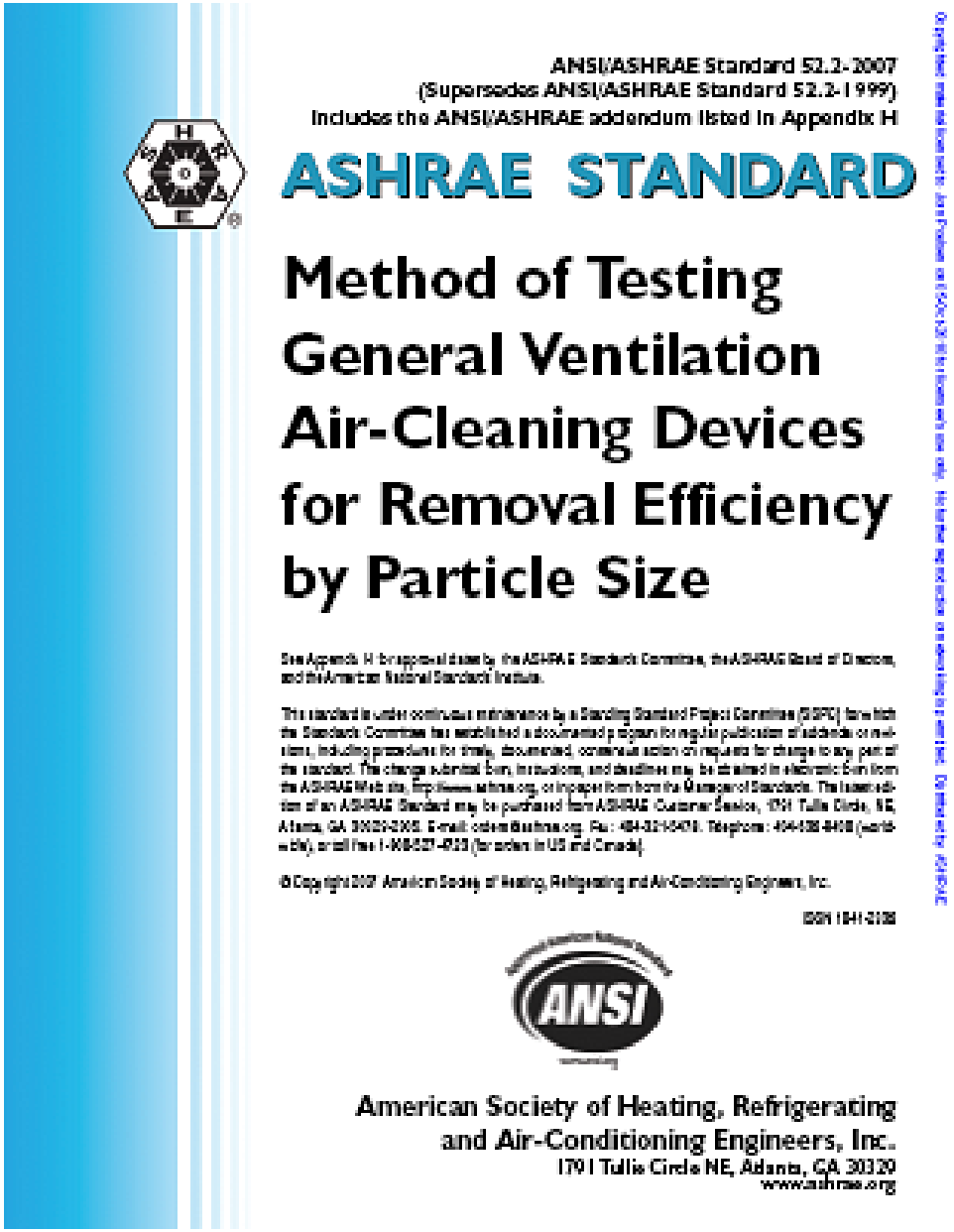
# ASHRAE 52.2:2007 "Method of Testing General Ventilation Air-cleaning Devices for Removal Efficiency by Particle Size"


# Standards

•Reduced quality risk;  clear, complete specs
•Reduced cost; no need to research the item,  -  standard is cheaper than custom made.

- M6 Nut
- ISO 4032 M6-5-hot dip galvanized hexagon nut



ANSI/ASHRAE Standard 52.2-2007
(Supersedes ANSI/ASHRAE Standard 52.2-1999)
Includes the ANSI/ASHRAE addendum listed in Appendix H

ASHRAE STANDARD

# Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

See Appendix H for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, http://www.ashrae.org, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada).



