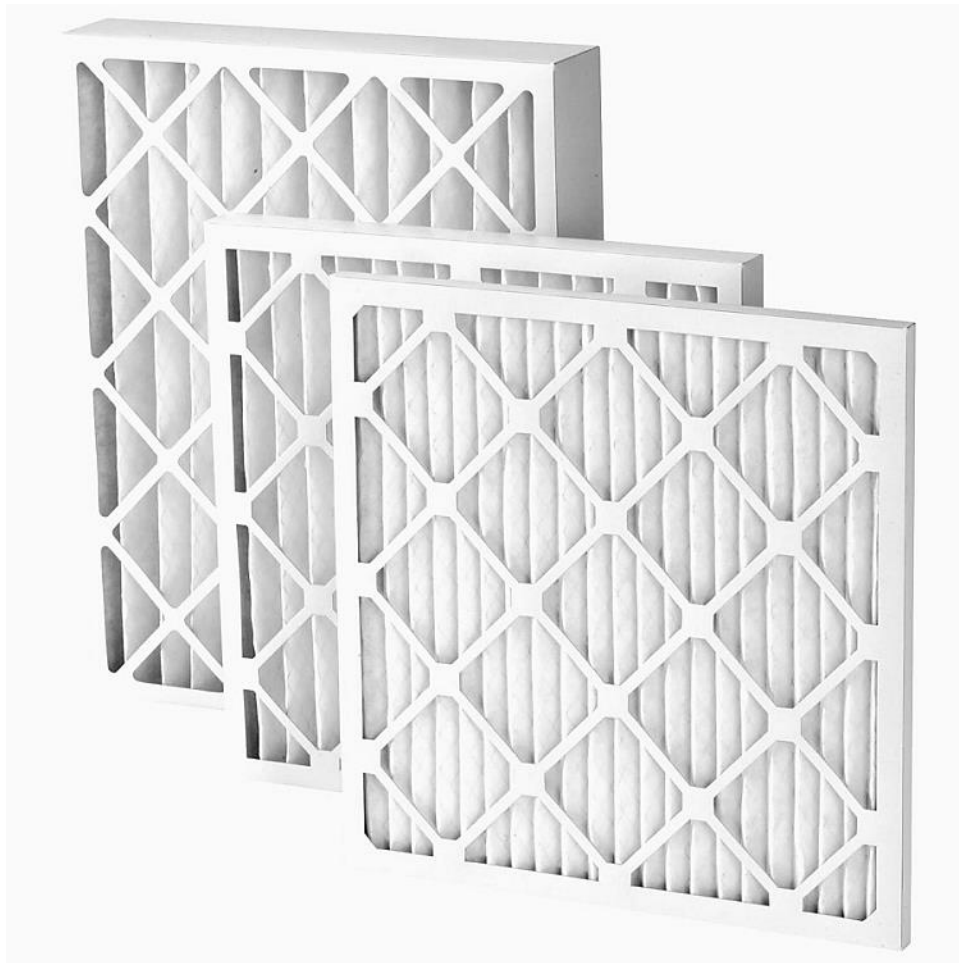


Air Filter Specifications

Bulletin 20-133



GENERAL INFORMATION

Air filters in an HVAC system have two purposes – to maintain system performance and to improve indoor air quality (IAQ). Filters are available in a wide range of efficiencies for removing particles from coarse dust and debris through bacteria and viruses. Residential filters are typically between 1-inch and 4-inch (25-102mm) in thickness. The choice of filter efficiency is based on the level of protection needed and is a balance with power consumption. For a given filter thickness, a more efficient filter will have a higher clean pressure drop. It is important to ensure that the blower can handle this increased pressure requirement when the filter is new and when it is dirty.

There is no fixed value for the allowable final pressure drop across a dirty filter. This is determined by the operational requirements of the system such as available external static pressure, filter replacement cost and blower power consumption targets. This Bulletin explains the different filter rating systems, how to select the right filter for Unico products and gives special guidance on compliance with California Title 24.

