Monokote® Type MK-6/HY

Blaze Shield D-C/F, Blaze Shield II Comparative Testing

Spray applied fireproofing is the most effective and economical means to protect structural steel from the effects of fire. To perform its critical function, fireproofing must remain in place. Any material which is too soft and friable (damageable) to remain on the steel after application has little fire protection value.

Tests are now available which measure significant characteristics of spray applied fireproofing materials. From these tests it is possible to establish reasonable levels of in-place performance — a critical element in achieving quality fireproofing. These tests should be used to determine the quality of all fireproofing materials for your specifications.

GCP Applied Technologies Construction Products has conducted a series of tests on Monokote® (cementitious) and Cafco (mineral fiber) fireproofings. Samples of each product, at various densities, were subjected to each of the performance tests. The results show the superior in-place performance of Monokote.

Comparative Test Results

Characteristic (Test Reference)	Performance Standard	Test Results					
		Cementitious Monokote Type MK-6/HY		Sprayed Fiber Blaze Shield D-C/F		Blaze Shield II	
		Density (pcf)	**Volume Removed, (cm^3)**	**Density (pcf)**	**Volume Removed, (cm^3)**	**Density (pcf)**	**Volume Removed, (cm^3)**
Impact Penetration (Developed by City of San Francisco)	6 cm^3** (Maximum)	16.1	3.3	19.0 15.6 13.7 13.5	5.75 17.0 66.0 *	19.4 16.4	15.3 21.0
		Density (pcf)	**Volume Removed, (cm^3)**	**Density (pcf)**	**Volume Removed, (cm^3)**	**Density (pcf)**	**Volume Removed, (cm^3)**
Abrasion Resistance (Developed by City of San Francisco)	15 cm^3** (Maximum)	16.0	8.3	19.0 15.6 13.5	13.0 26.5 158.3	19.4 13.6	26.1 26.3
		Density (pcf)	**Load at 10% Deformation (psf)**	**Density (pcf)**	**Load at 10% Deformation (psf)**	**Density (pcf)**	**Load at 10% Deformation (psf)**
Compression (E 761)	1000 psf**** (Minimum)	14.1	1440	19.0 14.0 12.5	518.0 62.9 59.0	18.1 17.3 14.1	1020 742 424
		Density (pcf)	**Bond Strength (pcf)**	**Density (pcf)**	**Bond Strength (pcf)**	**Density (pcf)**	**Bond Strength (pcf)**
Bond Strength Cohesion/ Adhesion (E 736)	200 psf***** (Minimum)	14.4	339	19.4 15.7 14.0 12.3	204.0 38.6 30.0 15.8	18.1 17.3 14.1	252 144 73
		Density (pcf)	**Weight Loss at 24 hours (gm/ft^2)**	**Density (pcf)**	**Weight Loss at 24 hours (gm/ft^2)**	**Density (pcf)**	**Weight Loss at 72 hours*** (gm/ft^2)**
Air Erosion (E 859/GSA)	.0025 grams per $foot^2$**** (Maximum)	14.3	0.000	20.2 15.0 14.2 12.1	.132 .171 .183 .339	18.1 16.3 14.1	.004 .006 .046

*Impact loss exceeds limitation of this test
**GCP recommended standards
***Samples were still losing weight after 72 hours
****Standard required by the Army Corps of Engineers
*****Standard required by the Army Corps of Engineers, Department of the Navy, Veterans Administration

Air Erosion Test (ASTM E 859/GSA)
This test is designed to measure the amount of fireproofing material eroded by air movement across its surface. Dusting and sifting of the material will lead to loss of fire resistive properties.

Samples are inserted into openings of a tunnel-like apparatus with the fireproofing exposed to the interior. A blower, forcing air down the tunnel at a velocity of 1200 ft./min., is activated for 24 hours. A filter at the end opposite the blower collects material which has been eroded from the samples. The filter is weighed at 1, 6 and 24 hour intervals to determine weight loss. If the material is still dusting after 24 hours, the procedure is continued until weight loss stops.

The test results are reported as the amount of weight loss in grams per square foot of sample area. Excessive air erosion of a fireproofing means premature loss of its ability to perform as intended.

Impact Penetration Test (Developed by City of San Francisco)
This test is designed to measure the resistance of a fireproofing material to penetration or removal due to impact forces. Low resistance to these forces means excessive damage to the material and loss of fire protection.

A sample, measuring 12 in. x 18 in., is subjected to a swinging pendulum. The pendulum length is set so that the low point of the swing is at a point ½ in. into the specimen. The impact device is then held horizontally and allowed to free-fall onto the fireproofing surface.

This procedure is followed three times on two samples. The amount of material dislodged is measured by filling the voids with sand and then weighing the sand used. If the pendulum swings past the vertical, dislodging material to the opposite side, the sample has exceeded the limitations of the test (it has failed).

An average volume of the sand from all six samples tested is determined and reported as the volume of material removed by impact forces.

Abrasion Test (Developed by City of San Francisco)
This test is designed to measure the amount of material removed by abrasion forces moving across the surface of the fireproofing material. Low resistance to these forces means an excessive amount of material may be removed after installation by normal construction activity.

The test allows a rake-like device to pass over the surface of a 12 in. x 18 in. sample. Multiple passes are made on each of two samples. All abraded fireproofing material is removed and the tracks made by the abrading instrument are filled with sand.

An average volume of sand used to fill the tracks caused by the "rake" moving over the samples is reported as the volume of material removed.

Compression Test (ASTM E 761)
This test is designed to measure the deformation resistance of a fireproofing material. With low compressive strengths a fireproofing material is easily deformed. These easily compressible materials cannot resist removal from the steel.

A 6 in. x 24 in. sample of fireproofing, applied to a steel sheet, is subjected to compression loads through a 6 in. square bearing surface. After application of an initial load and measurement of the thickness, the sample is then compressed to ultimate load or 10% deformation, whichever occurs first.

The test results are reported as the amount of compressive force (in pounds per square foot) required to produce a 10% deformation of the material (or ultimate load).

Bond Strength Test (ASTM E-736)
This test measures the force required to cause the fireproofing material to separate from itself (cohesion) or remove it from the substrate (adhesion). This test indicates how well the material will remain on the steel after installation.

The test is conducted by adhering a metal dish to the surface of the fireproofing. By using a two component urethane foam, the metal cap is tightly bonded to the fireproofing surface.

Uniform perpendicular forces are exerted to pull the dish from the fireproofing. The force required to separate the fireproofing from the substrate or itself is measured.

Results are reported as the force in pounds per square foot required to cause cohesive or adhesive failure. The higher the bond strength, the more resistant the fireproofing is to accidental removal and damage.

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