In-Line HEPA Filter Housings Bolt-Lock & Crank-Lock Models

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In-line (or side-access) filter housings are suitable for return-air, exhaust-air and supply-air HVAC systems that require enhanced particulate control.

Typically, these housings have two filter stages: **2" or 4" deep prefilter section** for MERV8-MERV13 efficiency (ASHRAE 52.2 Std) filters, followed by a **12" deep gasket-seal final filter section.** The final stage is a 12" deep rigid-cell filter, typically HEPA or ULPA level efficiency.

Industry Air Sales (IAS) offers two models of in-line gasket-seal filter housings: HEPA Bolt-Lock and HEPA Clamp-Lock.

HEPA Bolt-lock (HBL) housing uses threaded bolts at each filter corner to seal the HEPA/ULPA filter(s) against an upstream filter seal-face *(see picture left).*

HEPA Clamp-Lock (HCL) housing uses two cam-operated clamping mechanisms within the housing (one at top & one at bottom of each filter row) to seal the final filters. *(See next slide for details)*

Standard Construction for both types of housings is **16-gage Aluminized-steel**, with stitch-weld and caulking on all seams.
Optional construction is 16-gage 304L stainless-steel.
Housings are modular construction and suit industry-standard 24x24 and 12x24 filters.

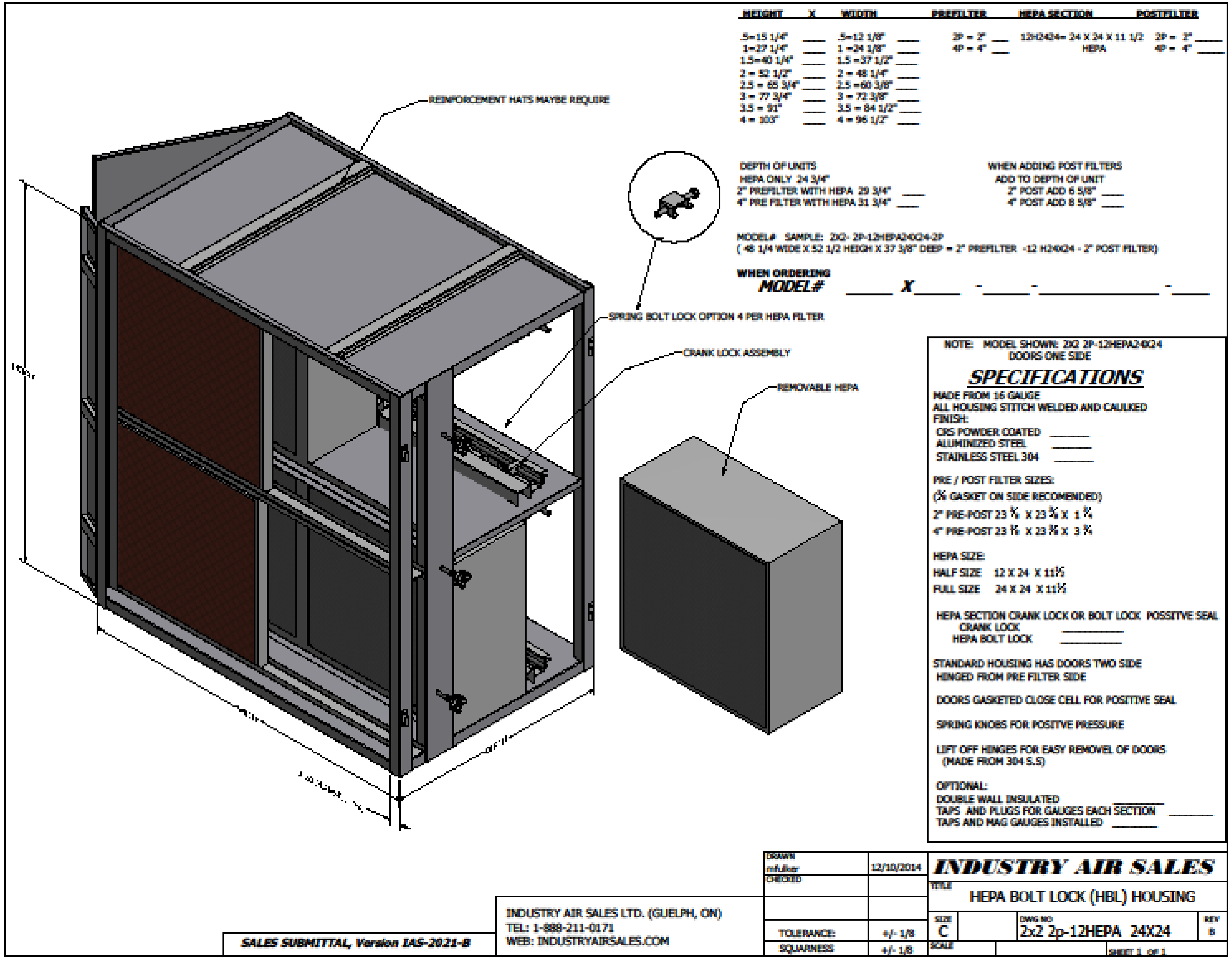
Housings have doors on both sides, and doors have outward-turned flanges and gussets to ensure rigid and durable construction. All filter access doors are fully gasketed with 0.25” thick closed-cell neoprene to ensure leak-free operation at +/-6”wc pressure-drop. Door latches are heavy-duty spring-load star-knobs on 3/8” thread.