FILTER EFFICIENCY RATINGS

There are multiple filter efficiency rating systems, each of which reports the percentage of standard test dust particles that a filter can remove from circulating air. The standard test dust used in this testing is of a very specific composition and particle size range. Rating systems typically measure the filter's ability to remove particles between 0.3µm and 10µm and report a composite score.

The two most common rating systems for residential filters are MERV, which is based on ASHRAE 52.2 and ePM which is based on ISO 16890. The difference between each of these systems is in the type of dust used, the particle size ranges considered, and the method of aggregating performance into a final score. Although these two systems are not the same, a list of approximate MERV-to-ePM equivalencies is given in Table 2 below.

MERV

The **Minimum Efficiency Reporting Value (MERV) system** is the primary method of rating filter efficiency in the US. This system is based on the percentage of particles that a filter can remove in three size ranges (E1: 0.3-1.0µm, E2: 1.0-3.0µm, and

E3: 3.0-10.0µm). Performance in these three ranges is then compiled into a composite score ranging from 1 to 16 where higher values indicate greater efficiency.

Table 1. MERV Filter Ratings.

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MERV Filter Ratings		
MERV Rating	Filter Efficiency by particle size	Example
7	E1: N/A E2: N/A E3 > 50%	Pollens, dust, mold spores, cement dust, hair spray mist
8	E1 N/A E2 > 20% E3 > 70%	
9	E1 N/A E2 > 35% E3 > 75%	Milled flour, lead dust, combustion soot, legionella, coal dust, some bacteria, process grinding dust
10	E1 N/A E2 > 50% E3 > 80%	
11	E1 > 20% E2 > 65% E3 > 85%	
12	E1 > 35% E2 > 80% E3 > 90%	
13	E1 > 50% E2 > 85% E3 > 90%	
14	E1 > 75% E2 > 90% E3 > 95%	Bacteria, smoke, paint pigments, face powder, some virus, droplet nuclei, insecticide dusts, soldering fumes
15	E1 > 85% E2 > 90% E3 > 95%	Superior Residential
16	E1 > 95% E2 > 95% E3 > 95%	Prefilter to HEPA
Based on 2020 ASHRAE Handbook HVAC Systems & Equipment and ASHRAE 52.2.		

ePM

Another system of rating filters is the **particulate matter efficiency (ePM) system** based on ISO 16890 (Replaced EN779 in 2016). The ePM system uses four filter groups based on particle size. A filter must capture at least 50% of the particles of a given size in order to be categorized in that group. For example, an ISO ePM10 filter must capture at least 50% of particles with diameter greater than 10µm. If the filter captures less than 50% of those particles, then it falls into the next lower ISO Class; in this example, ISO Coarse.

Table 2. ISO Class, ePM ratings and approximate MERV equivalencies.

ISO Class	Description	Example	Approximate MERV Equivalent
Coarse	Captures \leq 50% of 10 μ m particles	sand, hair	MERV 1-6
ePM10	Captures \geq 50% of 10 μ m particles	pollen, desert dust	MERV 7
ePM2,5	Captures \geq 50% of 2.5 μ m particles	bacteria, fungal and mold spores, pollen, toner dust	MERV 11
ePM1	Captures \geq 50% of 1 μ m particles	viruses, nanoparticles, exhaust gases	MERV 13

FILTER SELECTION

Filter selection is based on multiple criteria – manufacturer recommendations, equipment life, occupant health and local building codes. Equipment must be protected against excessive debris and dust. Occupants should select a filter that sufficiently

addresses any special health concerns such as allergies or respiratory illness. In some jurisdictions, blower power in terms of W/CFM must also be considered.

When meeting the requirements above, the filter must not be so restrictive that airflow is unreasonably reduced. Unico System blowers are designed for higher pressures than conventional blowers or furnaces. This allows our system to deliver full airflow even when using more effective and more restrictive filters. In many cases, Unico Sytem blowers can accommodate filter and accessory pressure drops of over 1.0 in. w.g.

Unico's standard filter is MERV 7. We also offer MERV 13 filters in 1-in. and 2-in. thicknesses as an optional upgrade. Higher MERV values indicate higher efficiency as described in Table 1.

