The ACT External HEPA Push-Through Filter Assembly

by

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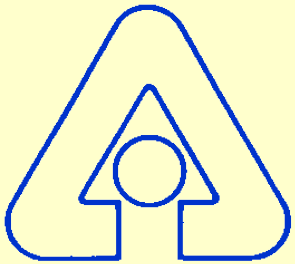
The ACT External HEPA Push-Through Filter Assembly

Abstract

Nuclear-grade HEPA filters are used throughout the nuclear-research and -processing industries for gloveboxes, exhaust hoods, and building exhaust systems. The current method for replacing these filters, in most cases, is costly, requiring special tenting operations and is risky with respect to the possible release of nuclear contaminants. It has been estimated that the cost to change a HEPA filter, when tenting is involved, is about $2.0K, not including the cost of the filter. An optimal push-through filter housing would simplify the replacement of these HEPA filters and significantly reduce the cost of operations associated with these replacements. With a push-through filter arrangement, this cost could be reduced to about $0.5K or even less. The possibility of releasing radioactive contaminants would also be considerably reduced, thus addressing a primary ALARA (as low as reasonably achievable) goal.

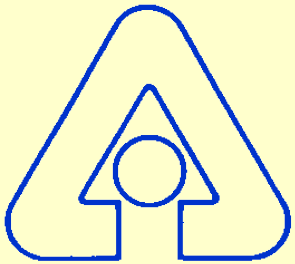
Argonne National Laboratory has developed a push-through filter assembly that satisfies these objectives. The assembly utilizes readily available, round, metal-cased filters as the primary filtering elements. These elements are fitted with a series of special seals that are backed with metal rings. This arrangement allows the filter assembly to be installed in any orientation, without fear of the seals taking a set. An assembly consists of an active filter and a second standby filter ready to be "pushed-through" and into service by a replacement filter. When a new filter is installed, the used filter can be easily removed into an awaiting waste bag and sealed in the end of the bag for site removal. The bag is sized to accept enough filters to meet long term operations requirements; however, the design allows for bag replacement. The internal diameter of the filter assembly is sized to ensure that a positive seal is obtained when the standby filter is pushed into active service. The assembly is designed so that contaminated gases pass only through the active filter and the clean gas passes out the assembly without passing through the standby filter.

Initial testing of the filter assembly has been concluded and performance expectations have been verified. Argonne is now investigating the possibility of commercializing this product.



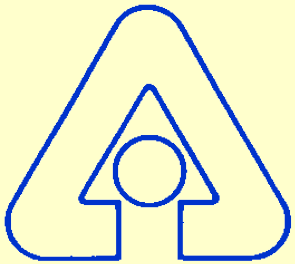
Outline

- Current design
- New design
- Design features
- Prototype
- Installation
- Conclusions
- Status

