| Category | Class | Efficiency | Test agent |
|---|---|---|---|
| Solid ..... | A | 99.97 | NaCl |
| Solid and liquid ..... | B | 99 | DOP |
| Solid ..... | B | 99 | NaCl |
| Solid and liquid ..... | C | 95 | DOP |
| Solid ..... | C | 95 | NaCl |

The behavior of filters to challenge by each of the two test aerosols depends on the filter type. Mechanical filters and electrostatic filters are the two fundamental types of particulate filters on the market. Mechanical filters' efficiencies are determined by mechanical features such as the diameter, orientation, and arrangement of the fibers that comprise the filter. Electrostatic filters have a static electric charge on the filter fibers to enhance the attraction and retention of the aerosolized particles. The enhanced efficiency due to the electrical charge means that an electrostatic filter generally offers lower breathing resistance than a mechanical filter with the same initial efficiency. This occurs because fewer fibers are needed in the electrostatic filter to achieve the same level of efficiency as a mechanical filter. However, the efficiency of electrostatic filters can be significantly reduced by exposure to certain aerosols while mechanical filters are generally more resistant to degradation.

Comments concerning resistance of filters to degradation were generally of two conflicting schools of thought. One school favored replacing the two proposed tests with a single, more severe test. The other favored retaining the two proposed tests at the same or reduced level of severity.

Commenters opposing the proposed classification system stated it was not a severe enough test of resistance to filter degradation because it did not represent a worst-case test. They recommended testing all filters with a DOP aerosol with the test continued until there was no further decrease in filter efficiency. Those supporting this position argued that the proposed filter classification system could result in overexposure of workers as workplace aerosols degrade some filters to a level below the certified efficiency level. It was indicated that various workplace contaminants can cause the beneficial filtering effects of the charge on electrostatic filters to become partially or totally ineffective without indication to the wearer. As the electrostatic charge on the filter fibers is masked by the deposition of aerosol, the efficiency of the filter can be reduced to below the anticipated level of protection, based on the certified efficiency level. Further, these contaminants have been identified as solids as well as liquids. With no warning to alert the wearer of a decrease in the performance level of the filter, these commenters believed that the proposed tests to determine filter efficiency should be modified to assure that the filters are tested until the minimum level of efficiency is achieved. The stated advantage of such an approach is that filters could be used with any aerosol for indefinite time periods without concern of filter degradation.

The other school argued that the two proposed categories were either appropriate or too severe. They suggested continuing with the two categories either as proposed or with a reduction in the amount of filter loading (to reduce the severity of the test). They argued that the two proposed filter tests, being a combination of worst-case and severe test parameters, would assure adequate filter performance in the workplace.

Several commenters stated that the great majority of respirator applications are in worksites with aerosols that do not significantly diminish the efficiency level of the electrostatic filters. Workplace studies were submitted to support the conclusion that, because of the highly degrading nature of DOP and the proposed high loading level, the proposed test were many times more severe than conditions realistically encountered by workers. These commenters recommended, not only the certification of two categories as proposed, but that the proposed test loading levels for both the NaCl and DOP aerosols be reduced to more closely simulate workplace exposures.

The advantage of the proposed tests was the benefit of potentially lower breathing resistance, with the resulting increased comfort, of electrostatic filters for the great majority of respirator wearers who are not exposed to highly degrading workplace aerosols. Further, the electrostatic filter types were reported by commenters to have a potentially lower cost than their mechanical filter counterparts.

This final rule provides for the needs of both the majority workers with no need for filters highly resistant to degradation and workers needing filters most resistant to degradation. To that end, this rule provides for a third category of filters added to the two categories provided for in the proposal. The new filter category is tested with the highly degrading DOP until no further decrease in filter efficiency is observed.

As discussed under VI. Discussion of Final Rule, D. Section-by-Section Discussion, § 84.170, NIOSH is introducing a new terminology for the three filter categories. The solid only filters in the proposal are labeled N-series filters in this final rule. The proposal's solid or liquid filters are now labeled R-series filters. Filters of the new, third category are labeled P-series filters. The three categories, therefore, provide filters for a complete range of applications.

Further, to address concerns about the use of A, B, and C in the proposal to indicate the efficiency level, the final rule uses numerical notations of 100, 99, or 95 to indicate filter efficiency. The rationale for retaining the proposed efficiency levels of 99.97, 99, and 95% is discussed in VI. Discussion of Final Rule, D. Section-by-Section Discussion, § 84.170(c)(3). The terminology of this final rule is related to that of the proposal as follows:

| Final | Proposal |
|---|---|
| N100 ..... | Solid only/type A. |
| N99 ..... | Solid only/type B. |
| N95 ..... | Solid only/type C. |
| R100 ..... | Solid & Liquid/type A. |
| R99 ..... | Solid & Liquid/type B. |
| R95 ..... | Solid & Liquid/type C. |
| P100 ..... | (Not included in proposal). |
| P99 ..... | (Not included in proposal). |
| P95 ..... | (Not included in proposal). |

As stated in the proposal, NIOSH selected the test criteria to be a combination of worst-case and very severe test conditions. The N- and R-series filters will be tested to a specified maximum loading level as in the proposal. Performance of these two filter classes at loadings beyond that maximum will not be evaluated. Furthermore, NIOSH is aware that few data are available to assess the performance of these respirators in workplace settings over an extended period of time. Therefore, the N- and R-series filters will be certified with the recognition that in some settings time-use limitations should be applied. A single shift limitation, for example, may be appropriate to guard against possible degradation of performance below the efficiency certified by NIOSH. In addition to possible time-use restrictions, the N-series filters should be restricted to use in those workplaces free of oil aerosols because the N-series certification tests will involve challenge with non-degrading sodium chloride aerosols. The R-series filters should require no such aerosol-use restrictions because R-series certification tests will involve challenge with highly degrading dioctylphthalate aerosols. Because the P-series certification tests will involve challenge with this highly degrading