form&function

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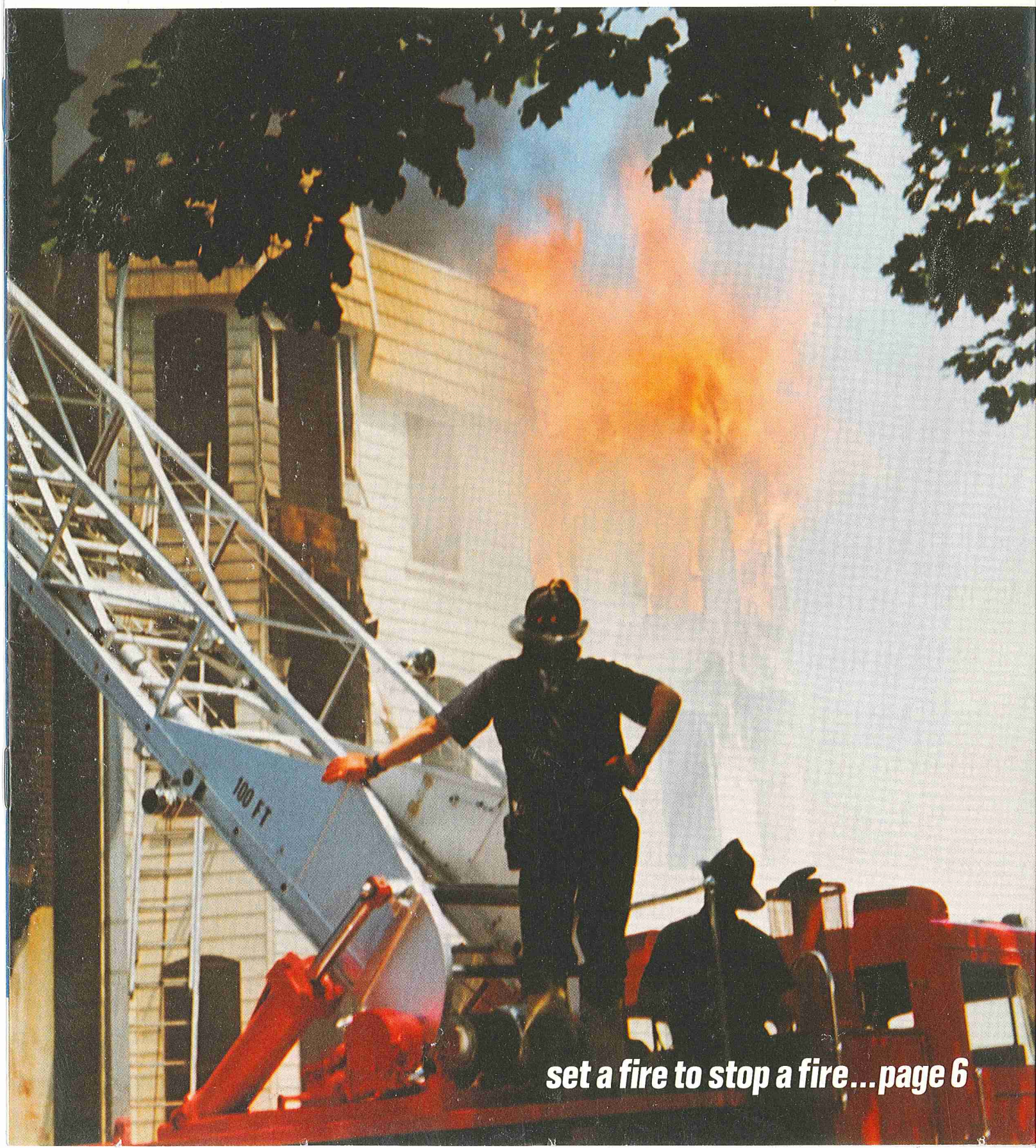

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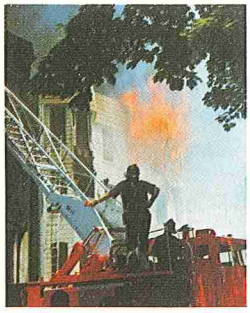

SET A FIRE TO STOP A FIRE

A dramatic series of onsite fire tests may reduce the vulnerability to fire spread of up to 300,000 existing row houses in the U.S. The tests were conducted in the Bushwick community of Brooklyn, N.Y., because thousands of fires in this area have spread through common "cocklofts(1)" to destroy adjacent residential units in aging row housing there.