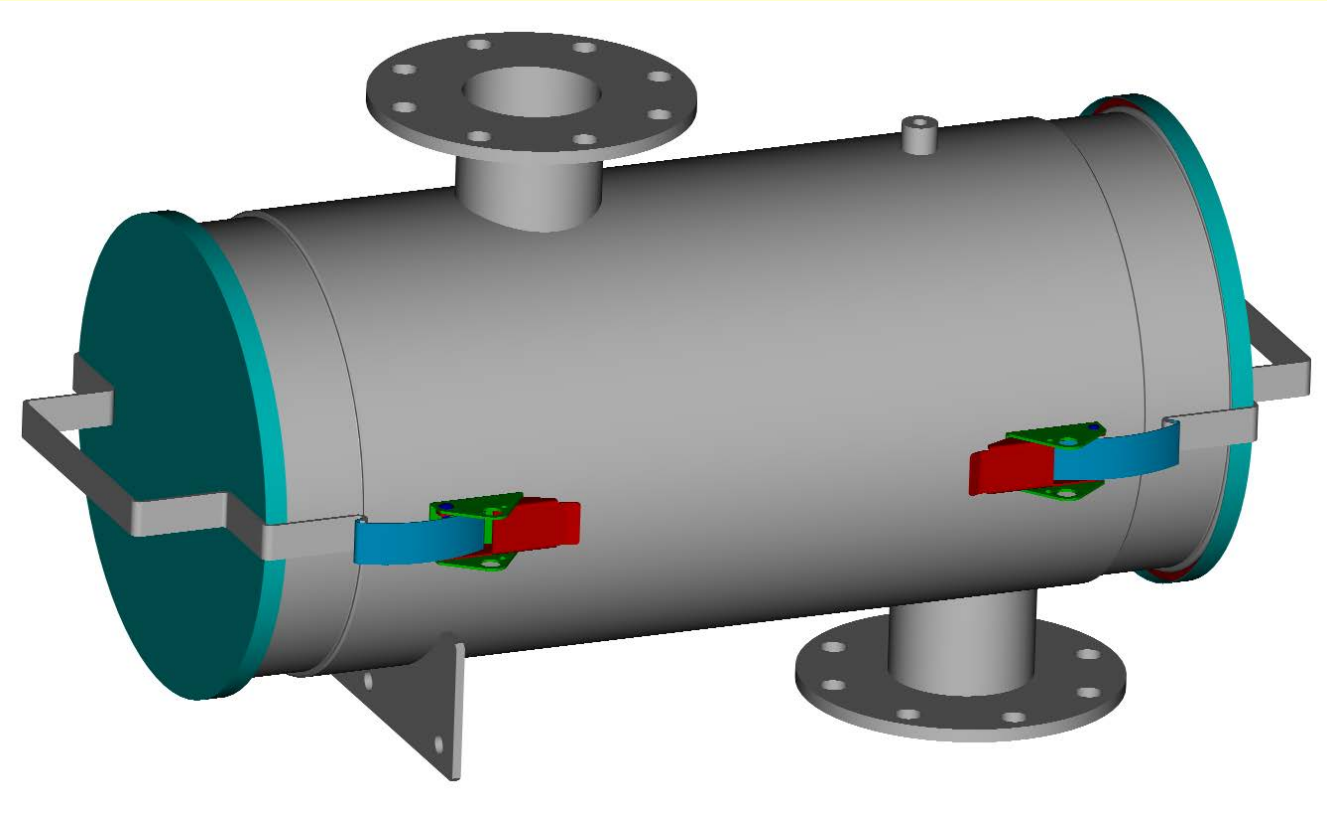


Example of a Typical In-Line Square HEPA Filter

