to ambient air seal or compromise of the overall housing integrity. Each housing is tested to this level and test reports are available on request. Camfil Farr has the ability to custom design housing integrity to most operating conditions.

## Access Door (s)

Access doors, of the same construction materials as the housing, include a built-in bagging ring cavity to store the filter change bag during system operation. Each access door includes a high-memory silicone gasket that recreates a positive housing to ambient seal after each filter change. Convenient permanent door handles are optimally placed so the doors have a natural balance during filter change.



## Removable Star-Style Door Knobs

Each door is secured through the use of four threaded studs with removable star knobs. After filter change the knobs are tightened in an alternating pattern to ensure an even and secure housing seal.



## Dual Ribbed Bagging Rings

Each filter access port includes a ribbed bagging ring assembly for attachment of an 8-mil



changing bag of poly vinyl chloride (PVC) construction. Two ribs are included as required to facilitate the filter changing process. The bagging ring is continuously welded and hemmed to prevent damage to the bag.

## Filter-Sealing Assembly

Camfil Farr GB Housings incorporate a linkage clamping mechanism that may be operated with a standard wrench from outside of the housing.



Filter seal adjustment is accomplished by a clearly identified hexagonal cranking bolt. Up to 1400 pounds of filter seal may be applied. Leak paths from the mechanism's penetration of the housing wall are eliminated through the use of a gasketed bolt-seal cover.



## Optional Components

(see last page for standard specifications on these items)

### Banding Kit

The Camfil Farr Banding Kit includes a case/lap apron, a heavy duty tie-banding gun, PVC bag cutting shears, a 7" Velcro cinching strap and ten 100-lb tensile strength banding ties. The kit offers assurance that all required change components are readily available in one convenient package. Consult Camfil Bulletin 3410.



### Construction Materials

Alternate materials of construction are available. As an example, the unit locking mechanism is available with all stainless steel components. Please consult the factory if your application requires non-listed components of construction.

### Dampers

Dampers allow isolation of components during filter change or decontamination processes. Camfil Farr manufacturers low-leakage and bubble-tight designs. Consult Camfil Bulletins 3440.



### Decontamination Ports



Camfil Farr can provide decontamination ports for the injection of materials designed to force neutralization of contaminants. This photo shows plug sitting on top of the port assembly. Plug type is ring-seal positive.

### DOP/Freon Test Ports

To facilitate in-place filter evaluation Camfil Farr can supply integral tests ports for the sampling of the challenge aerosol. Commonly referred to as DOP/Freon test ports, they are also applicable to today's modern technology of alternate test challenges.

### Drilled Flanges

Camfil Farr can provide pre-drilled duct connection flanges. Holes are typically 7/16" in diameter with spacing not to exceed 4" (per DOE-HDBK-1169-2003 "Nuclear Air Cleaning Handbook"). For a bolt hole drawing of your housing model please consult factory .

### Filter Change-out Tray

A filter change-out tray provides support for the filters during the service process. Connecting conveniently to the door latches it can support filters and bagging components up to 300-lbs. Filter change-out trays are highly recommended for housing applications where ladders may be required for service or housings are in a difficult-to-reach location, or where heavy carbon adsorbers may be applied. Consult Camfil Bulletin 3410.

### Lifting Lugs

Camfil Farr can provide lifting lugs for unit transport and support during installation. The lugs are of 1/4" thick 304 stainless steel and have a pre-drilled 1-1/2" hole. Common lifting lug locations include the top or side of the housing.



### Plenums & Transitions

Camfil Farr can manufacture all components required for complete system integrity. Matching plenums of the same construction as the housing are available to mate with existing equipment or ductwork. Transitions are also available to mate to equipment offsets.

### Prefilter Housings

Camfil Farr can provide housings with integral prefilter sections for application of 2", 4", or 6" deep prefilters. Various prefilter configurations are available. Camfil Farr can provide most of the filtration components that may be required. Consult Camfil Farr Bulletin 3403 for prefilter section information.



## Pressure Gages

Camfil Farr can provide factory-mounted differential pressure gages to evaluate resistance across individual filters or any combination of internal components. Gage connections include copper tubing and brass fittings. Stainless steel tubing and fittings are also available.

## Pressure Taps (static)

Static pressure taps are available to facilitate the connection of gages or other ancillary equipment. For on-site application of gages, taps include a removable brass plug.

## Security & Cinching Straps

Replacement straps are available. Consult Camfil Bulletin 3410

## Swivel Door Latches

Camfil Farr housings are available with swivel door latches to allow the latches to swing away from the filter change opening. Door latch components are captive as a precaution against dropping or losing them. Swivel door latches are highly recommended for housing applications where ladders may be required for service, or housings that are in a difficult-to-reach location.

## Test Sections (in-place)

Test sections allow evaluation of filters without the on-site inline space penalties associated with the proper mixing of aerosol challenges. Standard tests sections allow evaluation of an entire bank of filters. Scan test sections allow

evaluation of individual filters to ensure that an individual filter does not have any leaks. All testing is accomplished without exposing the service personnel to contaminants contained by the housing. Consult Camfil Farr Bulletin 3407-0902 for standard test sections and scan test sections.



## Weather Caps

Although Camfil Farr housings are weatherproof, an optional weather cap of the same construction materials as the housing, may be included to prevent water accumulation on the top of the housing. Standard weather caps are

attached and sealed against weather intrusion. If pre-drilled flanges are required the weather cap is bolted to the housing to allow access to mounting flanges.

## Additional Options

(require factory consultation)

## Casters

Camfil Farr Safety & Protection Housings may be mobilized with casters to allow use of the units in alternate locations.

## Certified Weld Inspection (CWI)

Visual weld inspection can be performed by a certified weld inspector qualified to Section 6.1 of the *American Welding Society Standards For Qualification and Certification of Welding Inspections, QC1-96*. The inspections will be performed under the guidelines of *AWS D9.1M/ D9.1:2000*.

## Flanges

Quarter-inch thick stainless steel plate flanges are available. The flanges can be furnished with 7/16" diameter holes no more than 4" on center as recommended in *DOE-HDBK-1169-2003 "Nuclear Air Cleaning Handbook"*, or to mate-up with standard pipe flange bolt hole patterns. Standard raised-face, slip-on, stainless steel flanges per ASA B16.5 are also available.

## Deformation Testing

Non-destructive deformation testing is available. This test confirms systems will not deform at higher pressures.

