

MSHA develops new fire-resistant check curtains

By Steven J. Luzik

The Mine Safety and Health Administration (MSHA) critically examines any devices or materials used as ventilation controls. Of particular concern are the controls' structural effectiveness and resistance to fire.

Title 30 of the Code of Federal Regulations (Sec. 75.333d) states: "Doors, other than personnel doors, construct-

ed after Nov. 15, 1992, that are used in lieu of permanent stoppings or to control ventilation within an air course shall be: made of noncombustible material or coated all accessible surfaces with flame retardant material, and of sufficient strength to serve their intended purpose of maintaining separation and permitting travel between or within the air course or entries. Installed in pairs to form an airlock."

To be considered a "noncombustible material," a door must not rupture or otherwise fail a fire test incorporating an ASTM E119-88 time/temperature heat input, or equivalent, for one hour, the time MSHA considers reasonable for miners to reach safety.

Large metal doors often are used as airlocks, but their high cost and relatively high degree of maintenance has caused some operators to seek alternatives. Another problem associated with the use of large metal doors is that they may not always be closed when equipment is not passing through. A recent MSHA fire investigation found that

smoke migrated into an escapeway when such a door was left open and 20 miners had to evacuate using self-rescuers in heavy smoke.

Testing performance

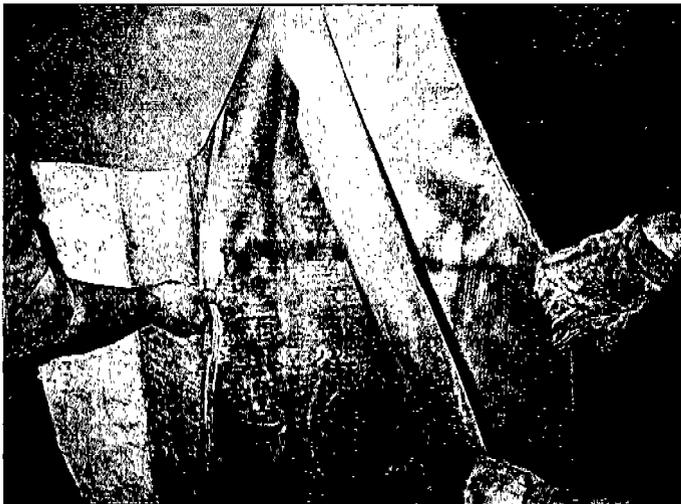
MSHA's Industrial Safety Division (ISD) has developed performance criteria and possible designs for air check applications. The emphasis was placed on the development of a run-through, curtain-type of control that would provide the flexibility, ease of use and low maintenance of hanging conveyor belting but with resistance to the spread of flame and smoke in the event of a fire.

The following performance criteria were developed as a result of this program and in the spirit of 75.333:

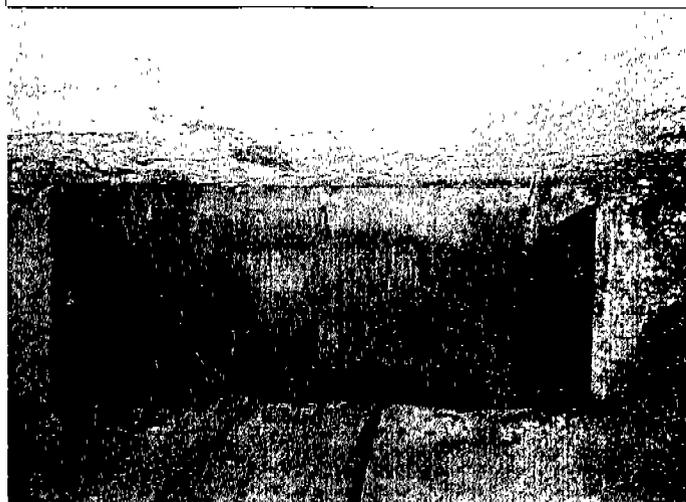
- The curtain shall perform its designed function as a ventilation control and resist the spread of flame and smoke for one hour.
- *The exposed surface of the curtain should have a low flame-spread (flame spread index of 25 or less when tested to ASTM E-1 62-87).
- The curtain should offer considerable resistance to the passage of air under normal conditions.
- *The curtain should possess sufficient inertia (weight) to withstand