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# Test Rig


Test duct
Particle counter
Test filter position
Dust dryer
Dust feeder
Fan
Particle counter

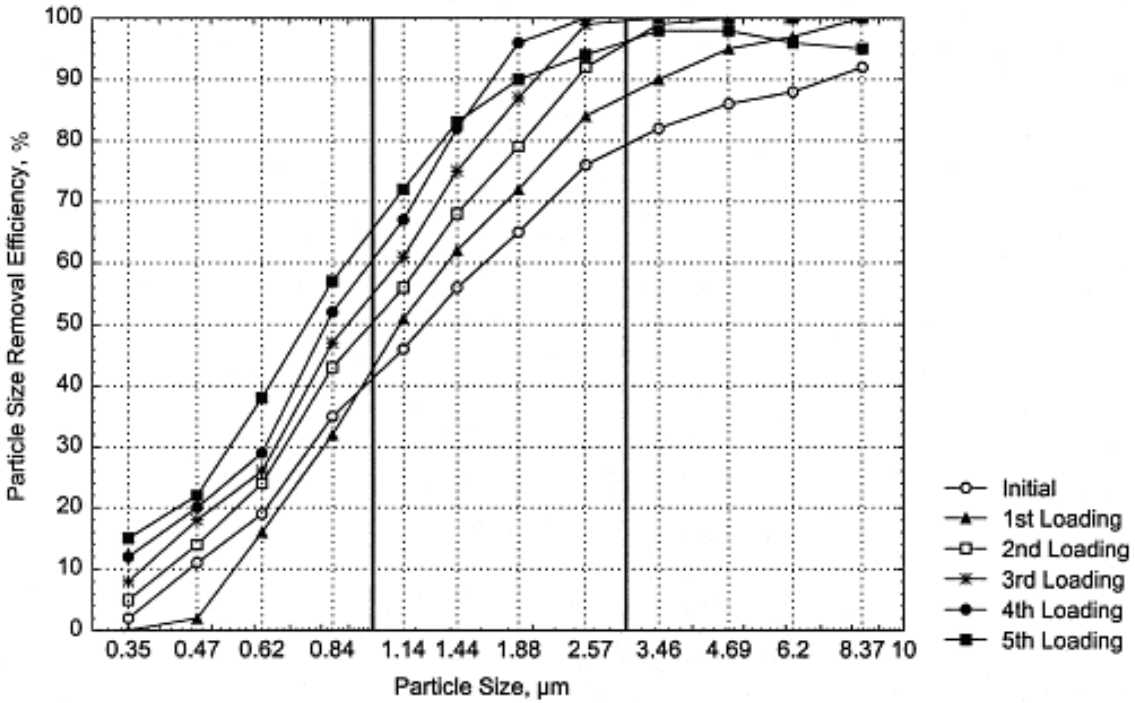
## TABLE 4-1 Particle Counter(s) Size Range Boundaries

| Size Range | Size Range Boundaries | | Geometric Mean Particle Size, µm |
|---|---|---|---|
| | Lower Limit, µm | Upper Limit, µm | |
| 1 | 0.30 | 0.40 | 0.35 |
| 2 | 0.40 | 0.55 | 0.47 |
| 3 | 0.55 | 0.70 | 0.62 |
| 4 | 0.70 | 1.00 | 0.84 |
| 5 | 1.00 | 1.30 | 1.14 |
| 6 | 1.30 | 1.60 | 1.44 |
| 7 | 1.60 | 2.20 | 1.88 |
| 8 | 2.20 | 3.00 | 2.57 |
| 9 | 3.00 | 4.00 | 3.46 |
| 10 | 4.00 | 5.50 | 4.69 |
| 11 | 5.50 | 7.00 | 6.20 |
| 12 | 7.00 | 10.00 | 8.37 |

## 10.8 Reporting Results of Loading Tests

**10.8.1** Results of loading tests shall be reported in the form of PSE curves for the test device:

a. clean;
b. after each incremental dust loading, a total of four curves; and
c. at its final loading point.




(b) PSE after incremental dust loading. (14)