## Dye Penetrate Testing

Dye penetrate testing is available to evaluate for weld defects.

## Electric Heaters

Electric heaters with pre-wired connection boxes are available.

## High/Low Pressure Options

Camfil Farr can assemble components to meet the pressure requirements of most applications.

## High-Temperature Construction

Camfil Farr housings are available with construction components that can accommodate process air to 450° F (232° C).

## Humidifiers

Humidifiers are available to meet specific application needs.

## Insulation

Housings may be insulated. All insulation incorporates double-wall housing construction.

## Low Leak Testing

Low-leak testing to lower than standard leak rates is available.

## Metal Door Pocket

A metal door pocket to store Operations & Maintenance Manual (O & M) during system operation is available.

## Moisture Removal Drains & Valves

Moisture removal drains and valves are available. These are typically applied in installations that have concerns with regard to condensation, or if moisture separators are used in the system.

## Moisture Separators

Moisture separators applied as prefiltration are available. Camfil Farr Moisture Separators have an efficiency of 98% on 5-micron size droplets. Other variations of moisture separators are available (consult factory).

## Mounting Bases

Custom mounting bases are available. These are applied for seismic security or to match a roof curb.

## Mounted Fans/Controls

Camfil Farr will assemble complete trains of containment that can include particulate filtration, gaseous filtration and ancillary components such as fans and controls.

## Seismic Qualification

Camfil Farr GB Housings can be qualified in accordance with the criteria of the *Uniform Building Code* (1994 & 1997). Multiple module systems consisting of filter housings, test sections, dampers, etc. can be qualified per application to meet most levels of severe seismic requirements. Additional information to provide assurance of seismic qualification requires factory consultation.

## The Complete System

Camfil Farr manufactures all of the components that may be required in a containment train of housings. From the filter, to the bag, to the dampers that isolate the system, quality is assured through unparalleled component compatibility. Performance and protection from one source, Camfil Farr, a worldwide leader in air filtration technology and production.

## Quality Assurance

*Any Industry that has processes of concern that may include possibly hazardous exhaust components (gases and/or particulates) has a vested interest in the well-being, and health and safety of employees or others that may have proximity to the process. Additionally, cognizant authorities including the United States Government, State bodies and engineering societies have defined minimum standards of care with respect to many hazardous containment applications. At the bare minimum, equipment assembled for these processes must be manufactured to exacting quality control procedures.*

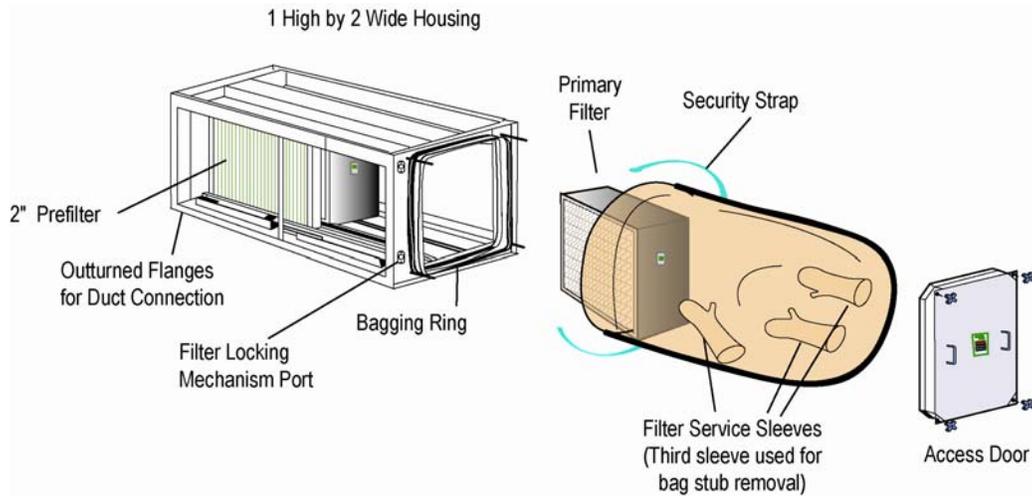
*Camfil Farr has in place, various quality control initiatives that ensure that our products meet or exceed these standards. These programs are inclusive of raw materials acquisition, procedures of transport and storage, preparation and assembly of these materials to a final product form, and the testing and qualification to ensure the finished product meets or exceeds the letter of the Standards.*

*Camfil Farr Safety and Protection product facilities have been audited by various entities and found to be acceptable. These procedures are part of a living doctrine that is updated based upon improved technologies and the increased needs of the applications. Camfil Farr containment products are manufactured under a Camfil Farr Quality Assurance program, including the basic requirements of ASME-NQA-1 when specified.*