In a major effort to analyze and prevent such fires, important scientific data on the subject was gathered by burning four abandoned, attached houses in Bushwick. The fire tests were conducted by the Center for Urban Environmental Studies of the Polytechnic Institute of New York under a grant from the New York Fire Department.

Two U.S.G. materials were used in the tests: SHEETROCK Gypsum Panels, an old, familiar product; and THERMAFIBER Mineral Fireproofing, a product developed for new uses. These materials performed most successfully in preventing fire and smoke penetration into adjacent buildings. Because of the low costs involved, they also promise realistic solutions to fire-spread dangers in hundreds of thousands of attached-housing units with the same problem from coast to coast.

Besides demonstrating efficient fire protection in row housing,

(1) Cocklofts are spaces between the upper-floor ceiling and roof in a majority of this type of residential unit (Fig. 1).

Live tests show fire-stopping ability of

the tests reinforce the important fire-retardency characteristics of these products when used in new construction, too. Various types of SHEETROCK Panels are currently used in fire-rated partition and ceiling assemblies for all types of construction. THERMAFIBER Mineral Fireproofing and related insulating products are used to protect against the spread of fire and smoke in high-rise construction.

The Bushwick fire tests were organized and conducted by Professor Paul R. DeCicco, director of the UES Center. A total of 24 fires were deliberately set to test fire-protection devices and systems, behavior of building materials and building design. The building design tests were performed to observe the action of ventilation and light-shaft fires and to study fire-stopping requirements related to the common cockloft. This latter series, involving three tests, highlighted the performance of SHEETROCK Gypsum Panels and THERMAFIBER Mineral Fireproofing.

"Row houses of the type which predominate in Bushwick are traditionally constructed of combustible materials," explained Professor DeCicco. "Generally, these buildings are in run-down condition, but we need to save them to house our

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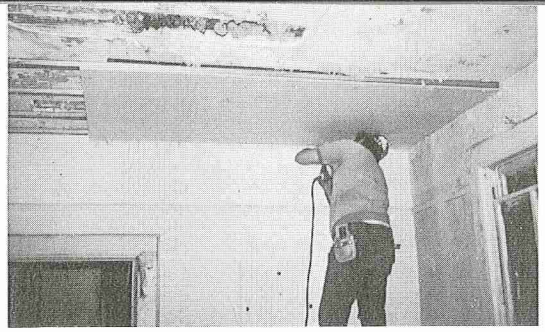
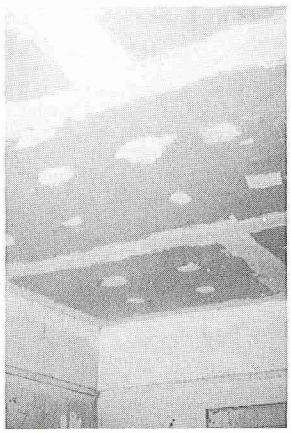
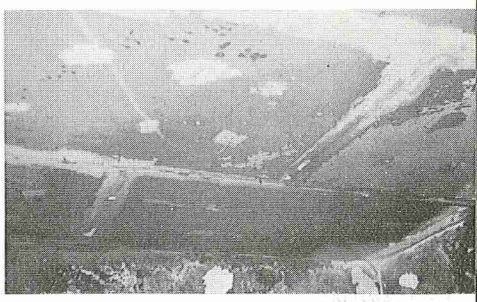
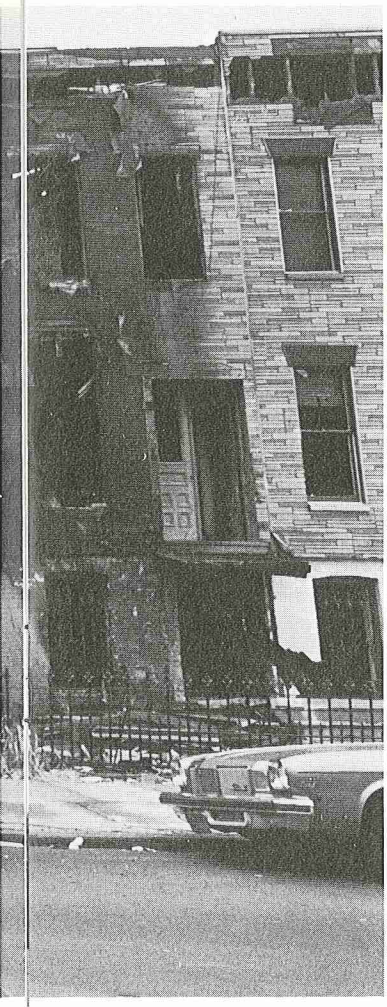