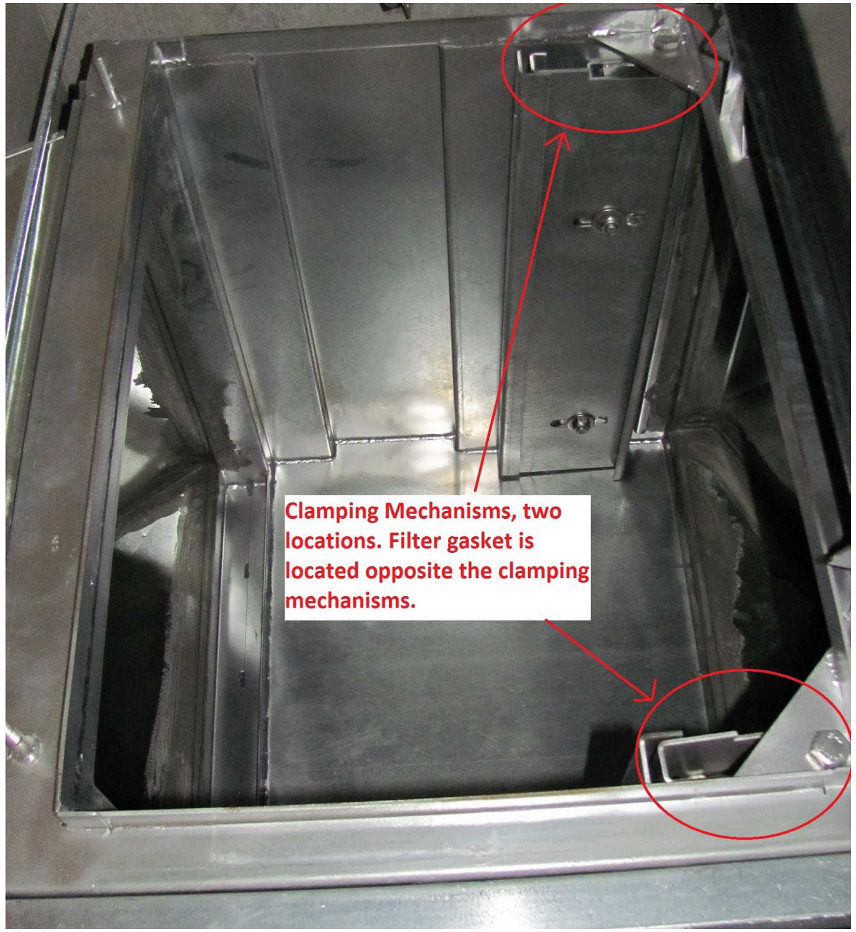
HEPA Bolt-Lock (HBL) Side-Access Housing:

The model **HEPA Bolt-Lock (HBL)** side-access housing uses four corner-mounted spring-loaded bolts to seal each 24x24 or 12x24 final filter against a one-piece, heavy-gage laser-cut sheet that is the filter seal-face. The one-piece sheet is stitch-welded and caulked around its entire perimeter to create an air-tight seal when the bolts are tightened, compressing the filter gasket against the seal-face. The bolts are on the clean-air side of the filter, keeping them free of particulates and other contaminants. Modular housings are up to three filters wide, with doors and access required on both sides. Always start with the inside filters when installing so that there is good access to the clamping bolts from both sides of the housing.

HEPA Bolt Lock Housing

Sales Submittal





HEPA Crank-Lock (HCL model) Housing:

The model HCL housing uses two cam-operated filter clamping mechanisms (one at top & one at bottom of each filter row) to seal the final (HEPA/ULPA) filters against a smooth, upstream sealing surface (filter seal-face) inside the housing. A driver is used to turn the two threaded rods, causing the cams to move a U-channel laterally and compress the filter's closed-cell gasket against the housing seal-face. The housing has doors on both sides, but the clamping mechanism is accessed from one side only.