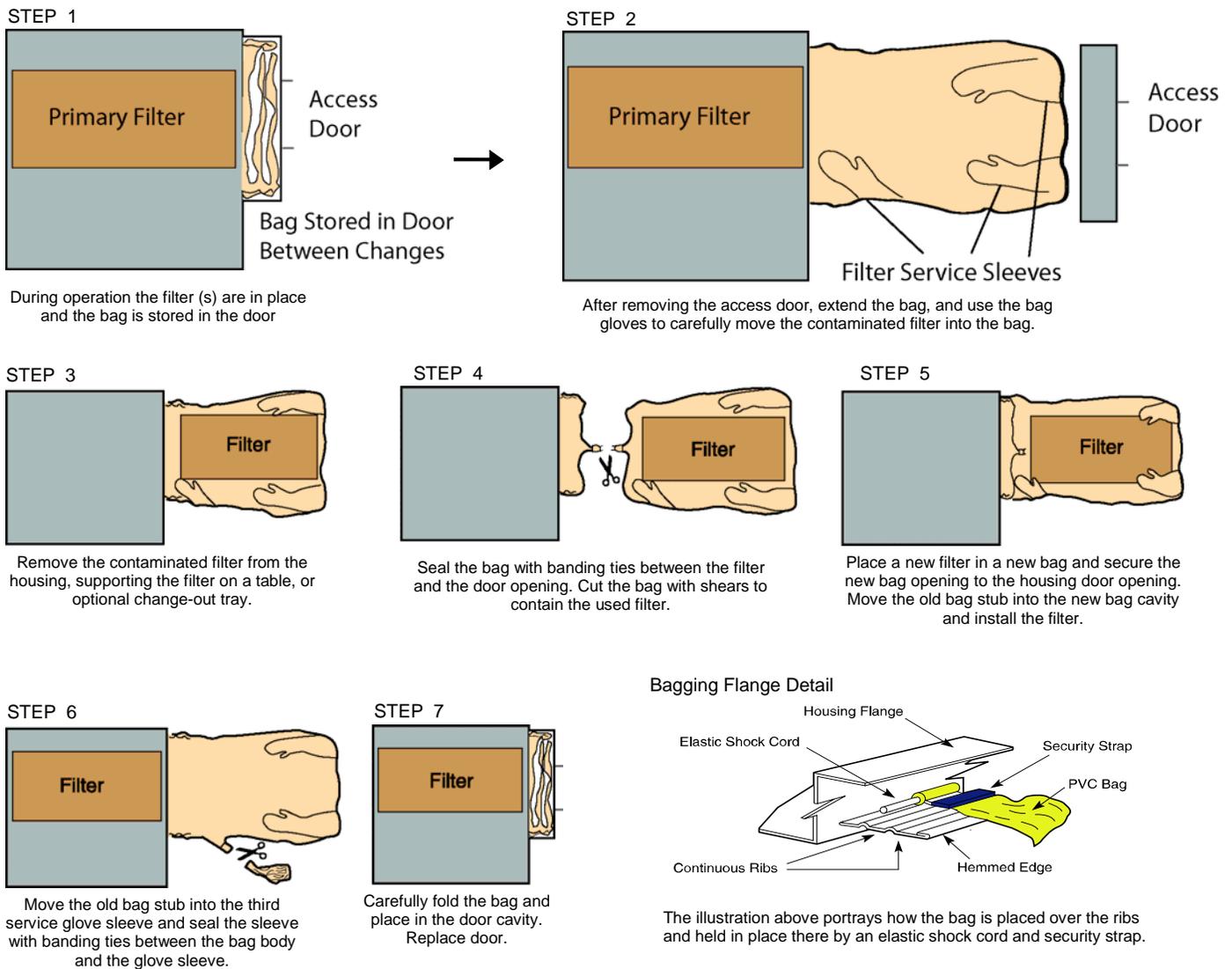
*Camfil Farr Absolute filters and ASHRAE grade filters that may be used in containment applications are manufactured in ISO 9001:2000 facilities. Camfil Farr Nuclear Grade Absolute filters complying with the requirements of Section FC of ASME AG-1 are manufactured under an ASME NQA-1 Quality Assurance Program.*

*Additional quality assurance procedures are in place to meet the needs of specific end users. These procedures are available for review and modification by end users, our authorized representatives, and Camfil Farr.*

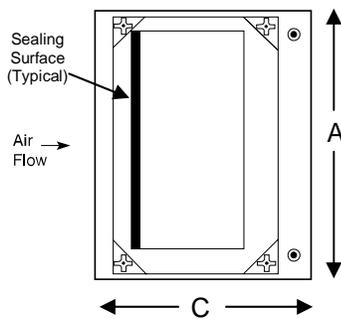
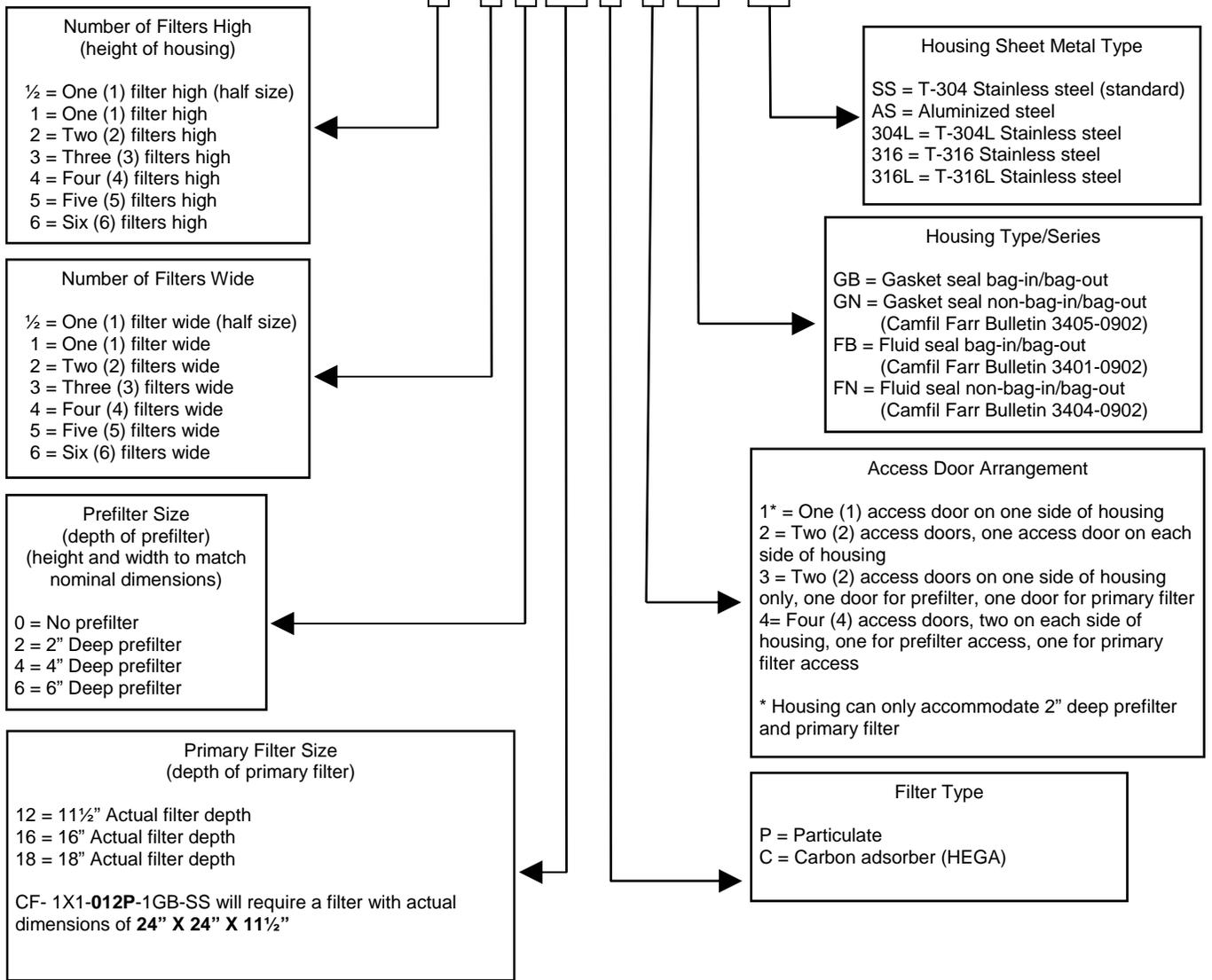
# Bag-In/Bag-Out Concept