Author information

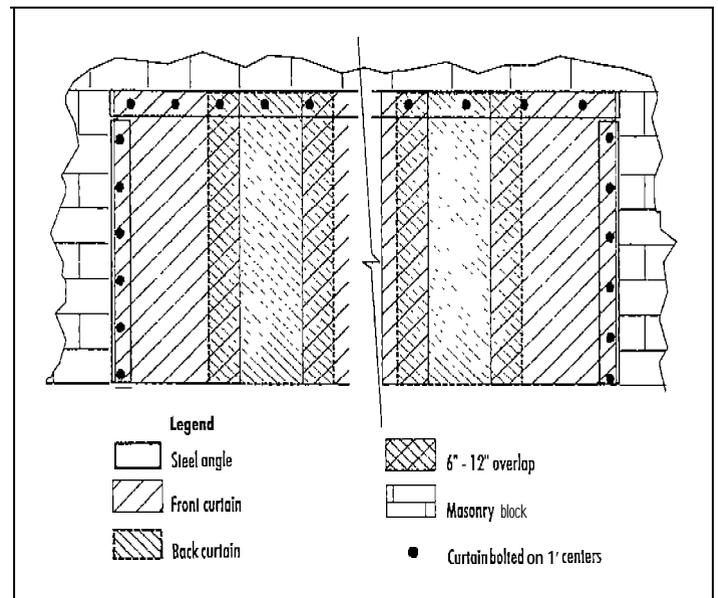
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This general design has been employed in several mines for more than one year with reported success. One mine incorporates an additional bumper of MSHA-approved conveyor belting over the plastic brattice to provide increased resistance to abrasion and impact from moving equipment.



The recommended design calls for masonry block wingwalls, which are necessary to achieve efficient separation.



Fire-resistant air check curtain installation.

OPERATING IDEAS continued

cient inertia (weight) to withstand the normal ventilation currents and pressure drops when either door is open.

*The curtain should be flexible and relatively lightweight so that it can be opened easily and neither create a personnel safety hazard nor damage equipment passing through.

Fire resistant curtain

A drive-through air check curtain was developed with the six previously mentioned criteria, the basis for testing and evaluation of candidate designs.

The fire resistance was determined by exposing a 6x6-ft section to a flammable liquid tray test fire for a period of one hour. This test, conducted in the LSD's fire gallery test facility, often is used to evaluate proposed stopping and seal construction materials. The test produces temperatures on the face of the curtain in excess of 1,500°F. A positive pressure of 0.15-inches water gauge is developed across the curtain on the fire side. This quantity is judged to be representative of typical pressures that may exist across a regulator. The test pressure differential can be varied if the end-use dictates the need to do so. Heat transmission through the curtain is monitored using thermocouples and smoke leakage is observed using video cameras.

Post-fire-test air leakage and pressure measurements were taken to determine the curtain's ability to control ventilation after exposure.

After testing many different types of heat-resistant materials fabricated in a variety of manners, a final design was selected that provided the best overall performance.

The curtain consists of a composite of double-layered, high-temperature (>36 ounces per square yard density) ceramic fiber textile (rated at 3,000°F continuous use) sewn together using ceramic thread and buffered on both sides with an approved 35-mil polyethylene plastic brattice. The brattice serves as a bumper to provide resistance to the abrasion caused by passing equipment. This curtain thermally degrades upon exposure to test fire. The ceramic fiber textile remains in place, providing a barrier to the spread of smoke and fire upwind.

Pressure differentials up to 0.75 inches water gauge were achieved in post-fire tests of the curtain- well in excess of the 0.10-inch water gauge necessary to control smoke.

Fire spread upwind in mine fires is normally caused by radiation generated by flame temperatures in excess of 1,000°F. The ceramic fabric attenuates the temperatures generated by the test fire, preventing the spread of flame.

This ventilation control provides the ease of use and flexibility of a synthetic curtain constructed with hanging conveyor belting but also has the air separation and fire-resistant properties consistent with non-resilient masonry and steel ventilation control structural materials. The low maintenance and fail-safe closing characteristics of the curtain make it an attractive alternative to the use of metal doors for this unique application.

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