Use Table 3 to select the proper filter for your unit. Standard filter dimensions as well as alternate filters that may be used with each module are shown. More than one return filter may be required depending on local building codes.

Table 3. Unico Filters by Module

Where Used	Filter Size in. x in. (mm x mm)	Standard Filter	Alternate Filters	
		MERV 7 1 inch (25mm)	MERV 13 1 inch (25mm)	MERV 13 2 inch (51mm)
M2430V2	18 x 25 (457 x 635)	A00558-004	A02654-004	N/A
M3036V2	18 x 30 (457 x 762)	A00558-007	A02654-007	N/A
M3642V2†	18 x 18 (457 x 457)	A00558-003	A02654-003	N/A
	18 x 20 (457 x 508)	A00558-005	A02654-005	N/A
M4860V2†	18 x 18 (457 x 457)	A00558-003	A02654-003	N/A
	18 x 20 (457 x 508)	A00558-005	A02654-005	N/A
M2430R1	14 x 25 (356 x 635)	A00558-001	A02654-001	N/A
M3036R1	14 x 30 (356 x 762)	A00558-002	A02654-002	N/A
M3642R1	14 x 38 (356 x 965)	A00558-011	A02654-011	N/A
M4860R1	14 x 38 (356 x 965)	A00558-011	A02654-011	N/A
V2430*	18 x 18 (457 x 457)	A00558-005	N/A	A02654-018
V3036*	18 x 22 (457 x 559)	A00558-008	N/A	A02654-021
V3642*	21 x 22 (533 x 559)	A00558-009	N/A	A02654-022
UPC-105-1218	12 x 16 (305 x 406)	A00558-013	A02654-013	N/A
UPC-01-1218	14 x 20 (356 x 508)	A00558-010	A02654-010	N/A
UPC-01-2430	14 x 25 (356 x 635)	A00558-001	A02654-001	N/A
UPC-01-3036	14 x 30 (356 x 762)	A00558-002	A02654-002	N/A
UPC-01-3642	14 x 30 (356 x 762)	A00558-002	A02654-002	N/A
UPC-01-4860	24 x 30 (610 x 762)	A00558-006	A02654-006	N/A
UPC-01-4860NC	20 x 30 (508 x 762)	A00558-012	A02654-012	N/A

† Denotes models in which two filters are used simultaneously. * Denotes models that can accommodate either 1-in. or 2-in. thick filters.

Most modules accept a 1-in. thick filter, but our V-Series one-piece vertical units can also accept 2-in. thick filters. Where multiple thicknesses are an option, the end user must select a filter based on the requirements described above.

MERV 13 DESIGN CONDITIONS

When upgrading from a MERV 7 filter to a MERV 13 filter, remember that MERV 13 filters are more efficient, but also more restrictive. If there is not enough external static pressure available from the blower, airflow will be reduced. In most cases, there will be no issue as our blowers are capable of reaching high static pressures. However, airflow should be measured after installation to ensure that the system is still able to achieve its design airflow and that there are no system modifications (such as installing additional outlets) necessary to accommodate the more efficient filter.

The initial filter resistance must be below the *Maximum Allowable Clean Filter Pressure Drop* shown in Table 4. This ensures that the system can deliver full High Cool airflow when the filter is clean. If an electric heater or hot water coil is used in the system, the maximum allowable clean filter pressure drop is reduced by the pressure drop of those components.

We recommend changing filters when filter loading causes an increase of 0.25 in. w.g. above the clean filter pressure drop. This ensures that all systems can deliver their normal High Cool airflow even with a dirty filter. Multiple returns are not required to achieve full airflow. This is true both for single-speed (PSC) and for variable-speed (ECM) blowers as long as the operating pressure (excluding filter pressure drop) is 1.15 in. w.g. or less. If your operating pressure is higher, you may need to change your filter earlier to maintain full airflow.

Keep the dirty filter pressure drop to less than the *Maximum Allowable Dirty Filter Pressure Drop* shown in Table 4. This will ensure that the system delivers at least 80% of High Cool Airflow when the filter is dirty.

Table 4. Filter Selection Specifications.