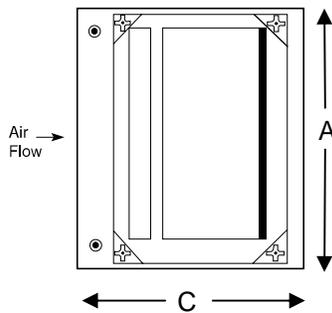
Camfil Farr GB Housings are designed with safety in mind. Each housing is shipped with an instruction book detailing how to change the filters. The basics of filter change include installing the new filters in the change-out bag, securing the bag over the ribbed openings on the housing door opening, and performing the filter change entirely within the bag.



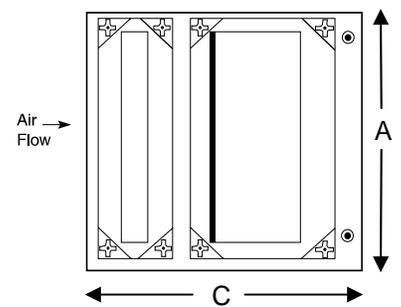
# CF-3X3-412 P-3GB-SS



Typical door arrangement 1 with a single primary filter. Designed to accommodate primary filter (s) through one door opening. Actual primary filter depth may be 11½", 16" or 18".



Typical door arrangement 1 with prefilter and primary filter. Designed to accommodate prefilter (s) and primary filter (s) through one door opening. Prefilter depth limited to 2". Primary filter depth may be 11½", 16" or 18".



Typical door arrangement 3 with dual access doors. Designed to accommodate prefilter (s) and primary filter (s) through separate access doors. Prefilter depth may be 2", 4", or 6". Primary filter depth may be 11½", 16" or 18".

Housing Dimensions    A = Height    B = Width    C = Depth

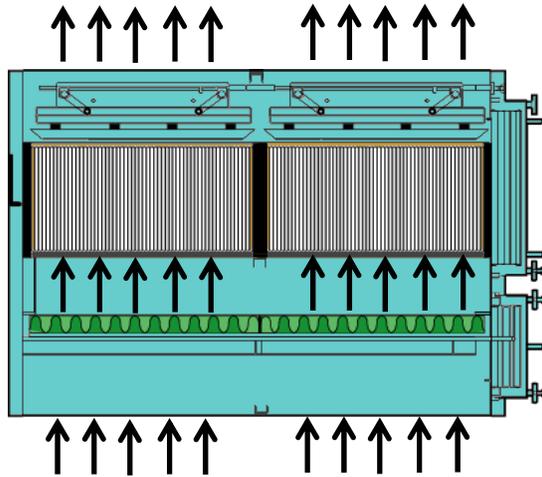
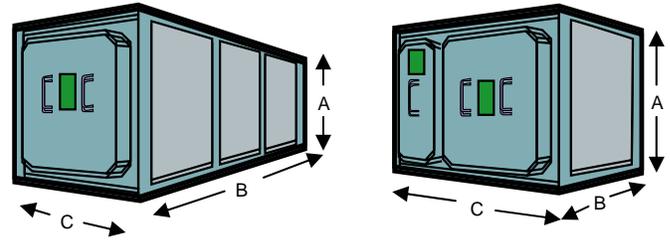
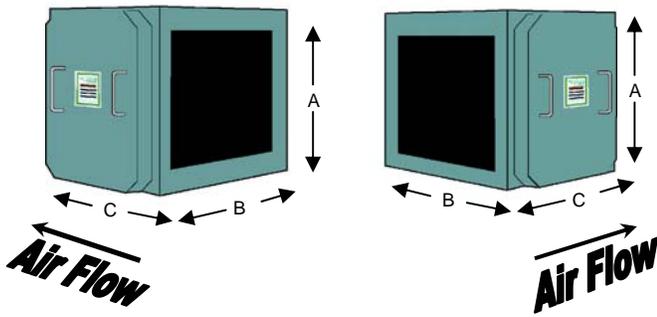
Above arrangements show upstream, downstream and upstream primary filter seals respectively. Arrangements 1 and 3 are also available with downstream primary filter seal when in-place scan testing is required.

Left Hand Access

Right Hand Access

1 high by 3 wide

1 high by 1 wide with prefilter section.



Camfil Farr housings feature smooth surface construction. Pocket areas, that would allow contaminant build-up are minimized. All pressure retaining joints on the interior of the housing are continuously welded.

Housing Size/Configuration Chart - 012-1GB

| Housing Size (H x W) | Prefilter Depth (inches) | Primary Filter Depth (inches) | Door Arrangement | Dimension A (inches) | Dimension B (inches) | Dimension C (inches) | Shipping Weight (lbs) |
|----------------------|--------------------------|-------------------------------|------------------|----------------------|----------------------|----------------------|-----------------------|
| ½ x ½                | N/A                      | 12                            | 1                | 18                   | 15                   | 26                   | 135                   |
| ½ x 1                | N/A                      | 12                            | 1                | 18                   | 27                   | 26                   | 175                   |
| 1 x 1                | N/A                      | 12                            | 1                | 30                   | 27                   | 26                   | 210                   |
| 1 x 2                | N/A                      | 12                            | 1                | 30                   | 51                   | 26                   | 320                   |
| 1 x 3                | N/A                      | 12                            | 1                | 30                   | 75                   | 26                   | 425                   |
| 2 x 1                | N/A                      | 12                            | 1                | 60                   | 27                   | 26                   | 375                   |
| 2 x 2                | N/A                      | 12                            | 1                | 60                   | 51                   | 26                   | 570                   |
| 2 x 3                | N/A                      | 12                            | 1                | 60                   | 75                   | 26                   | 745                   |
| 3 x 1                | N/A                      | 12                            | 1                | 90                   | 27                   | 26                   | 540                   |
| 3 x 2                | N/A                      | 12                            | 1                | 90                   | 51                   | 26                   | 815                   |
| 3 x 3                | N/A                      | 12                            | 1                | 90                   | 75                   | 26                   | 1070                  |
| 4 x 1                | N/A                      | 12                            | 1                | 120                  | 27                   | 26                   | 700                   |
| 4 x 2                | N/A                      | 12                            | 1                | 120                  | 51                   | 26                   | 1060                  |
| 4 x 3                | N/A                      | 12                            | 1                | 120                  | 75                   | 26                   | 1390                  |