“Push-Through” Filter Design



The ACT External HEPA Push-Through Filter Assembly



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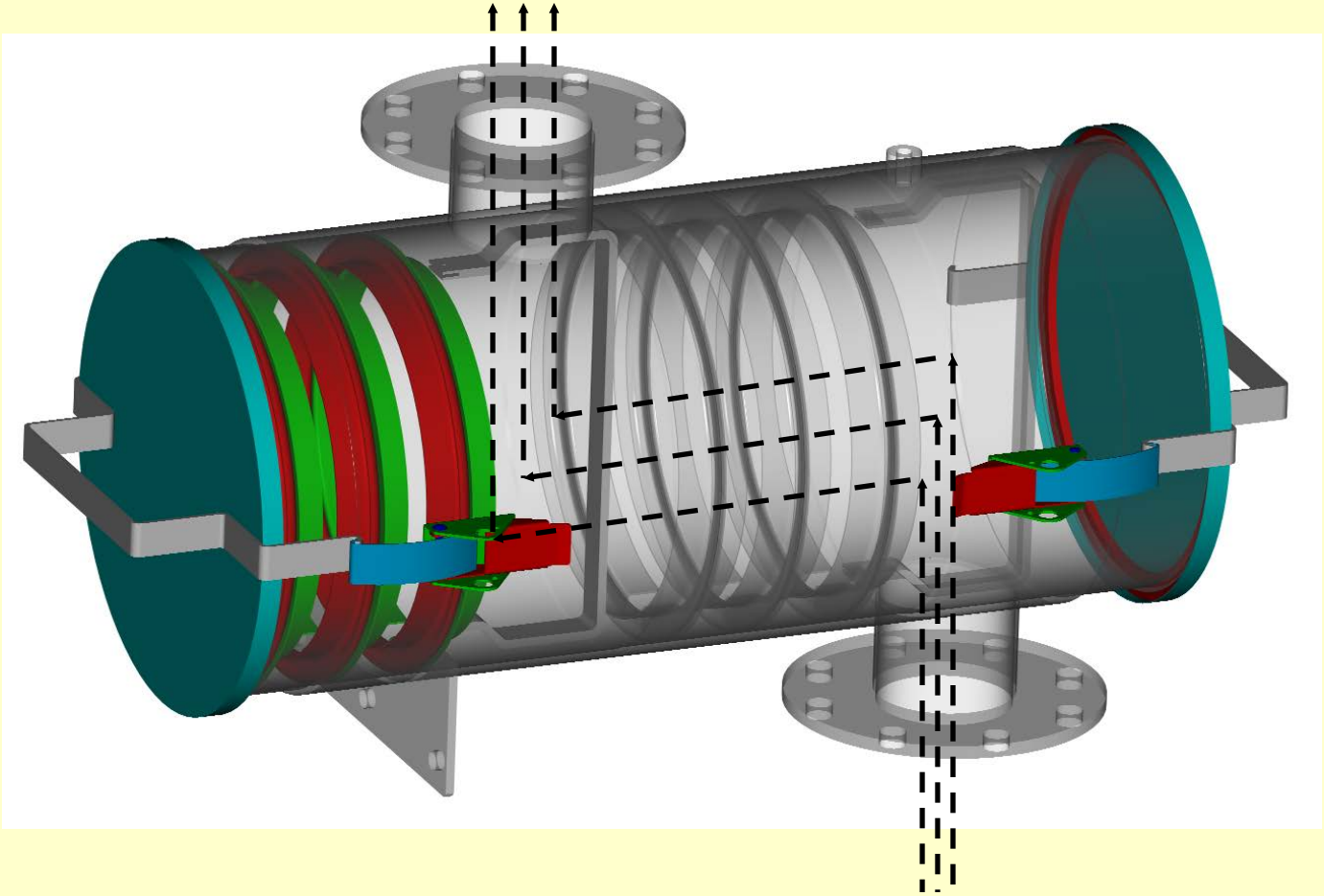