In gypsum board tests, SHEETROCK Panels were fastened to ceiling, top, and taped, left. Test results, above, show that panels discolored, but displayed no sign of failure.



Fire disasters, as this one occurring in 17 adjacent buildings in Bushwick section of Brooklyn, N.Y., were created by vulnerability of cockloft below roof.

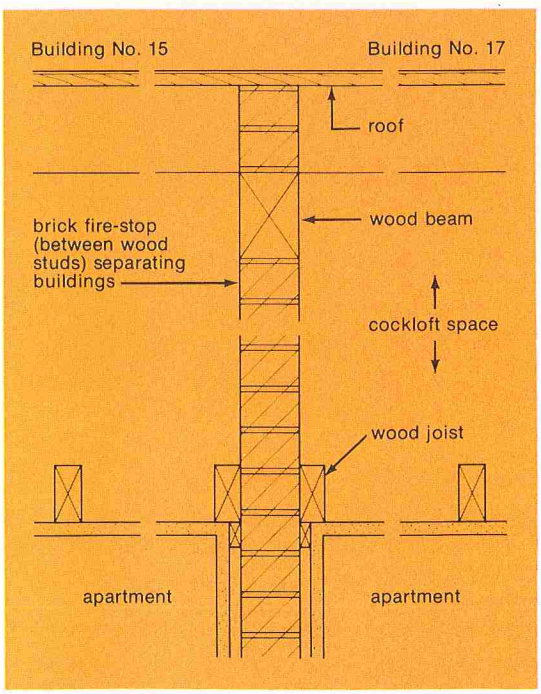


Fig. 1. *Common cockloft connects several buildings; brick fire-stop provides inadequate protection from fire spread.*

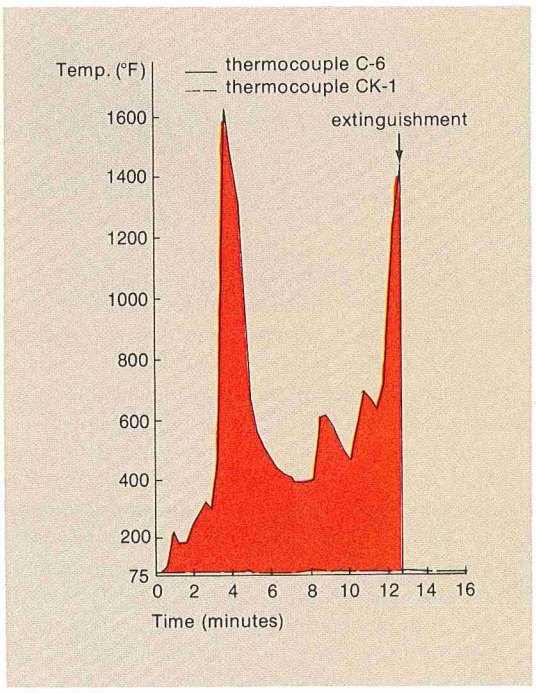


Fig. 2. *Time/temperature graph for gypsum-panel ceiling fire tests.*

drywall and mineral fiber insulation

low-income population for many years to come.