Housing Size/Configuration Chart - 016-1GB

| Housing Size (H x W) | Prefilter Depth (inches) | Primary Filter Depth (inches) | Door Arrangement | Dimension A (inches) | Dimension B (inches) | Dimension C (inches) | Shipping Weight (lbs) |
|----------------------|--------------------------|-------------------------------|------------------|----------------------|----------------------|----------------------|-----------------------|
| ½ x ½                | N/A                      | 16                            | 1                | 18                   | 15                   | 30                   | 145                   |
| ½ x 1                | N/A                      | 16                            | 1                | 18                   | 27                   | 30                   | 195                   |
| 1 x 1                | N/A                      | 16                            | 1                | 30                   | 27                   | 30                   | 230                   |
| 1 x 2                | N/A                      | 16                            | 1                | 30                   | 51                   | 30                   | 345                   |
| 1 x 3                | N/A                      | 16                            | 1                | 30                   | 75                   | 30                   | 460                   |
| 2 x 1                | N/A                      | 16                            | 1                | 60                   | 27                   | 30                   | 410                   |
| 2 x 2                | N/A                      | 16                            | 1                | 60                   | 51                   | 30                   | 615                   |
| 2 x 3                | N/A                      | 16                            | 1                | 60                   | 75                   | 30                   | 805                   |
| 3 x 1                | N/A                      | 16                            | 1                | 90                   | 27                   | 30                   | 590                   |
| 3 x 2                | N/A                      | 16                            | 1                | 90                   | 51                   | 30                   | 880                   |
| 3 x 3                | N/A                      | 16                            | 1                | 90                   | 75                   | 30                   | 1150                  |
| 4 x 1                | N/A                      | 16                            | 1                | 120                  | 27                   | 30                   | 765                   |
| 4 x 2                | N/A                      | 16                            | 1                | 120                  | 51                   | 30                   | 1145                  |
| 4 x 3                | N/A                      | 16                            | 1                | 120                  | 75                   | 30                   | 1497                  |

Housing Size/Configuration Chart - 018-1GB

| Housing Size (H x W) | Prefilter Depth (inches) | Primary Filter Depth (inches) | Door Arrangement | Dimension A (inches) | Dimension B (inches) | Dimension C (inches) | Shipping Weight (lbs) |
|----------------------|--------------------------|-------------------------------|------------------|----------------------|----------------------|----------------------|-----------------------|
| ½ x ½                | N/A                      | 18                            | 1                | 18                   | 15                   | 33                   | 155                   |
| ½ x 1                | N/A                      | 18                            | 1                | 18                   | 27                   | 33                   | 205                   |
| 1 x 1                | N/A                      | 18                            | 1                | 30                   | 27                   | 33                   | 245                   |
| 1 x 2                | N/A                      | 18                            | 1                | 30                   | 51                   | 33                   | 370                   |
| 1 x 3                | N/A                      | 18                            | 1                | 30                   | 75                   | 33                   | 485                   |
| 2 x 1                | N/A                      | 18                            | 1                | 60                   | 27                   | 33                   | 435                   |
| 2 x 2                | N/A                      | 18                            | 1                | 60                   | 51                   | 33                   | 645                   |
| 2 x 3                | N/A                      | 18                            | 1                | 60                   | 75                   | 33                   | 850                   |
| 3 x 1                | N/A                      | 18                            | 1                | 90                   | 27                   | 33                   | 625                   |
| 3 x 2                | N/A                      | 18                            | 1                | 90                   | 51                   | 33                   | 930                   |
| 3 x 3                | N/A                      | 18                            | 1                | 90                   | 75                   | 33                   | 1210                  |
| 4 x 1                | N/A                      | 18                            | 1                | 120                  | 27                   | 33                   | 815                   |
| 4 x 2                | N/A                      | 18                            | 1                | 120                  | 51                   | 33                   | 1210                  |
| 4 x 3                | N/A                      | 18                            | 1                | 120                  | 75                   | 33                   | 1575                  |

Continued on next page.

| Housing Size/Configuration Chart - 212-1GB |                          |                               |                  |                      |                      |                      |                       |
|--|--------------------------|-------------------------------|------------------|----------------------|----------------------|----------------------|-----------------------|
| Housing Size (H x W)                       | Prefilter Depth (inches) | Primary Filter Depth (inches) | Door Arrangement | Dimension A (inches) | Dimension B (inches) | Dimension C (inches) | Shipping Weight (lbs) |
| ½ x ½                                      | 2                        | 12                            | 1                | 18                   | 15                   | 26                   | 135                   |
| ½ x 1                                      | 2                        | 12                            | 1                | 18                   | 27                   | 26                   | 175                   |
| 1 x 1                                      | 2                        | 12                            | 1                | 30                   | 27                   | 26                   | 210                   |
| 1 x 2                                      | 2                        | 12                            | 1                | 30                   | 51                   | 26                   | 320                   |
| 1 x 3                                      | 2                        | 12                            | 1                | 30                   | 75                   | 26                   | 425                   |
| 2 x 1                                      | 2                        | 12                            | 1                | 60                   | 27                   | 26                   | 375                   |
| 2 x 2                                      | 2                        | 12                            | 1                | 60                   | 51                   | 26                   | 570                   |
| 2 x 3                                      | 2                        | 12                            | 1                | 60                   | 75                   | 26                   | 745                   |
| 3 x 1                                      | 2                        | 12                            | 1                | 90                   | 27                   | 26                   | 540                   |
| 3 x 2                                      | 2                        | 12                            | 1                | 90                   | 51                   | 26                   | 815                   |
| 3 x 3                                      | 2                        | 12                            | 1                | 90                   | 75                   | 26                   | 1070                  |
| 4 x 1                                      | 2                        | 12                            | 1                | 120                  | 27                   | 26                   | 700                   |
| 4 x 2                                      | 2                        | 12                            | 1                | 120                  | 51                   | 26                   | 1060                  |
| 4 x 3                                      | 2                        | 12                            | 1                | 120                  | 75                   | 26                   | 1390                  |