The HBL & HCL housings can be used with any ASHRAE 52.2 (MERV rated) rigid-cell filter(s), but they are used primarily where HEPA or ULPA efficiency final filtration is required. HBL & HCL housings are designed to provide leak-free operation at up to +/-6.00"wc pressure.

HEPA Crank Lock Housing

Sales Submittal

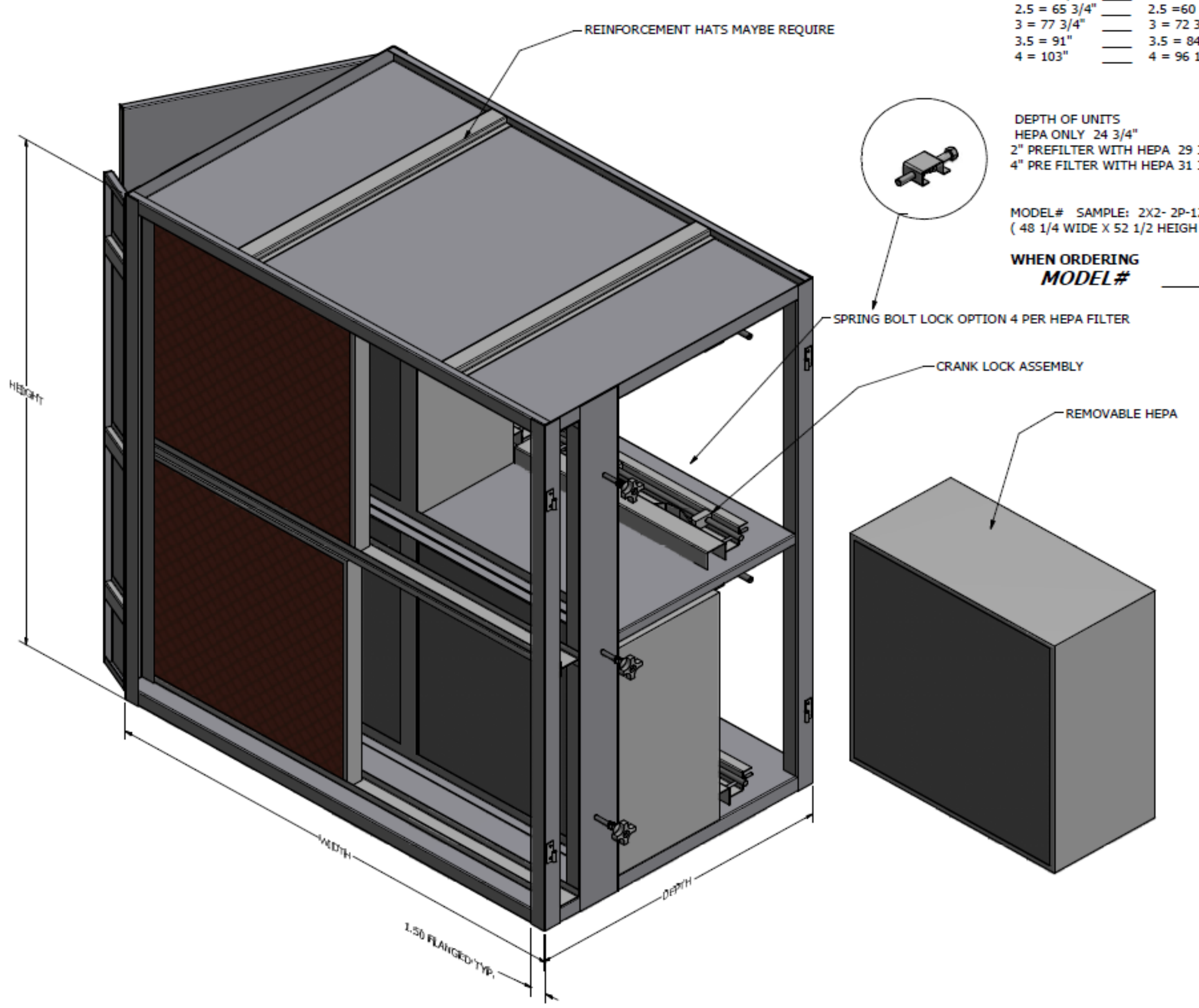
HEIGHT		X	WIDTH		PREFILTER	HEPA SECTION	POSTFILTER
.5=15 1/4"	____		.5=12 1/8"	____	2P = 2" ___	12H2424= 24 X 24 X 11 1/2 HEPA	2P = 2" _____
1=27 1/4"	____		1 =24 1/8"	____	4P = 4" ___		4P = 4" _____
1.5=40 1/4"	____		1.5 =37 1/2"	____			
2 = 52 1/2"	____		2 = 48 1/4"	____			
2.5 = 65 3/4"	____		2.5 =60 3/8"	____			
3 = 77 3/4"	____		3 = 72 3/8"	____			
3.5 = 91"	____		3.5 = 84 1/2"	____			
4 = 103"	____		4 = 96 1/2"	____			