Blower Model	High Cool Airflow	Maximum Allowable Clean Filter Pressure Drop [^]	Maximum Allowable Dirty Filter Pressure Drop [*]
	[CFM]	[in. w.g.]	[in. w.g.]
M1218BL1-ST*	400	0.35	0.85
M1218BL1-E**		0.45	0.85
M2430BL1-ST*	625	0.75	1.00
M2430BL1-E**		1.15	1.30
V2430*-E****		1.15	1.30
M3036BL1-ST*	750	1.00	1.15
M3036BL1-E**		1.20	1.30
V3036*-E****		1.20	1.30
M3642BL1-ST*	875	0.85	1.00
M3642BL1-E**		1.45	1.55
V3642*-E****		1.45	1.55
M4860BL1-ST*	1250	0.55	0.90
M4860BL1-E**		0.65	1.50

[^]These pressure drops allow the system to maintain 1.15 in. w.g. external static pressure at design HIGH COOL airflow. Additional reductions may be needed when using hot water coils or electric duct heaters.
^{*}Dirty Filter Pressure Drop includes the pressure drop of the clean filter plus any filter loading.

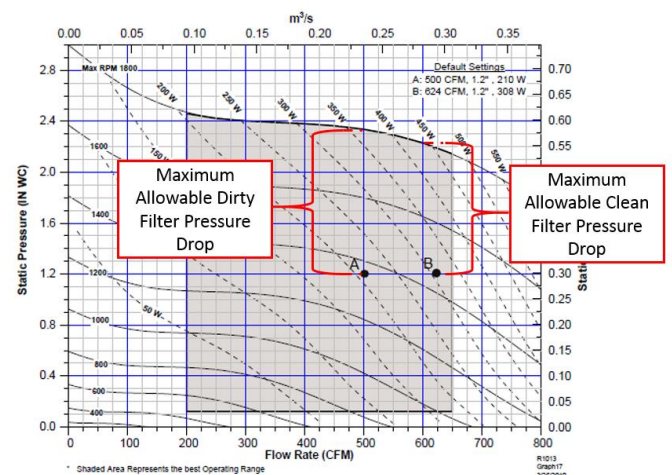


Figure 1. Typical Blower Curve

CALIFORNIA TITLE 24 COMPLIANCE

California Title 24 Section 120.1 (2019) specifies that MERV13 is the minimum filter efficiency that may be used in residential HVAC. These requirements apply only to systems installed in California. Nominal one-inch thick filters must meet two additional conditions to comply:

- Filter face velocity must be less than 150 fpm (0.76m/s).
- Clean-filter pressure drop must be no more than 0.1 in. w.g. (24.9 Pa)

In order for Unico products to meet these conditions and supply normal High Cool airflows, multiple returns must be used. Table 5 lists the total required filter area as well as the number of equally-sized returns required when complying with Title 24. Using the recommended number of returns ensures that both the velocity and the clean-filter pressure drop conditions are met. A field-fabricated return with the required Total Filter Area listed below may also be used.

Nominal two-inch thick filters are also regulated by Title 24, but they are not subject to the 150 fpm rule. They must be sized by the system designer while meeting the manufacturer-specified maximum clean-filter pressure drop requirements shown in Table 4.

Table 5. California Title 24 Requirements.

Blower Model	Total Filter Area Required for High Cool Airflow	Number of Equally- Sized Returns to Use	Return Grille p/n
	[in ²] (cm ²)		
M1218BL2-ST*	489 (3153)	2	UPC-01-1218
M1218BL1-E**			
M2430BL2-ST*	764 (4926)	3	UPC-01-2430†
M2430BL1-E**			
V2430*-E****			
M3036BL2-ST*	916 (5912)	3	UPC-01-3036†
M3036BL1-E**			
V3036*-E****			
M3642BL2-ST*	1069 (6897)	3	UPC-01-3642†
M3642BL1-E**			
V3642*-E****			
M4860BL2-ST*	1527 (9853)	3	UPC-01-4860
M4860BL1-E**			

†A return plenum must be field-fabricated for Vertical air handlers when multiple returns are required.