| Housing Size/Configuration Chart - 216-1GB |                          |                               |                  |                      |                      |                      |                       |
|--|--------------------------|-------------------------------|------------------|----------------------|----------------------|----------------------|-----------------------|
| Housing Size (H x W)                       | Prefilter Depth (inches) | Primary Filter Depth (inches) | Door Arrangement | Dimension A (inches) | Dimension B (inches) | Dimension C (inches) | Shipping Weight (lbs) |
| ½ x ½                                      | 2                        | 16                            | 1                | 18                   | 15                   | 30                   | 145                   |
| ½ x 1                                      | 2                        | 16                            | 1                | 18                   | 27                   | 30                   | 195                   |
| 1 x 1                                      | 2                        | 16                            | 1                | 30                   | 27                   | 30                   | 230                   |
| 1 x 2                                      | 2                        | 16                            | 1                | 30                   | 51                   | 30                   | 345                   |
| 1 x 3                                      | 2                        | 16                            | 1                | 30                   | 75                   | 30                   | 460                   |
| 2 x 1                                      | 2                        | 16                            | 1                | 60                   | 27                   | 30                   | 410                   |
| 2 x 2                                      | 2                        | 16                            | 1                | 60                   | 51                   | 30                   | 615                   |
| 2 x 3                                      | 2                        | 16                            | 1                | 60                   | 75                   | 30                   | 805                   |
| 3 x 1                                      | 2                        | 16                            | 1                | 90                   | 27                   | 30                   | 590                   |
| 3 x 2                                      | 2                        | 16                            | 1                | 90                   | 51                   | 30                   | 880                   |
| 3 x 3                                      | 2                        | 16                            | 1                | 90                   | 75                   | 30                   | 1150                  |
| 4 x 1                                      | 2                        | 16                            | 1                | 120                  | 27                   | 30                   | 765                   |
| 4 x 2                                      | 2                        | 16                            | 1                | 120                  | 51                   | 30                   | 1145                  |
| 4 x 3                                      | 2                        | 16                            | 1                | 120                  | 75                   | 30                   | 1497                  |

| Housing Size/Configuration Chart - 218-1GB |                          |                               |                  |                      |                      |                      |                       |
|--|--------------------------|-------------------------------|------------------|----------------------|----------------------|----------------------|-----------------------|
| Housing Size (H x W)                       | Prefilter Depth (inches) | Primary Filter Depth (inches) | Door Arrangement | Dimension A (inches) | Dimension B (inches) | Dimension C (inches) | Shipping Weight (lbs) |
| ½ x ½                                      | 2                        | 18                            | 1                | 18                   | 15                   | 33                   | 155                   |
| ½ x 1                                      | 2                        | 18                            | 1                | 18                   | 27                   | 33                   | 205                   |
| 1 x 1                                      | 2                        | 18                            | 1                | 30                   | 27                   | 33                   | 245                   |
| 1 x 2                                      | 2                        | 18                            | 1                | 30                   | 51                   | 33                   | 370                   |
| 1 x 3                                      | 2                        | 18                            | 1                | 30                   | 75                   | 33                   | 485                   |
| 2 x 1                                      | 2                        | 18                            | 1                | 60                   | 27                   | 33                   | 435                   |
| 2 x 2                                      | 2                        | 18                            | 1                | 60                   | 51                   | 33                   | 645                   |
| 2 x 3                                      | 2                        | 18                            | 1                | 60                   | 75                   | 33                   | 850                   |
| 3 x 1                                      | 2                        | 18                            | 1                | 90                   | 27                   | 33                   | 625                   |
| 3 x 2                                      | 2                        | 18                            | 1                | 90                   | 51                   | 33                   | 930                   |
| 3 x 3                                      | 2                        | 18                            | 1                | 90                   | 75                   | 33                   | 1210                  |
| 4 x 1                                      | 2                        | 18                            | 1                | 120                  | 27                   | 33                   | 815                   |
| 4 x 2                                      | 2                        | 18                            | 1                | 120                  | 51                   | 33                   | 1210                  |
| 4 x 3                                      | 2                        | 18                            | 1                | 120                  | 75                   | 33                   | 1575                  |

| Housing Size/Configuration Chart - 212-3GB |                          |                               |                  |                      |                      |                      |                       |
|--|--------------------------|-------------------------------|------------------|----------------------|----------------------|----------------------|-----------------------|
| Housing Size (H x W)                       | Prefilter Depth (inches) | Primary Filter Depth (inches) | Door Arrangement | Dimension A (inches) | Dimension B (inches) | Dimension C (inches) | Shipping Weight (lbs) |
| ½ x ½                                      | 2,4,6                    | 12                            | 3                | 18                   | 15                   | 38                   | 190                   |
| ½ x 1                                      | 2,4,6                    | 12                            | 3                | 18                   | 27                   | 38                   | 250                   |
| 1 x 1                                      | 2,4,6                    | 12                            | 3                | 30                   | 27                   | 38                   | 300                   |
| 1 x 2                                      | 2,4,6                    | 12                            | 3                | 30                   | 51                   | 38                   | 450                   |
| 1 x 3                                      | 2,4,6                    | 12                            | 3                | 30                   | 75                   | 38                   | 590                   |
| 2 x 1                                      | 2,4,6                    | 12                            | 3                | 60                   | 27                   | 38                   | 535                   |
| 2 x 2                                      | 2,4,6                    | 12                            | 3                | 60                   | 51                   | 38                   | 800                   |
| 2 x 3                                      | 2,4,6                    | 12                            | 3                | 60                   | 75                   | 38                   | 1045                  |
| 3 x 1                                      | 2,4,6                    | 12                            | 3                | 90                   | 27                   | 38                   | 770                   |
| 3 x 2                                      | 2,4,6                    | 12                            | 3                | 90                   | 51                   | 38                   | 1145                  |
| 3 x 3                                      | 2,4,6                    | 12                            | 3                | 90                   | 75                   | 38                   | 1500                  |
| 4 x 1                                      | 2,4,6                    | 12                            | 3                | 120                  | 27                   | 38                   | 1010                  |
| 4 x 2                                      | 2,4,6                    | 12                            | 3                | 120                  | 51                   | 38                   | 1495                  |
| 4 x 3                                      | 2,4,6                    | 12                            | 3                | 120                  | 75                   | 38                   | 1950                  |