DEPTH OF UNITS
HEPA ONLY 24 3/4"
2" PREFILTER WITH HEPA 29 3/4" ____
4" PRE FILTER WITH HEPA 31 3/4" ____

WHEN ADDING POST FILTERS
ADD TO DEPTH OF UNIT
2" POST ADD 6 5/8" ____
4" POST ADD 8 5/8" ____

MODEL# SAMPLE: 2X2- 2P-12HEPA24X24-2P
(48 1/4 WIDE X 52 1/2 HEIGH X 37 3/8" DEEP = 2" PREFILTER -12 H24X24 - 2" POST FILTER)

WHEN ORDERING
MODEL# ______ ***X*** ______ - ______ - ________________ - _____



NOTE: MODEL SHOWN: 2X2 2P-12HEPA24X24
DOORS ONE SIDE

SPECIFICATIONS

MADE FROM 16 GAUGE
ALL HOUSING STITCH WELDED AND CAULKED
FINISH:
CRS POWDER COATED ______
ALUMINIZED STEEL ______
STAINLESS STEEL 304 ______

PRE / POST FILTER SIZES:
(⅜ GASKET ON SIDE RECOMENDED)
2" PRE-POST 23 ⅜ X 23 ⅜ X 1 ¾
4" PRE-POST 23 ⅜ X 23 ⅜ X 3 ¾

HEPA SIZE:
HALF SIZE 12 X 24 X 11½
FULL SIZE 24 X 24 X 11½

HEPA SECTION CRANK LOCK OR BOLT LOCK POSSITVE SEAL
CRANK LOCK __________
SPRING BOLT LOCK __________

STANDARD HOUSING HAS DOORS TWO SIDE
HINGED FROM PRE FILTER SIDE

DOORS GASKETED CLOSE CELL FOR POSITIVE SEAL

SPRING KNOBS FOR POSITVE PRESSURE

LIFT OFF HINGES FOR EASY REMOVEL OF DOORS
(MADE FROM 304 S.S)

OPTIONAL:
DOUBLE WALL INSULATED ________
TAPS AND PLUGS FOR GAUGES EACH SECTION ________
TAPS AND MAG GAUGES INSTALLED ________

DRAWN mfulker	12/10/2014	**INDUSTRY AIR SALES**
CHECKED		TITLE: CRANK LOCK HEPA
		SIZE: C — DWG NO: 2x2 2p-12HEPA 24X24 — REV: B
TOLERANCE:	+/- 1/8	
SQUARNESS	+/- 1/8	SCALE — SHEET 1 OF 1

Model Example:
HCL = HEPA **CRANK**-LOCK
HBL = HEPA **BOLT**-LOCK

Example #1:
Model# **2X2-4P-12HCL**
Description: HEPA CRANK-LOCK Housing, 52.25"H X 48.25"W X 31.75"D
QTY (4) 24X24X4" PRE'S
QTY (4) 24X24X12" HEPA, Crank-locking mechanisms for final filters.

Example #2:
Model# **1X2.5-2P-12HBL**
Description: HEPA BOLT-LOCK, 27.25"H X 60.38"W X 29.75"D
QTY (2) 24X24X2" + (1) 12X24X2" PRE
QTY (2) 24X24X12" + (1) 12X24X12" HEPA, BOLT-locking mechanisms for final filters.

HEIGHT	X	WIDTH		PREFILTER		HEPA SECTION	POSTFILTER	
.5=15 1/4"	____	.5=12 1/8"	____	2P = 2"	___	12H2424= 24 X 24 X 11 1/2 HEPA	2P = 2"	_____
1=27 1/4"	____	1 =24 1/8"	____	4P = 4"	___		4P = 4"	_____
1.5=40 1/4"	____	1.5 =37 1/2"	____					
2 = 52 1/2"	____	2 = 48 1/4"	____					
2.5 = 65 3/4"	____	2.5 =60 3/8"	____					
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DEPTH OF UNITS
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(48 1/4 WIDE X 52 1/2 HEIGH X 37 3/8" DEEP = 2" PREFILTER -12 H24X24 - 2" POST FILTER)

WHEN ORDERING
MODEL# ______ ***X*** ______ - ______ - ________________ - _____

Standard Features:

Lift-off hinges are provided on every filter access door. *(See pic at right)* This facilitates filter access, particularly in tight spaces.