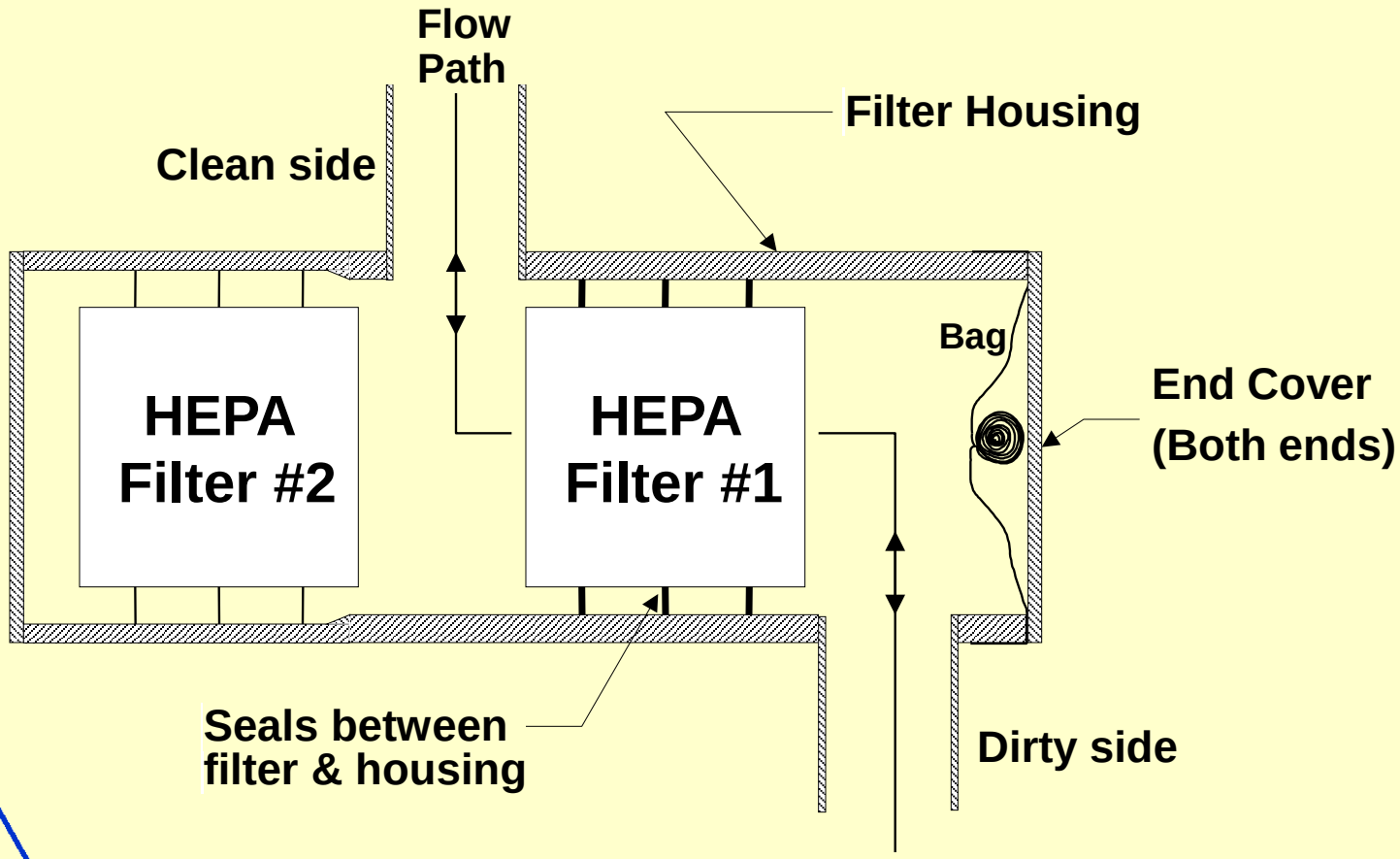
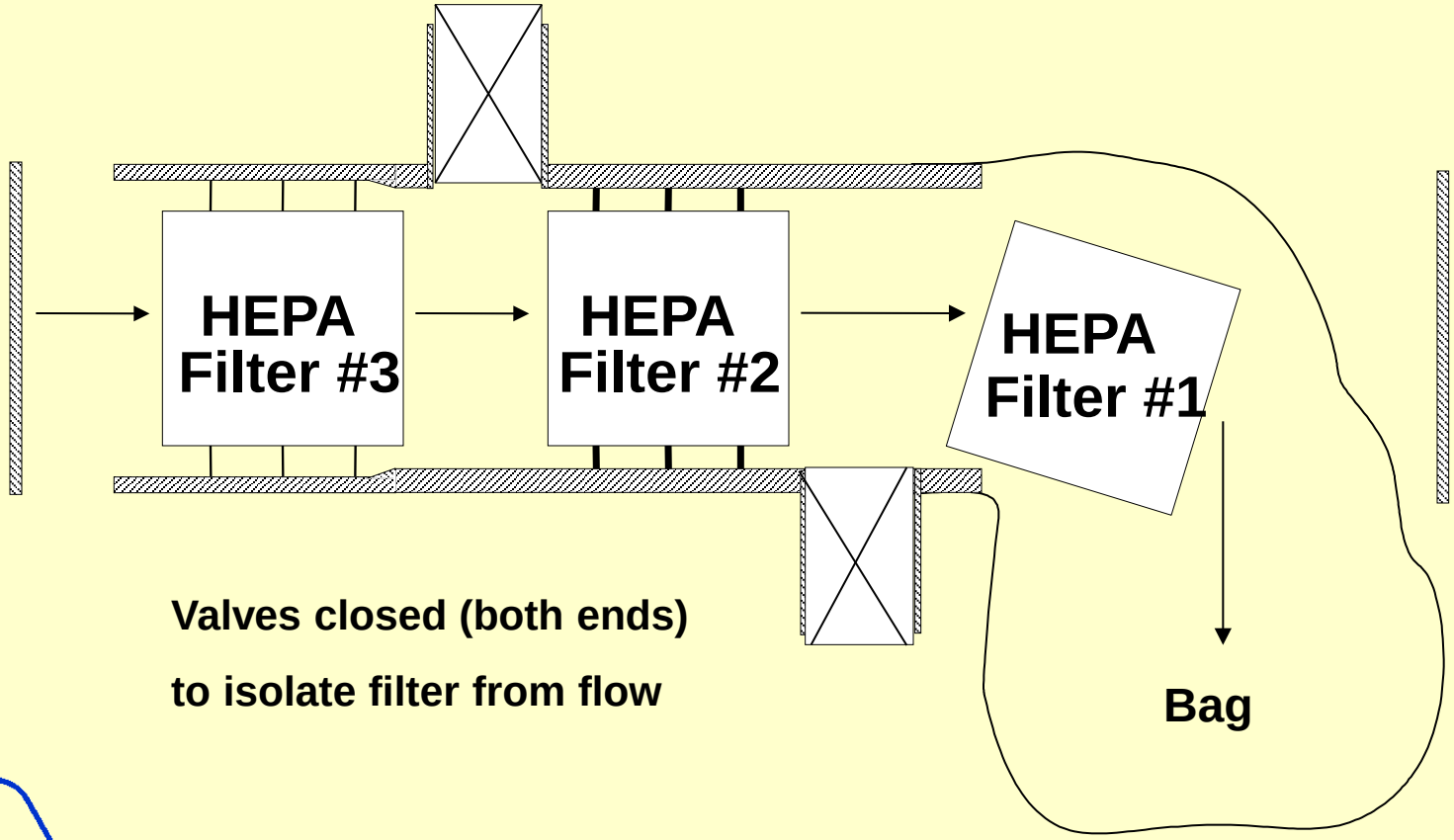