| Housing Size/Configuration Chart - 216-3GB |                          |                               |                  |                      |                      |                      |                       |
|--|--------------------------|-------------------------------|------------------|----------------------|----------------------|----------------------|-----------------------|
| Housing Size (H x W)                       | Prefilter Depth (inches) | Primary Filter Depth (inches) | Door Arrangement | Dimension A (inches) | Dimension B (inches) | Dimension C (inches) | Shipping Weight (lbs) |
| ½ x ½                                      | 2,4,6                    | 16                            | 3                | 18                   | 15                   | 42                   | 200                   |
| ½ x 1                                      | 2,4,6                    | 16                            | 3                | 18                   | 27                   | 42                   | 265                   |
| 1 x 1                                      | 2,4,6                    | 16                            | 3                | 30                   | 27                   | 42                   | 320                   |
| 1 x 2                                      | 2,4,6                    | 16                            | 3                | 30                   | 51                   | 42                   | 480                   |
| 1 x 3                                      | 2,4,6                    | 16                            | 3                | 30                   | 75                   | 42                   | 630                   |
| 2 x 1                                      | 2,4,6                    | 16                            | 3                | 60                   | 27                   | 42                   | 575                   |
| 2 x 2                                      | 2,4,6                    | 16                            | 3                | 60                   | 51                   | 42                   | 850                   |
| 2 x 3                                      | 2,4,6                    | 16                            | 3                | 60                   | 75                   | 42                   | 1110                  |
| 3 x 1                                      | 2,4,6                    | 16                            | 3                | 90                   | 27                   | 42                   | 825                   |
| 3 x 2                                      | 2,4,6                    | 16                            | 3                | 90                   | 51                   | 42                   | 1220                  |
| 3 x 3                                      | 2,4,6                    | 16                            | 3                | 90                   | 75                   | 42                   | 1585                  |
| 4 x 1                                      | 2,4,6                    | 16                            | 3                | 120                  | 27                   | 42                   | 1080                  |
| 4 x 2                                      | 2,4,6                    | 16                            | 3                | 120                  | 51                   | 42                   | 1590                  |
| 4 x 3                                      | 2,4,6                    | 16                            | 3                | 120                  | 75                   | 42                   | 2065                  |

| Housing Size/Configuration Chart - 218-3GB |                          |                               |                  |                      |                      |                      |                       |
|--|--------------------------|-------------------------------|------------------|----------------------|----------------------|----------------------|-----------------------|
| Housing Size (H x W)                       | Prefilter Depth (inches) | Primary Filter Depth (inches) | Door Arrangement | Dimension A (inches) | Dimension B (inches) | Dimension C (inches) | Shipping Weight (lbs) |
| ½ x ½                                      | 2,4,6                    | 18                            | 3                | 18                   | 15                   | 44                   | 210                   |
| ½ x 1                                      | 2,4,6                    | 18                            | 3                | 18                   | 27                   | 44                   | 275                   |
| 1 x 1                                      | 2,4,6                    | 18                            | 3                | 30                   | 27                   | 44                   | 330                   |
| 1 x 2                                      | 2,4,6                    | 18                            | 3                | 30                   | 51                   | 44                   | 495                   |
| 1 x 3                                      | 2,4,6                    | 18                            | 3                | 30                   | 75                   | 44                   | 650                   |
| 2 x 1                                      | 2,4,6                    | 18                            | 3                | 60                   | 27                   | 44                   | 590                   |
| 2 x 2                                      | 2,4,6                    | 18                            | 3                | 60                   | 51                   | 44                   | 870                   |
| 2 x 3                                      | 2,4,6                    | 18                            | 3                | 60                   | 75                   | 44                   | 1140                  |
| 3 x 1                                      | 2,4,6                    | 18                            | 3                | 90                   | 27                   | 44                   | 850                   |
| 3 x 2                                      | 2,4,6                    | 18                            | 3                | 90                   | 51                   | 44                   | 1250                  |
| 3 x 3                                      | 2,4,6                    | 18                            | 3                | 90                   | 75                   | 44                   | 1630                  |
| 4 x 1                                      | 2,4,6                    | 18                            | 3                | 120                  | 27                   | 44                   | 1110                  |
| 4 x 2                                      | 2,4,6                    | 18                            | 3                | 120                  | 51                   | 44                   | 1630                  |
| 4 x 3                                      | 2,4,6                    | 18                            | 3                | 120                  | 75                   | 44                   | 2115                  |

# Standard Specification for Camfil Farr GB Containment Housing

## 1.0 – General

**1.1** - Housing shall be Camfil Farr GB-series side-access bag-in/bag-out, gasket seal housing. The housing shall be adequately reinforced to withstand a negative or positive pressure of 15" water gage. Housing design and filter arrangement shall allow air to enter and exit housing without changing direction. The housing shall accommodate standard size filters that do not require any special attachments or devices to function properly in the housing.

**1.2** – Sizes shall be noted on enclosed drawings or other supporting materials.

## 2.0 – Construction

**2.1** – Housing shall be constructed of 14 gauge and 11 gauge T-304 stainless steel metal. All pressure retaining joints and seams shall be continuously welded with no porosities. Joints and seams requiring intermittent welds, such as reinforcement members, shall be intermittently welded. Housing shall be free of burrs and sharp edges. All weld joints and seams that are a portion of any gasket setting surface, (duct connection flanges and filter sealing surfaces), shall be ground smooth and flush with adjacent base metals. All welded joints and seams shall be wire brushed to remove heat discoloration. The housing shall be reinforced to withstand a positive or negative pressure of 15" w.g. The upstream and downstream ductwork connections shall have 1 1/2" outward-turned flanges.

**2.2** - The housing shall have a bagging ring around each filter access port that is sealed by a gasketed filter access door. The filter access door gasket shall be silicone and shall be replaceable, if necessary. The bagging ring shall have two (2) continuous formed raised ridges to secure the PVC change-out bag. The bagging ring shall be hemmed on the outer edge to prevent the change-out bag from tearing.

**2.3** – Ancillary hardware including filter clamping mechanism, door handles, door studs and labels shall be 300 series stainless steel. The threaded pivot blocks in the filter clamping mechanisms shall be of brass construction. Filter access door knobs shall be cast aluminum and designed to prevent galling of threads.