Heavy-duty door latches are provided on every door to allow excellent gasket compression while maintaining good form to the stiffened and gusseted filter access door.

Housing Options:

DOP Test Ports are available for HEPA/ULPA filter challenge.
(see pic at left)

Filter differential pressure gages & transmitters are an available option on any in-line filter housing. Gages are strongly recommended for any housing using HEPA or ULPA filters.

Housing Options:

Filter-Fan Units can be packaged with any in-line filter housing. HEPA/ULPA filter housings can be mated to utility fans and they can also be put into series with other filter housings including carbon-tray or carbon-canister housings to address both chemical/odor and particulate capture.

(see pic at left of HEGA-HEPA filter fan unit)

Housing Pre-Filters:

*Pre-filters are the first-stage filters, installed to remove large, heavy dust particles. Prefilters are needed to protect and extend the service life of the expensive after-filters. Pre-filters are usually MERV rated to ASHRAE 52.2 Std., see table at right. As an absolute **minimum**, use 2" deep **MERV8** efficiency prefilters upstream of any HEPA filter(s).*

FILTER TYPE	*SIZE*	*INITIAL RESISTANCE ("WG)*	*RECOMMENDED FINAL RESISTANCE ("WG)*
HIGH CAP 2" PLEATED **MERV8**	24X24X2	**0.20"WG** @ 2000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 2000 CFM
HIGH CAP 2" PLEATED **MERV8**	12X24X2	0.20"WG @ 1000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 1000 CFM
HIGH CAP 2" PLEATED **MERV11**	24X24X2	**0.28"WG** @ 2000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 2000 CFM
HIGH CAP 2" PLEATED **MERV11**	12X24X2	0.28"WG @ 1000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 1000 CFM
HIGH CAP 2" PLEATED **MERV13**	24X24X2	**0.37"WG** @ 2000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 2000 CFM
HIGH CAP 2" PLEATED **MERV13**	12X24X2	0.37"WG @ 1000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 1000 CFM

