

Study on the Performance Efficiency of Dust Respirators: Laboratory and Field Experiments

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Abstract

The existing regulations on performance requirements and test methods for dust respirators were reviewed and applied on eighteen models available on the local market.

Actual field experiment was conducted to supplement laboratory test procedures and elucidate some data resulting from the laboratory tests. Laboratory and field tests results showed that disposable dust respirators are better than the replaceable filter and cartridge type respirators as far as filtering efficiency and protection afforded are concerned. The field survey also indicates that the average worker is unaware of the problems of respirable dust and respiratory protection.

The two test results have provided some insights into the performance of dust respirators available on the market, from which our own certification standards may be based.

Summary

The existing regulations on performance requirements and test methods for dust respirators were reviewed and applied on eighteen models available on the local market. Laboratory test results on eighteen models of respirators, each of which has five samples included the following: filter efficiency, protection factors, inhalation resistance, exhalation resistance, increasing rate of inhalation resistance, elongation of head harness, tensile strength of head harness, dead space of facepiece, heat resistance of facepiece and visual field of view of facepiece.

Test results were analyzed and evaluated. Basing on this evaluation, only nine models which satisfy the minimum performance requirements (based on internationally accepted standards) were chosen for the field survey. Actual field experiment was conducted to supplement laboratory procedures and elucidate some data resulting from the laboratory tests. A cement plant was chosen from which to conduct the field survey since a previous study defined the hazards inherent in the industry and determined the efficacy of the measures employed to control these hazards. Field survey results included the following: respirable and total dust concentrations, hazard ratio associated with these ratios, increased rate of breathing resistance of respirators after use by each test subject, interview results, and general observations.

Laboratory test results showed that disposable and replaceable filter dust respirators have better inhalation and exhalation resistances than those of the cartridge type while both disposable and cartridge type respirators have better filter efficiencies than the replaceable filter type. Results of other laboratory tests such as visual field of view of facepiece, percent elongation and tensile

strength of head harness, heat resistance and dead space of facepiece were satisfactory.

Field test results showed that disposable dust respirators have better protection factors than those of the cartridge type. Their protection factors were greater than their hazard ratios. Statistical analysis of field test results also indicated that there was little correlation for increased inhalation resistances of disposable respirators and their corresponding respirable and total dust concentrations. For cartridge type respirators however, there was a strong correlation for the three quantities. An increase in the inhalation resistance was observed as the respirable and total dust concentration increase.

As for general observations, the cement industry is basically one of the dustiest and deplorable. Very minimal or sometimes inadequate and inappropriate respiratory protection were observed. The workers and even the management themselves were unaware of this inadequacy. Where respirators are provided and worn, it was observed that little care in selection was the rule. Any respirator that will find employee acceptance was used. Also, dust collectors and local exhaust systems were merely for purposes of recovering cement dust rather than for engineering control of airborne dust.

These two test results have provided some insights into the performance of dust respirators available on the market from which our own certification standards may be based and which may be used as guidepoints for respiratory protection.