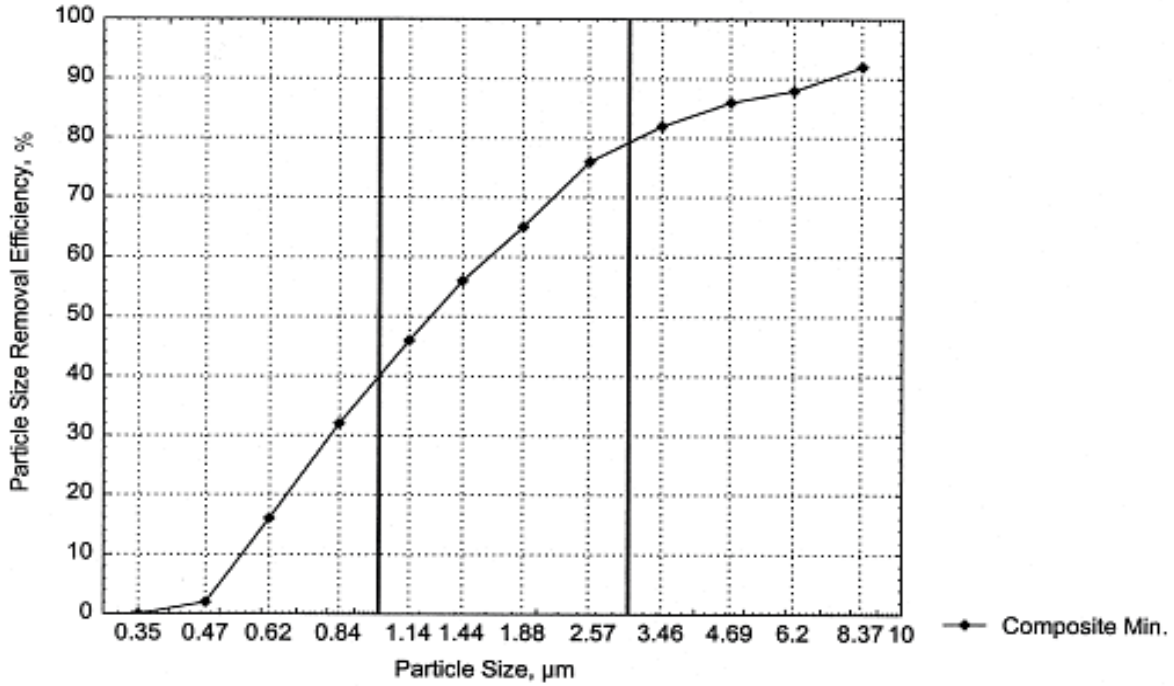
**10.8.2** Develop a composite minimum efficiency curve by plotting the minimum PSE in each of the 12 size ranges shown on the plots of each of the six curves from Section 10.8.1.

**10.8.3** The four data points from the Section 10.8.2 composite curve in each of the three size range groups from Table 10-2 shall be averaged and the resultant three average minimum PSEs ($E_1$, $E_2$, and $E_3$) shall be reported.

**10.8.4** Test results shall be reported in accordance with Section 11, and the air cleaner's MERV shall be determined in accordance with Section 12.

**TABLE 10-2 Size Range Groups**

| Average Minimum PSE Designator | Corresponding Size Range Group, µm |
|---|---|
| $E_1$ | 0.30 to 1.0 |
| $E_2$ | 1.0 to 3.0 |
| $E_3$ | 3.0 to 10 |




**Composite minimum efficiency curve.** (15)

## TABLE 12-1 Minimum Efficiency Reporting Value (MERV) Parameters

| Standard 52.2 Minimum Efficiency Reporting Value (MERV) | Composite Average Particle Size Efficiency,% in Size Range, μm | | | Average Arrestance,%, by Standard 52.1 Method | Minimum Final Resistance | |
|---|---|---|---|---|---|---|
| | Range 1 0.30–1.0 | Range 2 1.0–3.0 | Range 3 3.0–10.0 | | Pa | in. of water |
| 1 | n/a | n/a | $E_3 < 20$ | $A_{avg} < 65$ | 75 | 0.3 |
| 2 | n/a | n/a | $E_3 < 20$ | $65 \le A_{avg} < 70$ | 75 | 0.3 |
| 3 | n/a | n/a | $E_3 < 20$ | $70 \le A_{avg} < 75$ | 75 | 0.3 |
| 4 | n/a | n/a | $E_3 < 20$ | $75 \le A_{avg}$ | 75 | 0.3 |
| 5 | n/a | n/a | $20 \le E_3 < 35$ | n/a | 150 | 0.6 |
| 6 | n/a | n/a | $35 \le E_3 < 50$ | n/a | 150 | 0.6 |
| 7 | n/a | n/a | $50 \le E_3 < 70$ | n/a | 150 | 0.6 |
| 8 | n/a | n/a | $70 \le E_3$ | n/a | 150 | 0.6 |
| 9 | n/a | $E_2 < 50$ | $85 \le E_3$ | n/a | 250 | 1.0 |
| 10 | n/a | $50 \le E_2 < 65$ | $85 \le E_3$ | n/a | 250 | 1.0 |
| 11 | n/a | $65 \le E_2 < 80$ | $85 \le E_3$ | n/a | 250 | 1.0 |
| 12 | n/a | $80 \le E_2$ | $90 \le E_3$ | n/a | 250 | 1.0 |
| 13 | $E_1 < 75$ | $90 \le E_2$ | $90 \le E_3$ | n/a | 350 | 1.4 |
| 14 | $75 \le E_1 < 85$ | $90 \le E_2$ | $90 \le E_3$ | n/a | 350 | 1.4 |
| 15 | $85 \le E_1 < 95$ | $90 \le E_2$ | $90 \le E_3$ | n/a | 350 | 1.4 |
| 16 | $95 \le E_1$ | $95 \le E_2$ | $95 \le E_3$ | n/a | 350 | 1.4 |