"Unfortunately, the Bushwick homes serve as a nearly perfect example of the serious threat to life safety that prevails in row-frame housing in most of our cities. For these reasons, the improvement of life safety in such structures is as urgent as any problem in our urban communities.

"The ultimate objective of the fire-test series and related investigation is to develop new legislation, codes and standards (particularly in connection with rehabilitation work) in order to improve fire safety in these structures. It should be noted, however, that many *new* wood-framed garden apartments, townhouses and homes for senior citizens exhibit the same characteristics in terms of fire vulnerability," DeCicco said.

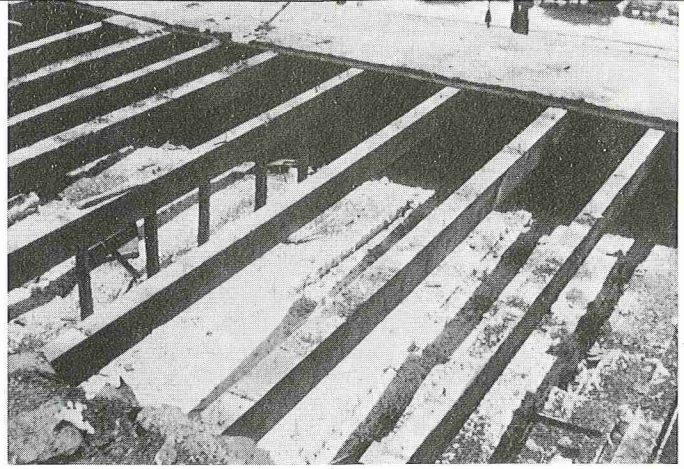
In the test using SHEETROCK Gypsum Panels, USG Metal Furring Channels were applied to wood joists above a broken, plastered bedroom ceiling. Then 5/8-in. SHEETROCK FIRECODE "C" Gypsum Panels were applied and the joints treated. Furnishings providing a typical fuel load were placed in the bedroom and a fire was set. During the 13 minutes that the fire burned, the temperature reached as high as 1,600° F in the room (see Fig. 2, thermocouple C-6). At the same time, the temperature above the SHEETROCK Panel ceiling was hardly affected (Fig. 2, thermocouple CK-1), indicating that the drywall ceiling membrane had effectively prevented penetration of the fire into the cockloft area.

In another test, THERMAFIBER Mineral Fireproofing, 2-in.-thick, nominal 8-lb./cu. ft. density, was laid as a horizontal blanket over the joists and ceiling in a cockloft over a bedroom. Again, a fire was set and allowed to burn for ten minutes (Fig. 3). While temperatures within the room exceeded 1,200° F (thermocouple C-1), the temperature in the cockloft increased less than 100° F.

The most significant test was the separation of the cockloft between buildings with THERMAFIBER Mineral Fireproofing. This material, 2 in. thick and nominal 8-pcf density, was installed vertically along the common wall separating two buildings (Fig. 1). A living room was furnished to create a typical fuel load for the fire, and the fire was set. The test ran for more than 30 minutes (Fig. 4) and temperatures in the cockloft on the fire side reached temperatures above 1,700° F (thermocouple CK-1). On the protected side, temperatures never rose above 150° F (thermocouple CK-8). Even though the fire spread throughout the apartment and even burned the roof, observers could find no sign of fire or smoke penetration in the THERMAFIBER Mineral Fireproofing.

"The performance of the THERMAFIBER Mineral Fireproofing was outstanding, particularly in the test where the product was used to separate the cockloft between two buildings," continued Professor DeCicco. "The existing separation at that point was a brick wall which had deteriorated and provided ineffective fire separation even where it seemed sound. The THERMAFIBER Fireproofing, however, resisted fire, smoke and temperature rise at a material cost of only about $50 per building," he said.