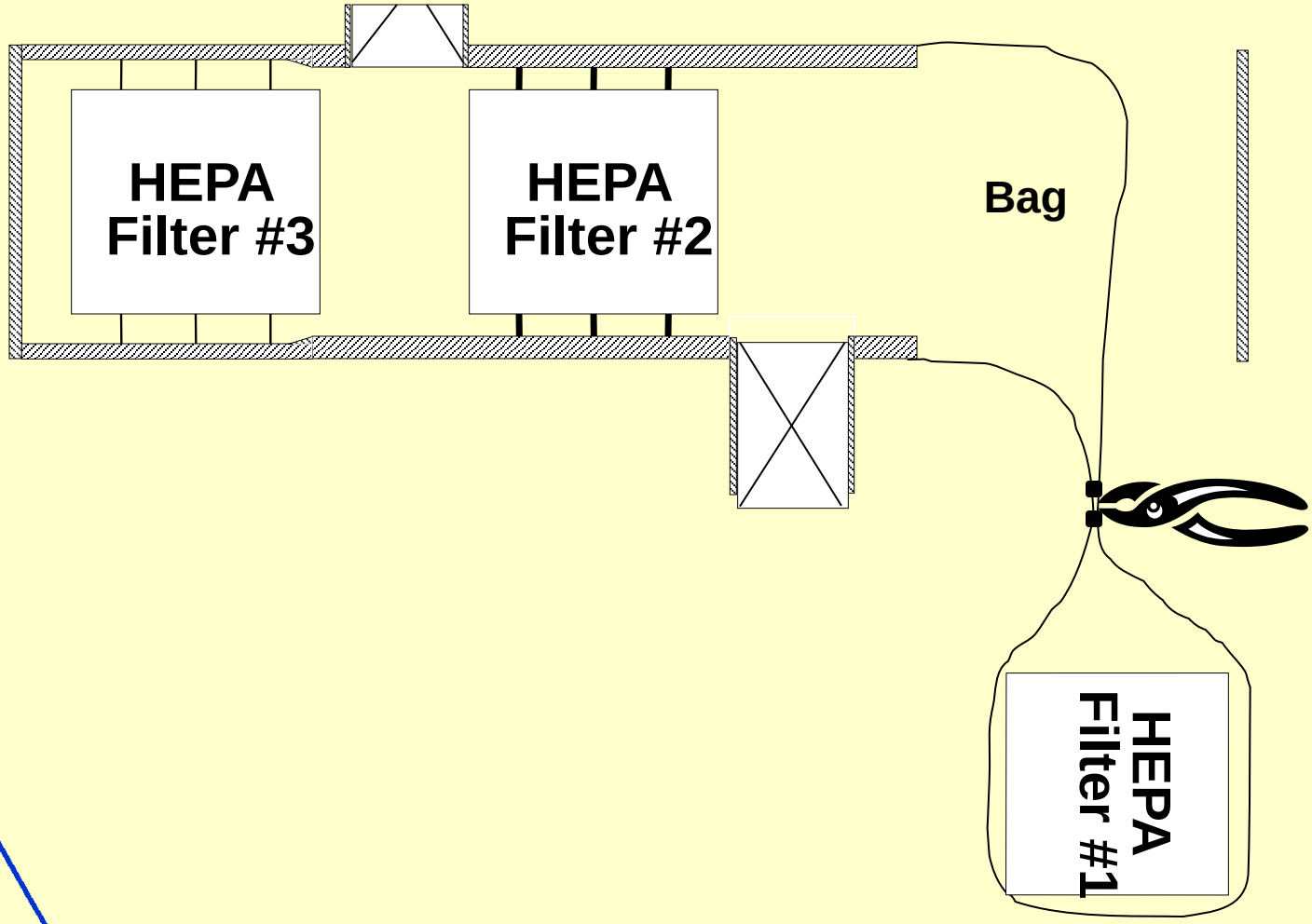
Normal Operation



Filter Change Procedure



Filter Change Procedure

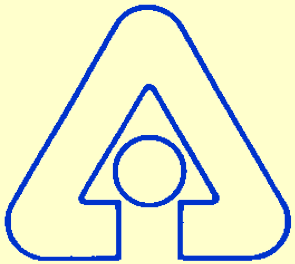


Unique Design Features

- Cylindrical housing
  - Stepped housing
  - Testing port
  - Integral transfer bag attachments
  - Standard size mounting flanges

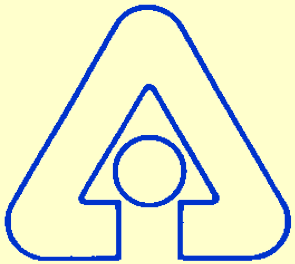
Unique Design Features

- **Cylindrical filter element**
  - **Improved sealing area**
  - **Easily compacted for less waste**
  - **Utilizes standard-size commercially available HEPA filter**
  - **Filter-mounted handles provide flow cavity**
  - **Clean filter ready to be “pushed” into service**