Note: The minimum final resistance shall be at least twice the initial resistance, or as specified above, whichever is greater. Refer to Section 10.7.1.1.[45]

# MERV-A rating

- The intention of the MERV-A rating is to determine the magnitude of loss of filtration efficiency a filter may have in a real life situation.
- In determining the MERV-A rating, a preconditioning step is introduced after measuring initial efficiency.
- The preconditioning is done with an aerosol of KCI in water and continues until efficiency have stabilized

**J10.1** After the initial efficiency test is completed, the filter shall be exposed to the conditioning aerosol. The duct airflow rate used during the conditioning step will be the same as is used during the dust-loading and particle size efficiency testing. Note that all filters tested according to this standard must be exposed to the same conditioning aerosol procedure, regardless of the specific materials, construction details, or other variables.

# MERV-A rating

- The MERV-A rating is then determined with the same methods as MERV rating:

**TABLE J-2 KCl Conditioned Per Appendix J Minimum Efficiency Reporting Value (MERV-A) Parameters**

| Standard 52.2 Appendix J Minimum Efficiency Reporting Value (MERV-A) | Composite Average Particle Size Efficiency in Size Range, % | | | Average Arrestance, % |
|---|---|---|---|---|
| | Range 1 (0.3–1.0µm) | Range 2 (1.0–3.0µm) | Range 3 (3.0–10.0µm) | |
| 1–A | n/a | n/a | $E_3$–A < 20 | $A_{avg} < 65$ |
| 2–A | n/a | n/a | $E_3$–A < 20 | $65 \le A_{avg} < 70$ |
| 3–A | n/a | n/a | $E_3$–A < 20 | $70 \le A_{avg} < 75$ |
| 4–A | n/a | n/a | $E_3$–A < 20 | $75 \le A_{avg}$ |
| 5–A | n/a | n/a | $20 \le E_3$–A < 35 | n/a |
| 6–A | n/a | n/a | $35 \le E_3$–A < 50 | n/a |
| 7–A | n/a | n/a | $50 \le E_3$–A < 70 | n/a |
| 8–A | n/a | n/a | $70 \le E_3$–A | n/a |
| 9–A | n/a | $E_2$–A < 50 | $85 \le E_3$–A | n/a |
| 10–A | n/a | $50 \le E_2$–A < 65 | $85 \le E_3$–A | n/a |
| 11–A | n/a | $65 \le E_2$–A < 80 | $85 \le E_3$–A | n/a |
| 12–A | n/a | $80 \le E_2$–A | $90 \le E_3$–A | n/a |
| 13–A | $E_1$–A < 75 | $90 \le E_2$–A | $90 \le E_3$–A | n/a |
| 14–A | $75 \le E_1$–A < 85 | $90 \le E_2$–A | $90 \le E_3$–A | n/a |
| 15–A | $85 \le E_1$–A < 95 | $90 \le E_2$–A | $90 \le E_3$–A | n/a |
| 16–A | $95 \le E_1$–A | $95 \le E_2$–A | $95 \le E_3$–A | n/a |

# ASHRAE 52.1 - Arrestance

ARRESTANCE

This test is also performed as part of the dust loading procedure in which approximately four equal dust loading increments are used.

ASHRAE synthetic dust consists of the following:

- 72% Standardized fine test dust by weight (sometimes referred to as Arizona Road Dust);
- 23% Molocco Black by weight;
- 5% #7 Cotton Linters by weight, ground in a Wiley mill with a 4mm mesh screen.

1. Cap off or cover the dust spot samplers.
2. Weigh the high efficiency final filter (95% dust spot efficiency or above) and install it downstream of the test filter.
3. Estimate the total amount of dust feed required to bring the test filter to the final resistance as determined by the manufacturer's literature. Introduce one-quarter of this requirement to the dust feeder.
4. Select a time span on the dust feeder so the dust feed approximates 2 grams per 1000 cubic feet of air through the filter. During the feed, monitor the flow rate and adjust as necessary.(As dirt loads, filter resistance increases, so airflow decreases.)
5. Any feed dust that accumulates in the test duct must be gathered, weighed and compensated for.
6. At the end of the dust feed, turn off the flow, remove the final filter and re-weigh it. The final filter weight gain is the amount passed by the test filter. The difference between total dust fed and the amount captured by the final filter is the arrestance of the test filter expressed as a percentage.