The fire-containment construction details for the SHEETROCK and THERMAFIBER fire tests were developed by technical services personnel from United States Gypsum Company's New York (Tarrytown) office. Vince Salvo, technical services manager, and his associates personally supervised installations and provided onsite technical service to Professor DeCicco. □



Roof section was removed after fire test to observe signs of failure of THERMAFIBER Mineral Fireproofing laid over ceiling; none were found.

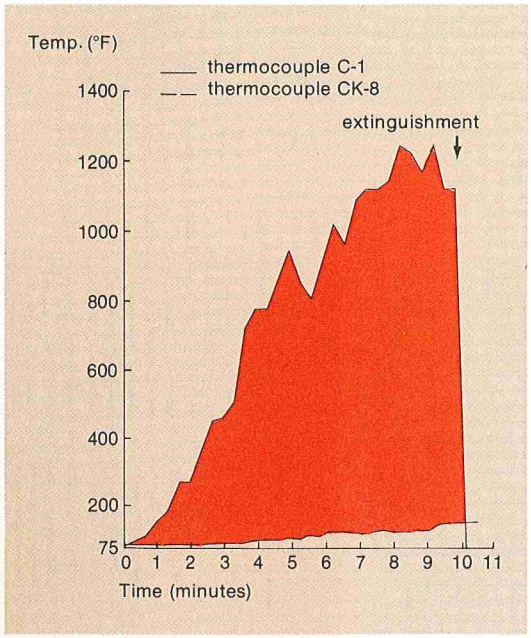
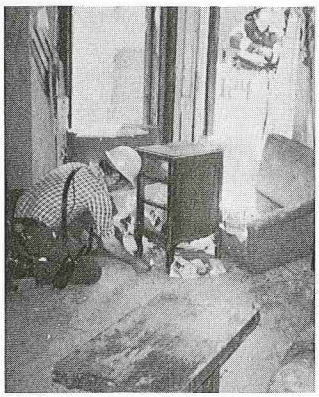


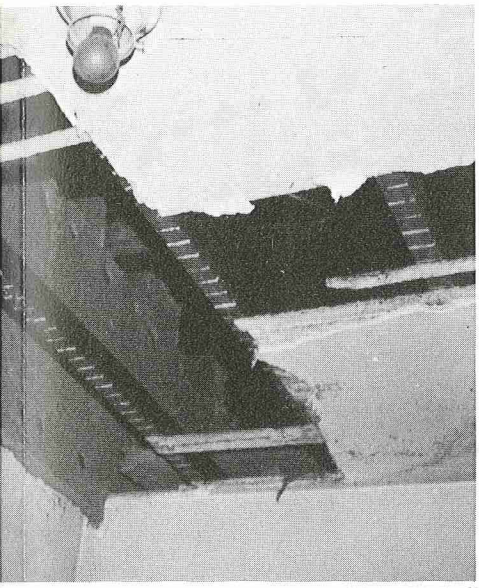
Fig. 3. *Time/temperature graph for mineral-fireproofed ceiling fire tests.*



Professor DeCicco ignites furniture in living room test, above; within five minutes furniture and curtains are ablaze, right.

The THERMAFIBER Mineral Fireproofing and SHEETROCK Gypsum Panels mentioned here are augmented by other products and systems developed by United States Gypsum to provide effective protection against fire. Recent and outstanding are these:

- USG Area Separation Walls, providing two and three-hour fire separation as common walls separating occupancies in wood-frame apartments and townhouses.
- USG Cavity and Solid Shaft Walls, rated at one to four hours, providing steel-framed drywall enclosure systems for elevator shafts, stairwells and mechanical shafts in multi-story buildings.
- THERMAFIBER Safing Insulation, effectively fire-stopping the openings between floor perimeters and exterior curtain walls of high-rise buildings. Also used to fire-stop penetrations in fire-rated assemblies.
- THERMAFIBER Curtain Wall Insulation, protecting exterior curtain wall panels from the effects of fire. □



View above shows application of THERMAFIBER Fireproofing as fire barrier between buildings in cockloft from fire test side.