**2.4** – A filter clamping mechanism shall be operated by means of a standard wrench from outside the housing. The clamping mechanism shall include two pressure channel assemblies with eight springs per filter and exert a minimum filter sealing force of 1,400 pounds per full size filter, 1050 pounds per half size filter, and 700 pounds per quarter size filter. The force shall be applied as an even, uniform load along at least 80% of the top and bottom of each filter outer frame. The filter clamping mechanism adjustment penetration through the housing wall shall be sealed airtight.

**2.5** - One (1) Camfil Farr manufactured PVC change-out bag shall be furnished with each filter access port. Change-out bags shall be 8-mil. thick with a yellow translucent, non-sticking, matte finish. It shall include a 1/4" diameter elastic shock cord hemmed into the opening of the bag so when stretched around the housing bagging ring flange, a secure fit is created. The bag shall

include three (3) integral glove ports to assist in filter change-out. One (1) nylon security strap shall be included per filter access port to prevent the bag from sliding off the bagging flange during the change-out process. Design of components shall be such that all change-out operations shall be within the bag so there is a barrier between the worker and the filter at all times.

## 3.0 – Performance

**3.1** - All welding procedures, welders, and welder operators shall be qualified in accordance with *ASME Boiler and Pressure Vessel Code, Section IX*. All production welds shall be visually inspected by qualified personnel, per Camfil Farr standard procedure number *CFW-10001, Visual Inspection of Welds*, which incorporates the workmanship acceptance criteria described in *Section 5 & 6 of AWS D9.1-1990, Specification for Welding of Sheet Metal*.

**3.2** - The filter housing shall be manufactured under a Camfil Farr Quality Assurance Program (see Note 1 below). The filter housing shall be factory tested for filter fit, flatness of filter sealing surface and operation of filter clamping mechanism. The filter sealing surface and the complete assembly pressure boundary shall be leak tested by the pressure decay method as defined in *ASME N510-1995 Reaffirmed., Testing of Nuclear Air Cleaning Systems*, paragraphs 6 and 7. The filter sealing surface shall be tested at +10" water gage and have a maximum leak rate of 0.0005 cfm per cubic foot of housing volume. The overall system pressure boundary shall be leak tested at +15" water gage and have a maximum leak rate of 0.0005 cfm per cubic foot of housing volume.

**3.3** - Filter bags shall be capable of continuous operating to temperature extremes of 0° F to 150° F.

**3.4** – Multi-wide housing shall be equipped with a filter removal rod to pull the filters to the change-out position. The removal rod shall operate from the inside of the filter change out bag.

**Note 1** (to specifying engineer): Camfil Farr manufacturers all of its containment products using more than one Quality Assurance Program. Our *product-wide* Quality Assurance Program is a stringent process that ensures the equipment is produced in conformance with our understanding of the intended application. However, this *product-wide* program does not address all the items specified in ASME-NQA-1. If this product must be manufactured under an ASME NQA-1 Quality Assurance Program, please add the following to this statement "including the basic requirements of ASME NQA-1." Please contact the factory if specific clarifications are required.

*Optional specification items on next page.*

# Optional Specification Items

The format of these additional specification items includes a section numbering system consistent with today's requirements. Items beginning with the numeral 1 relate to general items, numeral 2 for construction components, and 3 for performance criterion. Dependent upon the option there may be an addition to one or more specification sections. Replace the # with a proper sequencing number based upon options selected.

## Banding Kit

2.# - A banding kit that includes a case/lap apron, a heavy duty tie-banding gun, PVC bag cutting shears, a 7" cinching Velcro strap and ten 100-lb tensile strength banding ties shall be provided. Banding kit shall be manufactured by same manufacturer that manufactures the housing.

## Decontamination Ports

2.# - Housing shall be provided with decontamination ports for injection of materials to neutralize contaminants. (Specify details. Contact factory for assistance).

## DOP/Freon Test Port

2.# - Challenge aerosol sampling ports shall be provided upstream and downstream of each primary filter access door. The port shall be 3/8" FIPS and include a hex head brass plug for periods when it is not in use.

## Drilled Duct Connection Flanges

2.# - Housing shall include pre-drilled flanges to facilitate attachment to ductwork. Holes shall be 7/16-inch diameter with spacing between holes not to exceed 4" as recommended in DOE-HDBK-1169-2003 "Nuclear Air Cleaning Handbook".

## Filter Change-out Tray

2.# - A filter change-out tray of stainless steel welded construction shall be provided. The tray shall be designed for attachment to door studs during filter change. The tray shall be capable of supporting 300 pounds. (Specify quantity required).

## Lifting Lugs

2.# - Lifting lugs, constructed of 1/4-inch thick Type 304 stainless steel shall be provided on the (side, top) of the housing. The lugs shall be capable of supporting the housing without housing deflection during transport and installation.

## Pre-filter Housings

See Camfil Farr Bulletin 3403.

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*Camfil Farr has a policy of uninterrupted research, development and product improvement. We reserve the right to change designs and specifications without notice.*

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## Factory-Mounted Pressure Gages

2.# - Housing shall include factory mounted pressure gages to measure any combination of pressure drop across prefiltration, final filtration, or combination thereof (specify requirements). Gage increments shall be as noted on enclosed drawings or other supporting materials. Gage tubing shall be copper construction with brass compression fittings.

## Pressure Taps (static)

2.# - Static pressure taps with 1/4-inch FIPS threads that allow field installation of static measurement gages or other measurement devices shall be included upstream and downstream of filter stages. Taps shall allow measurement across (prefilter only, prefilter and primary filter system, primary filter only, or overall systems including multiple prefilter and primary filter combinations). (Specify requirements).

## Security Strap

2.# - ( ) additional security straps shall be included.

## Cinching Strap

2.# - ( ) additional cinching straps shall be included.

## Swivel Door Latches

2.# - Housings shall be equipped with swivel door latches that shall completely swing-away from the filter change opening. All latching components shall remain captive during change.

## Test Sections

2.# - Consult Camfil Farr Bulletin 3407.

## Weather Cap

2.# - Housing shall be provided with a weather cap that shall promote moisture run-off and prevent moisture accumulation on the top of the containment housing. The weather cap shall be constructed of the same materials as the housing and shall be (intermittently welded and sealed against weather intrusion, bolted to the housing to allow access to housing mounting flanges).

*Items in parenthesis ( ) require selection.*