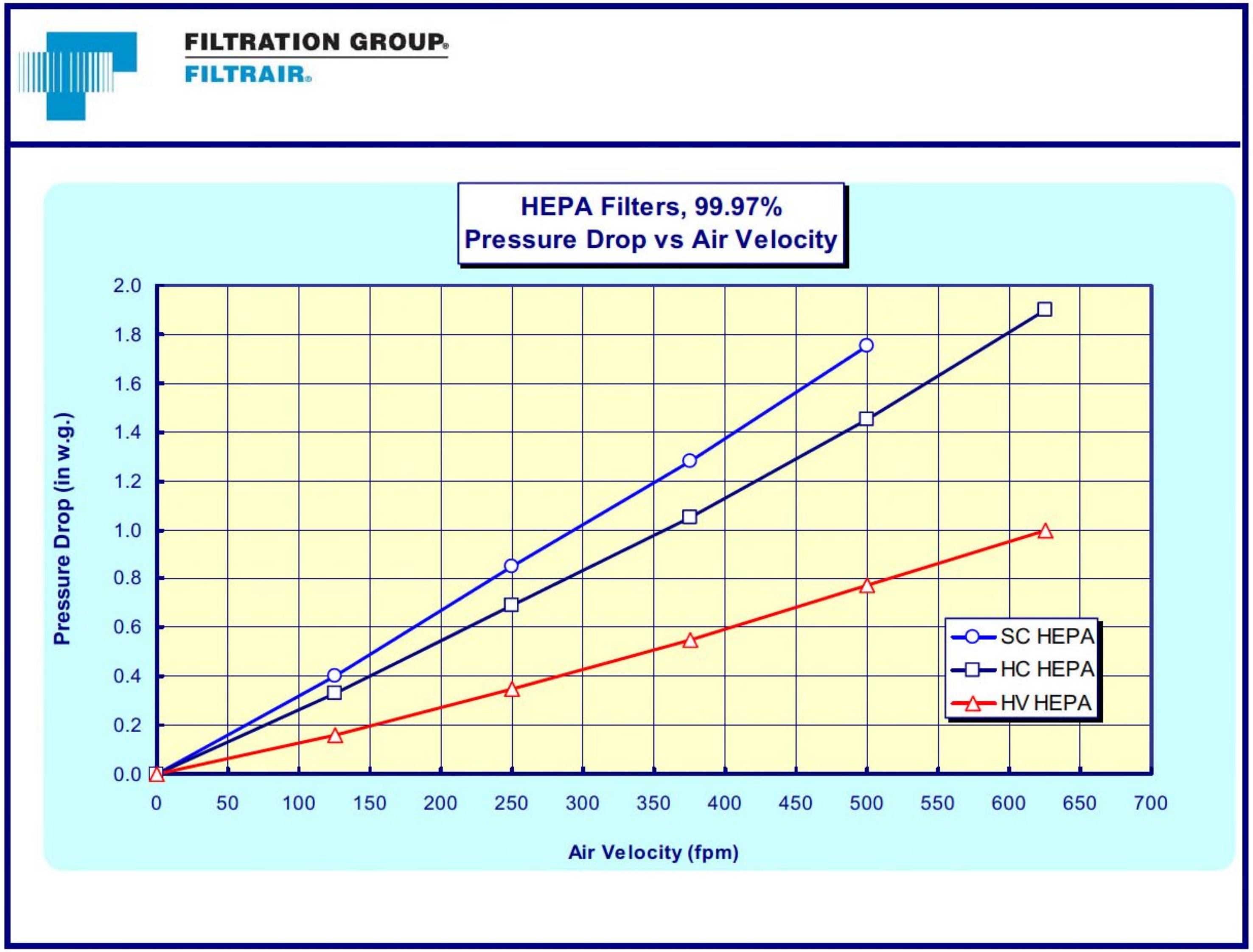
FILTER TYPE	*SIZE*	*INITIAL RESISTANCE ("WG)*	*RECOMMENDED FINAL RESISTANCE ("WG)*
HIGH CAP 4" PLEATED **MERV8**	24X24X4	**0.15"WG** @ 2000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 2000 CFM
HIGH CAP 4" PLEATED **MERV8**	12X24X4	0.15"WG @ 1000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 1000 CFM
HIGH CAP 4" PLEATED **MERV11**	24X24X4	**0.20"WG** @ 2000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 2000 CFM
HIGH CAP 4" PLEATED **MERV11**	12X24X4	0.20"WG @ 1000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 1000 CFM
HIGH CAP 4" PLEATED **MERV13**	24X24X4	**0.30"WG** @ 2000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 2000 CFM
HIGH CAP 4" PLEATED **MERV13**	12X24X4	0.30"WG @ 1000 SCFM (500 FPM FACE VELOCITY)	1.00"WG @ 1000 CFM

Housing Pre-Filters (continued):

Where space permits, IAS recommends the use of 4" deep prefilters. Advantages include longer service life and lower initial pressure drop, based on the equal MERV rating (versus 2" deep prefilters). As well, there are more options for efficiency and media selection with 4" deep filter models.

HEPA Filter Capacity Table: SC-HEPA, HC-HEPA & UHC-HEPA Filters

HEPA FILTER MODEL & CAPACITY	*RECOMMENDED BY IAS*	*TYPICAL CAPACITY @ 1.00"WC*	*RECOM-MENDED MAXIMUM FACE VELOCITY*	*RECOMMENDED PRESSURE DROP*		*IEST ACCEPTANCE (EFFICIENCY)*	
				INITIAL (CLEAN)	*FINAL*	*MINIMUM*	*IAS RECOMMENDATION*
SC-HEPA, STANDARD CAPACITY	NO	1050CFM	260FPM	1.00"WC	2.00"WC	99.97%, TYPE "A"	99.99%, TYPE "C"
HC-HEPA, HIGH CAPACITY	YES (AS A MINIMUM)	1450CFM	375FPM	1.00"WC	2.00"WC	99.97%, TYPE "A"	99.99%, TYPE "C"
HV-HEPA, HIGH VOLUME (ULTRA-HIGH CAPACITY)	YES (FOR EXTENDED SERVICE LIFE)	2400CFM	600FPM	1.00"WC	2.00"WC	99.97%, TYPE "A"	99.99%, TYPE "C"



HEPA Filter Initial (Clean) Pressure Drop Curves:

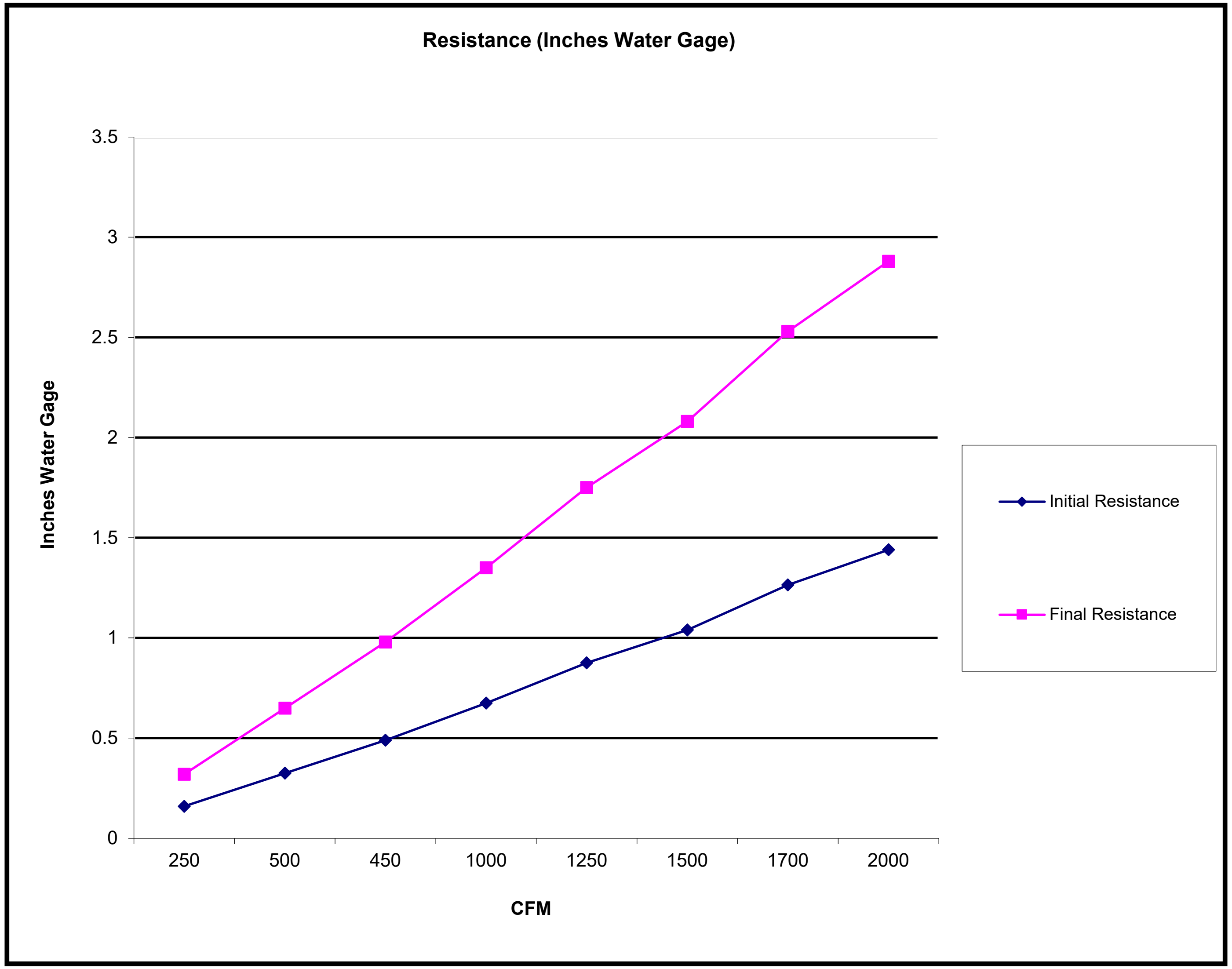
Initial Pressure Drop (IPD) curves for the 99.97% efficiency SC-HEPA, HC-HEPA and UHC/HV-HEPA filters, based on industry standard 24x24x11.5" gasketed filter. Although higher initial cost, HV-HEPA (UHC or Ultra-high capacity) filters offer the advantage of significantly lower pressure drop resulting in energy savings and longer service life.

Data courtesy of Filtration Group LLC, see left.

Initial (IPD) versus Recommended Final Pressure Drop, HEPA/ULPA Filters:

The Rule-of-thumb for HEPA & ULPA filter "Recommended Final Resistance" is 2x (double) the initial pressure drop at any given face velocity.
For example, HC-HEPA filters are rated at 375fpm @ 1.00"wc IPD, thus the final recommended pressure-drop is **2.00"wc** at 375fpm (1500cfm, 24x24 99.99% filter), *see curve at right.*

Data curves (at right) courtesy of AAF Int'l., based on 99.99% 24x24x11.5" HC-HEPA.