Unique Design Features

- **Cylindrical seals**
  - **Easily fabricated gasket rings**
  - **Quality seal without concern for gasket loading**
  - **Multiple configuration provides redundancy**

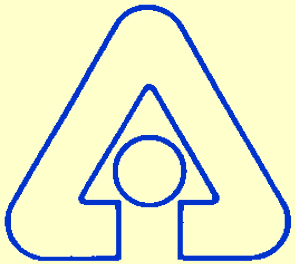


Unique Design Features

- **Support rings**
  - **Help to support the seals**
  - **Allows the unit to be installed in any orientation**

Unique Design Features

- **Risk minimization for operator contamination**
  - **Both end covers can be removed without exposure**
  - **Integral transfer bag attachment**
  - **Downstream piping not exposed to contamination**



Filter Assembly Components

The ACT External HEPA Push-Through Filter Assembly

Filter Assembly

The ACT External HEPA Push-Through Filter Assembly

Filter Assembly

Filter Housing and End Covers

Note

Bag Removed for Clarity

End Covers

Filter Housing with Installed End Covers

Filter Assembly Being Installed

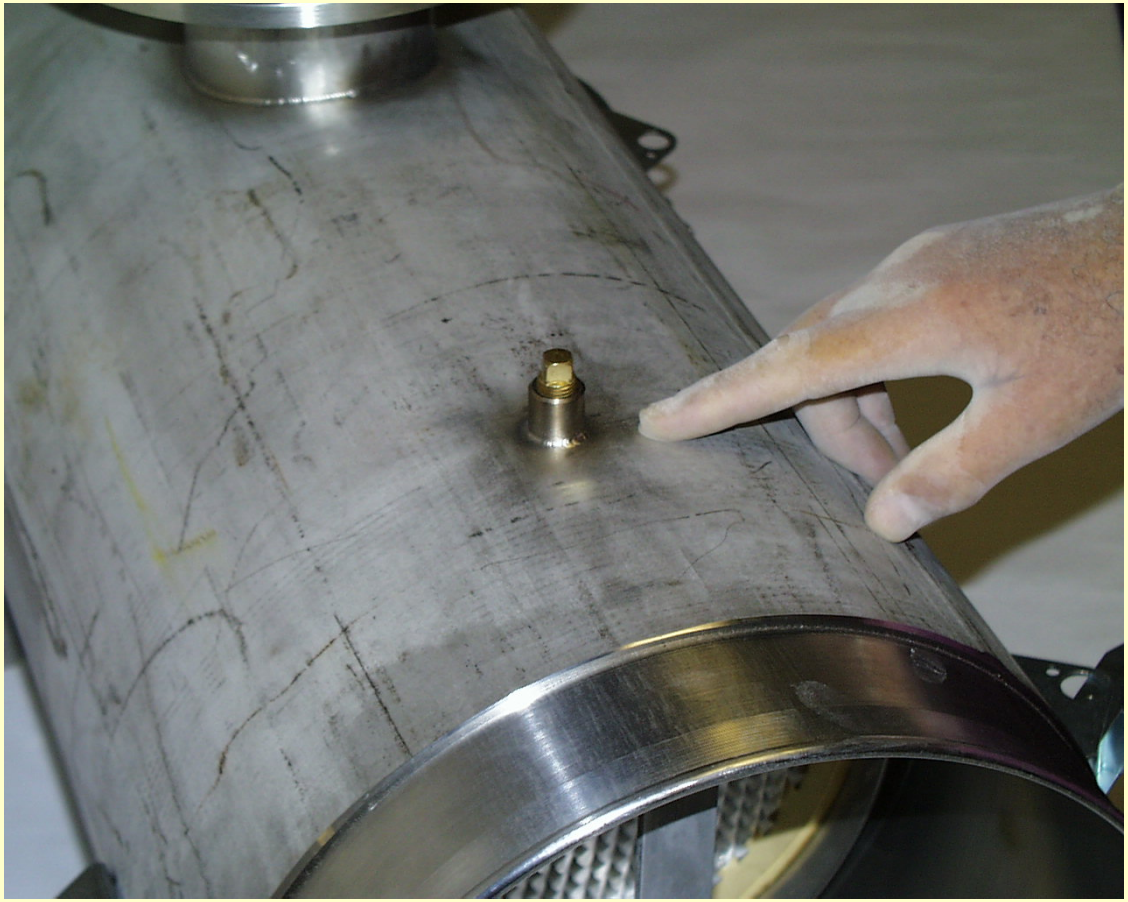
Clean Filter Assembly Installed and Ready to Be “Pushed Through”