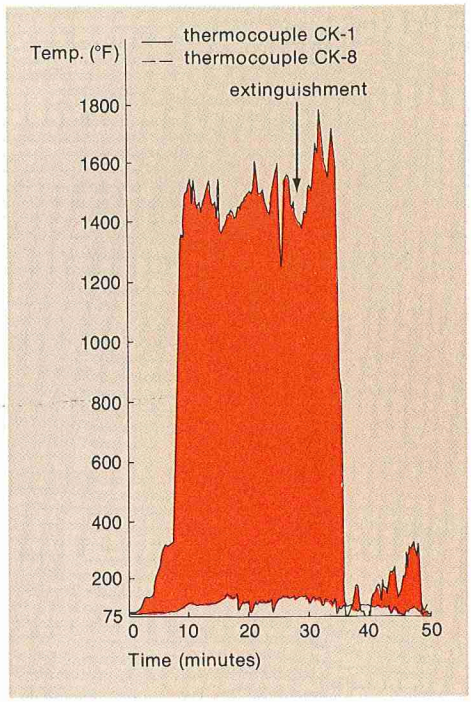
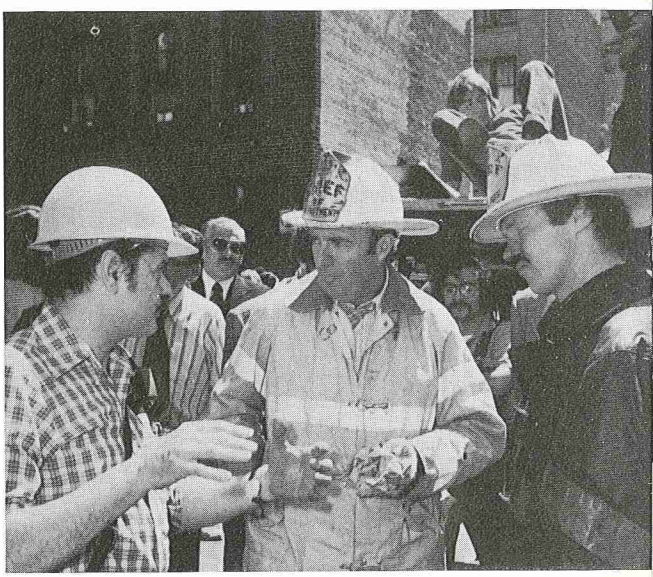
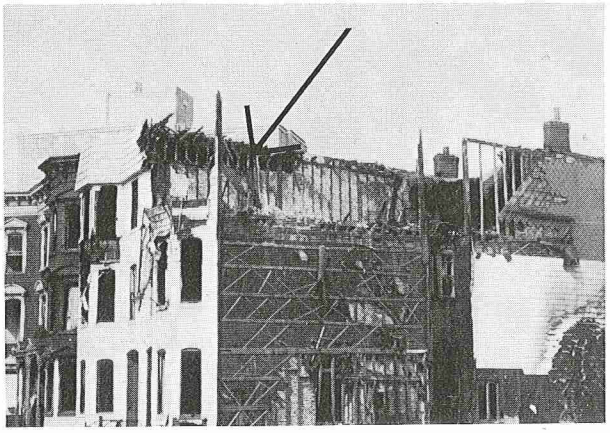


Fig. 4. *Time/temperature graph for mineral-fireproofed cockloft-separation fire tests.*



Professor DeCicco, left, describes fire test to New York Fire Commissioner O'Hagan and Chief Dunn.

Living room fire rapidly spreads to roof and other rooms in apartment.



Top floor was thoroughly destroyed by fire, but adjacent building was protected by THERMAFIBER Mineral Fireproofing (removed after fire for inspection) at cockloft separation (arrow).