IEST-RP-CC001.5:

Table D1 – Performance of common filter specifications, an extract from IEST-RP-CC001.5. The Table details IEST classifications and the test method and challenge used.

EN1822 is the European test Std. for HEPA & ULPA filters

IAS Recommends using **IEST Type-C (99.99% Eff.)** HEPA filters whenever in-place testing (certification) is required.

Table D1 - Performance of common filter specifications (all classifications are at the rated flow).

Filter Type	% Efficiency	PPM	at Particle Size µm	Comments
IEST Type A	99.97	300	0.3 MMD	No leak test
IEST Type B	99.97	300	0.3 MMD	Two-flow leak test
IEST Type C	99.99	100	0.3 MMD	Photometer Scan
IEST Type D	99.999	10	0.3 MMD	Photometer Scan
IEST Type E	99.97	300	0.3 MMD	
IEST Type F	>99.9995	<5	0.1-0.2 or 0.2-0.3	Approx. MPPS/IEST-RP-CC007
IEST Type G	>99.9999	<1	MPPS	IEST-RP-CC007; media test to IEST-RP-CC0021
IEST Type H	99.97	300	0.1-0.2 or 0.2-0.3	Approx. MPPS/IEST-RP-CC007
IEST Type I	99.97	300	0.1-0.2 or 0.2-0.3	Leak @20% rated flow/ IEST-RP-CC0007
IEST Type J	99.99	100	0.1-0.2 or 0.2-0.3	Approx. MPPS/IEST-RP-CC007
IEST Type K	99.995	50	0.1-0.2 or 0.2-0.3	Two-flow leak test
H10	85	150000	MPPS	EN1822
H11	95	150000	MPPS	EN1822
H12	99.5	150000	MPPS	EN1822
H13	99.95	150000	MPPS	EN1822
H14	99.995	150000	MPPS	EN1822
H15	99.9995	150000	MPPS	EN1822

IEST-RP-CC001.5:

HEPA & ULPA filters are rated based on Efficiency (or Penetration) at a given challenge particle size. Challenge size is either 0.3µM (micrometers) (typically DOP test) or 0.1-0.2µ MPPS (Most Penetrating Particle Size), a more stringent test particle. HEPA/ULPA filters are then given a “Performance Level” classification.

FILTER LABELING: All reputable HEPA & ULPA filter manufacturers will test and label their filters to meet IEST-RC-CC001, latest revision. Filter labelling includes Acceptance Level at tested airflow, pressure test at test airflow, an individual serial number and technician sign-off and test date, traceable to the factory test data.

Performance Levels of HEPA and ULPA Filters per IEST-RP-CC001.5

Performance Level	Efficiency (%)	Penetration (%)	Particle Size	Leak Scant Penetration (%)
Type A	≥ 99.97	≤ 0.03	0.3 µm	No Leak Test
Type B	≥ 99.97	≤ 0.03	0.3 µm	100% & 20% Flow
Type C	≥ 99.99	≤ 0.01	0.3 µm	0.01
Type D	≥ 99.999	≤ 0.001	0.3 µm	0.005
Type E	≥ 99.97	≤ 0.03	0.3 µm	ASME AG1 Sec. FC
Type F	≥ 99.9995	≤ 0.0005	0.1-0.2 & 0.2-0.3 µm	0.0025
Type G	≥ 99.9999	≤ 0.0001	MPPS	0.001
Type H	≥ 99.97	≤ 0.03	0.1-0.2 & 0.2-0.3 µm	No Leak Test
Type I	≥ 99.97	≤ 0.03	0.1-0.2 & 0.2-0.3 µm	100% & 20% Flow
Type J	≥ 99.99	≤ 0.01	0.1-0.2 & 0.2-0.3 µm	0.01
Type K	≥ 99.995	≤ 0.005	0.1-0.2 & 0.2-0.3 µm	0.008

IAS Recommended 2-Stage Filter Set:

Any filter system employing HEPA or ULPA final filters needs high-efficiency and high-quality prefiltration to protect and extend the service life of these expensive final filters.

Recommended Pre-Filtration: Use high-quality **4" deep MERV11 (ASHRAE 52.2) filters as the minimum prefilter** for any housing/system with 99.97% HEPA filters. If static pressures allow, consider using **4" deep MERV13 (ASHRAE 52.2) pre-filters.**

Recommended Final Filtration: Use **High-capacity (HC) 99.97% HEPA filters** from a quality manufacturer. HEPA filters must be manufactured in an ISO registered facility and tested/labeled to IEST-RP-CC0001. If filter face velocity exceeds 400fpm, strongly recommend using Ultra-High Capacity (UHC) type filters.

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