Active Filter Assembly in Position

Note

Bag Removed
for Clarity

Challenge Aerosol Introduction Port



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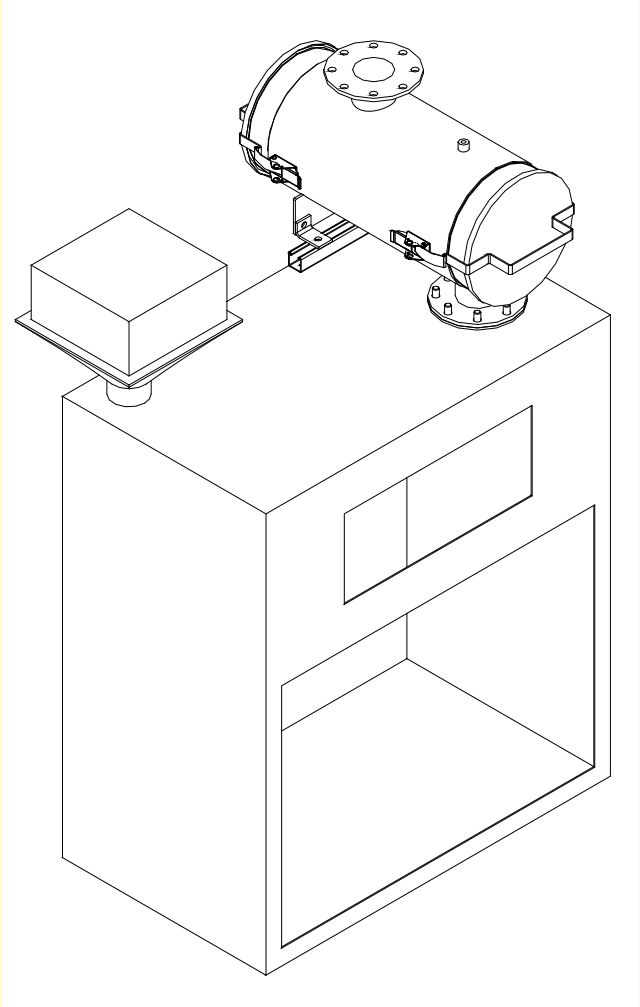
Filter Housing in Vertical Orientation

Internal View of Filter Housing

Machined Step to Ensure Seal Integrity When "Pushing" a Filter Assembly into the Active Position

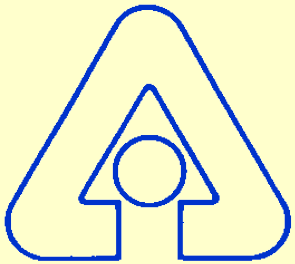
The ACT External HEPA Push-Through Filter Assembly



Installation Example

Conclusions

- Adds innovation to previously existing ideas
- Successfully bench-tested
- Cost Estimates to Change Filter
  - currently used tenting method: $2000
  - using Push-Through design: $500
- Reduces possibility of contaminant release



Status

- Patent application filed
- Two beta versions to be installed at Argonne National Laboratory
- Looking for an industrial partner to help complete the development and to market the ACT External HEPA Push-Through Filter Assembly